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Dr. Swapnesh Taterh

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FOREWORD

I am pleased to put into the hands of readers Volume-6; Issue-1: 2019 (Jan, 2019) of **"International Journal of Advanced Engineering Research and Science (IJAERS) (ISSN: 2349-6495(P) | 2456-1908(O)" ,** an international journal which publishes peer reviewed quality research papers on a wide variety of topics related to Science, Technology, Management and Humanities. Looking to the keen interest shown by the authors and readers, the editorial board has decided to release print issue also, but this decision the journal issue will be available in various library also in print and online version. This will motivate authors for quick publication of their research papers. Even with these changes our objective remains the same, that is, to encourage young researchers and academicians to think innovatively and share their research findings with others for the betterment of mankind. This journal has DOI (Digital Object Identifier) also, this will improve citation of research papers. Now journal has also been indexed in **Qualis (Interdisciplinary Area) (Brazilian system for the evaluation of periodicals, maintained by CAPES).**

I thank all the authors of the research papers for contributing their scholarly articles. Despite many challenges, the entire editorial board has worked tirelessly and helped me to bring out this issue of the journal well in time. They all deserve my heartfelt thanks.

Finally, I hope the readers will make good use of this valuable research material and continue to contribute their research finding for publication in this journal. Constructive comments and suggestions from our readers are welcome for further improvement of the quality and usefulness of the journal.

With warm regards.

Dr. Swapnesh Taterh
Editor-in-Chief
Date: Feb, 2019

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The Traditional Fishing in Parana Coast- Brazil, Implications, potentialities and Socioeconomics Aspects

Adilson Anacleto[1], Mariane Neves França[2], Karoline de Assunção Gomes[2], Marcos Paulo Marcondes Junior[2], Vinicius Vieira Surian[2]

[1]Administration Department, Associate Professor, Paranaguá Campus/Professor from the Interdisciplinary Postgraduate Program - Society and Development – PPGSeD, Campo Mourão Campus, State University of Paraná, Paraná, Brazil.
Correspondence Author: e-mail: Adilson.anacleto@unespar.edu.br
[2]Administration Department, Scientific Initiation Researcher, State University of Paraná, Paranaguá, Paraná, Brazil.

Abstract*—Paraná, a South Brazilian state, has a spectacular coast with coves, bays and islands. From the state coast, 90 kilometers are bathed by the Atlantic Ocean and along the coast, 60 communities with a population of 4256 fishermen practice a traditional fishing activity in the bays and open sea. Canoe is the most used boat in this small-scale trade. The question that aimed the research was the importance of the canoe fishing activity by the fishermen perception, then trace an elaborated understanding view about the social and economic effects and finally observe the potential development of the activity in the region and the management and helpful actions by the fishing associations. An exploratory and descriptive field research were conducted by Interviews specially targeted to 30 canoe fisherworkers from Paraná coast cities between July and October 2018 for the study.The research exposed that male fisherworkers are in the 44 age group and still use low technology in the fishing activity. The main potential observed was the good quality of the fish that are sold fresh without being frozed to be sold, the possibility of a production improvement and the exploit and development of an active participation from the female local labour helping. Sale instability, low price out of the summer season and lack of organization by the fisherworkers class and fishing local association were the negative aspects observed. Micro management and micro industrialization could be the solution for the excess of winter production in relation to low production in the summer season, when occurs massive consumers presence. Collective organization could result in a strenghthening trade and bargain involved in the fishing Paraná coast activity.*

***Keywords*— caiçara culture, fish, seafood, micron industry, small-scale trade transformation.**

I. INTRODUCTION

Fishing is probably one of the oldest activities practiced by the humankind. At the beginning it was a non-profit activity, the activity aim was the group subsistence and the production was to own consumption. However, along the years, beyond the subsistence exploration, it was observed a chance of a beginning trading as well as a wealth generation through it. In the context it is worth noting an excellent proeminence due the marine fishing. (Clauzet et al., 2005; Fields et al., 2017).

Fishing, in accordance with the Brazilian Ministry of Fisheries (2018), can be considered the extration, removal, capture and caught of fish, crustaceans, clams and aquatic plants from their natural marine ecosystem, for purposes such as: nutrition, recreation and trade.

According to FAO (2010), there are about 39 million fish workers in the whole world, and 156 million people who depend indirectly on fisheries. In Brazil, the Ministry of Fisheries (2018), certifies the existence of 1,084 million fish workers, that corresponds to an annual production of 765 thousand tons of fish.

About 7,4 thousand Kilometers of Brazilian coast is bathed by the Atlantic Ocean, 1.3% of them belong to the State mentioned before. Paraná coast has 90 kilometers of coast, and with the addition of Guaraqueçaba, Paranaguá and Guaratuba bays, it has more than 400 kilometers of coves or bays. In these areas, approximately 60 communities, with a population of approximately 4.256 traditonal fish workers who practice activity in the bays and open sea (Hiss et al., 2007).

Marine fishing in the coast of Paraná can be divided in two kinds of fishing activity based on the type of boat used by the fisherworkers. Industrial fishing and non-industrial traditional fishing. Industrial fishing is characterized for being a professional activity, with more technological resources giving favorable conditions to

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the activity as the engine power, places with bigger capacity of fish conservation and the possibility of sailing for more than 15 days (Silva et al., 2007: Fields et al., 2017).

Non-industrial traditional fishing according to Clauzet et al., (2005), in turn, is that one practiced by fishing the aquatic species, working alone or using familiar labour force or not wage-earning workmanship and exploring surrounding ecological sea next to the coast using boats and equipment with little autonomy.

Non-industrial traditional fishing, basically uses small boats with low engine power, fishing in a reduced area next to the coast, and between the small boat kinds, canoes are the most used in Paraná coast.

The canoes, according to Chaves and Robert, (2003), is traditionally wooden, made from 6 to 10 length meters with engine of center with the 24 force of 11 hp, being constructed from excavated only log (wooden trunk), with deep keel, in form of V. There are also the fibre glass canoes from 8 to 9 hp. In the last few decades, Paraná coast has presented a strong reduction of the fishing capacity, according to Silva (2010); one of the main reasons for this fact is the irrational use of the natural resources, with the capture of fish by great boats from other regions and the lack of effective monitoring of fish stocks.

The reduction in the fishing production, according to Lucena et al. (2017), also provoked in the last decades, a reduction of the fish workers number. According to Silva et al. (2007), the importance of this activity for Paraná coast cities, demonstrated an urgency to understand the real reasons to the fact studied, and few studies with a reasonable explanation, have been found by the fish workers perception.

In this context, this study aimed to elaborate an actual and real perception by the traditional canoe fish worker, giving an overview of the canoe use in the coast, as well as its social economic implications and potential effects in the region context.

II. MATERIAL AND METHOD

An exploratory and descriptive research was applied between July and October 2018, by interviews directed to 30 canoe fisherworkers, native coast inhabitants in Pontal do Paraná, Matinhos, Guaratuba and Paranaguá.

Aiming to verify the fish workers perception on the implications and the potential effects of the fishing activity with canoe, questionnaires surveys to the fish workers had been applied to those ones who had agreed to answer the field research, in search of fish workers view on the implications and potentialities of the fishing activity in the region, through qualitative boarding, which at the beginning had an individual point of view.

After the previous phase, five fish workers, with recognized strong leadership and knowledge in the fishing art, similarly to considered for Fields et al (2017), was organized a matrix of crossed impact, following the proposals of Anacleto et al. (2018), that describes the matrix as being the crossing of the implications between itself, and later of the chances between itself. The matrix uses percentile values from 0 to 100 to each opinion displayed for collective form interviews in relation to expressed opinions, comparing each item analyzed in the relation to administered influence and and suffered influence in traditional canoe fishing, the bigger is the index, the greater is the relevance and attention for the solution to the problem suffered or the chances to development.

The impact matrix generates a relevant index (importance for the development) that can be gotten by the equation:

$$IR = \frac{FA \times FB \times 100}{\sum SF}$$

IR= Relevance Index of the evaluated situation;
FA = Influence received indexes;
FB = Influence suffered indexes;
∑SF= Indexes sum (FA x FB) of all the issues analyzed.

Also according to Anacleto et al. (2018), after the end of the primary data collection, was adopted an interpretative and descryptive analyses about the obtained contents from interviews, carried out by means of the technique of triangulation between the observation and the similar commentaries and answers obtained from fish workers who are used to the traditional canoe fishing.

III. RESULTS AND DISCUSSION

Non-industrialized traditional fishing activity has diverse types of boats, one of them is identified in the present study: canoe. Canoe fishing is characterized by the fishing system called for the fish workers of this modality, as from dawn to dusk, that means that the fishworker leaves with the first rays of the sunrise, throw his capture net on the sea coast and at the end of the day when is the sunset period, collects the nets and returns to his residence, or throw his nets at dusk and collects them on the following day.

The canoes, according to Keys and Robert (2003), when used to fish shrimp, use trawl nets with timber planks (or wooden doors, when bigger and made by leaked boards); meshes vary from 1 to 6 cm between opposite knots; pulled for the poop or the boat side, always from the back. Still according to authors, when for capture of fish these types of boats use driftnets; meshes vary from 5 to 40 cm between opposite knots, operating by some particular

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forms: "caceio", when the net is thrown ina way that forms a jind of cage, of surface or deep; a variation of caceio of deep is the snail caceio fishing, when the net is forced in half-circumference through one of net edges is attached to the boat; and the other edge touchs the deep seafloor forced to the bottom by iron buoys. The fact is that in the cases of dawn to dusk fishing or dusk to dawn fishing, fresh fish is offered to consumers.

This model of fishing is the most traditional in Paraná coast, being characterized by men developing the activities in the sea, and on land women clean, store and sell the production. (Silva et al., 2007; Fields et al., 2017).

The castnet use was also observed in Guaratuba, Paranaguá and Antonina bays, according to Clauzet et al., (2005), Cast net use, in Portuguese language called tarrafa, is possible to have same or better performance in fish capture in environments of low depth, as well as in the capture of shrimps, that are sold to sport fishers, who use shrimp as bait.

Local canoe fishing communities in the south coast of Paraná, have as main characteristic, the simple technology with which also exerts its work and for the high cost of the materials that they use for fish capture. Work force comes on its majority for familiar force. The dedicated time to the fishing activity is from 3 to 10 daily hours, 6 or 7 days a week, it was evident that this period depends on the climatic conditions that need to be favorable for the security.

The average of the interviewed ones was 44-year-old males, similarly to the reported ones for other regions, the activities shared between the men fishing, and the women cleaning, taking care of the conservation and selling the production.

The study showed that the majority of the involved people with canoe fishing was married (n=68%), and that only 50% of the interviewed ones attended High School.

Questioned about their participation in any specific fishing course all the fish workers that accepted to participate in this study answered in a negative way, no one partipated of any type of fishing course, neither for the practical of the canoefishing nor conservation and commercial usage transformation of the production.

The totality of the interviewed ones had told that they had learned the profession by oral way and, being the knowledge gotten day by day in an empirical form, passed from father to son or learned with neighbors and other relatives practicing the activity. The fisheries have origin in the extrativism, which in some periods of the year create conflicts between fishermen and the ambiental and governmental agencies of defense and protection of the environment due disagreement with the closed period season, and with low fiscalization when great boats promote shrimp fishing near the coast, fact that reduces fisheries offer in the coast region (Table 1).

Table.1: Implications in the traditional canoe fish workers perception in Paraná coast.

	Implications	IR
1	Sale instability	24,99
2	Low price off summer season	21,12
3	Low class organization capacity	14,76
4	Unaivaiability of specific credit lines to fish workers	14,76
5	Lack of capital for buying products and equipment	11,06
6	Products with origin in the nature collection	3,92
7	Concurrence with well-structured fish workers	3,47
8	Lack of public and governmental incentives	2,18
9	Climatic instability	2,17
10	Precarious conditions work	1,57

That way, the reduction of fisheries offer, must promote a new conscience from the canoe fishing class, needs to be considered. Clauzet et al., (2005), highlights that a new conception of conservation of the biological diversity, must be perceived in these fishing communities that beyond the preservation of the biological resources, the conservation of the cultural diversity of the local fishing populations also should be included, remembering that the fishing local communities keep direct contact with natural environment, have great knowledge of history, environment and of the use of the natural resources in the region where they live.

According Andreolli and Silva (2008), theory knowledge establishes connection to practical knowledge that the traditional fish workers have about behavior, reproduction, cycles and habits fisheries have, these knowledge should be adapted to the new socio and environmental problems, without dismiss the culture, the tradition and all the knowledge repassed in centuries in an oral way from father to son. In this context, it urges that new proposals of traditional fishing are considered as form to develop the income of these families, preventing the dropout of the activity, and giving other alternatives as the seafood collection others than shrimp and fish (shellfish, sururu, oysters and siris), as well as the possibility of marine animals cultivation must be considered. Canoes, different from other boats, have permission to sail in some environments according to Federal Law 9,537/97,: the marine waters within and beyond the coast are the bays, coves and rivers of the coast, known by being sheltered waters of bad weather,

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where storms don't influence the production, in these waters an increase of fish capture and the seafood collection as oysters, shellfishes and siris happen. The coast areas are those that will be possible to see the coast from the sea, limited to a maximum of 20 nautical miles (about 37 km). The canoes in question sail in these two areas in such a way, exploring the capture of fish and shrimps in opened sea, as the capture of fish, oysters and shellfishes in the bays.

In accordance with the totality fish workers interviewed, the most propitious fishing period of the year is the winter, when the massive tourists presence is not observed, and some species of fish prefer cold waters to mate fact that majes easier the capture. On the other hand, according to fish workers, the months from December to February, is the best trade period, when they can sell their production to the tourists. So, fishing activity suffers a dilemma, in the period they can have a great procuction, they don't have consumers to trade it. And when tourists arrive in the summer season, the production decreases.

The interviewed canoe fish workers did not have any other kind of income that was not related to fishing, being tthe average income of the involved families with fishing, presented variation, in special due the summer season, between USD 409,83 until USD 573,77 monthly. As Fields et al (2017) urges that the scene of any activity be evaluated, so that if knowing the implications to the development and presented chances to have a successful activity in the future.

The Opportunities (Table 2) can be in accordance with the attractiveness and probability of success of a corporation project, also to the small-scale traditional canoe fishing in Paraná coast. According to Silva et al. (2007), the probability of success of a corporation project does not depend only on the force of its business, of the basic requirements occurred in a market-target, but of its abilities to outperform their rivals and their capacity of changing the scene where they are involved.

Table 2. Table 1. Implications in the traditional canoe fish workers perception in Paraná coast.

	Opportunities	**IR**
1	Quality due the fresh product	19,11
2	Processing the production to summer season	16,41
3	Active participation from female labour	14,22
4	Summer increasing trade	12,71
5	Products with quality and nutritional value	10,26
6	Important alternative as familiar income	10,26
7	Familiar work force	5,49
8	Flexible work hours	4,46
9	Proximity to large consumer centres	3,54
10	Knowledge of the activity	3,54

The corporation, independent of the scale that presents a better performance as Kotler (1998) will be that one that will be able to generate the better value to consumers and to support his value throughout the time, conferring to the product or service values that exceed the simple monetary value.

In this context, the set of the described chances in the perception of the canoe fish workers (Table 1; Table 2), shows a widely favorable scene, where the product quality is had as main positive question in the scene where these fish workers are immersed.

Other factors contribute, and chances have encouraging view, as exploit and development of an active participation from the female local labour helping, in general context.

These aspects with the good capacity of capture in winter period and the massive presence of consumers in the summer (Table 2) definitively show a positive scene, however dependent on internal and external actions of the families involved.

Although the set chances show a favorable scene, must be considered the set of the weak aspects that generate serious implications to the capacity of development of a productive sector.

The implications are the factors that can decrease or mitigate the potentialities, implications not observed many times by the involved ones. According to Silva et al. (2007), implications can be characterized as a recurrent challenge of a trend or favorable development to the corporation that can contribute directly for the deterioration of the production, of sales and consequent it promotes reduction of the profits.

A factor that deserves a more careful analysis, given that it can be associated innumerable to the other implications, is low the capacity of collective organization, that refers to the organization in fishing associations. The organization of a class on the basis of the interpersonal relations can result in improvement of the conditions of the traditional canoe fishing community. According part of the interviewed ones (n=25%) there are two associations that would have to act as fishing class representatives, but that they remain inoperative for low participation of the class.

Low efficiency of these institutions,plus the little participation of the fish workers, results in a scene where the problems of the class, that should receive better negotiations, do not occur, resulting that the precarious conditions of the work tools, lack of hygienic cleaning of

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the canoes and difficulties to get better conditions and technological equipment reduce the quality of the given service, and raise the costs of the fish workers, resulting a cycle of difficulties where the fish workers have a decrease in the familiar income for not having investment conditions to technology and for not to investing in new and more modern fishing technologies, finish for having the income below of the ideal.

The trade system adopted for the fish workers also deserves a deepest analysis, a great important data to the final profit results.

Fishing in Paraná coast demonstrates certain passivity in the commercial question, and are at the mercy of of the migratory flow of tourist to present a better profit scene, although fish workers have an excess of production in the winter period, few fish workers use the expedient of the small-scale industry, that is in evidence in the current times.

The processing of the production in excess, from the winter period, could be an income source in the summer season, when the customers are in great amount, and the region presents a lack of fisheries.

The traditional fishing transition to a small scale processing is possible, as cambira (cured and dry fish), fish hamburger, fish sausage, and frozen and packed fish fillets. This practical set does not demand great investments and could be adopted by significant number of traditional fish workers.

Silva et al. (2007) reinforce the question saying that to manage properties or small businesses as fishing, we must consider the professionalization and planning, investing part of the profit gotten in the season periods in structure to conserve the production gotten in the period of winter. Still according to Silva et al. (2007), this process is necessary due the constant environmental changes, demanding more attention on the part of the managers of these corporations. To organize, to plan, to direct and to control are necessary so that the company or property can be always in perfect and efficient production,and present quality products to satisfy the necessities of the consumers. A continuous monitoring is also necessary if divergences occur, being detected as soon as possible for correction and preventing future problems.

Thus, an alternative of changing the current scene in the canoe fishing, would be the careful and gradual adoption by the traditional canoe fish workers of a new model of corporation, using a model of described enterprising behavior as the beginning of the continuous professional development, in the case of the production, thus according Nakagawa (1991) the fish workers must always look for the fisheries quality, processing fisheries in long lasting products with the use of the micro industrialization, and also in what refers to the services of attendance the consumer, the viable alternative is that to each year the canoe fisherworkers insert a change of industrial behavior in relation to winter production excess.

Examples of change in relation to the entrepreneurship and the product maximization are described in other areas of the agrobusiness, according to Curvelo et al. (2016), the banana candies, and vegetables also have great offer of production in the winter, and into the proper properties they are transformed in small-scale, adding value and giving longevity to the production that would be lost if this process was not adopted. According to Fields et al. (2017), this process is long and can last one decade, but it is necessary it initiates. It is observed that many times the community for itself does not organize itself for the change of the scene, in this case the support of the governmental institutions could promote the process, modifying the chain of operations that involve since the fisheries manufacturing, the transformation (micron industrialization), distribution and commercialization, arriving until the final consuming.

The success of this considered model can be tied to the fish workers interaction degree, and the capacity of communication with the different segments of the productive chain, the collective form, reduces the risks and uncertainties, in this context the fishing canoe class capacity can result in greater bargaining power in the processes of negotiation with the universities, asking for extension free management courses, as well ass asking for fishing fairs and special fishing local trade to coast city halls, to the agency of defense of environment they could receive guidelines about aquatic period reproduction, and in special solidary access endorsement with financial agencies, to equipment achievement as well as, necessary equipment to industrialization.

IV. CONCLUSION

The study showed, in a general context, that the canoe fish workers from Paraná south coast, are in average 44 years old, all of them male.

The fishing canoe system in the coast of Paraná is characterized by the use of low technology for the exercise of the profession, having been the fishing capture observed, as well as the cleaning of the production and the trade made exclusively for the family, being that the totality of the interviewed ones had in traditional canoe fishing the only source of income.

The main potentialities observed in the perception of the interviewed ones were the good quality of fisheries, the possibility to promote the improvement of the production for the commerce in the summer and the valuation of feminine workmanship. The main observed implications had been the sale instability, fisheries low price outof the

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summer season and the low capacity of the class organization in the search for the resolution of the collective problems.

The micro industrialization can be the solution for the excess of production in the winter in relation to low production in the summer, when exactly occurs great presence of consumers.

Apparently, the limit factors and the implications of the activity could be mitigated by the strenghtening capacity of collective organization that could result in greater ability of negotiation next to other involved social factors in the fishing activity with canoes in Paraná coast.

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Cloud-based RFID access control using lightweight messaging protocol

Pedro Hericson Machado Araújo[1], Sandro César Silveira Jucá[1], Diego Lima Carvalho Gonçalves[1], Vinícius Ferreira da Silva[1], Renata Imaculada Soares Pereira[2], Solonildo Almeida da Silva[3]

[1] Computing Department, Federal Institute of Ceará (IFCE), Brazil
E-mail: hericson.araujo@ppgcc.ifce.edu.br, sandrojuca@ifce.edu.br, zyhazz@gmail.com, viniciusdasilva.ti@gmail.com
[2] Electrical Engineering Department, Federal University of Paraíba (UFPB), Brazil
E-mail: renata@dee.ufc.br
[3] Pedagogical Department, Federal Institute of Ceará (IFCE), Brazil
E-mail: solonildo@ifce.edu.br

***Abstract*—** *This article describes the development of an access control with online monitoring based on radio frequency identification (RFID) technology. Access time and date together with user tag code are sent to an online database. The entire process of identification and registration is done by a PIC microcontroller and an embedded Linux system (Raspberry Pi), that by having communication with the Internet updates a database table with the access information. The table with the data can be accessed from any computational device Internet connected. For improving the system, we implement a new version using only the Internet of Things (IoT) module ESP8266 that has a low cost and various peripherals. All information about tag actions is displayed for the user on an LCD display and each action is signaled by a specific beep.*

Keywords*— *Internet of Things; Radio Frequency Identification; Monitoring.

I. INTRODUCTION

The search for profitability, through the rationalization of processes, influences companies to know new technologies and methods of improvement. Radio Frequency Identification (RFID) "is one of those rare technologies that 'change the world', which will force a reconsideration of many strategies in the value chain" [1].

The concept of radio frequency identification that has recently been used for various industrial applications [2] has received a great deal of attention from researchers [3] and is gaining more and more space in the world, growing exponentially in recent years. RFID labels have a low cost and can be placed on goods, vehicles or any object that needs to be monitored [4].

Based on this principle, a people monitoring project was developed based on radiofrequency technology, where each user has an identification tag that can be registered in the system so that monitoring can be performed.

When registered tag is identified, the information is automatically sent to a local and an online database, together with date, time and the tag code, so that you can keep track of the time of entry and exit of each user.

II. BIBLIOGRAPHIC REVIEW

Currently being connected to the Internet is much more than simple connectivity and messaging. The biggest network in the world is open and people are constantly adding things to it and it is only natural that they want things to interact in a slightly automatic way [5].

Internet of things (IoT) is much more than just connecting light bulbs through the smartphone. It is not just connecting "things" over the Internet, but also making them smart, capable of collecting and processing information from the environment or the networks to which they are connected. The Internet implementation of things is totally changing the way we relate to the things that are around us, transforming security, energy, environment, traffic, mobility and logistics.

The first technology associated with the IoT concept is known as RFID (Radio Frequency Identification). RFID is a device that sends, by radio frequency, a unique identification. Today it is used in badges, vehicles and products in supermarkets, replacing other types of identification, such as the bar code. It is a technology that emerged in 1940, with the electronic communication devices (transponders) used in the planes of World War II, with the function of identifying other airplanes around. Its purpose is to transmit a code identifier by a radio frequency channel that can be associated with an object [6].

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Radio frequency identification (RFID) has been widely discussed in recent years in business, academia and the media. Several companies have been developing RFID initiatives to identify the possible applications of this technology and to map the benefits derived from its use.

Today, the Internet is an expression in the media for presenting a twist in the environments, transforming them into intelligent environments by bringing together a network of forward components, such as software and sensors, that collect and exchange data between themselves and with the user.

For its operation, the elements are identification technologies for objects, such as the already mentioned RFID and two-dimensional codes (QR code, a bar code that can make the same settings, which are then directed to websites, videos, in addition to using sensors to get information on how objects are.

They are also important: a performance of objects connected to the transmission of data in a safe way; cloud computing, and other intelligent computing, data processing and analytics technologies [7].

IoT adds the power of connecting anything to the Internet and communicating with everything. According to [8], the term "is defined as the extension of the Internet in the physical world, making possible the interaction with objects and the autonomous communication between objects". When thinking about its operation in practice, its resources extrapolate the use through physical devices, such as cars, clocks and smart TVs, being present in the most diverse services, as in banks, with technologies that facilitate purchases by approaching one cell phone. The power of connecting the real and the virtual, making static objects dynamic, incorporates intelligence into the environments of our conviviality.

According to [6], the presence of this phenomenon daily becomes frequent due to several technical factors: the RFID sensors and systems are more accessible; wireless networks are expanded; there is a wide variety of data analysis platforms with different characteristics; the evolution of sensors; the storage of information in the cloud and increasingly faster data analysis algorithms.

This [9] aims to find good logistics and management practices for the electricity generation authority. In the survey was used RFID placed on lignite coal trucks where the RFID data passes through a server and is stored in a private cloud. To perform the research, we used an RFID reader, passive UHF RFID tags, an Arduino Mega 2560 with Ethernet shield, PHP, Node.js, Jason, and for the Database system was used the Maria DB, and the protocol used was MQTT. The System is designed to operate 24 hours a day and 7 days a week.

In another paper, proposed by [10] a system of automatic detection of vehicle registration is proposed, where RFID tags are used to identify vehicles with MQTT protocol for the transfer of data from one system to another. The System is divided into two parts being transmitter and receiver, where an RFID tag is placed on the vehicle and there is a checkpoint for the reader, while the fingerprint module is placed on the vehicle where it is used to verify the authenticated data.

In another project, proposed by [11] an adjustable RFID Security System is created using IoT modules and sensors. The system basically consists of the security of devices equipped with RFID tags where through a smartphone the user can write the information of the device in the RFID tag and the computer of the module of the sensor that is directly connected to the tag can also read the information and use it, as an MQTT topic.

In the work proposed by [12] a System is created thinking about the problem of baggage loss at airports, where the System consist of the use of RFID tags. These tags are placed in the suitcases of passengers where each tag has passenger information and this informations can be accessed at a distance using the IoT principle.

In the work proposed by [13] an IoT system is made for monitoring, data acquisition and remote monitoring of cloud-based sensors. It is a very versatile system because it allows the addition of more sensors only making some small changes in the source code which is available for modifications. The System also has an alternative storage option, in which when the system is offline it avoids the loss of information. The user can query the data storage in a graphical way and the system still provides several search modes to facilitate and provide greater precision for the sensor monitoring.

In another work [14] a system for data acquisition using the concepts of IoT is developed. The system monitors the environment by means of sensors where a photovoltaic solar module is located. From the monitoring, generated voltage, ambient temperature and incident data are collected for a cloud server through the MQTT protocol.

In [15] a low-cost retro gaming system using a Linux Raspberry Pi system was developed. The system can be easily configured by beginners in the area of computing and electronics, as well as used for didactic tool. The system also has an ESP8266 module to count the coins inserted in the arcade and the data is stored in a database, constituting the principle of IoT.

In [16] a system for controlling students in a school was proposed. The system consists of using RFID technology together with the Linux system based on Raspberry Pi + where the system proposal is to have a greater frequency control of the students generating monthly reports of the students frequency. Each student has a tag in which this tag contains the information about it.

In [17] it was proposed a system to control the flow of people in a school environment using RFID. The basic

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idea of the system is radiofrequency identification technology, highlighting the development of a people flow control application that demonstrates the feasibility of an RFID system and explains how this technology can be inserted simply in institutions. In order to prove and exemplify the potential use of this technology, an experiment was conducted managing the entry and exit registration of students in a school environment.

In the work proposed by [18] a Raspberry Pi was used, a tagged RFID reader containing the tag identifications for the monitoring of swimming activities. The work consisted of designing a prototype to track swimming practice using RFID technology and the Raspberry Pi to process swimmer training information. A functional test was performed to verify the behavior of the use of these technologies in the swimming activity in a swimming pool. With the tests performed it was observed with the results, to be an efficient way of monitoring swim training, since it does not need to be a present person to record the time values of each lap, providing in an automated way the calculation of time of each lap. In addition, to obtain a complete analysis with the values of average speed, number of laps, average time and distance covered in the training.

In the proposed work, a system was developed for the online monitoring and control of people using RFID technology where they send information to an online database containing information such as the tag number and the date of registration. The table with the data can be accessed from any place because of the creation of a web site for such a query, the whole process of identification is done by a Linux embedded system based on Raspberry Pi where it has access to the Internet and updates a bank table with the information sent online and compared to ESP8266. All information about tag actions is displayed on an LCD display.

In Table 1 we show a summary of the works previously mentioned aiming at comparing with the proposed project.

Table.1: Comparative table of the projects cited.

Reference	Microcontroller	Protocol	RFID	Application
[9]	Arduino Mega 2560	MQTT	Yes	Solve the problem of coal mine logistics management Power Generation Lignite Authority of Thailand (EGAT) Mae Mao, Lampang.
[10]	Arduino UNO	MQTT	Yes	Vehicle plate detection using RFID and the MQTT protocol.
[11]	Not used	MQTT	Yes	Adjustable security system for RFID devices connected to the Internet for industrial environments.
[12]	Not used	Not used	Yes	Airport baggage screening system.
[13]	Raspberry Pi, PIC 18F2550	Not used	No	Versatile things Internet system for cloud-based sensor monitoring.
[14]	ESP8266	MQTT	No	The system monitors the environment in which a photovoltaic solar power module is located and sends the generated voltage data, ambient temperature and incident light to a server through the cloud
[15]	Raspberry Pi B +, ESP8266	Not used	No	Creating a retro game using Raspberry Pi.
[16]	Raspberry Pi B +	Not used	Yes	Frequency monitoring and verification of students in a school by using RFID technology
[17]	Not used	Not used	Yes	Flow control of people.
[18]	Raspberry Pi	Not used	Yes	Monitoring Swimming Activities.
Proposed Project	ESP 8266, Raspberry Pi B +	MQTT	Yes	Monitoring and authentication of people.

III. DESCRIPTION OF THE FIRST STAGE COMPONENTS

In this topic the components and embedded systems used for the development of the first stage are described.

Through the SanUSB development system, which is a tool composed of basic software and hardware of the PIC18Fxx5x family with USB interface, it was possible to carry out the project. The applied version uses PIC18F2550. This tool allows the compilation, burning and emulation of a program quickly and efficiently from the moment the microcontroller is connected directly to a computer via USB [19]. There are many projects that use

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SanUSB tool microcontroller board (Figure 1) as can be observed in [20].

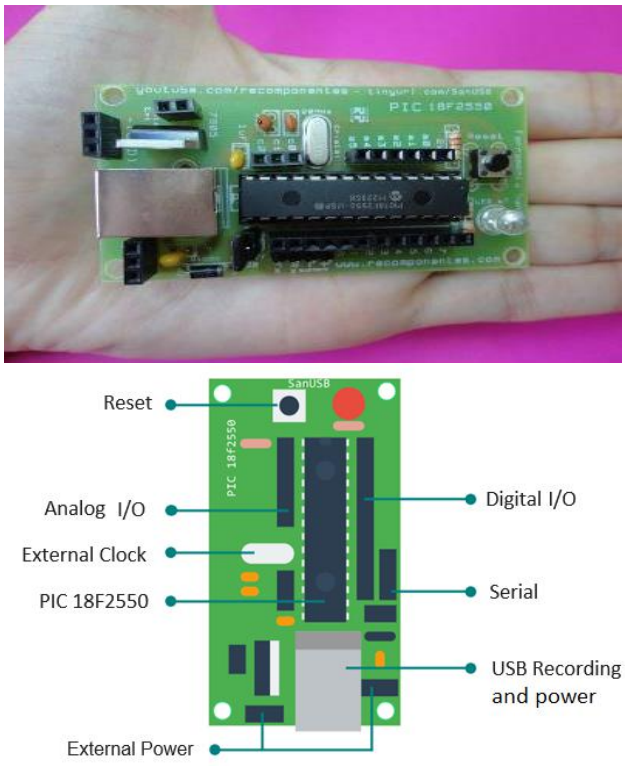

Fig.1: SanUSB tool (PIC18F2550).

The Linux embedded system based on Raspberry Pi also called RPI is a minicomputer created by the Raspberry Pi Foundation for the purpose of applying it in the area of education and for scientific initiation in computer science. RPI is suitable for systems because it is cheaper than an entire network of closed-circuit cameras and a computer system to run them. It is small enough to be installed in a location for monitoring and because it is also connected to a home network, which can alert you when something is wrong [21].

This device has reduced hardware and software factors, greater flexibility and lower cost compared to a personal computer. It is small, inexpensive, educational, and it is a mistake to describe it as only a plug-and-play device, since it is not considered a consumer device [22].

In relation to the connection to the Internet, it can be in two ways: wired network, because it has a standard Ethernet RJ45 port; or, over WiFi with an external USB dongle. The HDMI port provides digital audio and video output, making the system appear on any monitor it is connected to.

The General-Purpose Input/Output (GPIO) pins are the programmable ports of the Raspberry Pi and responsible for communicating incoming and outgoing digital signals. Pins are a physical interface between RPI and developers. Even offering a wide range of possibilities that allow the development of projects, the device does not use the digital logic system (TTL), with logic level 5V. Since the RPI has its own 3.3V logic system and does not have this protection system, improper handling by applying higher voltage to the doors can damage it, such as burning the board or a short circuit in one of the pins [23].

IV. DEVELOPMENT

In the following subtopics we have the description of the stages for the development of the project.

4.1 Tag Archives RFID System Operation

The basic idea of radio frequency identification technology is to use a static electromagnetic inductor reader and a mobile microchip with antenna, which can operate in both the order of KHz and MHz. This mobile microchip consists of a transponder or tag that does not need of the power supply, since the signal that excites it comes directly from a reader-inductor circuit that can also be used for recording. Upon being excited, the mobile circuit is powered by sending or receiving data that is recorded [24].

One of the working principles of RFID technology is electromagnetic radiation, which is defined as being waves of electrical and magnetic energy that are radiated together through space and, by radiation, the propagation of energy through space in the form of waves or particle [25].

A small part of the emitter field interacts with the transponder antenna coil, which is a certain distance from the reader coil. By magnetic induction, a voltage is generated on the transponder antenna coil. This voltage is rectified and serves as the power supply for the microchip. A capacitor is connected in parallel to the reader's antenna coil. The capacitance is selected so as to match the inductance of the antenna coil to form a parallel resonant circuit, i.e. to obtain a resonant frequency corresponding to the frequency of the reader transmission, the illustration is shown in Figure 2.

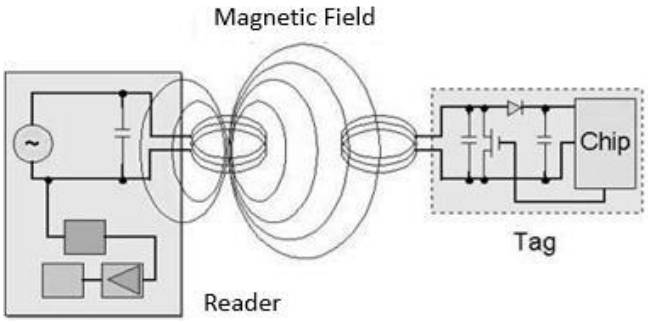

Fig.2: Principle of inductive coupling [26].

The RFID tag has 14 bytes of data, this way the first byte 02H to determine the beginning of the tag, the next 10 bytes referring to the characters of the ASCII table are referring to the identity of the tag and are unique, then the

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checksum which is the checksum of all 10 bytes of data and finally the byte containing 03H to determine the end of reading of the RFID tag as indicated in the datasheet and shown in Figure 3.

TTL Interface RS232 Data output format

1. 9600bps,N,8,1
2. CHECKSUM: card 10byte DATA entire do XOR operation

02	10ASCII Data Characters	Checksum	03

Example: card number: 62E3086CED
Output data:36H、32H、45H、33H、30H、38H、36H、43H、45H、44H

CHECKSUM: (62H) XOR (E3H) XOR (08H) XOR (6CH) XOR (EDH)=08H

Fig.3: Data Format [27].

4.2 Circuit Operation

The hardware is divided into two parts, the RPI is responsible for reading the RFID tag serially and activating components such as relay, LED and buzzer. The 18F2550 microcontroller is responsible for the LCD display, where messages are displayed according to information received from Raspberry Pi. Communication is done through the serial port with a transfer rate of 9600 bps.

Using the Raspbian operating system it is possible to perform audio with synthesized voices indicating each action of the system as: 'Tag not registered', 'Tag recognized', for greater assimilation of the actions that is happening.

The system is divided into parts. Serial reception and tag filtering are in a specific task for this use. The online posting of the data is in an infinite loop, in this way, the processes of identification and posting are independent, making the system work more smoothly, since it is not necessary to wait for the post to recognize a new tag.

With the use of multitasking programming it was possible to recognize numerous tags quickly. There is an infinite loop responsible for posting without interfering with reading. This approach was relevant to the best practical operation of the system.

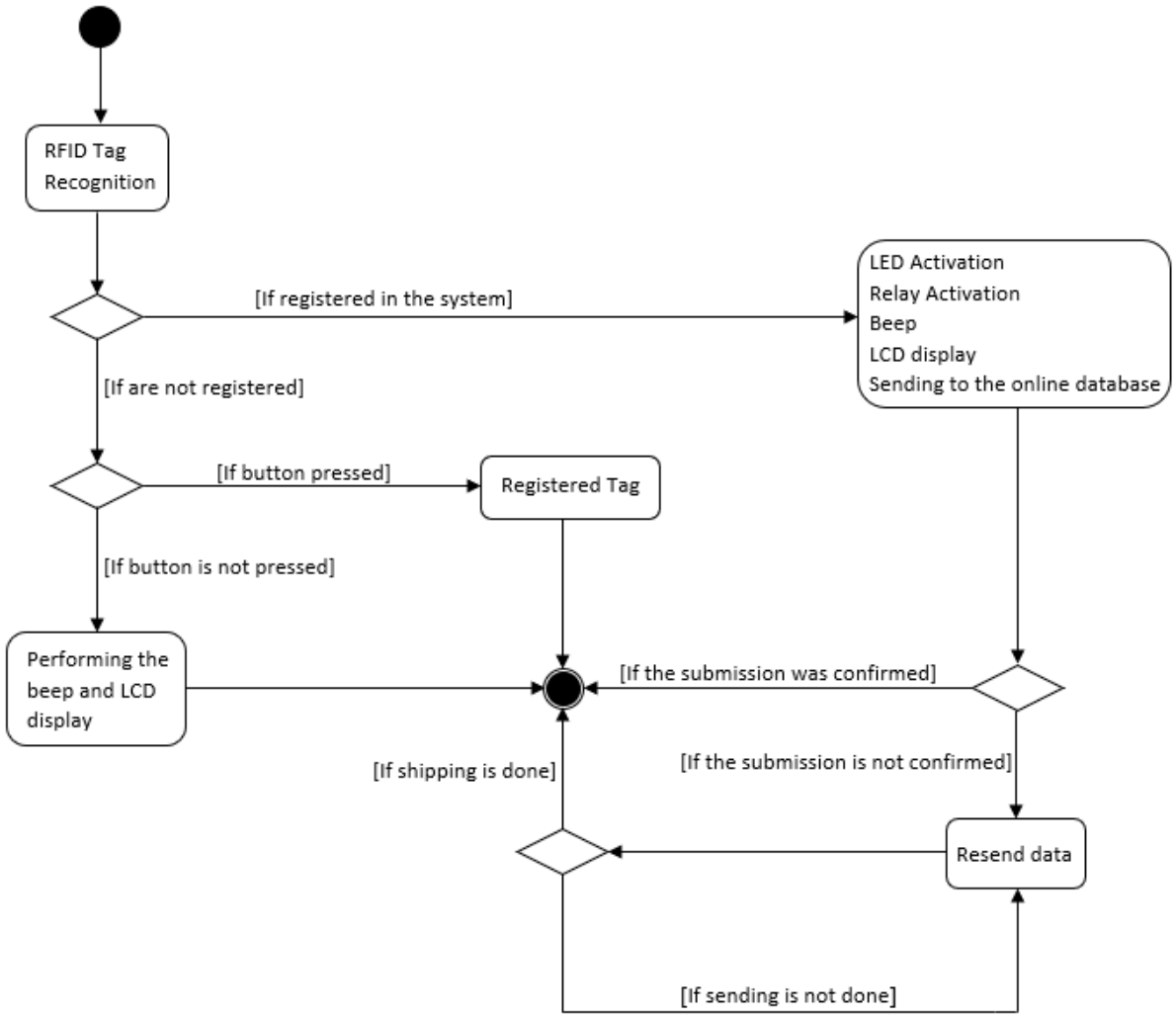

Fig.4: Identification Process Flowchart.

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Initially, the RPI receives 14 bytes referring to the tag by the serial input, from the information, options can be executed as described in the topics below.

For the registration to take place, the tag must not be previously registered, and the record button must be pressed. Upon receiving the tag data, the system compares with the data already registered. If the comparison returns true, the registration cannot be performed, and a beep will be given, informing the event. If it returns false, the registration is performed and automatically the number corresponding to the new tag will be created, followed by actions such as activating the acknowledgment LED, beep indicating that the tag has been registered and finally a message on the LCD display.

If the recognized tag is not registered in the database, a beep will be sent indicating the event as well as a message on the LCD. If the tag is registered, the LED alternates the illumination according to the tag number, the relay is activated, a beep is emitted indicating that the tag has been successfully recognized together with a message on the LCD display. Finally, the tag number, the date, the time and the name of the user are sent to a database.

If there is a failure to communicate with the online database and it is not possible to send the data correctly, then the systemstores the tag number that was not posted and continues the posting process until it is done correctly, so problem with internet crash, for example, does not disturb the operation of the circuit. The steps of the operation are exemplified in the flow chart available in Figure 4.

4.3 First Stage Results

Raspberry PI B (1), microcontroller, LCD display, RFID reader, buzzer and relay shown in Figure 5 were mounted in a plastic case (2).

Fig.5: Complete System.

Based on the IoT principle, information such as date, time, and user number are automatically sent to the cloud on any server. The application in question used the storage of data initially in Google Drive.

4.4 Second stage: ESP8266 IoT module

The platform used for the development of the project was composed of an ESP8266 microcontroller that contains a 32-bit microprocessor with support for Wi-Fi connection, as well as power and programming ports - 10 digital inputs and one analog [28].

Because it was developed with a focus on mobile devices, wearable electronics and IoT, the ESP8266 has a very low power consumption, ranging from 10uA when in sleep mode and reaching a maximum of 215mA when it is operating at its maximum capacity, being able to operate in three modes: active, sleep and deep sleep.

The operation of the proposed system with the ESP8266 is like that used in Raspberry Pi, the reading and registration of the tag continue following the same reasoning. The reader of this version has a frequency of 13.56 MHz that allows, for example, the reading of student portfolios used in urban transport systems.

The date and time value are required for posting the data, but the ESP8266 module does not have an internal clock for checking this data. Initially the time was obtained from an online server that was requested whenever a tag was recognized. This method showed that since the internet connection is not stable, it takes a long time to recognize the tags. Thus, the solution used was to synchronize the time and date with an Internet NTP server only once a day, and to use interrupt of a software-emulated ESP8266 internal timer to perform the time counting, thus eliminating the need of Internet connection for this purpose, thereby increasing the stability of the embedded system.

In this step, there was also an investigation to solve the problem of scalability, so now the data is stored on a platform called Firebase provided by Google, which is a non-relational database that stores the data in the cloud. Data posted to Firebase is subdivided by user number, followed by the date and time the tag was recognized. It is worth noting that scalability is performed when a new tag is registered, because when inserting a new user, a new structure is automatically created in the database for that user.

To carry out the project was designed and built a hardware composed of components such as: ESP8266, Buzzer, Led, Relay, Transistor BC337 and LCD display. The developed circuit is shown in Figure 6.

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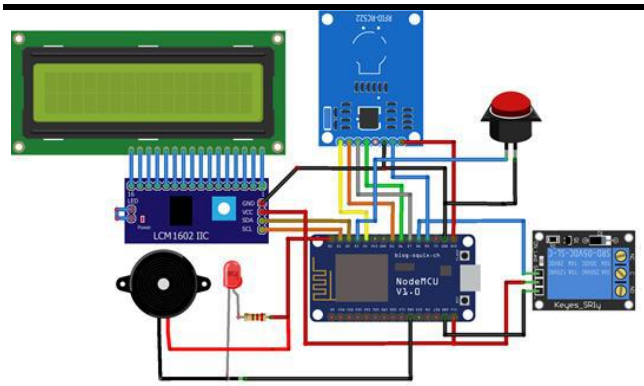

Fig.6: Circuit developed.

In this version, new features were increased due to the needs encountered during the testing period. Figure 7 shows a flowchart that best exemplifies the overall operation of the system.

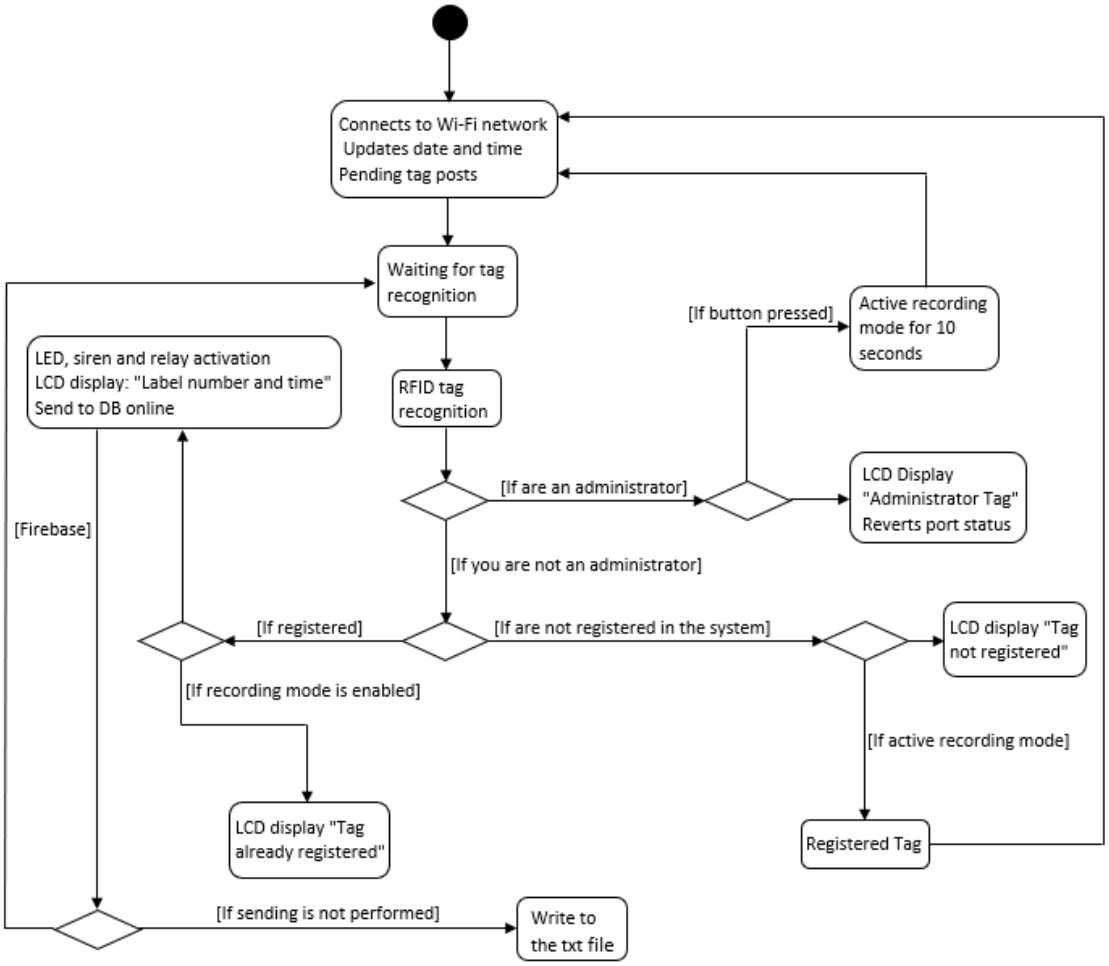

Fig.7: System Flowchart.

The system now has an administrator tag that can perform specific functions, such as: Tagging new tags and releasing or locking the port for a specific period. The tag registration has been modified with a greater security now, a new tag can only be registered when approaching the administrator tag and then pressing the button that is located at the top of the project. In this way, the system releases the register for 10 seconds, period to approximate a new tag to be registered, after this process will create a new structure in the online database Firebase.

One feature was to free the door of the environment for a period of 60 minutes when the system administrator approximates the tag due to the class period, where users who are not registered in the system have access to the environment only by pressing the button in the part of the system. It is noteworthy that in this mode, there is no user registration, there is only the port release for user access.

V. RESULTS

Aiming to minimize the final cost of the actual project, the 32-bit microcontroller ESP8266 was implemented

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replacing the embedded Linux Raspberry Pi B system, reducing around 70% of the final cost, which allows the replication of the project in other environments more economically.

Because RPI is a microcomputer and has a Debian-based operating system (Raspbian), it requires that the developed software be added as a process at system startup, a task that can be performed in different ways due to constant updates of the operating system and requires of periodic modifications, since the microcontroller, because it is dedicated to only one task, does not require configuration.

Tag data is stored in Firebase and is separated by user number, date and time as shown in Figure 8. It was developed a box with metallic material on the sides and acrylic on the front in order to obtain a resistant system encompassing all the components used, as shown in Figure 9.

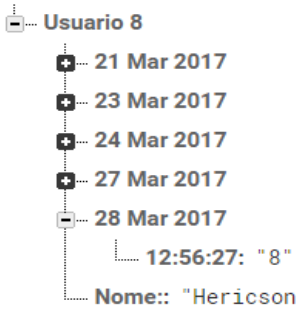

Fig.8: Cloud Data.

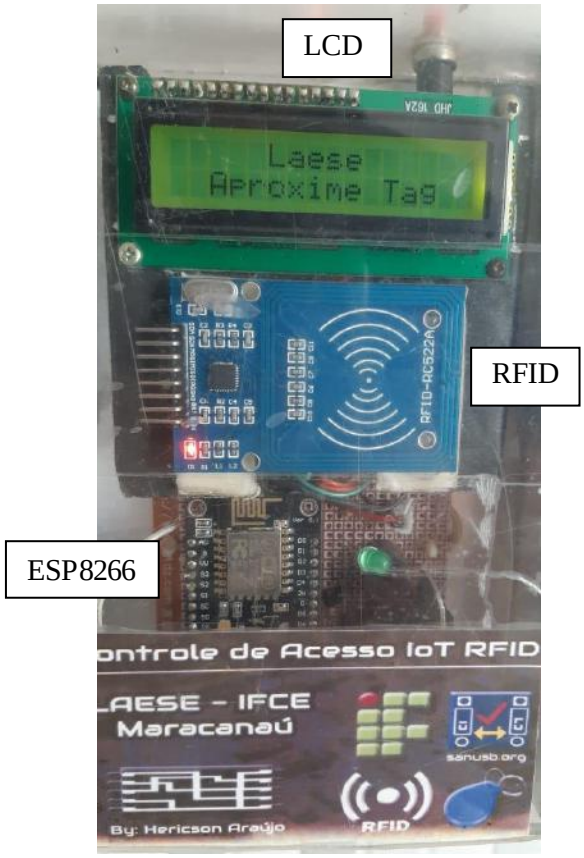

Fig.9: Developed System.

5.1 IoT Platform MQTT interface

In the subtopics below, we have a detail of each part of the site created.

In Figure 10 it is possible to observe the complete functioning of the created system. The figure is divided into sessions to better exemplify the system. In the first session "Client Slave" we have the process of collecting data where the data collection device detects and reads the tag and manages the transmission to the remote server. If the connection is not available immediately, save for later sending. In this operation a json object is sent. In the other "Server" process we have the MQTT listener service, this is a process that happens on the server, where the process is subscribed to the topic waiting for updates of the collection devices. Each received json is validated and entered into the database. Device queries to tag entries are also provided by this service. And finally, we have "Admin services" where we have the administrative panel which is an application modeled in MVC (Model, View and Controller).

MVC is an architecture or standard that allows you to divide system functionalities into layers, this division is performed to facilitate resolution of a larger problem. Where we have three basic layers, and each one of them, with its well-defined characteristics and functions.

The Model is used to manipulate information in a more detailed way, and it is recommended that whenever possible it is used of the models to perform queries, calculations and all the business rules of the system. It is the model that has access to any and all information coming from a database, XML file.

The view is responsible for everything that the end user views, the entire interface, information, regardless of its source, is displayed thanks to the view layer.

The Controller, as the name already suggests, is responsible for controlling the entire flow of information passing through the site / system. The controller that decides "if", "what", "when" and "where" should work. It defines what information is to be generated, what rules should be triggered and where the information should go, it is at the controller that these operations must be performed.

In summary, it is the parent that performs a business rule (model) and passes the information to the view. As well as the administrator can register tags, generate reports and monitor the functioning of the system. In this section we use backbone.js to prevent page refresh to display new data.

Figure 11 shows the users screen where we can register, edit, view and delete registrations, linking name to an RFID tag for later data crossing in the access reports.

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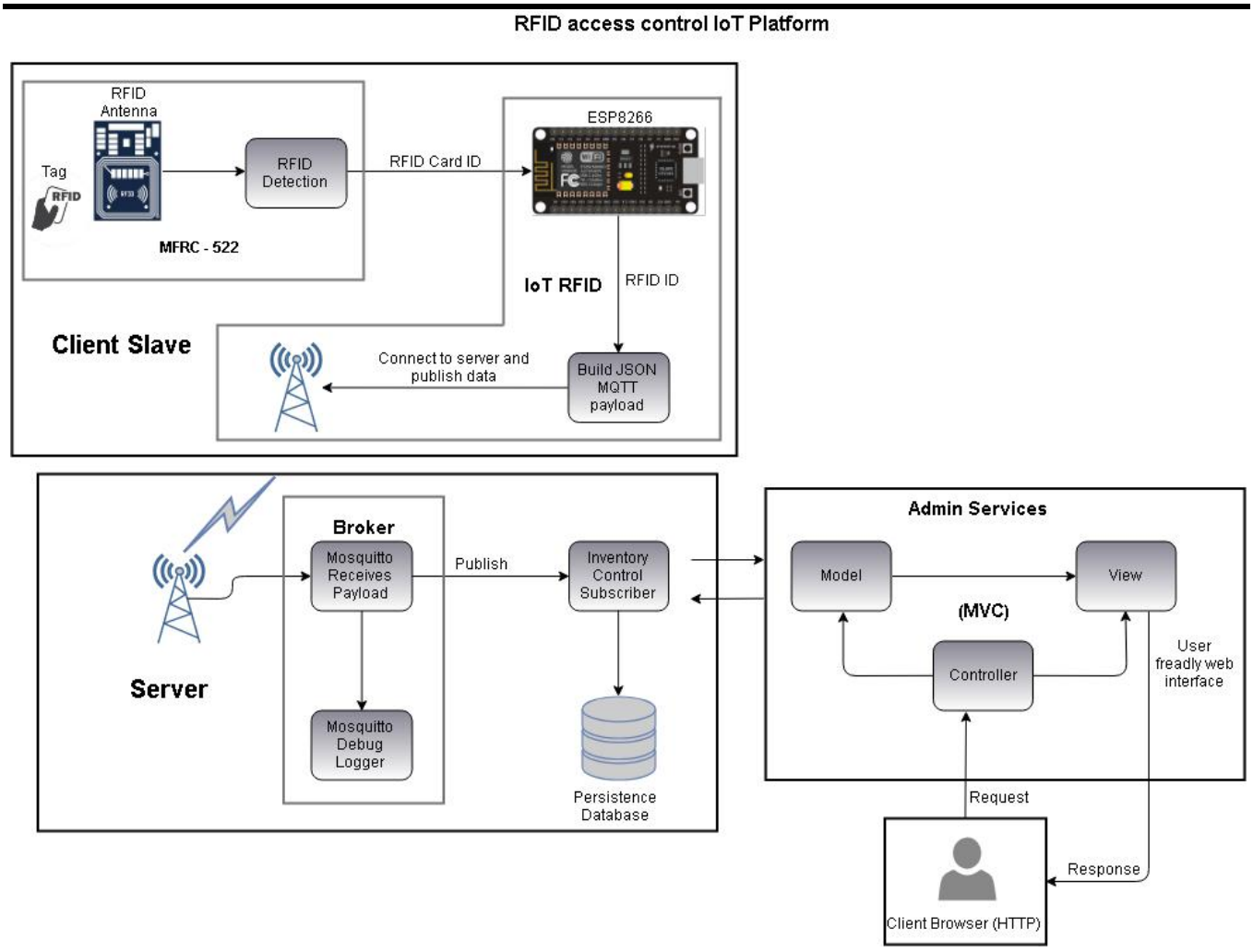

Fig.10: RFID access control IoT platform.

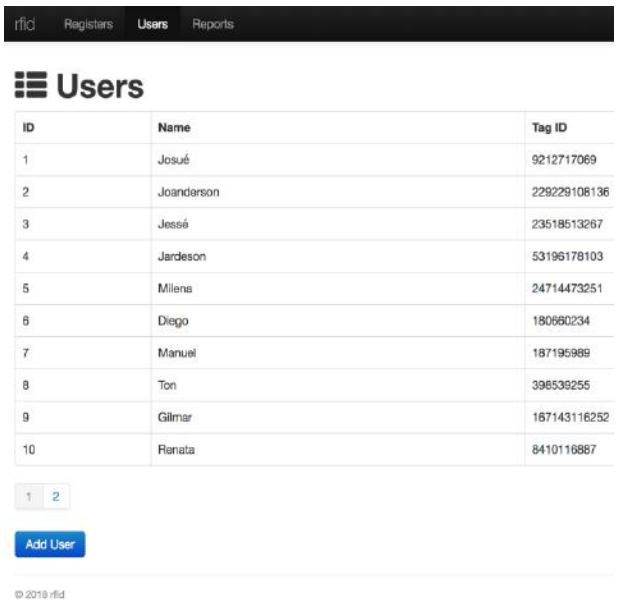

Fig.11: Users Screen.

Figure 12 shows the logs screen, where we can include, edit, view and delete access records. The user name shown on this screen comes from the cross-reference of user data and is not editable on this screen.

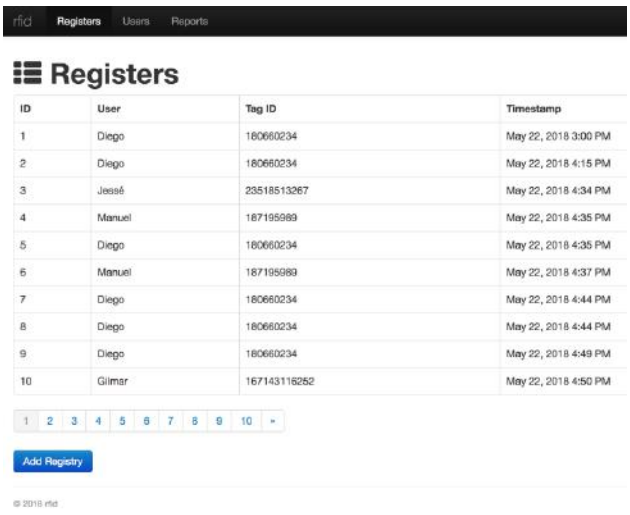

Fig.12: Screen Registers.

In Figure 13, the screen of the last 10 accesses is shown. The update is performed via pooling, showing the tag and crossing the register to show the user name.

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All screens use twitter bootstrap: 'backbonejs', 'underscorejs' and 'jqueryjs'. They update the data via pooling, making it not necessary to update using the F5 key of any of the pages to gain access to the latest data.

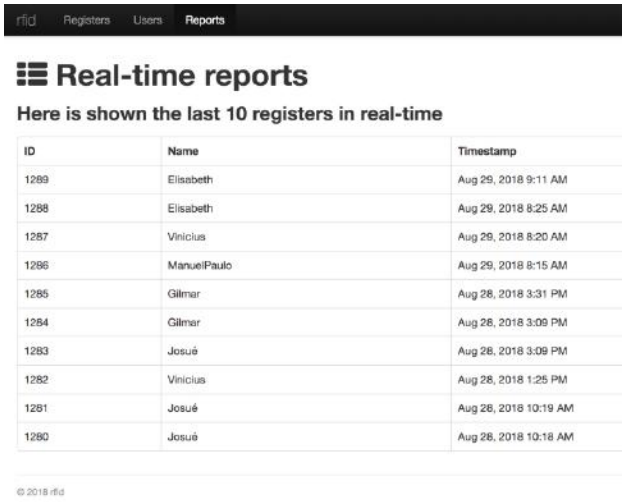

Fig.13: Screen Real-Times Reports.

In Figure 14, an example of user editing is shown. This screen is refreshed by clicking the user. User and records allow editing.

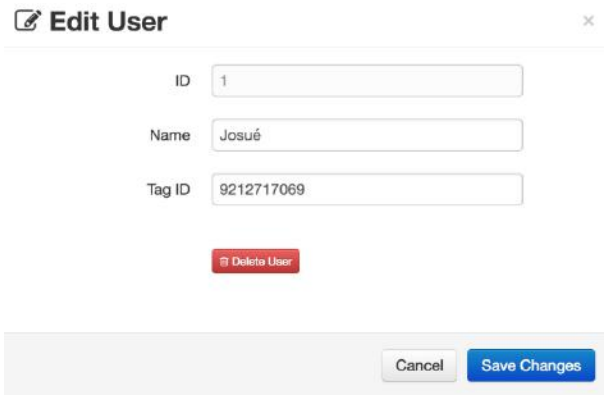

Fig.14: Users-Edit Screen.

VI. FINAL CONSIDERATIONS

According to tests performed, the embedded Linux system (Raspberry Pi) presented excellent results in the aspect of robustness, the various accessories present in the RPI were fundamental for a better use of the embedded system. The hardware division of the initial stage between the PIC microcontroller and Raspberry Pi was a very important factor because the components are well divided thus allowing a better understanding of the operation of all parts such as maintenance.

The use of multitasking in the first step allowed for greater practicality of the system by assigning specific functions running in independent processes.

Problems with Internet access are possible, in this way, an algorithm that stores the unposted data is implemented in both steps so that the posting continues until a satisfactory result is obtained.

After replacing the hardware of the Raspberry Pi for the Microcontroller (ESP 8266) several advantages were perceived, the system allows the operation with current less than 1 A which facilitates the use with energy sources with low cost. The WiFi connection in the ESP8266 Microcontroller allows the physical installation of the system, requiring only a voltage supply, which also allows greater portability.

For the time update, the interruption of an ESP8266 internal timer emulated by software was used, reducing the need for the Internet to check the time.

The need to use the Internet has been reduced to the maximum so that the project continues to function even after connection failure so that the system is robust enough to allow users to access and register using the minimum Internet connection.

Finally, the proposed project can be replicated in many environments with portability, low cost components and easy access in the Brazilian market.

ACKNOWLEDGEMENTS

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An Experiment with DDoS Attack on NodeMCU12e Devices for IoT with T50 Kali Linux

Antonio Carlos Bento[1], Ellen Martins Lopes da Silva[2], Marcelo Galdino[3], José Carmino Gomes Júnior[4]

[1]Computing Dept., Universidade Nove de Julho, Brazil
Email: acb01@hotmail.com
[2]Computing Dept., Universidade Nove de Julho, Brazil
Email: ellenmmartins@yahoo.com.br
[3]Computing Dept., Universidade Nove de Julho, Brazil
Email: gmgaldino@uni9.pro.br
[4]Computing Dept., Universidade Nove de Julho, Brazil
Email: mat.jose.carmino@gmail.com

***Abstract*—** *This paper presents the results of an experiment with the Kali Linux operating system and T50 tool to simulate Distributed Denial of Service (DDoS) attacks on the NodeMCU12e controller device used in Internet of Things (IoT) projects. The motivation for the development of this study arose with the creation of different projects that deal with the subject involving the Internet of Things, as a necessity to evaluate the safety and capacity of these devices during an attack simulation, which affects security and exposes the fragility of architecture and construction model. The results showed the types of attacks that can be carried out, as well as the device's lack of ability to avoid these types of attacks, as well as the speed at which it is possible to stop the device services.*

Keywords—security; IoT; NodeMCU12e; T50; Kali Linux; DDos.

I. INTRODUCTION

The projects involving the Internet of Things stand out in the national and international market, mainly for the ease of connection between the different types of devices and equipment, allowing the creation of different types of projects that can meet the most varied needs, low cost and the experience of creating solutions quickly, yet with the ease of remote communication, provide an innovative and flexible experience.

When faced with academic research projects that use the Internet of Things as an object of study, it was possible to perceive the great possibilities of applications that this new technology provides, in this way several experiments were carried out with updated models to control equipment monitoring, or even to keep track of the health of individuals. The question that surrounds this study is a security analysis related to the access and use of the Internetof Things devices, which are usually interconnected by some type of network.

The Internet of Things as explained by CERP [8] and ITU-T [12], is a new technology that allows communication between things such as objects, devices or even equations can somehow communicate with one another, this by the ease of communication between a local network, internet type, radio and others. Evolving in conjunction with automation and mechatronics, the Internet of Things is an inexpensive and easily accessible technology, enabling the creation of the most varied solutions.

Due to the fact that it is an emerging technology, it lacks scientific content that can collaborate with the development and serve as a study base for new projects, in this way this work proposes to present the rest of an experiment that involves the security of the normally used disasitives in projects for the Internet of Things, and can serve as a theoretical basis for the creation of new solutions.

Security studies are also a great challenge because the possibilities and types of attacks can in some way stop several types of services or even damage equipment of different types of applications, so this study provides a type of simulation that may allow the researcher to apply in their projects, to somehow study the types of attacks that the devices may suffer during their use, also considering the impacts they may cause.

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Several projects on residential, business or even service monitoring are presented, as well as applications directed to the health area, all of which may be impacted by some kind of invasion or security attack. strategies and techniques of prevention, with the most known types of attacks, in this study as a restriction of the project, only some types of attacks should be analyzed, these being the best known, proposed solutions may be presented in future studies, due to their extension and complexity.

The experiments were performed on a specific type of device, such as a controller, this device is usually used in conjunction with other devices, or even sensors, such as temperature, heart rate, pulse or devices as Arduino Uno, the most common, with little capacity, being used for small prototypes, or even for projects where a large operating process is not necessary and with very advanced controls.

With the rapid creation of devices provided to meet the different needs of the market, this project intends to attend a moment in which the concepts of INternet of Things are still in evolution, on the most varied processes, thus allowing a reflection on the need to to devote greater attention, also to studies that involve the security of the types of networks and devices used for the Internet of Things.

II. BIBLIOGRAPH REVIEW

When the bibliographic research was carried out on the key words that compose this work, the most relevant bases were used with IEEE Xplore, IEEE Latinamerca, Scopus and Google Scholar, and these did not present relevant results for the keywords IoT and T50, demonstrating that this research has relevant subject to compose the content in these basses of knowledge.

In this way, the scientific work involving general subjects, such as those that deal with the Internet of Things, was used as basic theory, some equivalent devices, as in the case of the Arduino controller, also relating the experience of some authors about the System Operational kali Linux, this being an appropriate environment for conducting simulations involving security.

Due to this lack of scientific references, technical papers and documentation, provided by manufacturers and specialists, were analyzed, as well as code libraries and discussion blogs. The technical documents collaborated with the practical experiment, enabling the tests and configurations, adapting the project to meet its objectives in the creation of a model that allows the simulation of DDoS-type attacks.

The internet of things is the main subject addressed in this study, considering the documents presented by CERP [8] and ITU-T [12], which are organizations responsible for maintaining, defining and releasing the relevant contents with the projects developed for the Internet of Things , being these models that are adopted by specialists in all the world.

The IEEE baselines are also of major importance because they are the main basis for information on academic contents, journals, conferences on subjects that deal with electronics, computing, security, networks and systems, often many important references are found in this base, allowing the distribution of academic and technical knowledge on different subjects and projects that approach the theme.

Most of the results obtained with this study are of practical origin, with the experience obtained in previous projects such as those presented by Bento [7], these experiences were the pillar of support for the realization of the project, incorporating other studies of relevant authors, even of specialists in the area who collaborated with the materials and references.

The bibliographical references on the methodology and techniques used to develop the structure of this article were developed based on the books and documents presented by Bento [7], Lakatos and Marconi [19], being thes last reference on best practices in the structure of project development of national research.

The studies were developed on the subject Internet of Things based on the works presented by: T. Shah ; S. Venkatesan [23]; F. Wu ; C. Rüdiger ; J.-M. Redouté ; M. R. Yuce [11], E. R. Naru ; H. Saini ; M. Sharma [10]. CERP[8], ITU-T[12].

Studies on the NodeMCU12 controller were developed based on: D. Naranjo ; P. Córdova ; C. Gordon [9], A. P. Murdan ; M. Z. A. Emambocus [3], L. K. P. Saputra ; Y. Lukito [14], M. Edward ; K. Karyono ; H. Meidia [18],

Topics that addressed the types of DDoS attacks were based on the documents presented by: L. Liang ; K. Zheng ; Q. Sheng ; X. Huang [15]; V. Visoottiviseth ; P. Akarasiriwong ; S. Chaiyasart ; S. Chotivatunyu [24]; A. H. Dar ; B. Habib ; F. Khurshid ; M. T. Banday [1]; S.P. Kadam ; B. Mahajan ; M. Patanwala ; P. Sanas ; S. Vidyarthi [22]; S. Arkadii ; C. Vadym [21].

Studies on the Kali Linux operating system were performed considering the works presented by: R. Gaddam ; M. Nandhini [20]; M. Denis ; C. Zena ; T. Hayajneh [17]; J. Narayan Goel ; B. M. Mehtre [13]; A. Hussain Dar ; B. Habib ; F. Khurshid ; M. Tariq Banday [1]; M. A. C. Aung ; K. P. Thant [16]; B. Scott ; J. Xu ; J. Zhang ; A. Brown ; E. Clark ; X. Yuan ; A. Yu ; K. Williams. [6].

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III. METHOD AND MATHERIALS

As a method, an experimental research was used, in which the technical studies developed on the devices are applied, as explained by Lakatos and Marconi [19] the objective of an experimental research is the creation of experiments that may represent some determinate phenomenon for analysis and evaluation purposes of the data collected during the research development.

Some types of research methods such as Lakatos & Marconi [19] and Bento [7], it is possible to verify the different forms of survey and analysis that can be applied in the most varied study models. In this case, this work has as specific objective to present the results according to the experiments developed on technological resources available in the national and international market.

As a first step, research was done on scientific research materials, technical documents and manuals of manufacturers, after the studies carried out, a comparative and practical analysis was developed on the devices to understand their workings, as well as their adequacy with the proposal of the studies, thus taking as its basis its technological resources and applicability.

After the studies were performed with the tools available in the Kali Linux operating system, with the purpose of understanding their application and structure characteristics, in this way it was possible to choose among the various tools available in the operating system, the library was then selected T50 tools, by itself a model with clear documentation and with simplicity for application in different environments.

After the initial understanding and tests, the devices and equipment necessary to apply the hypothesis of creating a possible environment for simulation of the attack tests with the T50 tool available in the Kali Linux Operating System were selected.

As material was used: a NodeMCU12e controller device, this device was selected due to comparative tests performed in the studies presented by Bento [7], highlighting its capacity, speed, size and low cost, incomapration with other controllers available in the market, such as the Arduino Uno.

The NodeMCU12e device was used in isolation during the project, only to meet the DDoS attack tests, because it has a system that allows it to act as a WiFi access point, because it has this recurrence already built into its architecture, in this way it was possible to carry out the attack simulations.

A Samsung 4G smartphone was also used to be used as a Web connection service, thus enabling the smartphone to communicate with two other computers, one notebook running the Kali Linux Operating System and the T50 library, another notebook with the Windows 10 64 operating system bits to connect to the NodeMCU12e controller and access your home page with Mozilla Firefox web browser, verifying that the connection is online and monitoring the resources used in the network.

In this way it was possible to analyze communications and data traffic between the devices, observing the results of the simulated attacks, enabling the creation of reports and the discussion about the data collected during the survey, a miniUSB cable was also used to connect the controller to the notebook and supply the power required to power the device, the Arduino IDE was used for construct the controller Algoritm.

IV. RESULTS AND DISCUSSIONS

In the initial studies, tools were analyzed that allow the simulation of Distributed Denial of Services (DDoS) attacks [1] [2] [6][13], that is, the sending of a large amount of data packet to stop the services of Web page servers, in this case the NodeMCU12e [7] [18], has features that enable it as an access point server, providing access to internal pages as if it were a web server.

A smartphone with external WiFi access was only used to allow external access to a WiFi network, the NodeMCU12e [7] controller can work in both formats, ie as an access provider and a client, and also has the ability to access pages in other external servers, these features can be manually configured in the device algorithm.

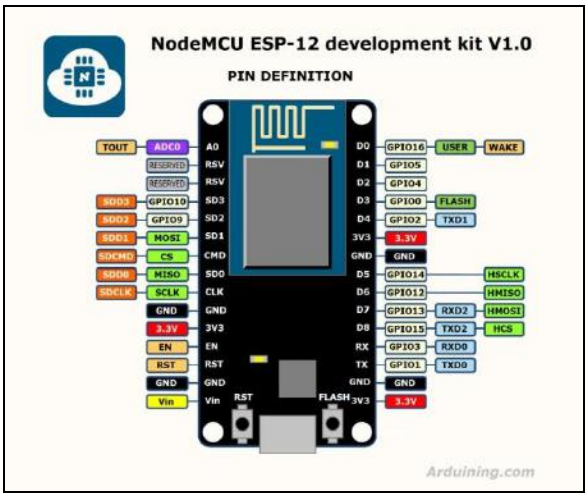

Fig. 1.NodeMCU 12e device connection diagram.

The NodeMCU12e controller device was configured as an access point, using the IP address 192.168.43.39, in this way the computers were used as clients to access the network provided by the device, thus allowing the simulation of the attacks and the monitoring of the services, for analyzing the results and tests, as shown at Fig 2.

Some important characteristics for NodeMCU controller are: CPU 32-bit RISC: Tensilica Xtensa LX106 with 80 MHz; 64 KB RAM memory; 96 KB data; Flash

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QSPI External - with 512 KB to 4 MB; IEEE 802.11 b / g / n Wi-Fi; 16 pins GPIO; SPI, I2C.

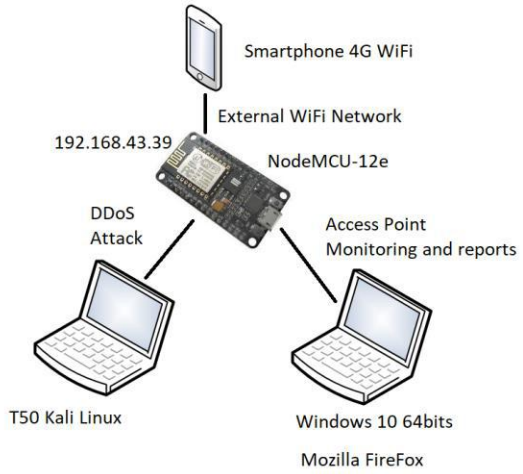

Fig. 2.Network diagram with the devices and connections used during the project.

For the construction of the algorithm, the Arduino IDE, an available tool for the development of algorithms for controller devices, was used, after the proper configuration, downloading of the libraries and access tests, one of the algorithm examples available in the tool, called NodeMCu AdvancedWebServer.ino, available soon after the installation of the correct library of the controlling device.

As an initial part of the configurations, the following libraries were used as well as the settings to access the controller device, it is important to observe the ESP8266WebServer command which allows configuring the device with an access server on port 80, the complete algoritm can be found with the Arduino IDE settings.

```
#include <ESP8266WiFi.h>
#include <WiFiClient.h>
#include <ESP8266WebServer.h>
#include <ESP8266mDNS.h>
const char *ssid = "yourSSID";
const char *password = "YourSSIDPass";
ESP8266WebServer  server ( 80 );
```

Another important point is to observe the *ssid and *password variables, these must be used to access the external WiFi network available on the Smartphone, this feature is used simply for the controller to have client access and on external websites, such a resource should not be used in this project.

The controller algorithm generates a random graph when accessing the address by the web browser, demonstrating its active operation during access, in this way it is possible to monitor the access, the values vary every three seconds, presenting a new graphic, thus it is possible to identify if the access point is operational.

Fig. 3.NodeMCU 12e monitoring screen via WiFi site.

Before the DDoS attack simulation Fig. 3, the network and devices have the following status, observing that there is only one computer with the Kali Linux operating system and another one computer with the Windows operating system on the same network, one to validate the attack and another to monitor the accesses to the controller, to generate the transfer tax reports Fig. 4.

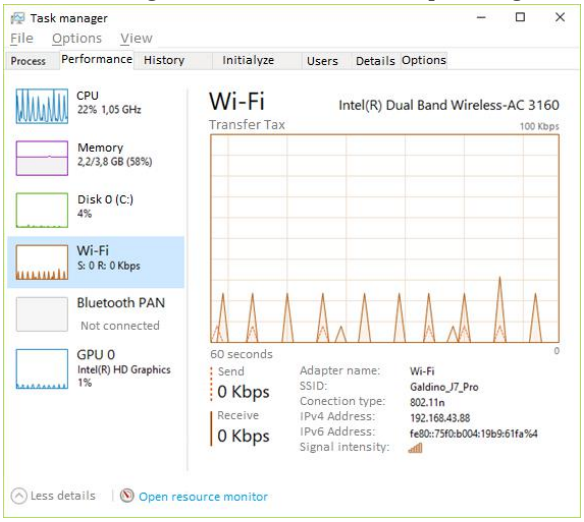

Fig. 4.Task monitor running on the Windows 10 computer for monitoring the network tax transfer.

Fig. 5.

At this moment the constant status of the transmission rate and reception of the network data before the attack simulation is considered, considering an updated analysis every sixty seconds interval, after which the transmission processes for DDoS attack simulation are started Fig. 5.

Denial-of-service attacks are a specific class of pentest attacks (Penetration Testing, in which the idea is to send an excess of packets to a particular server.

Because the device or server is not ready to receive this high packet load, it will be overloaded, this will cause your bandwidth to slow and even crash.

Basic commands used with T50:

```
root@kali:~#  t50 --flood 192.168.43.39
entering in flood mode...
```

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hit CTRL+C to break.

T50 5.4.1-rc1 successfully launched on Oct. 10th 2018 10:48:51

Was used the follow command with the project for test the NodeMCU12e controller:

root@kali:~# t50 192.168.43.39 --flood -S --turbo --dport 80

Details about the command:

t50 : t50 command

192.168.43.39 : target Web server internet protocol

--flood : replace the threshold

-S : TCP SYN Flag

--turbo : Increase the attack performance

--dport 80 : Port 80 used for the attack

How demonstrated in the figures 5, 6, 7, 8 e 9, was used around six windows running the same T50 application for DDoS test attack with the NodeMCU12e device.

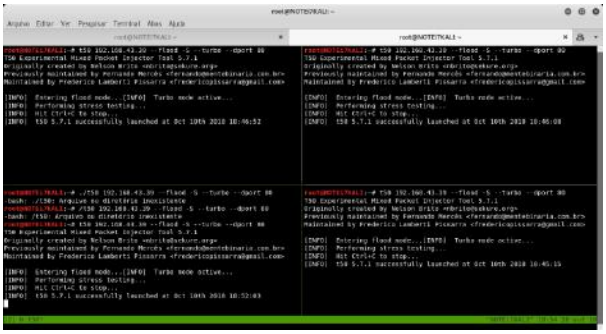

Fig. 6. Four DDoS attack simulation with T50 Kali Linux and packet injection tool 5.7.1.

In that windows fig. 5, is displayed the T50 application in conjunction with another windows.

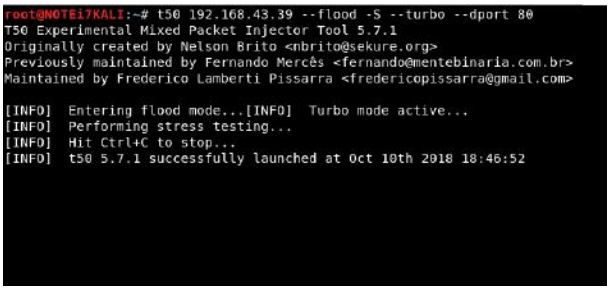

*Fig. 7.*Window 1, packet injection tool 5.7.1.

Fig. 8.

In the fig. 6, is displayed the first command running and sending packages for the device.

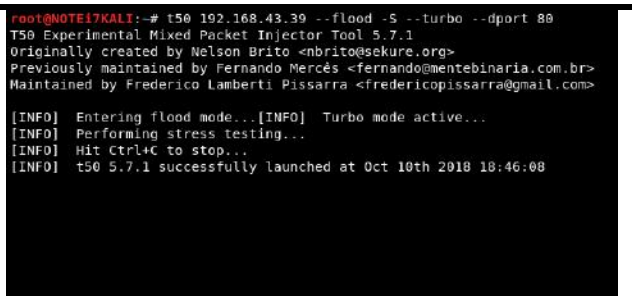

Fig. 9.Window 2, packet injection tool 5.7.1.

Fig. 10.

The same occour with the another windows, where the window 2, 3 and 4 the commands were used in the sequence.

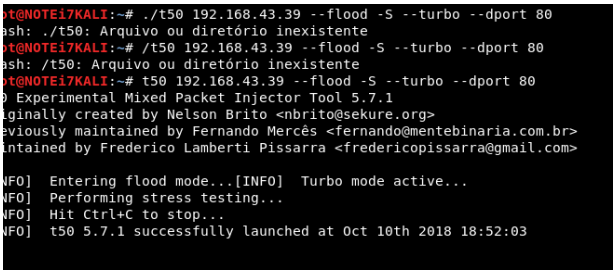

Fig. 11. Windows 3, packet injection tool 5.7.1.

Fig. 12.

With the window 3 fig. 8, is possible verify the DDoS attack in the sequence.

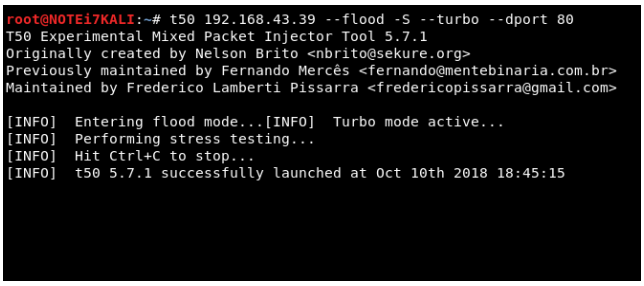

Fig. 13. Windows 4, packet injection tool 5.7.1.

Fig. 14.

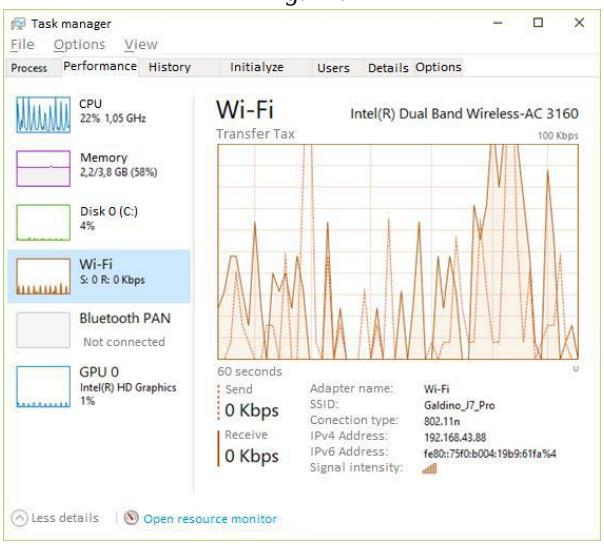

Fig. 15. Results attack after the DDoS simulaton, with the network and NodeMCU12e controller overload.

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In the same time another computer was connected with the NodeMCU12e access point address, 192.168.43.39, that computer was used for monitoring the network and to access the NodeMCU12 webserver, monitoring the site access during the attack, the results show the site out of operations during the attack fig 11.

Fig. 16. NodeMCu12e monitoring site not working after the overload test.

Fig. 17.

After the six sequence of commands was possbile to analyze the results, when overloading the device NodeMCU12e with packages of data, this kind of attack is very usual when using address available in the internet, the results has demonstrated the capacity of the device for stay in operation during a usual attack, for only few seconds.

V. CONCLUSIONS

Based on the results obtained, it is possible to conclude that the Internet of Things presents many advantages ahead of the current devices used in clinics and hospitals, and even in the face of the difficulties, the use of Internet of Things in the area of health can bring several benefits to the professionals and institutions, benefits that contribute to an active monitoring, providing greater quality to the patients and ease of control for the doctor.

When analyzing the advantages of the adherence of a project developed with the Internet of Things, the low cost, the ease in the consultation of data for monitoring and in future visits, sharing of the information by several health information bases, objective organization and clear data and information, preventing diagnosis errors, during prescription and in drug interaction.

As disadvantages, one should consider the lack of a technical professional who understands the various interdisciplinary issues involved, for example, it is necessary to understand electronics, computing, networks, database, programming and still understand about the health area and the type of analysis that can be developed.

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Test Production Model on Varieties to Produce Quality Sesame Oil

Budi. LS, Puspitawati. I. R, Nurwantara. M.P

Agriculture Faculty, Merdeka Madiun University, Madiun, Indonesia
luluksb@unmer-madiun.ac.id

Abstract*— *The potential of local regions determines the progress of agro-industry. The aim of the study was to determine the effect of drying models and varieties on the levels and quality of sesame oil. The research method used factorial complete randomized design, namely the first factor was drying using the oven and roasting method. The second factor is 5 sesame varieties namely SBR1, SBR2, winnas1, Winnas 2 and independence. Parameters observed included seed moisture content, oil content, oil aroma, oil taste and oil color. The results of the study show that there are interactions between the use of varieties and heating models.

Keywords*— *Sesame, oil, quality, aroma, bright color, taste

I. INTRODUCTION

To develop agroindustrial sector, it needs the right policies (Syam & Ma'arif, 2004). Especially the policies regarding raw material (Budi, Rahayu, & Hanafi, 2010). The quality of raw material will determine the quality of the final product. A research that done by Budi (2011) about some processing types in producing sesame oil before splitting process, such as roasting or drying (Budi, 2011). Temperature and duration of heating of the raw material influences the quality of the oil that produced, excessive heating can reduce the oil quality (Romadhona, Lutfi, & Yulianingsih, 2015a), (Mulyati, Pujiono, & Lukis, 2015). Besides of temperature and duration of heating of the raw material, the types of raw material also gave some effects to the quality of the final product. It happens in sesame agroindustry too (Budi, Maarif, Sailah, & Raharja, 2009). Characteristics of sesame seeds are divided based on the size of the seeds, the color of sesame shell, and the shape of the seeds (Budi, 2011). The cultivation place of the raw material will influence the quality of oil produced (Budi, 2011). The quality of sesame oil is divided into the color of the oil, the taste of the oil, and the aroma of the oil (Handajani, et al., 2010). The quality of sesame oil influenced by the raw material, if the quality of the raw material were good the oil that produced would be good too.

The purpose of this research was to determine the effect of the drying models, the variety of sesame seeds in the quality of production the sesame oil, and to know the correlation between the variety of sesame seeds with the quality of sesame oil. The purpose of this research was to determine the effect of drying models and difference varieties on the levels and quality of sesame oil (moisture content, oil content, oil aroma, oil taste and oil color) and to determine the relationship between the characteristics of varieties with oil quality. The quality of the oil will contribute in economic value or selling value of the oil (Budi & Wardhani, 2017). The high quality of sesame oil will use as supplement and the low quality of sesame oil will use as seasoning. The high quality of sesame oil has a unique aroma, bright color, and good taste (Wiyono, 1994).

II. MATERIAL AND METHODS

1.1 Place and time

This research was done in processing of Pengolahan Hasil laboratorium, Merdeka Madiun University on May until August 2018.

1.2 Material and tools

The material that used in this research was five varieties of sesame seeds which is SBR1, SBR2, Winnas 1, Winnas 2, and H2. The tools that used in this research was test tube, beaker glass, oven, pan, stove, grinder, hydraulic press, monel fabric, scales, pipettes, filter paper, and others.

1.3 Methods

The method of this research is factorial completely randomized design. The first factor is five varieties of sesame seed. The second factor is roasted (P1) and oven (P2). Each treatment has five samples and is done three times.

1.4 Research Stage

As for the stages of this research shown in the Figure

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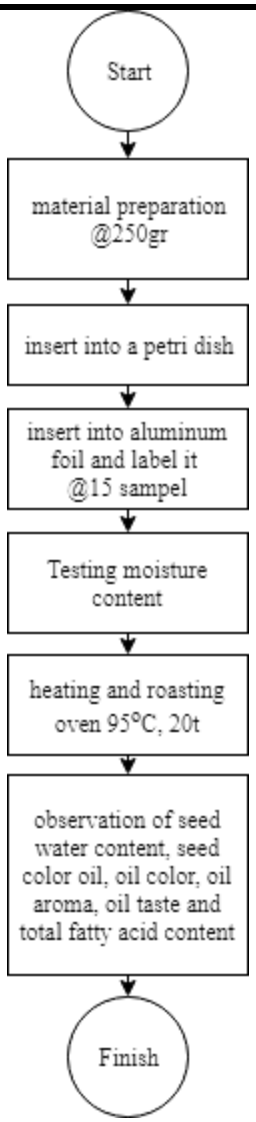

Fig. 1: research stage

1.5 Data Analysis

The result of organoleptic testing which is color, taste, and aroma then tested quantitatively. The quantitative method that used to analyze the data is multiple comparison tests and the correlation between parameters using SPSS software. Duncan test with confidence level is 0.5%.

III. RESULTS AND DISCUSSION

3.1. Result

Figure 1 shows if the weight every 1000 seeds is significantly different. Figure 1 shows that sesame which has the highest score is W2P2 (3.78g).

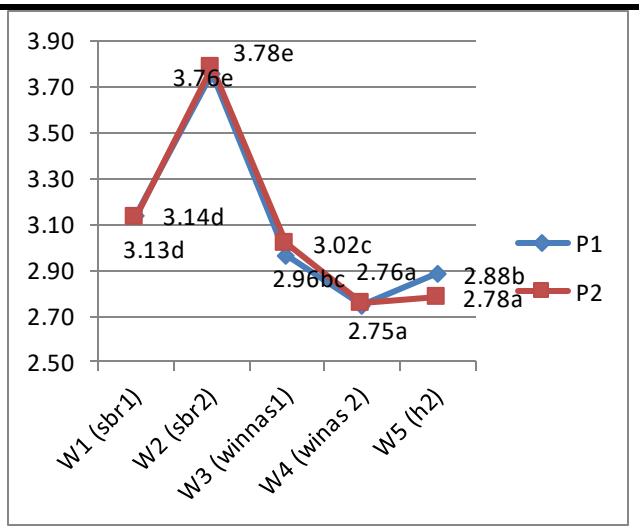

Fig. 1: The average weight of 1000 seeds

Tabel 1. The average of seed water content

Water Content	Average score (%)	
W1P1 (SBR1 variety *roasting)	2.99	d
W1P2 (SBR1 variety *oven)	2.78	d
W2P1 (SBR2 variety *roasting)	3.03	e
W2P2 (SBR2 variety *oven)	2.78	ab
W3P1 (Winnas1 variety *roasting)	2.88	bc
W3P2 (Winnas 1 variety *oven)	2.80	ab
W4P1 (Winnas2 variety *roasting)	2.96	cd
W4P2 (Winnas2 variety *Oven)	2.77	ab
W5P1 (H2 variety *roasting)	2.88	bc
W5P2 (H2 variety *Oven)	2.71	a

Table 1 shows that water content is significantly different. The highest score of the water content is W2P1 (3.03%) and significantly different to the other treatments. The lowest score of the water content is W5P2 (2.71%).

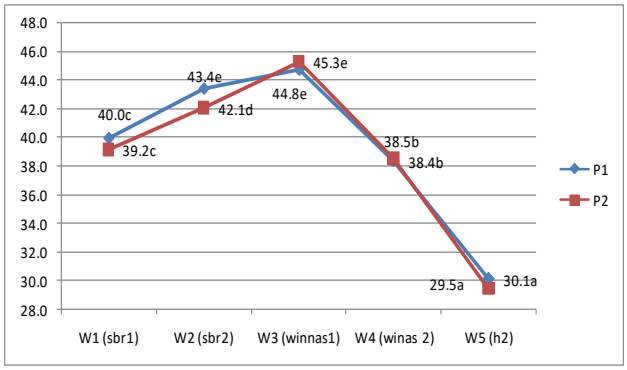

Fig. 2: The average score of oil content

Figure 2 is the analysis result for oil content. The result is the variety of sesame seeds having interaction with the drying model. W3P1 treatment combination has the highest oil content with the value 45.30% and

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significantly different with the other treatment. The lowest oil content is W5P1 with the value 29.5% and does not significantly different with P2.

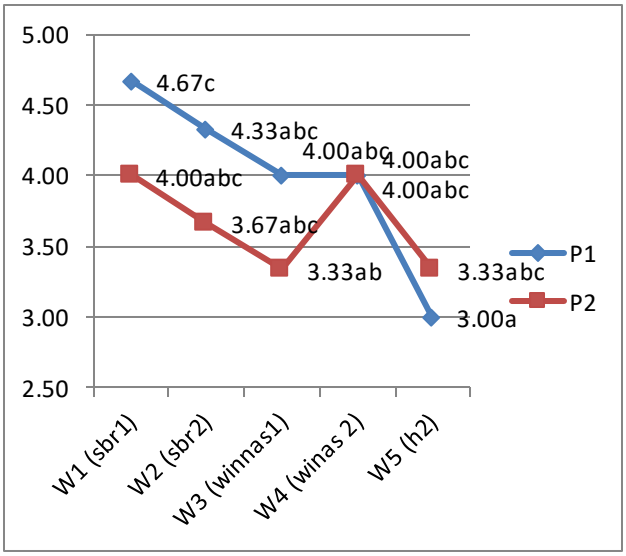

Fig. 3: The average of the color value

Figure 3 is the result of the organoleptic test of the color of sesame oil which has significantly different. The best color is W1P1 with the score 4.67 and significantly different with W5P1, while does not significantly different with the other treatments.

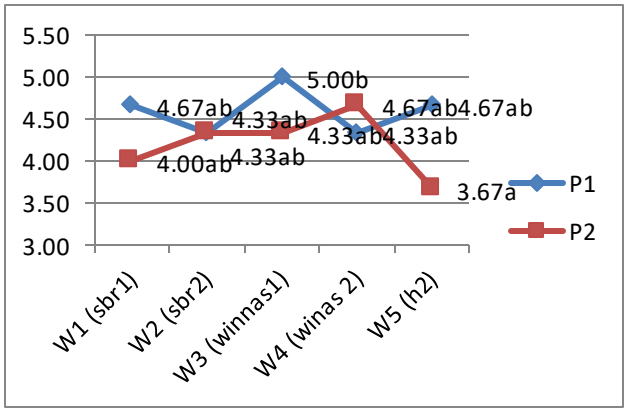

Fig. 4: The average score of aroma

Figure 4 shows the result from aroma organoleptic testing. The result is the combination of treatment has significantly different with the aroma. The W3P1 has a specific smell and significantly different with W5P2 and does not significantly different with the others.

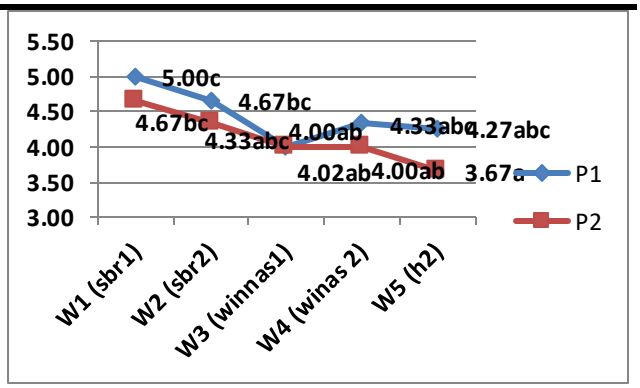

Fig. 5: The average score of sesame oil taste

Figure 5 is the result of sesame oil taste. The combination treatment has significantly different with the sesame oil taste. Figure 5 shows that W1P1 has the highest score with the value 5.00, and significantly different with W5P2.

Table 2 is the result for fatty acid analysis. There is any significant interaction from the combination of sesame variety and the drying model. W1P1 and W1P2 has the highest score for total fatty acid (95%) and significantly different with the other treatment. The lowest total fatty acid is W4P1 and W4P2 with a score of 84%.

Table 2. The average score of fatty acid influences from combination of variety of sesame and the drying model

Oil Aroma	The Average Organoleptic Score	
W1P1 (SBR1 variety *roasting)	95.00	f
W1P2 (SBR1 variety *oven)	95.66	f
W2P1 (SBR2 variety *roasting)	90.48	e
W2P2 (SBR2 variety *oven)	90.50	e
W3P1 (Winnas1 variety *roasting)	90.26	d
W3P2 (Winnas 1 variety *oven)	90.95	d
W4P1 (Winnas2 variety *roasting)	84.08	a
W4P2 (Winnas2 variety *Oven)	84.06	a
W5P1 (H2 variety *roasting)	85.13	c
W5P2 (H2 variety *Oven)	85.44	b

Table 3 is the result of correlation analysis for each research factor. Table 3 shows that the weight of 1000 seeds has a strong correlation with the oil content in the value of 0.500**, and the total of fatty acid with the value 0,516**. Water content and the taste of oil has a correlation, and the value is 0.394*. The correlation of oil content and the total fatty acid has score 0.533**.

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Table 3. Correlation between observational parameters

		wight_of_ 1000 seeds	Water_ content	taste of oil	Oil Content	Total_fatty_ Acids
wight_of_1000_seeds	Pearson Correlation	1	.232	.278	.500**	.516**
	Sig. (2-tailed)		.217	.137	.005	.004
	N	30	30	30	30	30
Water_content	Pearson Correlation	.232	1	.394*	.230	.190
	Sig. (2-tailed)	.217		.031	.222	.314
	N	30	30	30	30	30
taste_of_oil	Pearson Correlation	.278	.394*	1	-.058	.342
	Sig. (2-tailed)	.137	.031		.763	.064
	N	30	30	30	30	30
Oil_Content	Pearson Correlation	.500**	.230	-.058	1	.533**
	Sig. (2-tailed)	.005	.222	.763		.002
	N	30	30	30	30	30
Total_fatty_Acids	Pearson Correlation	.516**	.190	.342	.533**	1
	Sig. (2-tailed)	.004	.314	.064	.002	
	N	30	30	30	30	30

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

3.2 Discussion

The Duncan multiple tests (p = 0.05 and 0.01) indicate that all parameters are significantly different. It because variety and drying model is significantly different. The high of drying temperature will reduce the moisture content of the seeds, and impact to the final result (Derlean, 2009). Besides that, the weight of 1000 grains has a potential effect in produce oil with good quality and has high economic value. The weight of 1000 seeds has the potential to produce high oil (Hagose, 2017)

The drying model gave a significant impact on water content, oil content, and the quality of sesame oil (taste, aroma, and color). It suspects the different drying model will give a different quality of sesame oil (Romadhona, at.al 2015), but the increases of the temperature will not impact to the increasing of the extraction (Elkhaleefa & Shigidi, 2015).

The highest correlation occurs between the weight of 1000 seeds with oil content and total fatty acid. It is because if the weight of seeds increases then the oil content and the total fatty acid will increase too. Budi (2011) stated some variety of sesame with different weight has different oil content, increasing the volume of raw material is positively correlated with oil content (Wildan et al, 2013).

II. CONCLUSION

The combination of the treatment and drying model has significantly different. Variety of sesame is very influential to the oil produced quality (oil content, oil color and total fatty acid). The best varities to provide the high quality of sesame oil is has the highest weight 1000 seeds, positively correlated with oil content and total fatty acid. The model drying is very influential to oil taste and oil aroma. The roasted models provide high oil quality (aroma and taste of sesame).

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(3) The LLDIKTI chairmen Region VII Surabaya,
(4) The Rector of Merdeka Madiun University
(5) The Chairman of the Institute for Research and Community Services Merdeka Madiun University.

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Improving Teacher Competency in Developing Learning Equipment Based on E-Learning through Metamorphosis Learning

Titin Kartini[1], Mukhamad Zulianto[2], Ermita Rizki Albirri[3], Sri Wahyuni[4]

[1]Department of Economic Education, University of Jember, Indonesia
Email: titin.fkip@unej.ac.id
[2]Department of Economic Education, University of Jember, Indonesia
Email: zulianto.fkip@unej.ac.id
[3]Department of Mathematics Education, University of Jember, Indonesia
Email: ermitara@unej.ac.id
[4]Department of Economic Education, University of Jember, Indonesia
Email: sriwahyunipe.fkip@unej.ac.id

Abstract**—** *Learning by utilizing E-learning facilitates students in the learning process, because E-learning does not require the presence of teachers and students physically in the classroom. Students can interact with teachers anytime and anywhere. The purpose of this activity provides training on E-learning along with learning tools, assisting E-learning utilization to MTs Walisongo and MA Walisongo Jember teachers. Training activities are E-learning, instructions for E-learning and applying E-learning media to one of the subjects. Through the above activities, teachers are able to develop learning equipment based on E-learning and improve ICT competencies.*

Keywords**— Competencies of ICT Teachers, E-Learning, Learning Metamorphosis.***

I. INTRODUCTION

Technological developments give a significant impact on the sustainability of the learning process. Technological sophistication offers changes in learning from conventional to ICT-based learning. Information and communication technology-based learning media are easily obtained and accessed. Currently, the learning media are learning media based on E-Learning. E-learning is an alternative model in learning. Darin E. Hartley (2001) says that e-learning is a type of teaching and learning that allows teaching material to be conveyed to students using the Internet, Intranet or other computer network media.

E-learning aims to facilitate the implementation of learning, can improve learning achievement, and train students' soft skills independence. For this reason, the use of e-learning is an alternative method of learning. Learning by utilizing E-learning facilitates students in the learning process because E-learning does not require the presence of teachers. Students can interact with teachers anytime and anywhere, as long as there are electronic facilities and internet access.

Many schools already have internet networks but the use of using E-learning as a learning media has not been widely used. Many factors cause low use of E-learning, one of which is the low interest of teachers in utilizing the use of E-learning, because E-learning does not solely rely on academic abilities but also must be supported by the skills of teachers in terms of internet usage.

MTs / MA Walisongo is one of the schools that has an internet network. During this time the internet facilities are used as a means to send school data reports requested by related parties sent via the internet, sometimes used as a source of enriching school lessons. Even though this facility besides the above can be used as an alternative media in the learning process. The use of E-Learning in the learning process at Walisongo MTs / MA is very low. It is inversely proportional to the use of social media by teachers and students. In their daily lives, they often use social media, such as Facebook, Instagram, Twitter, paths, etc., to interact and share information.

MTs / MA Walisongo is at the Walisongo Islamic Education Foundation. The number of teachers at MTs / MA Walisongo is 33 people consisting of 16 MTs teachers and 17 MA teachers. The location of MTs / MA Walisongo is approximately 30 kilometers from the city of Jember. Because the location of the school that is far from the city is used as a reason for rarely taking part in the E-learning utilization workshop held by educational institutions in the city of Jember.

Learning with the use of E-learning to be implemented properly, teachers need to prepare learning devices.

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Learning equipment in E-learning is almost the same as conventional learning equipment, only different in developing the learning process. Learning equipment developed include Learning Plans based on E-learning and Modules based on E-learning.

Teachers who have undergone a metamorphosis process are teachers who are ready to use their abilities to create change. By being an agent of change, it means that a teacher is no longer present in the midst of the students simply shaking up the obligation to teach. Conversely, a teacher must appear as a lighter for his students. When he was in the school where he served, he became an agent of positive change for students and fellow teachers. According to H.D Irianto (2013), learning metamorphosis is divided into three main phases namely the caterpillar phase, the cocoon phase, and the butterfly phase. The caterpillar phase in this service activity is likened to the teacher still in the stage of not understanding and weak in developing learning devices and utilizing E-learning so that training is held related to learning device materials and E-learning. The cocoon phase is a mentoring activity in the development of learning devices and the use of E-learning, then in the butterfly phase the teacher can develop learning tools and apply the use of E-learning independently.

II. METHOD

The obligation of teachers to plan deep learning is a form of pedagogic competence in teacher performance appraisal for the development of the career of the teacher as a professional teacher. One of the learning plans of teachers can develop E-learning based learning tools and the use of E-learning as a medium that can help in the learning process in the classroom. Therefore the approach method used in this activity is training on E-learning and its use as a learning media with steps (instructions) for its use, and assistance in applying E-learning media in one of the subjects taught by a teacher. The target of this activity is all teachers under the Walisongo Islamic Education Foundation which consists of 2 (two) schools, namely: (1) MTs Walisongo, and (2) MA Walisongo.

III. RESULT AND DISCUSSION

Stages in learning metamorphosis, (1) Caterpillars, conducted training by providing e-learning-based learning materials and partner teachers need additional material specifically on e-learning-based learning devices, (2) Cocoon, assisted in the development of e-learning based tools learning and partner teachers have begun trying to apply the results of training through mentoring to develop e-learning based learning tools, and (3) Butterflies, partner teachers have been able to develop their own e-learning based learning tools without assistance from the service team. In detail the results of dedication are presented as follows:

1. Arranging e-Learning Based Learning Devices Module

This module contains learning tools, e-learning-based learning, and steps in the preparation of e-learning based learning tools. In this module examples of e-learning-based learning tools are presented and hints at some examples of the use of e-learning in learning.

2. Carrying out e-Learning Based Learning Device Training

The training was held on Saturday 10 November 2018 at the MA Walisongo Jember. The training was attended by partner teachers consisting of two schools, MTs Walisongo, and MA Walisongo. The number of training participants is 50 partner teachers. With the help of 3 students, the training participants immediately practiced the use of e-learning in learning so that partner teachers were interested in developing learning equipment based on E-learning.

Before assistance, pre-assistance is done via email or WhatsApp. During training, partner teachers are asked to develop learning equipment in the form of Learning Plans (RPP) and Student Worksheets (LKPD). Learning equipment is sent via email or WhatsApp discussed E-learning that is done during mentoring.

Pre-mentoring activities have not been able to run optimally because there are still many service participants who have difficulty in compiling learning indicators and objectives and formulating E-learning based learning steps based on their choice of model/strategy. In formulating learning indicators there are still many who have not used operational verbs. For the formulation of objectives, the problems that arise there are those that have not referred to the indicators, there are those who formulate goals only pay attention to the results (do not pay attention to the process), the objectives formulated there are fewer than indicators. The resource person again gave confirmation to the participants about what things were needed in developing learning equipment based on E-learning, starting from school identity writing, core competencies, basic competencies, indicator formulation, learning goals, teaching materials, models/strategies learning, activity steps, media, learning resources and assessment, and any attachment that need to be in the learning device. The participants were guided to make improvements to the devices that had been compiled. The results of the activities at the mentoring meeting were better than the results at the pre-mentoring meeting.

IV. CONCLUSION

Based on several activities can be concluded that in the training on the development of learning equipment based n E-learning, teachers get additional material about the

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characteristics of each learning equipment, E-learning, and utilization of e-learning.

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Aerial Mapping Large Areas Replacing Extensive Measurements and Research of Field

Denison Lima Correa[1], Jose Bruno Santos Pinheiro[2], Marcelo Augusto Machado Vasconcelos [3], Paulo Celso Santiago Bittencourt[4]

[1]Department of Engineering, Federal Rural University of Amazonia- Paragominas-PA- BRAZIL
Email: denison.lima.@ufra.edu.br
[2]MSc in Agricultural Engineering, State University of Western Paraná- BRAZIL
Email: jbrunopinheiro@hotmail.com
[3]Geoprocessing Technology school, Federal University of Para, BRAZIL
E-mail:vasconcelos@ufpa.br
[4]Geoprocessing Technology school, Federal University of Para, BRAZIL
E-mail:paulocsb@ufpa.br

Abstract**—** *The project presented here brings results of images and the registration of producers in the municipality of Balsas in Maranhão, home to large grain explorers since from the field visits we can highlight that the predominant crops are soy, maize, sorghum and cotton in order of production, the municipality of Balsas stands out for mechanized agriculture For the 1 000 km² service of air mapping in the municipality of Balsas was divided into 10 zones of 100 km² and each area of 4 subplots of subdivide 25 km ² was divided so that there was a better combination for the images the main objective was to perform an aerial mapping in order to generate orthophotos that evaluate the conditions of land use in the municipality, together with field interviews for the verification of rural producers' licenses, in order to create a database in order to subsidize future civil works and determine the current land use. From the preliminaesr results were registered 27 large producers of these 18 already had or have some type of environmental licensing all issued through the State Department of Environment. The aerial mapping yielded a single georeferenced orthophoto GSD 15 cm where it is possible to analyze many parameters of land use.*

Keywords**— Mapping, Drone, Land Use, Maranhão**

I. INTRODUCTION

According to the work of MOTA & PESSOA (2009) the Southern Maranhense Meso-region and, in particular, the Microregion dos Gerais of Balsas where the city of Balsas / MA is located, was inserted in this "modernizing" process. From the 1970s onwards, the micro-region saw the arrival, with greater intensity, of agriculturalists from the southern center of the country, particularly the Southerners, who settled in this region to spread agriculture linked to grain production. It is important to emphasize that the low price of land, together with the flat topography of the region, are understood as fundamental in this process, however, they are not the only elements that have made the South of the State of Maranhão emerge as an economic frontier. Nevertheless, they are the main elements that account for the causes of the migration of farmers from the Center-South toward this locality. In relation to the relief of the region, there is a flat topography favorable to the use of agricultural machines. The basic idea of this relief profile is to demonstrate that the physiographic aspects played an important role in the installation of mechanized agriculture in the region.

Balsas is a town typically made up of people of all ethnicities, covering a large number of Northeastern and Southerners who discovered a great place to work with agriculture. Balsas, has a large agricultural area that contains fertile land where it is widely known throughout Brazil for its management, use of state-of-the-art agricultural technologies and work in soybean, rice, corn and cotton crops, as well as fruit growing. The city has asphalted exits to all the capitals of Brazil, as well as a small airport and also the Railroad distant 225 km, which connects the Agricultural Pole to the Port of Madeira in São Luis - MA. Soybean production in Maranhão is almost destined to the external market of 85% and 15% for the domestic market which is a large part of the world's largest economy, CASTRO & CASTRO (2005).

How to solve this problem is more and more common use of RPAS Remotely Piloted Air) or VANT's (Vehicles Aircraft) for the mapping of the surface in both civil and military spheres. Because the background levels are resolutions of a few centimeters and accuracies compatible with photogrammetric conventional aerial surveys or LIDAR (Ferreira A.M.R., 2014).

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The VANTs can be used for various applications such as archaeological documentation, precision agriculture, property registration, security and other applications (Eisenbeiss 2009).

The result is: orthophoto and a digital elevation model. With orthophoto generated from the processing of VANT images, it is possible to apply geographic information extraction techniques. The extraction of geographic information can be carried out using traditional techniques of automatic extraction of information based on digital classifiers or manual vectorization (Santos, Freire et al., 2010).

Przybilla and Wester-Ebbinghaus (1979) did the first experiments with VANT in photogrammetry. They flew in the 1: 1000 scale, shutter speed of the camera. order of 1/1000 s, with aircraft speed sufficient to obtain acceptable images even on the move. Zischinsky et al. (2000) used images obtained with a model of the type helicopter to get the 3D model in Studiesf of agriculture, have begun to interest early by(ALBERS, NYQUIST, PURDY,1996; SNYDER et al., 1999; JOHNSON et al.2001).In particular, there are at present several challenges and prospects and for agriculture highlighting the monitoring of resources natural, environment, atmosphere, imaging hyperspectral, observations of rivers and lakes, and such as the imaging of agricultural practices and (JORGE et al., 1999; JORGE, 2003; EISENBEISS, 2004). Herwitz et al. (2004) carried out a mapping of 1500 ha of coffee plantations in Hawaii, obtaining images of multispectral high-resolution by VANTs.

II. OBJECTIVE

Perform aerial survey with the use of VANTs in the municipality of Balsas state of Maranhão aiming the mapping of large areas replacing extensive measurements and field surveys, thus compose an inventory with the relation of the owners or responsible for the exploration of the land.

III. MATERIALS AND METHODS

The municipality of Balsas is in the southern state of Maranhão is about 815 km from the capital São Luiz, and has a climate according to the classification of Koppen, is defined as AW With a precipitation around 1,232 mm a year .

For the location of the study area was divided into 10 zones of 100 km² the rural area where the main agricultural activities stand out. Each zone contained 4 subplots of subdivide 25 km² so that there was better combination to compose the mosaic of images. The municipality in question presented some particularities as access, resistance of the owners and mobility. Thus, a reorganization was made in accordance with the permissions of the owners, as mentioned there was a lot of rejection, so some areas were started and when the permissions were made the remaining areas were raised and with that some areas have a different aspect in some cases since there was cleaning or use of the area in the transitional period to return to sub area. The SEMA of the municipality can not cooperate since it did not have the information of Environmental Cadastre and Rural Licensing, until the closing of this report there was no return with the rural union, since these are restricted only to foundations and companies of its personal character, there was the demand to map large rural extensions in a safe manner to the staff. Figure 01 below shows how the total mapping area was chosen and figure 02 shows the subdivision of the areas into 1 000 km².

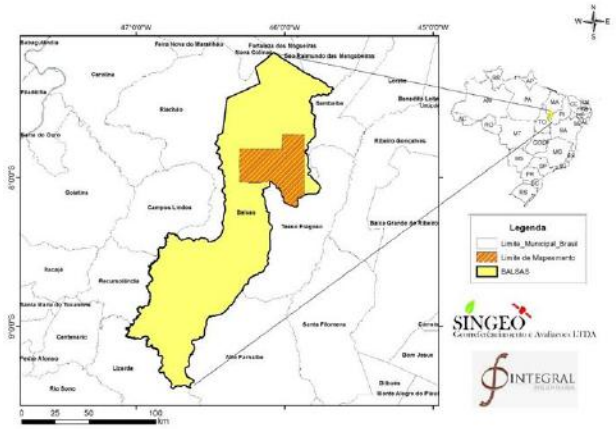

Fig. 1: Location Map of Desktop

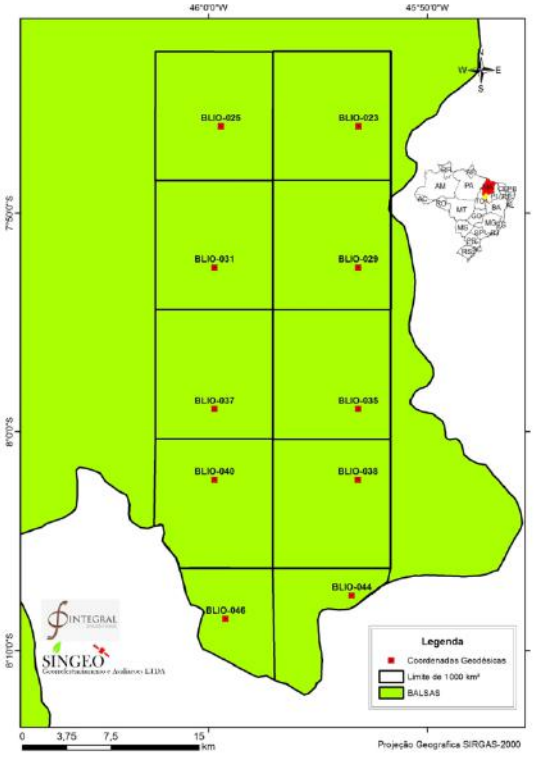

Fig. 2: Work Zones.

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The choice of the subdivisions of the work areas was done in an automated way with the help of ArcGIS 10.1 software.

The flight plans were made according to the accesses and topography of the zones where in each zone center a geodesic coordinate was generated and the visualization points were generated according to figure 3 below. The flights were programmed according to the time of each battery about (25 min / 300 ha) created in the dronedeploy (dronedeploy.com) application that managed the productivity of this work, which generated a daily average of 1000 ha / day in days of "good" weather without rain, the control point reports are in the table below. Later the zones were combined in the software agisoft photoscan and mosaicados in its due group (zone), forming only one file rectified and adjusted. The telemetry was very successful since in ideal topographic conditions it was efficient.

IV. PRODUCERS REGISTRATION

To carry out the registration of the producers, interviews were initially made with the Rural Union of the Municipality "SindiBalsas", the end Environment Secretariat of the Municipality "SEMMA" and the State Secretariat of the Environment "SEMA-MA" to obtain information about the land register and contacts of rural producers. SEMAS does not have a register or information about Rural Environmental Registration (CAR) or Environmental Licensing (LAR) of rural properties. The state does not pass information and there is no possibility of downloading them online since the SICAR System of Maranhão does not allow consultation by: name, CPF or property.

Thus the Work had to visit the properties and environments of the work area, many properties that plant big grains are family complexes and the same are not welcoming in the work since the reluctance about the objectives this study, questions about the main motivation, and if they are going to have benefits, this in a way causes discomfort in getting the job done.

V. RESULTS AND CONCLUSIONS

The families of producers are of southern majorities and have a very restricted cultural form which in some situations did not allow the mapping in more detail. We have been able to obtain information about each Georreferenciada Rural Property and the Official Gazette of the Federal Government (INCRA) with information about the properties they have, or have had environmental permits, and together with some producers who have provided information on the property. A spreadsheet with name, situation of CAR and LAR name of the property, Certification via INCRA and other information such as CPF or contact was made.

The results of the aerial survey allowed to reach the objective of this study, in each zone of 100 km ² generated about 850 photos with average altitude of 120 meters obeying the current legislation on operations with drone, for the composition of the mosaic of each zone it was necessary to use a computer core i7 with 4 gigabytes of video card and ram of 16 gigabytes where it took about 8 hours of processing in high quality, the routine was as follows (1) alignment and insertion of control points (2) Adjustments and calibration of (3) Creation of points cloud (4) Development of Digital Elevation Model figure 3 (5) Extraction of contour lines (6) Ortortification.

With 10 zones of 100 km² all processed, the mosaic was done with the help of the ArcGIS 10.3 program and the generation of a single spatial resolution product "GSD" 15 cm with size of 180 gigabytes in tiff format, the figure 4 below presents the result of this mosaic.

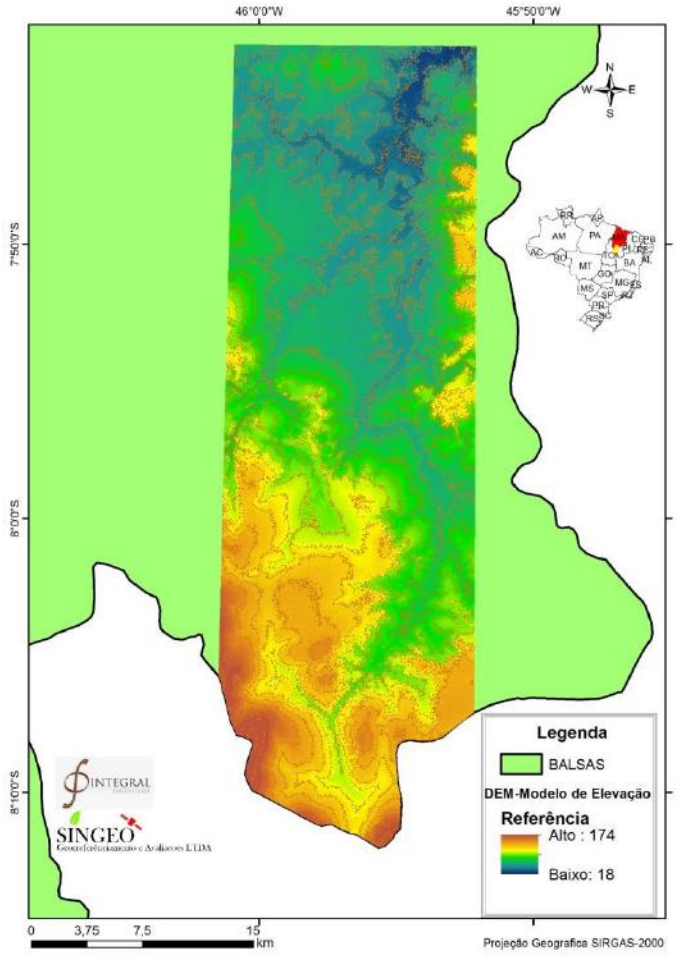

Fig. 3: Map of Altimetry of the Desktop.

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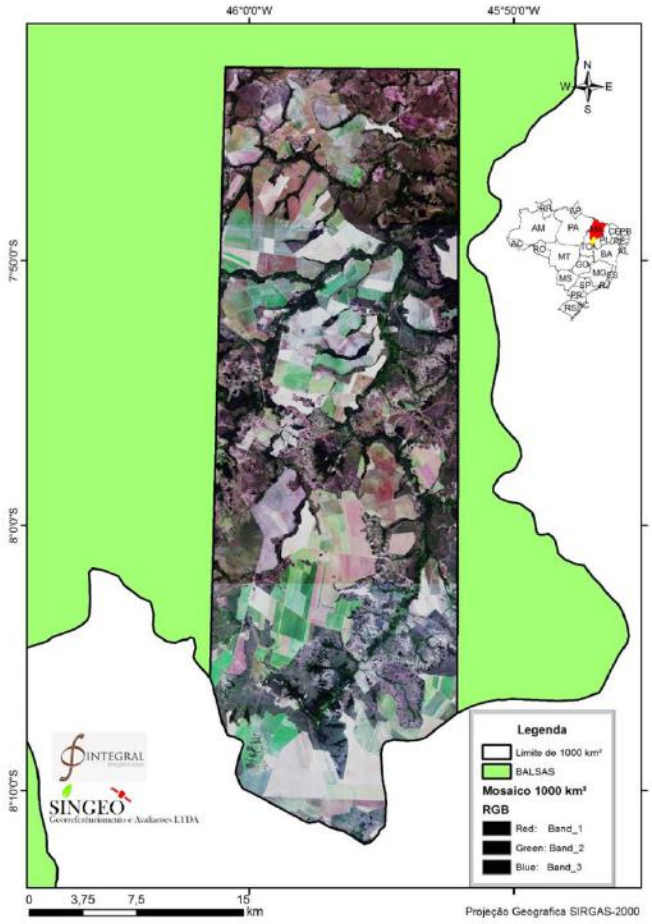

Fig. 4. Adaptive orthophoto of the Work area.

VI. CONCLUSION

From this preliminary results were registered 27 large producers of these 18 already had or have some type of environmental licensing all issued via the state SEMA. Everyone already has CAR, there are large tracts of land that have not been registered for reasons of not having owners, headquarters or something that can prove the use of the soil. The products were organized in folders and sub-folders recorded on media, containing level and drainage curves in dwg (CAD) and shp (GIS) format, Ortofoto Mosaico Integral of the area of 1 000 km² in TIFF format, Elevation model in TIFF format , flight recording and simulation models, xls worksheet with information of the owners of this area (1000 km²), obj and LAS 3D models. The aerial mapping allowed to obtain a unique georeferenced orthophotometer with GSD of 15 cm where it is possible to analyze several parameters of land use.

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NodeMCU12e + Nextion Tft an Experimental Survey with Virtual Keyboard in IoT Projects

Antonio Carlos Bento[1], Anderson Rocha de Barros[2], Érica Oliveira Lopes da Silva[3], Leonardo Augusto Taniguti Mantovani[4]

Computer Science, Universidade Nove de Julho, São Paulo, Brazil
[1]acb01@hotmail.com; [2]andy.rb@hotmail.comr; [3]ericaolsilva@gmail.com; [4]leonardo.mantovani@hotmail.com.br

Abstract*—This manuscript presents the results of an experimental research on the construction of virtual keyboards for the Internet of Things (IoT), using the NodeMCU12e controller in conjunction with the Nextion touchscreen display. The creation of projects for the Internet of Things is in constant development, applying technical and scientific models that meet the different types of solutions, in this way, the results of this experience are presented during the construction of a solution that serves parts of academic projects, contributing in this way as a research base for more complex projects, which require a solution with virtual keyboard for data entry, or even for the configuration of different types of devices, such as Arduino or Raspberry Pi controller. With the results obtained with this study, it was possible to make feasible the construction of a proposal that meets the needs of a small project, allowing to expand its possibilities and resources according to the need of the project to be developed.*

Keywords*—*IoT; NodeMCU12e; Nextion; Virtual Keyboard; Internet.

I. INTRODUCTION

The main objective of this work is to present the results of an experimental research, using the Internet of Things or IoT, in which different devices connected to objects are used, so that it is possible to control at a distance, as well as the monitoring of environments, normally used in residential and business automation, nowadays it is very common to build and develop various solutions to meet the most complex types of projects [2].

As a specific objective, a solution was developed which demonstrates the main devices and tools necessary for the construction of a virtual keyboard, usually used for data entry, such as for accessing Internet access point names, passwords , locations and user information, these data are normally used to control and send information in different media, allowing, for example, access to a WiFi network, or even setting a given limit for device control, such as maximum or minimum temperature.

The motivation for the development of this project was based on an academic need that involved the creation of solutions for monitoring and controlling patient activities, such as people with disabilities, special needs, the elderly or even children, for the construction of solutions which could serve the project, it was necessary to develop projects that could control the data, as well as user input to access a residential WiFi network, or somewhere remote, allowing to enter the network name, user name and password.

It is observed that there are contents on the development of solutions in a technical way, but for scientific studies there is not a relevant quantity which can serve as bibliographical reference on the subject addressed, thus intending to contribute to the scientific knowledge, providing quality and theoretical and practical reference for more complex projects,

II. BIBLIOGRAPHY REVIEW

As a bibliographical basis technical and scientific materials were used, which made possible the creation of the project, much of the content on the subject has originated in technical materials developed and made available by the device manufacturers, these materials are usually developed by technical teams or specialists, the which make their work available on blogs, websites and discussion forums.

The bibliographies with academic contents were basically searched in the bases of IEEE Xplore, IEEE Latin America and Scopus, which did not provide a significant content for the study, few of the contents found, served as a basis for the theories and specification of the devices used, also demonstrating some concepts, such as Internet of Things, use of controllers, and applications in different projects.

The technical bases that were used include the controllers for the Internet of Things, types of touchscreen display, and have been the results of other comparative studies between different brands and types of devices. The algorithms used were adapted from the examples, models and templates provided by the manufacturers themselves, thus following a working model according to the best practices of the manufacturers.

With references on the topics covered on IoT, bibliographies were used: Frustaci et al. [19]; Muñoz et al [22]; Voas et al. [15]; Oteafy [24]; Want et al. [23]; Taivalsaari

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& Mikkonen [5]; Bedi et al. [10]; Chernyshev et al. [18]; CERP [7]; ITU-T [14]; Arduino [6].

With references on the NodeMCU12e controller and the Nextion Tft, the following were used: Naranjo et al. [8]; Murdan & Emambocus [4]; Al-Kuwari et al. [17]; Kodali & Gorantla [21]; Ngamsuriyaroj et al. [25]; Rahman et al. [16]; Villamil et al. [27]; Arya et al. [20]; Zhang et al. [11]; Durrani et al. [26]; Mouna et al. [3]; Bento [1]; Bento [2]; Itead [12]; IteadNextion [13].

III. METHODS AND MATERIALS

It was used the experimental research method, which consists in the accomplishment of experiments using tools and techniques, thus allowing to perform an analysis on the results obtained during the development of the project, initially were conducted studies on manuals and technical documentation, enabling the understanding of possible solutions for the project, after the bibliographic studies, were carried out tests with prototypes on the solution, with the results it was possible to discuss and evaluate the proposal, allowing to make decisions about the best approach model on the problem.

The prototypes served as a basis for a practical validation of the studies, making it possible to simulate situations, as well as sending and receiving data, in the case, for the configuration of the controlling devices, for the purpose of transmitting or receiving data, over a WiFi network, or even to store information about the date and time when events may occur, during a monitoring process, or any other alert about problems that may occur during a follow-up, thus enabling more effective control over the event.

The NodeMCU12e devices were used as materials, being this one Arduino type controller, which is commonly used in design for projects that involve Internet of Things, being a device with low cost, also because it is easy to locate in the national and international market , this device was selected, by these main characteristics besides others as they are discussed by Bento [1].

Another device that has been selected is the touchscreen Nextion Tft display, this device allows to communicate with the NodeMCU12e controller, with advanced features such as touch, in which it is possible to use buttons and a simple interface, in which is easy to use for an user without much knowledge about the Nextion display was selected after the studies carried out by Bento [2].

A notebook with the Windows 10 64-bit operating system was also used for the construction of the algorithms, as well as for the development of the screen for use with the Nextion display, also serving for the transmission and reception of the data between the devices, also making possible the validation during data transfer.

As a development tool, the Arduino IDE was used [2], being a platform commonly used for the creation and configuration of the controllers used for projects on the Internet of Things, was used the C++ programming language for the construction of the algorithm that will allow communication between devices. Another tool used was the ITEAD Nextion display editor, which is necessary for the construction of Nextion display screens, this tool is available by the manufacturer itself, which facilitates the construction of the screens in a simpler and more intuitive way.

Other materials used were: mini USB cable for communication with the NodeMCU12e controller and Notebook, wires for connection between the Nextion and NodeMCU12e devices, enabling a communication between them, a 16GB microSD memory card was also used to load the screen project between the Notebook and the Nextion display, enabling the update of features.

IV. RESULTS AND ANALYSIS

As a first step, studies were carried out on the materials and techniques used for the construction of solutions using the controllers normally used for projects involving the Internet of Things, based on other projects and experiences of professionals and technicians in the area of solutions for residential and commercial, equipment was then selected according to its capacity, cost and ease, and these premises are important and necessary for the development of the project.

During the studies, the different types of controllers, such as the Arduino Uno [1], were considered. This presented little capacity for storage, processing and memory, besides needing other devices to complete the project, such as an external WiFi device, another important factor that was considered the size of the device, compared to the NodeMCU12e controller, which has greater capacity, processing and memory as presented in the studies developed by Bento [2], besides the ability to have an integrated WiFi device, also having a good size less compared to the Arduino controller.

For the display device, different models such as ILI9341 and Nextion tft were evaluated, and the ILI9341 model, despite being one of the most used and available in the market, presented a lower cost, was observed in the results of other studies presented by Bento [2] , that its structure and direct programming in lines of code, makes difficult its use, since it is necessary the development of many lines to solve a simple problem, as for example, to present a value on screen, besides not having the resource of touchscreen, these problems increase the use of programming code lines and processing, in addition to needing more devices, as buttons to control user actions, as well as using many outputs or ports of controller connections.

After the comparative studies developed, the Nextion display was selected because of its high capacity, design, image quality, touchscreen features, and the ease of programming and creation of screens for control, with its own development tool called ITEAD [12], which enables the creation of professional screens with quality and ease, using diverse libraries, with drag and drop capabilities.

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The studies provided the choice of devices that could contribute to the development of the project, such as the NodeMCU12e controller and the Nextion Tft touchscreen display, for its ease of use, capacity and speed, and the tools provided by the manufacturers, which effectively collaborated to the development of the solution, presented below.

A. The devices

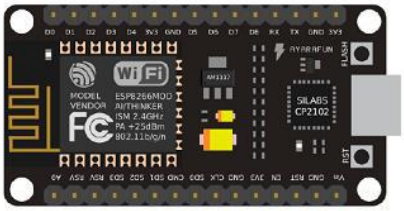

Fig. 1.NodeMCU 12e device, used in the project.

For the use of the NodeMCU12e controller, it was necessary to configure with the libraries and technical information available on the manufacturer's website, as well as the follow-up and studies developed by technical professionals, such as those presented in [2].

After the proper settings in the Arduino IDE, it was possible to perform the first tests of the component use, making some data transfers and using some examples available in the billiotheques of the device.

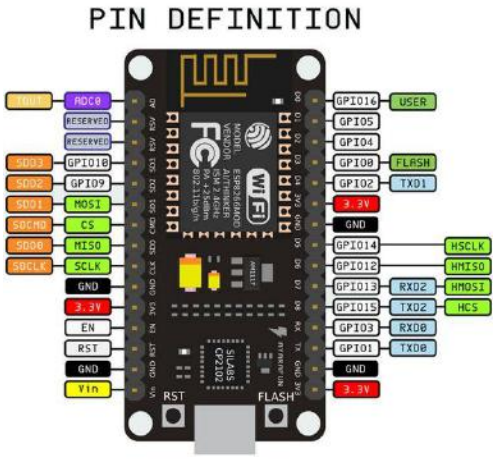

Fig. 2.The NodeMCU12e pin definition, used for connection with another devices.

The Nextion display has some parts, such as cables and a micro USB connector, making it possible to connect to other devices, as well as having a large number of libraries that can handle different types of projects. For the design the Nextion display mini-USB connector should not be used, this is normally used for transferring data directly between the NExtion display and a computer, or even to perform the transfer of power.

Fig. 3.The display Nextion Tft NX3224T024 2.4".

The Nextion connection settings allow the device to be used with different controllers, such as Arduino Uno, Raspberry Pi, NodeMCU12e, as the device uses only two cables, one for TX data transmission, one for RX data reception, this provides better facility for the availability of ports to other devices in the controller.

Fig. 4.The connection pins used with the display Nextion.

As shown in Figures 2 and 4, there are a large number of connection pins available on the NodeMCU12e controller, for the ease of connection of the Nextion device, which uses only 2 pins, this provides greater flexibility for the use of other devices that can be connected, such as a temperature sensor, humidity sensor, or even for heart rate monitoring.

For the presentation of this project only a virtual keyboard must be used, so that it is possible to configure a connection to a WiFi network, where the user must enter the name of the access point and the password, as the NodeMCU controller already has a device, it allows the connection in another local network, such as in a residence, then the algorithm developed and made available in the controller will allow communication with the local WiFi network, informing if the access was successful or not.

The feature of a virtual keyboard is very useful, in situations where it is necessary for the user to perform some type of configuration manually, to define, for example, some alert threshold, date and time information, as well as the configuration of a network access, such as WiFi.

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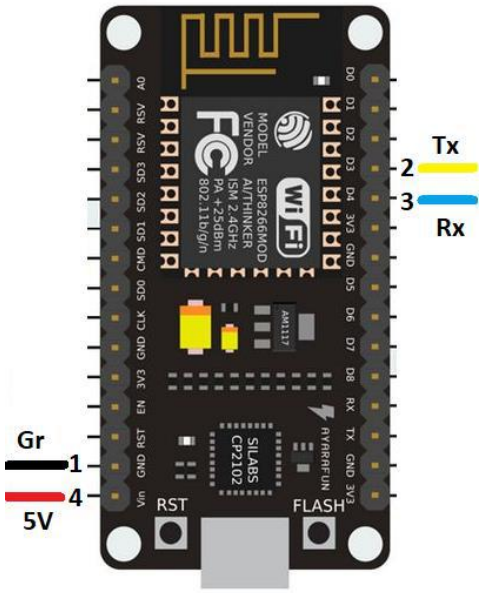

Fig. 5.The connection pins used with the display Nextion and NodeMCu12e.

As a basic configuration, the documents and manuals presented by the manufacturers of the devices, as well as other sources of information such as technical documents and blogs of different authors, were used to create solutions for the Internet of Things using the NodeMCU12e controller as they present [2]. After the necessary configurations and tests, it was possible to begin the construction of the algorithms of the project, to effectively develop the screens for the Nextion display.

B. The Nextion screen editor Itead

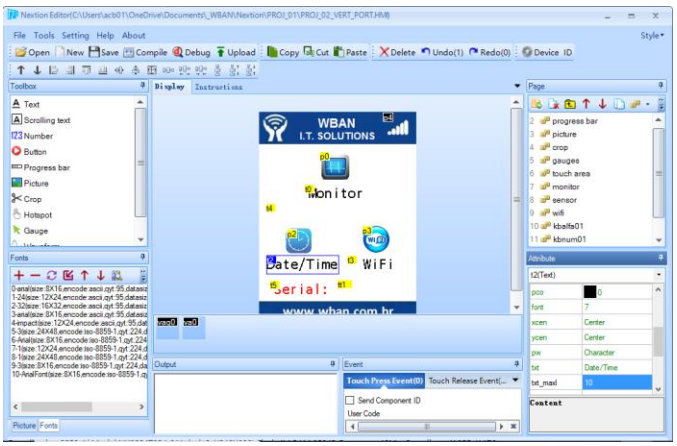

Fig. 6.The project main screen created with the Nextion editor [12].

The main screen was developed to meet the project, initially presenting the options for the monitoring screen, another icon for setting Date and Time, another option for the configuration of the WiFi access point, the latter having the features necessary for discussion in this study. The other options should not be discussed during this project, as they contain a large amount of information, forming part of other sub-projects, which complete the main project.

For the WiFi access point configuration screen, one object button was used to save the data, two text boxes to enter the access point name and the password, by pressing the name field of the access point system directs the user to the virtual keyboard's main screen.

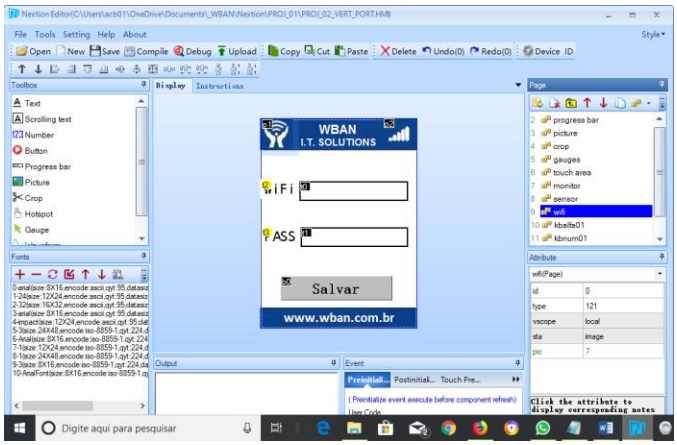

Fig. 7.The setup WiFi screen created with the Nextion editor [13].

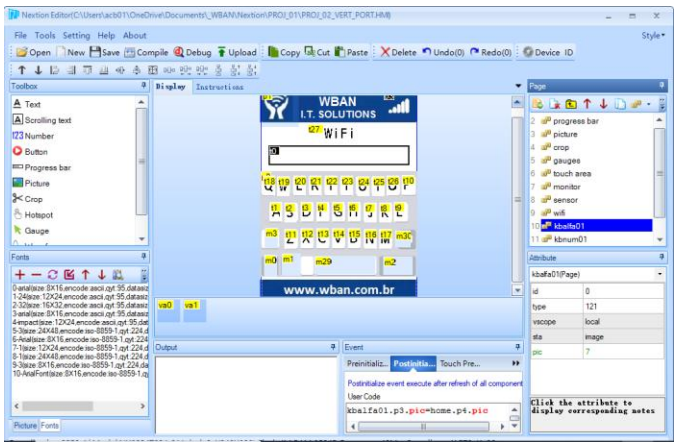

Fig. 8.The setup WiFi screen created with the Nextion editor [13].

For the virtual keyboard was used a figure that represents a keyboard, on the figure and the keys, were created buttons to identify the object that was pressed by the user, this was the systemcreated with the Nextion Editor, records the characters selected by the user in a text box, just above the screen, this to present the user with their options during the configuration.

Three more keys have been created to meet the needs of the user, one to change the characters from uppercase to uppercase, another to be used as input only for numbers, and another for input of special characters, all screens use a text type , which should keep the data selected by the user, then this data is transferred to the main screen of the access point configuration.

Was created also buttons to delete the characters, and a space button, in addition to the Save button, used to store the data entered in a variable and pass them to the main screen of the access point of the WiFi access point, as in a keyboard these functions are defined in each action of the buttons.

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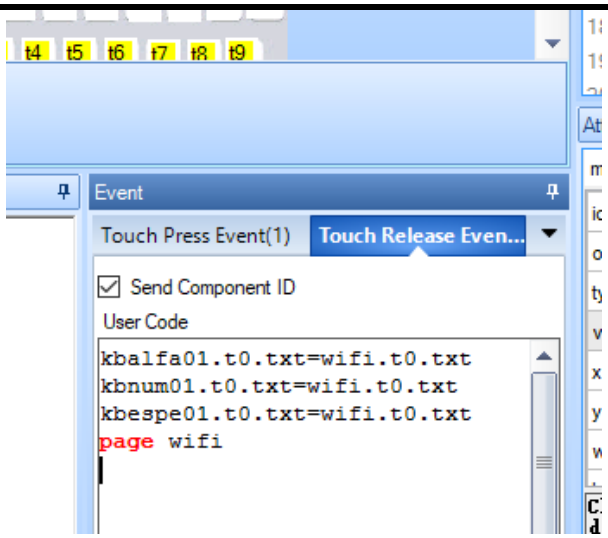

Fig. 9.The Save button commands created with Nextion editor [12].

For the Save button, a basic code has been created to pass the selected data to the main screen, in this case the values that are presented in the field of type text box are passed to the main screen, then the system redirects the user to the access point input screen WiFi.

C. The algoritm created with the Arduino IDE

For the construction of the algorithm, the Arduino IDE tool was used, which allows the configuration of the devices, as well as the construction of algorithms that can take care of the project, for more details on the configurations an extra analysis is necessary, available in the works presented by Bento [2] and Arduino [1].

The #include "Wire.h" library was used, for the connection of the devices, the Nextion binaries are available on the GitHub website, the Neo Nextion binaries were used.

```
#include <Nextion.h>
#include <NextionPage.h>
#include <NextionText.h>
#include <NextionButton.h>
#include <NextionVariableString.h>
#include <NextionVariableNumeric.h>
#include <NextionSlidingText.h>
#include <SoftwareSerial.h>
#include <NextionPicture.h>
SoftwareSerial nextionSerial(D3, D4); // BLUE_D3=RX, YELLOW_D4=TX
Nextion nex(nextionSerial);
```

The following algorithm was developed by means of a function to perform the procedure of recording the data sent by the Nextion display after the user presses the Save button.

```
void t9_callback0(NextionEventType type,
INextionTouchable *widget) {
Serial.println(F("Callback..."));
t9_vb0.setText("Saved-Restart");
char buffer[19];
if (t9_vt0.getText(buffer, 19)) { Serial.println(buffer); }
qsid=buffer;
if (t9_vt1.getText(buffer, 19)) { Serial.println(buffer); }
qpass=buffer;}
```

After creating the algorithms and transferring the code to the devices, it was possible to perform different tests, correcting problems such as incorrectly configured buttons, as well as some loss of communication during the use of the display, thus allowing validation of the solution development, enabling new adaptations.

The data were cleared in the EEPROM of the controller, after the information about the WiFi access point is configured, the device requests that it be restarted, during the initialization the device tries to make the connection with the configured WiFi access point, error or success during operation.

Fig. 10. The project in operation with the NodeMCU12e controller and with the display Nextion touchscreen [2].

As the final result shown in figure 10, there is the input screen of the WiFi access point of the user's residence, in this way it is possible to send information and data collected during the use of the device to be sent to a remote base by the user. internet, making it possible to create reports and remote monitoring.

Some difficulties faced, involve the understanding of the tools as well as the lack of skill gift devices, which after a brief period of study was possible to improve the solution by using more advanced features compared to other existing projects.

V. CONCLUSION

The results allowed to conclude on the possibilities of creating solutions using virtual keyboards with Arduino type controllers for the Internet of Things, making possible the validation of the functionalities, as well as the use and application of the resources developed with the Nextion device and the NodeMCU12e controller, making possible the

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construction of a viable solution that can meet the different types of projects.

Due to the great amount of technical content, it is intended that this work may contribute to the development of more complex solutions, collaborating with the scientific society, involving students, researchers and professors, who are interested in constructing simple solutions, which can be complemented depending on the type of project.

With the rapid evolution and growth of solutions for projects that involve the Internet of Things, it is understood that there is still a great need to develop solutions for the academic area, as well as practice in this type of solution, although it is a study that involves interdisciplinarity, since several studies are used, such as the development of algorithms, electrical, data transmission, these factors end up inhibiting new projects, because it is necessary a period of study and practice to understand all the infrastructure used.

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Do I know what I eat? The use of QR code in Food Packaging to Provide Traceability Information

Joao Guilherme de Camargo Ferraz Machado[1], Jose Flávio Diniz Nantes[2], Fabiana Cunha Viana Leonelli[3]

[1]Facult of Science and Engineering, Sao Paulo State University, Tupa-SP, Brazil
Email: jg.machado@unesp.br
[2]Department of Production Engineering, Federal University of Sao Carlos, Sao Carlos-SP, Brazil
Email: fnantes@ufscar.br
[3]Facult of Animal Science and Food Engineering, Sao Paulo University, Pirassununga-SP, Brazil
Email: fabiana.leonelli@usp.br

Abstract *— This research aimed to analyze the use of QR code in the packaging of agri-food products as a tool for communication and relationship between consumer and company, aiming to make the product and process traceable information available. In a specific way, the information considered relevant to the final consumer was identified under normal purchasing conditions. This research has an exploratory and descriptive character, and its data were collected with consumers in supermarkets located in two cities of Sao Paulo State: Marilia and Sao Carlos. The results showed that not all the information obtained in the tracking process is made available to final consumers and that the lack of knowledge about QR code is still considerable for consumers. In general, the consumers interviewed in Sao Carlos had higher income and higher education than those interviewed in Marilia, and these characteristics seemed to have resulted directly in the knowledge about the technology of the QR code, higher in Sao Carlos. The main contribution of this research is based on the survey of the information that the interviewed consumers consider important for the purchase decision of agri-food products, constituting an important reference so that the companies that currently work with traceability, be it industry or retail, can improve their labels, adding value to the marketed product. The study can be used as a starting point for other researches, testing new information and other products, making even possible comparisons.*

Keywords — Packaging; Product information; QR Code; Food Traceability.

I. INTRODUCTION

Food safety problems and the growing consumer interest in food traceability stand out in consumer relations. Therefore, concern about food safety and possible health risks added to the need for transparent information has influenced food demand, increasing the importance of traceability of these products [1].

For [2], the detailed information that a traceability system provides can add value to food products, address legal security issues, improve consumer confidence and satisfaction, and make companies more competitive.

Considering that consumers are increasingly interested in practical information, it is believed that they are predisposed to use their smartphones to access information from the manufacturer/producer at the point of sale, assisting in decision making. In recent years, the number of people who have a smartphone with internet access has grown considerably. In 2018, Brazil already had more than 234.6 million wireless connections, 73% of which were through smartphones and 35% using 4G technology, which put the country first in Latin America among the countries with the highest number of smartphones connected to the Internet. Besides, between 2012 and 2016 the number of households with mobile connections grew 86%, reaching 9.3 million, indicating that 54% of households and 61% of Brazilians, over ten years old, are connected [3].

As mobile access technology progresses, company websites are increasingly being visited through mobile devices. However, according to [4], this growth is not accompanied by websites concerning browsing and mobile search, since mobile access to the web differs from current access by the format of the screens, content types and mode of interaction with the user.

According to [5], QR code technology has been increasingly used in packaging and print advertisements (magazines, newspapers, folders) and promotional

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campaigns, although many consumers are still unaware of this new "Symbol" printed on the packaging.

According to [6], the QR code has gained great commercial popularity due to mobile technology. However, its use is less widespread in western countries than in Asian countries. In Brazil, it was from 2007 that some companies began to adopt the QR code in movie tickets, air tickets, magazines, and some food packaging.

[7] pointed out that this technology has become popular as a marketing strategy, spreading the offer and the company or even directing the consumer's choices, since the buying process involves several small decisions besides the search for information, which with the type of product and the degree of buyer involvement. Thus, [8] understood that companies need to consider this behavior, so that the use of QR code can make the purchasing environment more attractive, broaden the senses involved in the consumption experience and provide information product, brand or company.

A QR code is one of the most popular types of two-dimensional barcode and was created in 1994 by the Toyota-Denso Wave subsidiary, with the purpose of enabling the catalog of different parts in the automobile industry [9]. [10] described it as a bitmap image converted into information, which can range from a text (interactive), a URL address, a telephone number, a geo-referenced location to an email, contact, or SMS.

Other identification technologies such as traditional barcodes and radio frequency identification (RFID) can be integrated into traceability systems. [11] evaluated the use of barcode and RFID technologies in manual fruit harvesting to improve traceability. [12] explored the feasibility of adopting linear and 2D barcodes for the traceability of poultry products. More recently, [13] have instituted a wheat flour traceability system based on the 2D barcode and RFID technologies, spanning the entire supply chain, especially the processing steps.

However, [9] reported that companies still have not been able to figure out how to maximize the benefits of using QR code, which offers interactivity when scanning, allowing access to different content from mobile devices, increasing the potential of interactivity through clicks or by performing a specific task to receive a special offer, for example. With the use of this tool, designed for quick and easy access to content on smartphones, consumers may feel more connected to the brand.

One of the main purposes of this research is to associate the interest of consumers with fast information and content about the characteristics of food, to a technology that makes such information practical and straightforward. [14] noted that consumers recognize the importance of the information contained in the labels and are more interested in practical information, such as methods of preparation, safety assurance, brand quality, and its products.

In this sense, traceability associated with the use of QR code may be the answer to safer foods, since it can provide a lot of information and transparency of the complex productive chains, thus guaranteeing the quality and safety of the products [15].

In view of these findings, and especially that there is little research focusing on the use of QR code, and consumer attitudes towards it, the general objective of this research was to analyze the use of QR code in packaging of agri-food products as a communication tool and relationship between company and consumer, aiming to provide additional product traceability information.

The article was divided into five topics, including this introduction. Next, we present the theoretical review of the topics covered in the research, including traceability, QR code technology, and its application as a marketing strategy, and packaging for food, including its age marketing function. Section 3 explains the methodology adopted in the research. The results are presented in section 4, divided into socioeconomic and demographic characteristics of the consumers, their previous contact with the QR code, the information of the product considered more critical by him and the respective analyzes. Finally, section 5 deals with the final considerations of the study, including its contributions, limitations, and future suggestions.

II. THEORETICAL REFERENCES

2.1. Food Packaging

Packaging is essential, as it performs critical functions such as protection, packaging, and storage, enables distribution logistics, allowing the product to arrive at its destination in the best possible way, preserving the quality attributes of the product. [16] reported that packaging is practically a symbol of the product, reaching in some cases, to be as important as its content.

In self-service outlets, such as food retailing, the attendant and salesperson figures are practically non-existent, with packaging being responsible for communicating to consumers the product and brand messages. Most of the time, the packaging is the only form of communication that the product has, since about 90% of the products on display, according to [17], do not have any communication and marketing support at the points of sale.

Packaging represents the element that positions the product to face competition, establishes consumer segments and enhances the image of the brand and the company. According to [18], it symbolizes the product and identifies the brand on the supermarket shelf, in the stores and the cabinets of the houses, making the difference between the various products belonging to the same category.

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The distribution chains have driven the changes that have been occurring in the markets. Supermarkets prefer innovative packaging because they believe they influence sales and play a critical role in maintaining product status. This concern is because most purchase decisions occur at the point of sale. For these reasons, the size and dimensions of the package should be planned based on its shelf display and subsequent accommodation in consumer shopping bags. Also, the packaging should always be functional, comfortable to open, close, discard and allow the use of suitable portions, giving convenience to the consumer, a critical factor in the choice of product [19].

The appearance of the packaging affects the way in which the quality and value of the product are perceived. Labels are essential elements, as they act both on the functional aspects of packaging, communicating the product information, and on the aesthetic aspects, attracting the consumer and motivating him to purchase. In this sense, the use of clear and objective language on the label helps the consumer to make the right decision at the time of purchase.

Product labels should prioritize the mandatory information established by the Consumer Defense Code. The primary information relates to the name of the product (brand) and the company, expiry date, full address, and composition in the case of food. Non-mandatory information such as promotions, logo, and codes are also essential elements.

The National Agency for Sanitary Vigilance (ANVISA) defines a label as "any inscription, legend, and image or any descriptive or graphic material that is written, printed, stamped, engraved or pasted on the food packaging" [20]. Packaging-related regulations include packaging and materials that come into direct contact with food and are intended to contain them, from their manufacture to delivery to the consumer, to protect them from external agents, changes and contamination, as well as adulteration.

2.2. The use of QR code as a marketing strategy

The industry, in general, has been working to stamp the QR code on the packaging of the products, from which the consumer can access, instantaneously, gifts, services, and information hosted on the Internet [21].

For [22], there is little research available on the factors that affect consumers' response to QR codes, especially from the marketing point of view. According to [9], the QR code, originally designed to track parts in vehicle manufacturing, has been used in a much broader context, ranging from commercial tracking to entertainment, and marketing the labeling of the product. Many of these applications are intended for smartphone users who can receive text messages, add a vCard contact to the device, open a URL or compose an email or text message after reading the code.

[22] included other applications such as product images and coupons. The main benefit of this technology is the ease of use since it is only necessary to scan the codes with the mobile device so that the consumer has access to the coded data. QR codes have been made available in different media, such as magazines, newspapers, posters, packaging, labels, and receipts, and play a key role in bridging the advertising media with promotional sites in cross-media strategy-average).

[23] called these mobile marketing strategies, which are characterized by the marketing actions developed with the help of the cellular telephone, generally used to leverage the construction of a satisfactory and lasting relationship between the companies and their clients.

Marketing communication using a QR code in the retail environment offers utilitarian and non-utilitarian benefits to consumers, such as business and convenience information or a more enjoyable shopping experience, respectively [24], and [25]. For [26], food labeling is a powerful tool for consumer education, and the information on the label can contribute to the decision to purchase the product.

In this sense, the concept of mobile tagging arises, which refers to the labels of products with expanded communication capacity, going beyond the presentation of traditional information, such as weight, validity, and constitution of the product, beyond the space-temporal and printed language. For [8], the use of mobile labels tends to become an essential component in shaping consumer opinion.

Considering that consumers, in general, have difficulty interpreting food labels accurately or objectively, there is a gap in the information that marks the purchase decision [5]. In this sense, a mobile tagging system can be the solution for these consumers to access accurate and adequate information through the QR code available on the product packaging. The QR code mind allows retrieving extra information stored in any database, which can also be customized accordingly with the preference and need of different groups of consumers, constituting a strategy of market segmentation and product positioning.

Thus, information provided on the label of food and beverages can contribute to the decision to buy the consumer, because according to [27], this is facilitated using digital strategies in communication and marketing campaigns of companies, which has diversified with the integration of mobility and portability of access to the web, constituting new pillars of integrated communication.

2.3. The QR code and traceability in the food industry

The topic of food traceability has been more frequently verified in the economic literature, for example, [28] and [29], who discussed their effect on market failures in the food sectors. [30]estimated the consumer's willingness to pay for a tracking system, and [31] explored the relationship between traceability and food safety regarding the assignment of responsibility.

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Traceability has become a frequent feature of international agrifood chains because of problems related to food safety and consumer demand, especially in developed countries, and is, therefore, is increasingly valued by policymakers and food industry [1].

Resende Filho (2006) and Pouliot (2008), cited by [32], pointed out that the use of traceability is part of the strategies of coping with competition, providing differentiation of supply, contributing to the brand/company credibility and safeguarding origin of the products offered, to take account of consumers' interests in safe food.

For [2], the necessary traceability information provided in product labels is not adequate for purchasing decisions as some consumers look for more detailed information that is not available on the packaging label, such as the location of the farm or pesticides used. Thus, companies have adopted some strategies to solve this problem. [33], for example, proposed the use of QR code on the fish packaging label, combined with traceability, providing the consumer with access to additional information regarding different stages of the production chain that could be accessed by consumers, decision making and greatly facilitating the process of inspection and control within the production chain.

[34] proposed the use of intelligent packaging integrated with traceability systems, in order to create more effective communication channels. Barcodes and RFID tags enable electronic records and information sharing, especially when connected to external instruments that can quickly measure quality attributes and monitor food safety.

III. METHODOLOGY

The objective of the study and its scope make it possible to define the research as exploratory and descriptive. The exploratory research aims to provide the researcher with a greater familiarity with the problem under study, with the goal of making a complex problem more explicit or even constructing more appropriate hypotheses. According to [35], the exploratory research is conducted to enable an understanding of the problem faced by the researcher and is used when it is necessary to define the problem more precisely and to identify relevant courses of action or to obtain additional data before an approach can be developed. As the name suggests, exploratory research seeks to explore a problem or situation to provide criteria and understanding, using broad and versatile methods such as surveys of secondary sources, surveys of experience, selected case studies, and informal observation.

On the other hand, the structure of data collection was typical of a descriptive study. The descriptive research aims to know and interpret reality without interfering in it to modify it, seeking to discover and observe phenomena, to describe them, to classify them and to interpret them, establishing a relation between the variables [36].

The research had a qualitative approach because this methodological procedure houses several techniques that try to describe and translate the main question, promoting the understanding of the problem. The qualitative method is more directed to the understanding of the facts than in the measurement of phenomena [37]. Qualitative research is adequate in studies of complex subjects, allowing the researcher to obtain more detailed information and work in more depth the question to be studied. The most significant advantage of this type of research lies in the richness of the details obtained.

This research step used a structured form with closed questions applied to end consumers. The tests were carried out in supermarkets in two cities of Sao Paulo State - Marilia and Sao Carlos -, and the interviews were conducted by the researchers who, after the agreement of the retailers, approached the people in the place, inviting them to participate in the search. The total number of samples in the two retailers was 70 participants.

The researchers presented the application to the volunteers, read the QR codes, using a smartphone with the iOS system, belonging to the interviewer, to identify the interest of consumers in the information provided by a QR code printed on the label of products with labels modified for the search. Three product categories were selected: (i) FV (Fruits and Vegetables): papaya and banana silver; (ii) Meat: fillet steak and mature file steak; and (iii) Alcoholic beverages: wines.

After analyzing the information provided in an application specially developed for this research, respondents answered a set of 14 questions, which were weighted by a 5-point Likert scale (I strongly disagree, partially disagree, do not know how to comment, partially agree and I agree). [38] affirmed that the Likert-type scale presents more precise information on the opinion of the individual about each question presented to the respondent because it is a classification scale that allows indicating a degree of agreement or disagreement with each of the assertions presented.

The assertions addressed the interviewee's knowledge about the information available in the current labels, the quality of the information provided by the current labels, traceability information, purchase decision making from the use of the application and questions about the application used as a tool and facilitator information.

The data were analyzed utilizing descriptive statistics and the chi-square test, using the Cramer's V correlation coefficient to measure the intensity of the statistically significant association of the variables. In general, the intensity of association is only of interest if it is statistically significant, that is when the p-value (probability of significance) of said test is less than or equal to the level of significance α established, which in this case was 5%. Statistical software SPSS 22.0 was used for these analyzes.

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The Cramer coefficient V is a measure of association between two variables measured on a particular scale and can be applied in situations where the information is distributed. In general, the intensity of association is only of interest if the association is statistically significant. Cramer's V ranges from 0 to 1, and when the variables are independent, V will be approximately equal to zero. A significant value of V indicates only a high degree of association and not how the variables are associated [39].

IV. RESULTS

Consumers were approached in two supermarkets, in Marilia and Sao Carlos. The two cities were chosen because they had similarities in the number of inhabitants (216,745 and 221,950, respectively), area (1,170,250 km² and 1,137,332 km², respectively), Human Development Index - HDI (0.788 and 0.805, respectively), number of operating companies (9,175 and 10,717, respectively), but they have different per capita GDP (R$ 20,303.30 and R$ 30,245.20, respectively), according to data from the 2010 Census [40]. Fig. 1 illustrates data collection at both supermarkets.

Fig. 1: Research conducted with consumers in supermarkets in Marilia-SP and Sao Carlos-SP.

The participants of the research were presented to a specific application for reading QR codes explicitly prepared for the research and received a brief explanation of their functionalities. They then answered some questions about the information available in the current labels of the products, the quality of the information made available by the companies and the use of the said application for purchasing decision making. Fig. 2 shows some screens of this application, regarding the readings of the QR codes realized during the test with the consumers.

Fig. 2: QR code reading history screens, product and comparative information between searched products - Qinfo application

The main results of the research are presented below, starting with the profile of the consumers, where the socioeconomic and demographic characteristics are presented, and whether they knew the QR code at the time of the research. The primary information considered by consumers in purchasing decision making for four product categories: meat, alcoholic beverages, FVs and grocery, and bakery products are presented below. Finally, the analyzes of the correlation between the variables of the consumer profile and the information considered necessary in the purchase decision are presented.

In Sao Carlos, more women than men were interviewed, unlike Marilia. The predominant age among respondents in Sao Carlos was the age group between 25 and 34 years, followed by the age group between 35 and 44 years, while in Marilia the ages were between 16 and 34 years (54.3%). There was also a higher number of consumers aged 55 to 64 years in Sao Carlos (17.1%).

Table 1 presents the consumers' profile in Sao Carlos-SP and Marilia-SP.

	Sao Carlos		**Marilia**	
	Total		**Total**	
Base	35		35	
Genre	**A.N.**	**%**	**A.N.**	**%**
Female	21	60.0	16	45.7
Male	14	40.0	19	54.3
Education Level				
No instruction	0	0.0	0	0.0
Some grade school	0	0.0	3	8.6
Grade school	0	0.0	0	0.0
Some high school	0	0.0	5	14.3
High school	6	17.1	14	40.0
Some college	3	8.6	5	14.3
College	11	31.4	8	22.9
Postgraduate	15	42.9	0	0.0
Age				
16-24 years	0	0.0	9	25.7

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25-34 years	13	37.1	10	28.6
35-44 years	10	28.6	7	20.0
45-54 years	5	14.3	4	11.4
55-64 years	6	17.1	3	8.6
Over 65 years	1	2.9	2	5.7
Marital status				
Single	11	31.4	12	34.3
Married	20	57.1	20	57.1
Divorced	2	5.7	3	8.6
Widower	1	2.9	0	0.0
Stable union	1	2.9	0	0.0
Family income				
Less than 1 M.W.	0	0.0	0	0.0
1 - 3 M.W.	8	22.9	9	25.7
3 - 5 M.W.	7	20.0	15	42.9
5 - 7 M.W.	5	14.3	8	22.9
7 - 10 M.W.	4	11.4	0	0.0
More than 10 M.W.	11	31.4	3	8.6
Did you already know QR code?				
Yes	25	71.4	16	45.7
Not	10	28.6	19	54.3

Source: Elaborated by authors from data research

Marilia's consumers were mostly full-time graduates (40.0%), followed by higher education (22.9%), while in Sao Carlos, the principal level of education was postgraduate (42.9%), followed by complete higher education (31.4%). This difference can be justified by the location of the two establishments (in Sao Carlos the establishment is located in a more central area, while in Marilia, the retail is located in a more peripheral region). Moreover, San Carlos has two public universities and is recognized nationally as the city with the highest number of doctors per capita [41]

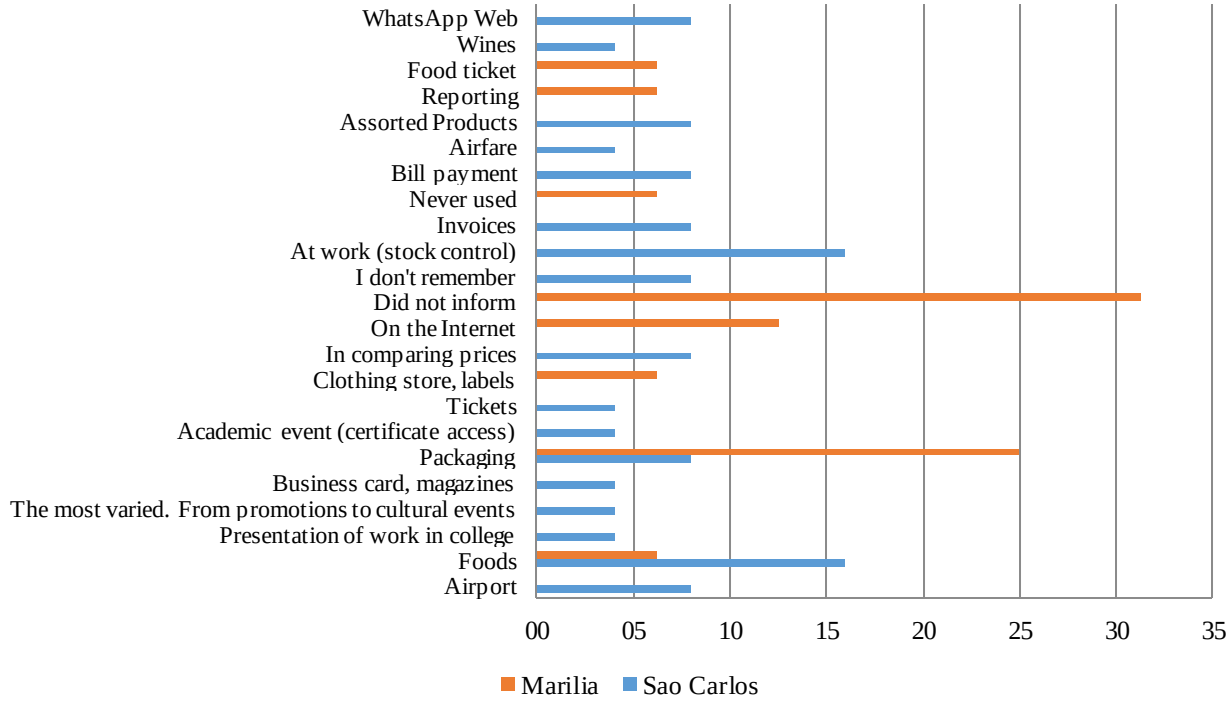

Fig. 3: Situations in which the interviewee knew/used the QR code (%)

While in Sao Carlos, the average family income was concentrated in the range of more than seven minimum wages (42.8%), in Marilia, the effective income range was three to five minimum wages (42.9%). This

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characteristic of the profile suggests that the target audience of the Sao Carlos supermarket has a greater focus in the A-B-C classes, while the Marilia one focuses more on the C-D-E classes, later confirmed by the assortment of products and prices practiced by each one.

These two characteristics of the sample directly reflected how well the interviewees knew the QR code, and 71.4% had seen or used the technology in different situations in Sao Carlos, while in Marilia, more than half (54.3%) of the respondents did not know it. Fig. 3 presents a comparison of the situations in which the interviewees of the two cities knew/used the QR code before the survey.

In order to verify the information that should be made available by the companies / products in the QR codes, the interviewees pointed out the ones that they considered relevant in the purchase decision for four different categories of products previously established: meat, alcoholic beverages, FVs, and other products (grocery, baking, and own production). Tables 2 and 3 present these results for the cities of Sao Carlos and Marilia, respectively.

Table 2. Information considered more critical by consumers of Sao Carlos in the purchase decision for meat, alcoholic beverages, FVs and products of grocery, baking and own production.

Base	**35**										
Meats	**A.N.**	**%**	**Alcoholic beverages**	**A.N.**	**%**	**FV**	**A.N.**	**%**	**Other products**	**A.N.**	**%**
Lot	16	45.7	Grape variety	24	68.6	Expiration date	32	91.4	Manufacturer	26	74.3
Breed	13	37.1	Region	21	60.0	Lot	16	45.7	Gluten	29	82.9
Age	20	57.1	Harvest	24	68.6	Link (access to report)	15	42.9	Dye	26	74.3
Technical manager	12	34.3	Ground	6	17.1	Harvest date	26	74.3	Sodium	32	91.4
Location	13	37.1	Climate	9	25.7	Date of production	15	42.9	Trans fat	31	88.6
Distributor	20	57.1	Color	13	37.1	Farm of origin	22	62.9	Sugar *	5	14.3
Fridge	31	88.6	Aroma	13	37.1	Defensive	25	71.4	Lactose *	4	11.4
SIF	28	80.0	Palate	20	57.1	Variety	17	48.6	Monosodium glutamate *	1	2.9
Date of slaughter	26	74.3	Winemaking	5	14.3	Organic	31	88.6			
Property name	15	42.9	Aging	19	54.3	Producer	11	31.4			
Name of producer	13	37.1	Bottling	9	25.7	Planting date	8	22.9			
Total area	3	8.6	Alcohol Content	20	57.1	Harvest date / Time	8	22.9			
Legal reserve area	13	37.1	Total acidity	15	42.9	Existence of waste	24	68.6			
Date of the last vaccines	24	68.6	pH	12	34.3	Processor	9	25.7			
food	24	68.6	Suggestion for harmonization	17	48.6	Processing date	14	40.0			
Carcass finishing	10	28.6	Conservation	20	57.1	Property name	8	22.9			
Certifications	28	80.0	Longevity	13	37.1	Location	18	51.4			
			Operating Temperature	19	54.3	Distributor	24	68.6			
Total	309			279			323			154	
M.A.											

Source: Elaborated by authors from data research

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There was a more significant difference in the meat information on the slaughter production lot (45.7% for Sao Carlos and 71.4% for Marilia), the name of the slaughterhouse (88.6% for Sao Carlos and 68.6 % for Marilia) and name of the rural property (60.0% for Sao Carlos and 25.7% for Marilia).

About alcoholic beverages, the information highlighted referred to the wine. It was observed that the consumers interviewed in Sao Carlos had the habit of consuming more frequently than those approached by the research in the supermarket of Marilia. Therefore, the result showed a greater difference in the information considered most relevant for grape variety (68.6% for São Carlos and 54.3% for Marília), production region (42.9% and 40.0%, respectively), palate (57.1% and 45.7%, respectively), suggestion of harmonization (48.6% and 28.6%, respectively), longevity (37.1% and 22.9%, respectively) and temperature (54.3% and 42.9%, respectively).

Table 3. Information considered more critical by consumers of Marilia in the purchase decision for meat, alcoholic beverages, FVs and products of grocery, baking and own production.

Base	**35**										
Meats	**A.N.**	**%**	**Alcoholic beverages**	**A.N.**	**%**	**FV**	**A.N.**	**%**	**Other products**	**A.N.**	**%**
Lot	25	71.4	Grape variety	19	54.3	Expiration date	31	88.6	Manufacturer	27	77.1
Breed	15	42.9	Region	14	40.0	Lot	24	68.6	Gluten	29	82.9
Age	19	54.3	Harvest	21	60.0	Link (access to report)	14	40.0	Dye	28	80.0
Technical manager	16	45.7	Ground	10	28.6	Harvest date	23	65.7	Sodium	32	91.4
Location	18	51.4	Climate	11	31.4	Date of production	21	60.0	Trans fat	32	91.4
Distributor	24	68.6	Color	10	28.6	Farm of origin	17	48.6	Sugar *	3	8.6
Fridge	24	68.6	Aroma	12	34.3	Defensive	19	54.3	Lactose *	4	11.4
SIF	33	94.3	Palate	16	45.7	Variety	21	60.0	Monosodium glutamate *	2	5.7
Date of slaughter	24	68.6	Winemaking	10	28.6	Organic	30	85.7			
Property name	9	25.7	Aging	19	54.3	Producer	18	51.4			
Name of producer	11	31.4	Bottling	14	40.0	Planting date	11	31.4			
Total area	5	14.3	Alcohol Content	19	54.3	Harvest date / Time	14	40.0			
Legal reserve area	15	42.9	Total acidity	16	45.7	Existence of waste	25	71.4			
Date of the last vaccines	28	80.0	pH	12	34.3	Processor	14	40.0			
food	27	77.1	Suggestion for harmonization	10	28.6	Processing date	20	57.1			
Carcass finishing	13	37.1	Conservation	18	51.4	Property name	9	25.7			
Certifications	27	77.1	Longevity	8	22.9	Location	12	34.3			
			Operating Temperature	15	42.9	Distributor	22	62.9			
Total	333			254			345			157	
M.A.											

Source: Elaborated by authors from data research

In the FV category, the most significant differences were found for production batch information (45.7% for São Carlos and 68.6% for Marília), date of production (42.9% and 60.0%, respectively), (31.4% and 51.4%, respectively), the name of the processor (25.7% and 40.0%, respectively), processing date (40.0%Sao Carlos

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and 57.1%, respectively) and location, which can be applied to the property, processor or distributor (51.4% and 34.3%, respectively).

Finally, the information of the category other products, which included grocery, bakery, and own products, were the most similar, possibly because it was a set of information of greater consumer domain, being widely disseminated and discussed, which are the nutritional table information.

Finally, analyzes of the correlation between the variables of the consumer profile and the information considered necessary in the purchase decision for the categories of products surveyed were carried out: meat, alcoholic beverages, FV and other products (grocery, baking, and own manufacturing). Table 4 presents the results found for the category 'meats.'

There was a greater concern of women (significant association of moderate to low) with information about the animal's consumption during its creation (62.7%), information on production certification (59.3%) and information (69.6%), although this information was not considered essential for two-thirds of the respondents (67.1%).

Information about the slaughterhouse and the carcass finishing had a moderate association with the level of education of the interviewees. The first was considered significant for the purchase decision among 52.7% of those with higher schooling (30.9% with complete higher education and 21.8% with post-graduation), while the animal's carcass finishing proved to be relevant information for only 32.9% of the interviewees, is more important for the purchase decision of those who own secondary education (47.8%).

Table 4. P-values of the chi-square test of the association of the variables of the consumer profile with information about the product considered necessary in the decision to buy meat.

INFORMATION – MEAT	PROFILE VARIABLE									
	Genre		Education level		Age		Marital status		Family income	
	Cramer	P-Value	Cramer	P-Value	Cramer	P-Value	Cramer	P-Value	Cramer	P-Value
Lot	0.097	0.417	0.381	0.071	0.097	0.985	0.242	0.393	0.177	0.702
Breed	0.016	0.894	0.351	0.124	0.329	0.180	0.254	0.341	0.180	0.685
Age	0.151	0.208	0.125	0.955	0.348	0.131	0.220	0.497	0.278	0.249
Technical manager	0.219	0.067	0.341	0.149	0.215	0.663	0.182	0.680	0.311	0.147
Location	0.066	0.580	0.289	0.322	0.206	0.707	0.277	0.251	0.225	0.472
Distributor	0.134	0.263	0.328	0.185	0.202	0.721	0.133	0.871	0.235	0.425
Fridge	0.144	0.227	**0.418**	**0.032**	0.372	0.084	0.152	0.805	0.212	0.532
SIF	0.065	0.588	0.273	0.391	0.382	0.070	0.205	0.567	0.210	0.545
Date of slaughter	0.036	0.762	0.294	0.301	0.387	0.062	0.212	0.534	**0.396**	**0.027**
Property name	0.079	0.507	0.205	0.708	0.291	0.314	0.192	0.632	0.327	0.112
Name of producer	0.112	0.348	0.186	0.789	0.198	0.740	0.278	0.249	0.243	0.389
Total area	0.021	0.863	0.337	0.159	0.151	0.902	0.120	0.909	0.329	0.109
Legal reserve area	0.019	0.873	0.253	0.482	0.254	0.476	0.145	0.831	0.183	0.673
Date of the last vaccines	0.199	0.095	0.235	0.568	**0.433**	**0.022**	0.208	0.552	0.311	0.148
Food	**0.325**	**0.007**	0.336	0.161	0.333	0.171	0.290	0.208	0.357	0.063
Carcass finishing	**0.234**	**0.050**	**0.460**	**0.011**	**0.423**	**0.028**	0.251	0.353	0.289	0.212
Certifications	**0.236**	**0.049**	0.172	0.838	0.363	0.100	0.339	0.090	0.211	0.538

Subtitle:
Bold: Significant association at 5%.
Source: Elaborated by the authors from the research data

Carcass finishing also showed a moderate association with the variable age group. This information was not considered essential for 67.1% of the interviewees, and the incidence of this association was higher for consumers between 25 and 34 years (34.0%) and 35-44 years (29.8%). On the other hand, knowing the date of the last

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vaccines applied in the animals is a concern of 75.7% of the interviewees, also presenting a moderate significant association between these same age groups (32.1% and 26.4%, respectively).

The date of the slaughter of the animal was another information that showed a significant association with the family income of 71.4% of the interviewees, concentrating mainly among consumers with an income of up to five minimum wages (64.0%).

Table 5 presents the results found for the category 'alcoholic beverages.'

Information on the aging process of the beverage (wine, in the example) and suggestion of food harmonization showed a moderate association with the degree of education, the first information being most valued by most consumers (54.3%) who are attending (31.6%), and the second, considered to be less critical for purchasing decisions for the majority of respondents (61.4%), of which 39.5% high school. The results suggest that this information has its importance increased as people qualify more, because of the 38.6% who considered this information relevant, the majority (59.3%) have completed higher education or are postgraduate.

Table 5. P-values of the chi-square test of the association of the variables of the consumer profile with information about the product considered necessary in the decision to purchase alcoholic beverages.

INFORMATION - ALCOHOLIC BEVERAGES	PROFILE VARIABLE									
	Genre		Education level		Age		Marital status		Family income	
	Cramer	P-Value	Cramer	P-Value	Cramer	P-Value	Cramer	P-Value	Cramer	P-Value
Grape variety	0.105	0.379	0.277	0.373	0.247	0.509	0.222	0.484	0.163	0.760
Region	0.056	0.642	0.316	0.223	0.343	0.144	0.218	0.504	0.203	0.579
Harvest	0.134	0.263	0.226	0.611	0.238	0.555	0.133	0.871	0.107	0.939
Ground	0.065	0.588	0.205	0.711	0.341	0.148	0.091	0.965	0.309	0.154
Climate	0.036	0.762	0.310	0.242	0.318	0.214	0.301	0.175	0.158	0.781
Color	0.010	0.936	0.321	0.206	0.267	0.417	0.259	0.321	0.264	0.300
Aroma	0.073	0.544	0.155	0.892	0.372	0.085	0.206	0.565	0.142	0.842
Palate	0.086	0.473	0.167	0.856	0.258	0.457	0.179	0.691	0.151	0.808
Winemaking	0.065	0.588	0.072	0.996	0.275	0.382	0.337	0.093	0.238	0.412
Aging	0.053	0.660	**0.402**	**0.046**	0.366	0.095	0.246	0.374	0.323	0.121
Bottling	0.023	0.848	0.295	0.297	0.258	0.461	0.133	0.871	0.288	0.215
Alcohol Content	0.050	0.678	0.267	0.418	0.371	0.087	0.169	0.736	0.102	0.947
Total acidity	0.035	0.767	0.123	0.958	0.297	0.291	0.235	0.423	0.100	0.952
pH	0.019	0.874	0.212	0.679	0.200	0.729	0.204	0.574	0.176	0.705
Suggestion for harmonization	0.160	0.180	**0.404**	**0.044**	0.239	0.547	0.229	0.451	0.149	0.819
Conservation	0.195	0.103	0.220	0.641	0.263	0.437	0.160	0.772	0.205	0.566
Longevity	0.067	0.574	0.260	0.449	0.225	0.617	0.221	0.493	0.153	0.801
Operating Temperature	0.116	0.331	0.356	0.114	**0.417**	**0.033**	0.364	0.055	0.218	0.504

Subtitle:
Bold: Significant association at 5%.
Source: Elaborated by the authors from the research data

The service temperature was another important information for approximately half of the interviewees (48.6%), with a significant moderate association, mainly with the age group of 25 to 34 years (44.1%).

Table 6 presents the results found for the category 'fruits and vegetables (FV).'

The information on the application of pesticides in the production of FV showed a moderate association with three variables of the profile of the respondents: education level, age group, and marital status. Approximately two-thirds of the respondents (65.7%) with higher education (56.5% with full and post-graduate education), aged between 25 and 44 years (63.0%) and married (71.7%) considered this information relevant.

Other verified associations referred to the information on the name of the rural producer with the degree of

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education (moderate significant association) and were not considered essential for 55.7% of respondents (61.5% with full tertiary and post-graduate education). The association of property name with gender (low significant association), showed that this information was not considered necessary for 78.6% (of which 60% were women), while 73.3% of those who considered this information necessary for decision making were men. When the name of the distributor is associated with family income (significant association of moderate to low), this information is considered essential for 65.7% of respondents, the majority (58.7%) with family income between one and five minimum wages.

Table 6. P-values of the chi-square test of the association of consumer profile variables with product information considered necessary in the decision to buy fruits and vegetables (FV).

INFORMATION - FV	PROFILE VARIABLE									
	Genre		Education level		Age		Marital status		Family income	
	Cramer	P-Value	Cramer	P-Value	Cramer	P-Value	Cramer	P-Value	Cramer	P-Value
Expiration date	0.067	0.576	0.322	0.203	0.394	0.054	0.125	0.894	0.254	0.341
Lot	0.107	0.369	0.342	0.146	0.232	0.586	0.158	0.782	0.200	0.590
Link (access to report)	0.039	0.744	0.173	0.837	0.236	0.564	0.255	0.335	0.202	0.580
Harvest date	0.036	0.762	0.220	0.642	0.292	0.309	0.139	0.852	0.155	0.796
Date of production	0.143	0.231	0.252	0.486	0.151	0.903	0.246	0.374	0.044	0.998
Farm of origin	0.062	0.602	0.339	0.153	0.260	0.452	0.189	0.645	0.228	0.458
Defensive	0.079	0.507	**0.403**	**0.044**	**0.535**	**0.001**	**0.502**	**0.001**	0.276	0.256
Variety	0.165	0.167	0.247	0.511	0.268	0.411	0.188	0.651	0.171	0.728
Organic	0.200	0.094	0.177	0.823	0.233	0.580	0.150	0.813	0.293	0.199
Producer	0.137	0.250	**0.428**	**0.025**	0.344	0.142	0.180	0.688	0.258	0.325
Planting date	0.067	0.574	0.242	0.537	0.155	0.891	0.180	0.685	0.126	0.892
Harvest date/Time	0.100	0.401	0.146	0.913	0.175	0.827	0.264	0.300	0.132	0.876
Existence of waste	0.163	0.173	0.142	0.923	0.273	0.390	0.212	0.534	0.221	0.491
Processor	0.162	0.175	0.312	0.234	0.298	0.287	0.186	0.660	0.097	0.957
Processing date	0.002	0.989	0.232	0.586	0.236	0.563	0.263	0.305	0.273	0.265
Property name	**0.274**	**0.022**	0.388	0.062	0.245	0.522	0.124	0.898	0.206	0.562
Location	0.062	0.602	0.328	0.185	0.216	0.661	0.207	0.558	0.275	0.260
Distributor	0.102	0.395	0.306	0.257	0.278	0.368	0.271	0.273	**0.368**	**0.050**

Subtitle:
Bold: Significant association at 5%.
Source: Elaborated by the authors from the research data

Table 7 presents the results found for the category 'other products (grocery, baking and own manufacturing).'
This set of information was what consumers most indicated as being essential for decision making, probably because they are more familiar with its terms and meanings. Therefore, the results of this group did not present a significant association, except for the information on cholesterol, which was pointed out as crucial by only 1.8% of the interviewees, all over 66 years of age, with a moderate association.

V. CONCLUSION

The work focused on the use of QR code technology in the packaging of products by agri-food companies, verifying the available traceability information and its reflexes in the decisions of the consumers. The analyzes presented a consumer profile with higher education and family income in Sao Carlos than in Marilia. These consumers, in turn, were more familiar with QR code technology, including packaging of agri-food products, though most of the time they had not made use of it.
Consumer preference for traceability information has reinforced companies' notion of the importance of information in most cases. In this study, it was observed

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that younger female consumers with higher schooling and income are more concerned with information about traceability and product quality. This information relates to feeding the animal during the production process, dates of the last vaccines, slaughtering, and certification of production in the case of meat, the aging process, a suggestion of harmonization and temperature of service in the case of wines, and use of pesticides in the case of FV. Already information on carcass finishing for meat, and the name of the producer and the rural property, for FV, were not considered essential for most interviewees.

In this way, the results suggest that there is a higher predisposition of consumers for less technical and more commercial information, possibly because the traceability information is of lesser knowledge and domain of the interviewees.

Table 7. P-values of the chi-square test of the association of consumer profile variables with product information considered necessary in the decision to purchase other products (grocery, baking and self-made).

INFORMATION - OTHER PRODUCTS	PROFILE VARIABLE									
	Genre		Education level		Age		Marital status		Family income	
	Cramer	P-Value	Cramer	P-Value	Cramer	P-Value	Cramer	P-Value	Cramer	P-Value
Manufacturer	0.075	0.532	0.196	0.749	0.253	0.481	0.113	0.925	0.213	0.531
Gluten	0.064	0.592	0.171	0.844	0.345	0.140	0.168	0.739	0.347	0.077
Dye	0.043	0.719	0.326	0.189	0.296	0.293	0.188	0.650	0.197	0.606
Sodium	0.137	0.250	0.329	0.182	0.346	0.137	0.213	0.528	0.263	0.304
Trans fat	0.183	0.127	0.295	0.298	0.364	0.098	0.136	0.861	0.286	0.222
*Sugar **	0.021	0.862	0.249	0.503	0.236	0.566	0.131	0.879	0.365	0.053
*Lactose **	0.111	0.355	0.225	0.616	0328	0.184	0.224	0.478	0.305	0.164
*Monosodium glutamate **	0.114	0.341	0.231	0.590	0.172	0.839	0.172	0.722	0.241	0.398
Cholesterol	0.127	0.286	0.197	0.743	**0.569**	**0.000**	0.104	0.944	0.241	0.398

Subtitle:
Bold: Significant association at 5%.
Source: Elaborated by the authors from the research data

The main contribution of this research is based on the survey of the information that the interviewed consumers consider essential for the purchase decision of agri-food products, constituting a vital reference so that the companies that currently work with traceability, be it industry or retail, can improve their labels, adding value to the marketed product.

On the other hand, it is essential to recognize that the nature of the theme chosen confers some limitations to the results obtained. The first one concerns the focus of the research, since the consumers, although open, often answered questions hurriedly, which may have led to presenting unrealistic data, by mistrust or even discrediting the purpose of this investigation.

Another limitation, justified by the methodology used, refers to the fact that the sample of the study was restricted to the consumers that were in the retail equipment itself, in addition to the low number of interviewees, which does not make possible a generalization of the results found. However, despite these limitations, it is believed that the present study can be used as a starting point for other researches, testing new information and other products, making even possible comparisons.

Regarding future research, in addition to expanding the universe surveyed, this study may pave the way to answer, in more depth, questions related to the information available, of great relevance to companies and consumers, increasingly interested in knowing the origin of what they consume.

As a suggestion, the continuity of work may occur with the application of new research to other product categories, to test new sets of information, or even applying new techniques of data collection to consumers.

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Development of a Self-Manageable News Virtual Environment

Fabio Machado de Oliveira[1], Carlos Henrique Medeiros de Souza[2], André Fernando Uébe Mansur[3] , Bruna Moraes Marques[4] and Fabrício Moraes de Almeida [5]

[1]Universidade Estadual no Norte Fluminense – UENF, Campos dos Goytazazes-RJ, Brasil, fabiomac@gmail.com
[1]Universidade Estadual no Norte Fluminense – UENF, Campos dos Goytazazes-RJ, Brasil, chmsouza@gmail.com
[3]Instituto Federal Fluminense – IFF, Campos dos Goytazazes-RJ, Brasil, andreuebe@gmail.com
[4]Universidade Estadual no Norte Fluminense – UENF, Campos dos Goytazazes-RJ, Brasil.
[5]PhD in Physics (UFC), with post-doctorate in Scientific Regional Development (DCR/CNPq). Researcher of the Doctoral and Master Program in Regional Development and Environment (PGDRA/UNIR). Leader of line 2 — Technological and Systemic Development, and Researcher of GEITEC — Federal University of Rondônia, Brazil. E-mail: dr.fabriciomoraes001@gmail.com

Abstract— *This work proposal contributes to the advancement of the frontier of knowledge in the area of new information and communication technologies, where the object of this study helps to understand the particularities of cyberspace and cyberculture. The discovery of new technological resources produces theoretical and practical unfolding of new socio-technical elements in the knowledge age. To materialize this proposal, it was necessary to reflect deeply on information systems and database storage in light of the General Theory of Systems, revisiting its concepts and abstractions, converging to define open systems. Due to its generalist nature, adherence with the 3C model, for the development of collaborative systems, as well as its variables and technologies, have proved to be the cornerstones of framewok development to house a self-manageable news virtual environment (AVNA). Supported by the theoreticians who studied and established the primacy of consolidated terms and concepts, an innovative thesis was derived that establishes a synergy between techno-social elements, designing a system to host news production, considering new elements present in the context of a society each more connected and with new demands. Finally, all the theoretical conception architecture, software engineering and systems modeling techniques, have produced the genesis of vectors that added up in the development of a collaborative system, open and committed to meeting the technological and social demands of the producers and consumers of inserted news in cybercultural dromocracy.*

Keywords— ***Communication, Collaborative Systems, New Technologies.***

I. INITIAL CONSIDERATIONS

Just as demand defines and influences supply or production, the development of information and communication technologies has changed our forms of relationship in work, study and leisure. For Monteiro (2007), this virtual world is not only conceived by representation, but through simulation we have real world possibilities and reflexes.

The author points out that "the virtual is not the opposite of the real", as well as, the cyberspace is linked to the real world by the flows of dematerialization of social relations that connect in a network, that is, "what was concrete and material acquires an immaterial dimension in the form of electronic impulses" (MONTEIRO, 2007, p.14).

Thinking of a system that can host journalistic or news production in a collaborative way that is fed back and maintained in a self-manageable way, represents a sustained innovation in the consolidation of cyberspace and cyberculture that fosters a new society with a new notion and representation of the Space time.

The development of this system is divided into five parts, where the concepts of cyberspace and cyberculture were first presented and discussed, together with their main authors and researchers who focused on the understanding of the phenomena which are present in their natures.

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The second part presents a theoretical contribution of the General Theory of Systems, aiming at basing the concept of systematization, presenting the development and maintenance of a self-manageable system that hosts and serves news, considering the new skills and behaviors of readers and news authors. Deepening the theoretical elements, in the third part, the focus is the 3C model, which reveals tools available for the development of systems of a collaborative nature. Collaborative systems add concepts of collective intelligence and generation of knowledge, which in an increasingly connected world converges to the fullness of its potentiality.

The primacy of the conception of a system composed of such peculiarities, which is indeed difficult, is more simplified and objective, when we use the strategy of adopting an acronym. With regard to a self-manageable system that feeds on journalistic production or the news of its authors and readers, it is best expressed as the Self-Manageable News Virtual Environment (SMNVE), highlighting in this nomenclature its main characteristics as well as production and consumption of news by individuals inserted or orbiting in this environment by heterogeneous interests and motivations.

The theoretical specification of the environment was contemplated in the fourth part of this work, therefore, it is possible to note the convergence of all the main theories considered a priori, which gave origin to the support vectors of the structuring elements of an innovative environment, marked by unique and peculiar concepts.

Finally, the fifth part deals with presenting the architecture and organization of the environment, as well as detailing the Software Engineering artifacts, such as: requirements analysis, class diagram, database modeling, framework for web development, as well as the programming language and other technologies that sustained the development of this environment. At this point, the work reveals the details of modeling and design of the virtual news environment, differentiating it as self-manageable, thanks to its news classification algorithm, which integrates many variables observed in the adhesion usability of its actors.

II. CYBERSPACE AND CYBERCULTURE

The canonical model of communication, also known as cybernetic model, has its main precursor the mathematician Norbert Wiener, who, in 1948, publishes the book, "Cybernetics", which sowed the basis for the conception of biological or mechanical living organisms and the notion of information. Later, this work served as inspiration for countless filmmakers in science fiction. Yet, he also laid the foundation for both the development of computer science and awareness of the importance of interdisciplinary. Cybernetics according to this author is "the art of governing" (from the Greek kybernetiké, pilot). During the Second War, he had his studies directed to missile guidance and automatic piloting of airplanes.

The primacy in citation of the term cyberspace is attributed to Gibson (1984) in his book Neuromancer, which shows an abstract world with representations of the real world and where computational technological resources provide the mind with a fluid journey and continues wherever it wishes.

Using the most current theorists, Lévy (1999) reports on the artificiality of non-physical environments, that is, virtual spaces that concentrate large numbers of individuals connected by common or unimportant interests.

Castells (2001) says that cyberspace is a new space, known as the worldwide computer network.

The knowledge about the use of resources by primitive man is remarkable in order to gather and preserve the knowledge, experiences and ideas that formed his culture, that is, how he identified himself in the environment and with the other individuals.

To clarify this issue, Santos (2002, p.50) states: "Culture is the dimension of society that includes all knowledge in an expanded sense and all the ways in which this knowledge is expressed. It is a dynamic, creative dimension, itself a process, a fundamental dimension of contemporary societies".

The network society generates cyberculture as a space within this place of communication through computers. To paraphrase Capobianco (2010), the technological advances are absorbed by the different social sectors that underpin the cyberculture, as well as require a new format for labor relations, education, leisure and communication among people.

In the understanding of Eugênio Trivinho on cyberculture, the author presents the following definition:

> Cyberculture means the material, symbolic and imaginary configuration of human life corresponding to the worldwide predominance of advanced digital technologies and networks in the sphere of work, leisure and leisure. (TRIVINHO, 2007, p.116).

To enrich the understanding of what the cyberculture is, Souza (2009) says that it is formed by the set of customs and knowledge added to the technological apparatus implanted, however, they are still referenced in traditional customs and practices. In this context the internet presents itself as the greatest exponent of cyberculture.

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III. GENERAL THEORY OF SYSTEMS

In a society that lives and consumes technological advance with great intensity, the term "systems" is widely spread. The constant need to implement new means of accomplishment of tasks, makes ideas emerge with systemic elements, seeking to maximize efficiency and minimize costs.

Revisiting the paradigms that marked the development of thought in the Christian era can contribute to the understanding of how multiple factors influenced the advances of scientific knowledge. According to Sühnel (2001 cited by Uhlmann, 2002), the classification outlined in Figure 1 reveals this path:

O Desenvolvimento do Pensamento da Era Cristã	
Segundo Prof. Norberto Sühnel da UFSC	
Período (aprox.)	**Era do / da**
800 até 1600	paradigma Escolástico (Idade Média)
1500 até 1700	paradigma Renascentista
1700 até 1800	paradigma do Mundo Mecanicista e do Determinismo
1800 até 1900	hegemonia do paradigma Determinístico
1900 até 1950	paradigma da Teoria da Relatividade e da Mecânica Quântica
1950 em diante	Teoria Geral de Sistemas ou do paradigma Holístico

Fig.1: The development of thought
Source: UHLMANN (2002, p.4)

For Sühnel (2001), in the Scholastic paradigm, the direction of the way of thinking was conditioned by religious dogmas, opposing this idea, the Renaissance paradigm, rebelling to the dictates of the Catholic Church and seeking a "rebirth" of the sciences. This author also explains that the Mechanistic and Deterministic paradigms had in common the idea that natural phenomena needed methodical and mathematically based studies, seeking a kind of equation that revealed the equilibrium and functioning of the universe.

In the paradigm of Relativity Theory and Quantum Mechanics, in light of their complexities and scope, they point to the need for a more holistic view that contemplates several variables, finally leading to the Holistic or General Systems Theory paradigm, with its genesis already in the 20th century, with a striking transdisciplinary aspect and approaches of: systems philosophy, systems engineering, systems analysis, management and empirical research.

Abbagnano (2000) reminds us that the concept of a system is already consolidated in ancient Greece, in terms of the tradition of communication of knowledge, with a focus on constructs, employed by philosophy in "organized deductive discourse", indicated by "premises and conclusion", that is, "a discourse that constitutes a whole whose parts derive from one another".

From the late nineteenth and early twentieth centuries, many authors presented their definitions of the concept of system, but a priori, the modern western landmark of thought directed to approach the "all integrated" is attributed to Ludwig von Bertalanffy, through works published between 1950 and 1968, conceived in the model of open system, where the environment configures a continuous interchange of interaction with the complex of its constituent elements (BERTALANFFY, 1968).

Bertalanffy's (1968) proposal unified several chains of thought that were convergent in considering, analyzing from the perspective of the parts, interacting in the environment, forming, configuring and defining the whole. Figure 2 presents a semiotic representation of the General Systems Theory.

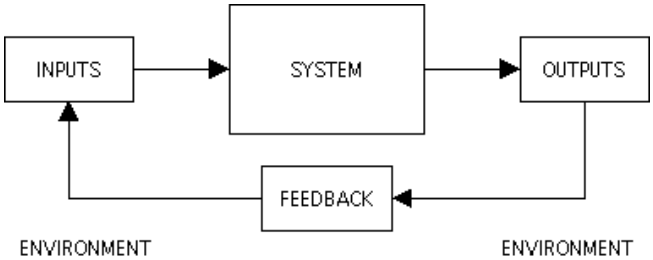

Fig.2: Diagram of the General Theory of Systems
Source: (BERTALANFFY, 1968, p.69)

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With the advancement of the scientific knowledge, the contribution of this theory gets clear, in the scope of research thinking in relation to the challenges of complexity that are imposed during the process of knowledge construction and the dromocratic changes present in the society of the information.

MODEL 3C FOR THE DEVELOPMENT OF COLLABORATIVE SYSTEMS

The complexity of this type of proposal demands new strategies in the development of systems and the 3C Collaboration model (Communication, Coordination and Cooperation) has shown to be an advance in systems development paradigms. According to Ellis, Gibbs and Rein (1991), the primacy of the Model 3C proposal establishes the need for a joint work of experts that included social scientists and computer scientists in the effort to promote more integration of individuals with technologies, establishing three dimensions of collaboration, i.e. communication, coordination and cooperation. Therefore,

> Communication is related to the exchange of messages and information between people; coordination is related to the management of people, their activities and resources; and cooperation, is the production that takes place in a shared space (MICHALSKY, MAMANI, GEROSA, 2010, p.1).

Empirically, the 3C model is presented as a means to classify collaborative systems and an adaptation of the original diagram can be seen in Figure 3.

Fig.3: The diagram of the 3C collaboration model
Source: (MICHALSKY, MAMANI, GEROSA, 2010, p.1)

These efforts inaugurate a new field of multidisciplinary studies called Computer Supported Cooperative Work (CSCW). (Ellis, Gibbs, Rein, 1991, p.39).

SELF-MANAGEABLE VIRTUAL NEWS ENVIRONMENT - SMVNE

This paper is also concerned with proposing a re-reading of the main historical studies of press equipment and technologies, considering their impacts on the development of humanity. Consequently, a review, also of a historical nature, of the evolution in the logistic process of production and distribution of newspapers is necessary, interweaving a comparison of this mechanism through information and communication technologies.

Initially, from a bibliographical research, we will present the technological concepts of the terms used in the research on general systems theory, dynamizing the understanding of social collaboration software environments, Wiki environments, as well as their tools and applications.

The field research presented the technological artifacts that will sustain the development of a system of great complexity. Before arriving at the analysis of the questions to be raised in this research, it is necessary to carry out a conceptual analysis on some social implications that are present in this technology innovation and to reflect critically on the possible positive and negative unfoldings for the network society.

The core of the system follows the Wiki software model, which, according to Primo (2004), can be analyzed and framed as a collaborative software.

Created by Cunningham (1995), the first Wiki was made available on the web under the name Portland

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Pattern Repository. Cunningham's proposal was to develop a site that made it possible for users to generate content. Another peculiarity that has determined the success of this social software is its type of free use license, i.e. GNU GPL license, which freely allows its copy, redistribution and adaptation to the needs of users' demands.

> (...) Wikis have several purposes: they can be used as dynamic web sites, tools for project and document management, and mainly as dynamic knowledge bases adaptable to different environments such as companies, schools, universities, civil society organizations and the web itself (RAMALHO, TSUNODA, 2007, p.1).

The operation of the system is based on a time-line news accessed by producers and consumers of news. To produce news on the platform, it is necessary to register an identification with acceptance of the terms of responsibility of authorship and publication auditable. With the advancement of credibility and number of postings of news positivadas by the authors, the system stratifies its degree of influence and analysis of the flows that vary in the time-line of news. This way the system establishes a cycle of news that can be segmented by areas of interest or general aspects, which allows the reader to be the producer of the news that it consumes. The modeling represented by Figure 4 presents this idea.

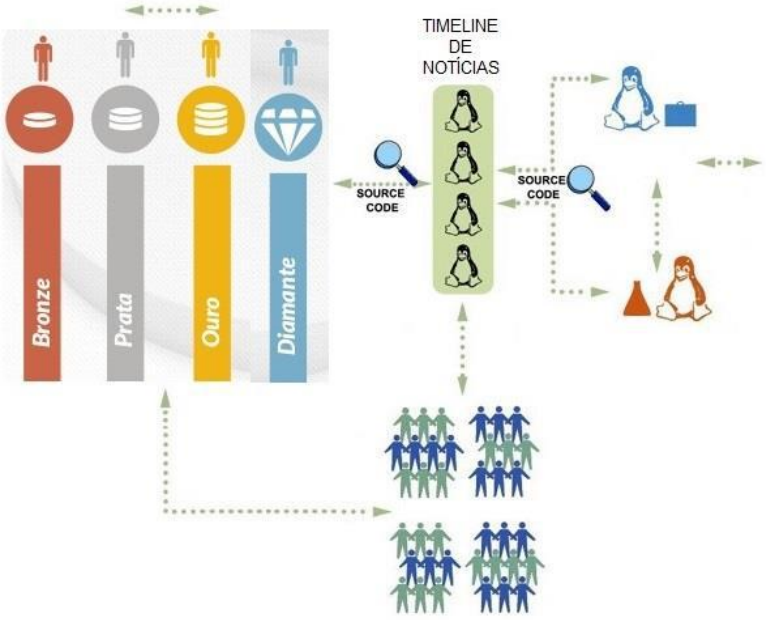

Fig.4: Schematic of system operation
Source: the author himself

Based on the idea of positivation and advancement of credibility and number of news postings, the system stratifies the authors, as well as their degree of influence and revelation in the face of news flows in time-line. Figure 5 shows how this process happens:

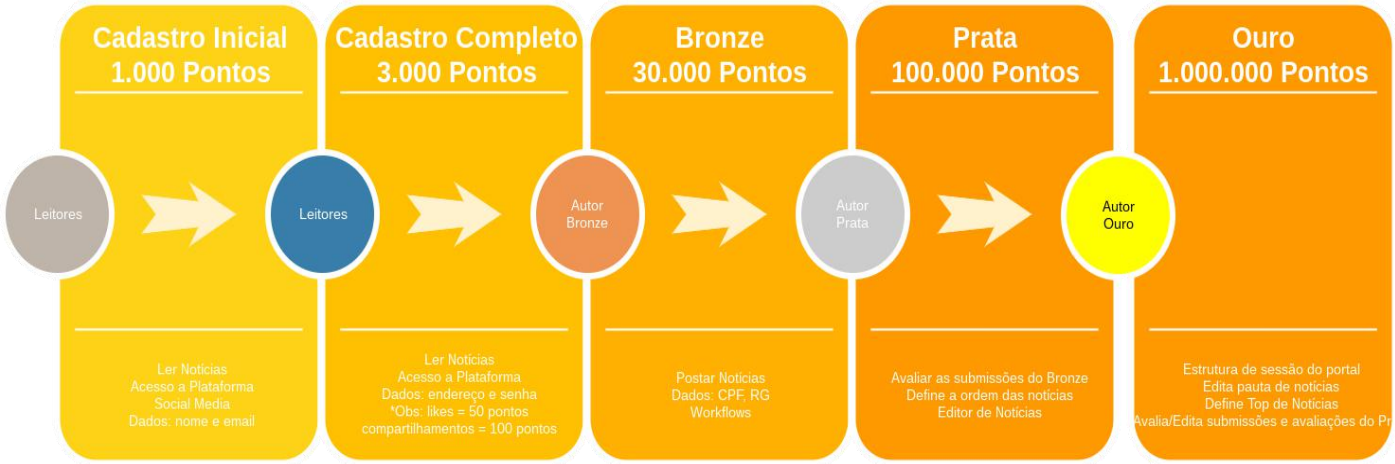

Fig.5: Scheme of classification and punctuation of authors of SMVNE
Source: the author himself

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Thus, the project is already born with general and specific characteristics, very striking and objective, to meet the challenges of its proposal.

ARCHITECTURE AND ORGANIZATION OF THE VIRTUAL NEWS ENVIRONMENT

The field research presents the technological artifacts that originated the system, that is, the hosting infrastructure, the class diagram and the main algorithm, the modeling of the database system, as well as the detailing of the technologies used in the construction of the system.

The acronym designed to refer to the system highlights the first letter of each word that names the SMVNE (Self-Manageable Virtual News Environment), making the citation of the system more objective, as well as marking a new category of system with their respective peculiarities.

SMVNE: technologies and development tools

The technological support for the system was the adoption of the Python programming language (https://www.python.org/), using the Flask web microframework (http://flask.pocoo.org/), which was written in the python language. According to Ronacher (2010), Flask prioritizes a framework to address key operating issues with the minimum of packages, along the development and modeling of new elements and new demands can be addressed with the inclusion of other applications or plugins, present in the framework repository. Figure 6 shows visually the combination of technologies used in the development of the system.

Fig.6: Technological artifacts
Source: the author himself

Figure 7 shows how the microframework gears work, so it is possible to understand the range of possible functionalities of the system, as well as guiding system maintenance and auditing work.

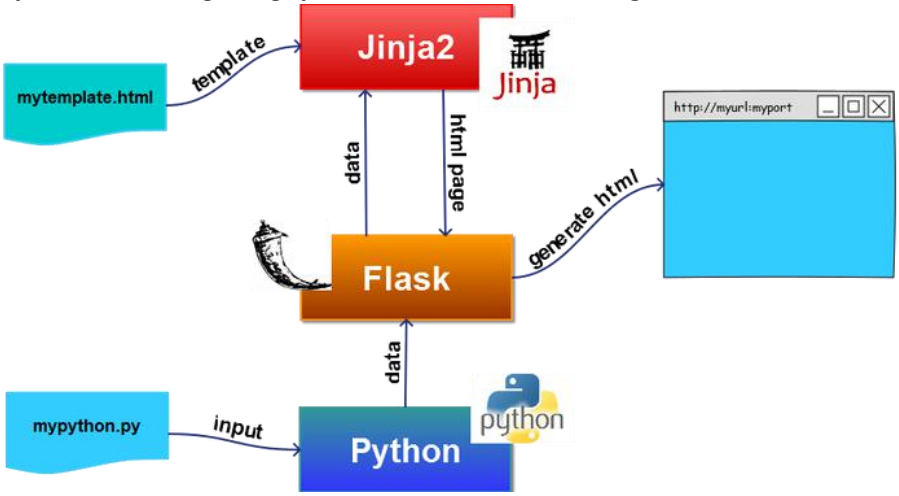

Fig.7: Relationship Entity Model (REM) of the system
Source: the author himself

In the next topic, we will describe the workflow of system activities, guided by modern software engineering design techniques.

SMVNE: class diagram and central algorithms

The representation of real-world elements by objects in the computational world classifies a system-building paradigm known as object-oriented, because this way computational objects would always seek the closest proximity to the real object. With this, the work of abstraction and construction of the functionalities and virtual characteristics would be a more faithful copy of this proposal. The class diagram, widely diffused in software engineering techniques that contemplate the object-oriented paradigm, is a great practical example, and we can observe this idea in Figure 8, with regard to the SMVNE.

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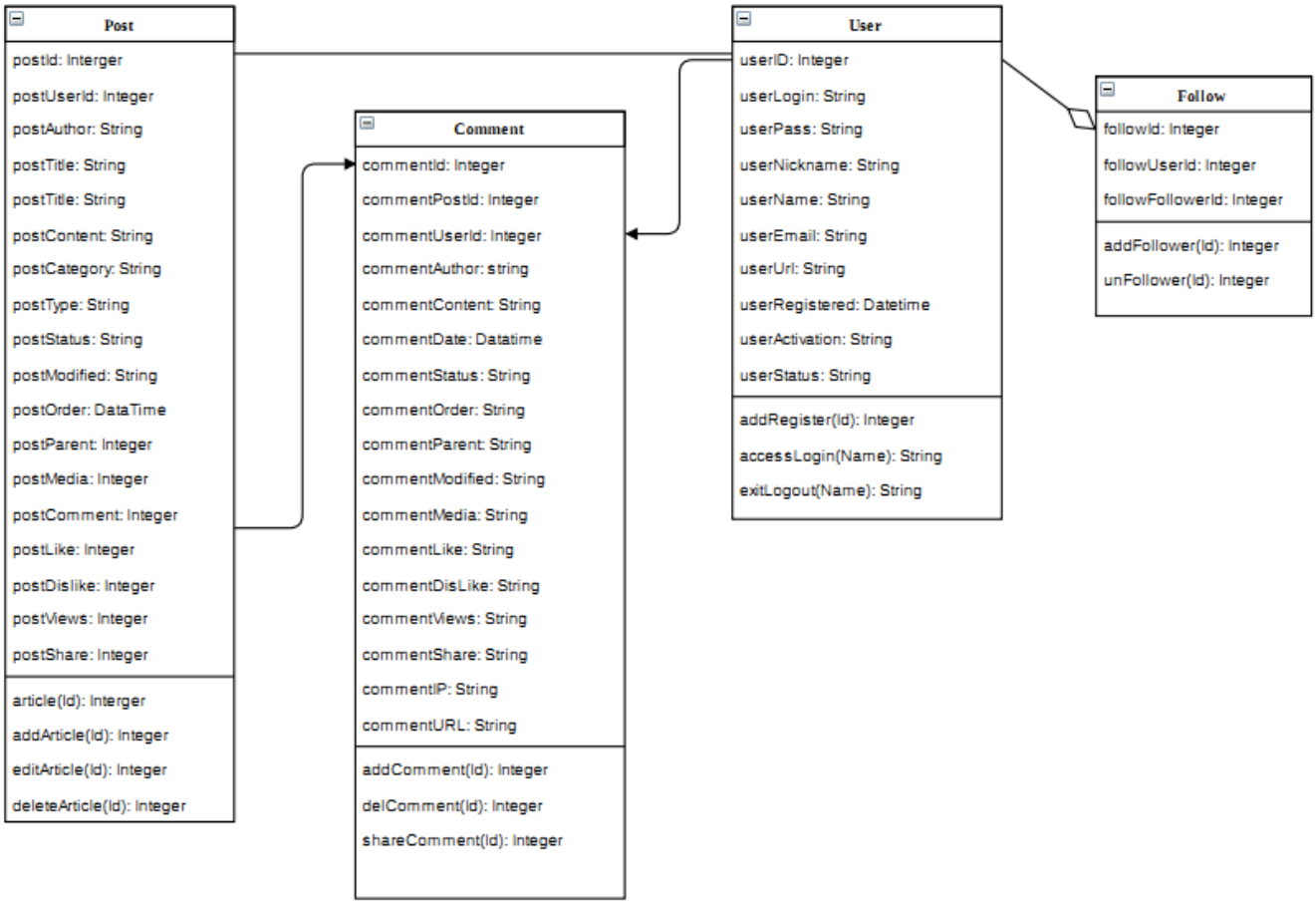

Fig.8: Relationship Entity Model (REM) of the system
Source: the author himself

The main kernel algorithm of this system essentially uses a data structure, native to the Python programming language known as List Comprehensions, that is, List Understanding, which is a Python implementation of a mathematical notation known and used for sets, where mathematically , the square numbers of the natural numbers are, for example, created by $\{x2 \mid x \in \mathbb{N}\}$ or the set of complex integers $\{(x, y) \mid x \in \mathbb{Z} \wedge y \in \mathbb{Z}\}$. Thus, the List Understanding seeks out the qualities of a set, but they are not joint in all cases. Below is the cross-product algorithm of two sets, which, in our case, will define our time-line news, considering the most accessed posts with the statistical classification of credibility of the authors (Bronze, Silver, Gold, Diamond) registered in the news platform.

```
def timeline(posts, authors)
   posts = [ "news1","news2","news3","news4" ]
   authors = [ "authors1","authors2","authors3",authors4
]
   time_line  = [ (x,y)  for x in posts for y in  authors ]
   print time_line
```

Another resource used for natural language processing was the Natural Language Toolkit (NLTK), developed in Python language, which provides a suite for human language text processing, aiming at the classification, tokenization, parsing, stemming, tagging and semantic analysis, with Portuguese language support. The following is an example of how to tag tags in a phrase.

```
>>> import nltk
>>> sentence = """At eight o'clock on Thursday morning
... Arthur didn't feel very good."""
>>> tokens = nltk.word_tokenize(sentence)
>>> tokens
['At', 'eight', "o'clock", 'on', 'Thursday', 'morning',
'Arthur', 'did', "n't",'feel', 'very', 'good', '.']
>>> tagged = nltk.pos_tag(tokens)
>>> tagged[0:6]
[('At', 'IN'), ('eight', 'CD'), ("o'clock", 'JJ'), ('on', 'IN'),
('Thursday', 'NNP'), ('morning', 'NN')]
```

The following is a database modeling that records all system activities, as well as provides integrity and availability of operations.

SMVNE: database modeling

Figure 9 shows the modeling to house data persistence in a relational object model.

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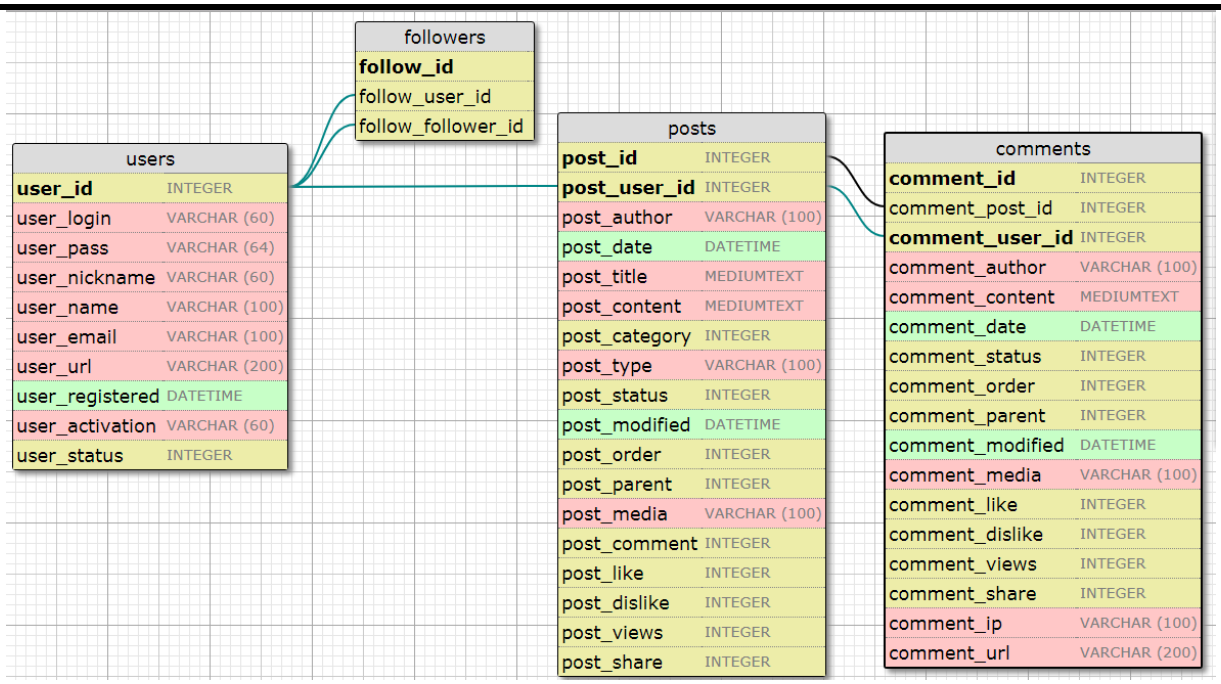

Fig.9: Relationship Entity Model (REM) of the system
Source: the author himself

The next topic specifies the system implementation process, as well as the infrastructure elements to house the same.

SMVNE: infrastructure, implementation and hosting

In order to house this system, from the beginning a VPS (Virtual Private Server) type server was chosen to make possible the hardware expansion, according to the demand of access and adhesion of new users. This type of infrastructure is based on Cloud Computer, with the server fully virtualized, with remote access via SSH protocol, which allows administration of the environment very safe and qualified.

The Digital Ocean service (www.digitalocean.com) was chosen to provide network administration tools for virtualized servers with a primary DNS (Domain Name Server) server registration functionality, as well as a domain server hosting the system. Thus, as the administration interface of Digital Ocean, the task of publishing the domain becomes easy and efficient.

Finally, the implementation of the system advocates the adoption in Web Proxy server for an initial contribution of the connections and simple HTML request on port 80, the chosen server was the NGNIX, for being admittedly fast and stable. Consequently, a second Web server, native to the Flask framework, running on port 5000, is responsible for processing system functionalities, as well as persistent compilers in MySQL Server database.

Figure 10 graphically explains the operating mechanism of the system in production environment.

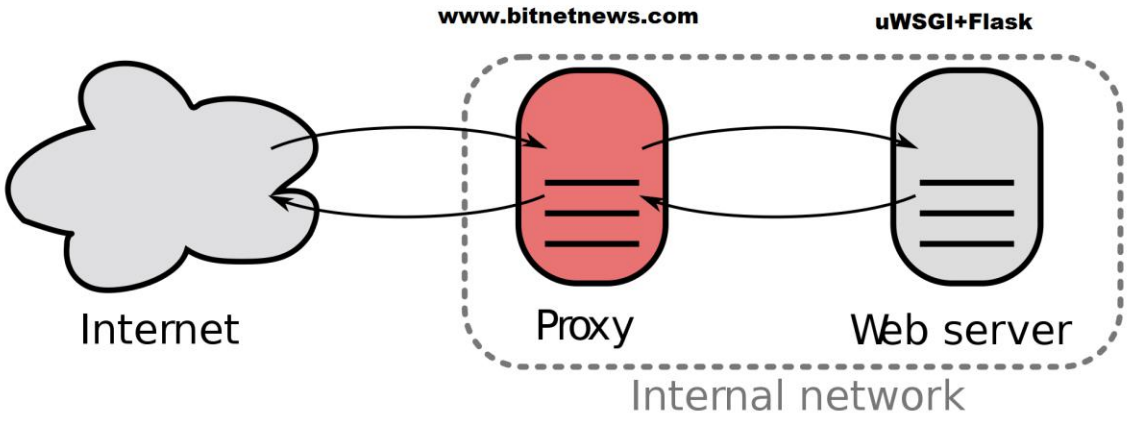

Fig.10: Relationship Entity Model (REM) of the system
Source: Google Images

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In Figure 11 we can understand in detail each step of the system operation, where:

1. Web client requests (browsers)
2. Proxy web server from primary requests to basic requests
3. Communication interface
4. Secondary request webserver
5. Interaction interface with the Flask micro framework and the Python language
6. Persistence and queries to the database system

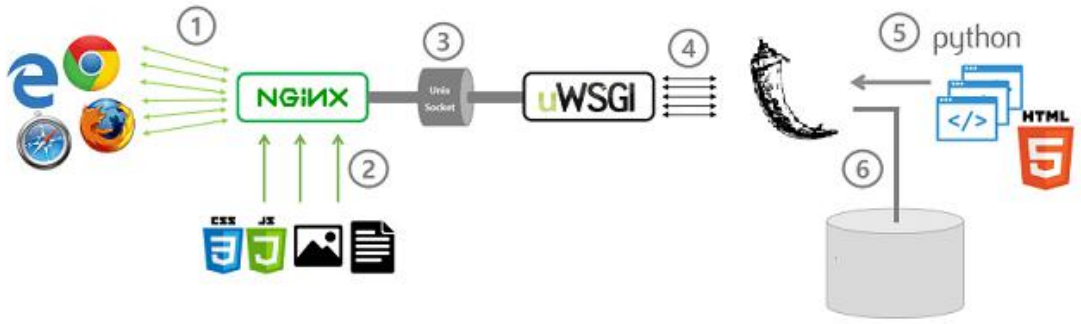

Fig.11: System architecture in production
Source: adapted by the author

To increase the visibility of the environment, the domain www.bitnetnews.com has been registered, in the maximum convergence intensity of access in any device that has a web browser, with responsive screen accessibility, that is, the environment screen adapts to the size of the screen of the device, being this a desktop computer, notebook or even a smarthphone. Finally, Figure 12 shows the system in production, consolidating the defined objectives, and with a responsiveness technology that aims to guarantee its usability in any screen dimension, increasing its accessibility and comprehensiveness.

Fig.12: SMVNE – Home screen
Source: the author himself

IV. CONCLUSIONS

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The initial theoretical elements contextualize this research, as well as establish the conceptual and scientific bases, retaking the main authors and researchers who innovated and contributed to the consolidation of scientific knowledge. Thus, the interpolation of theories, mediated by interdisciplinarity, shows a fertile ground for the unprecedented theoretical conception presented in this research.

The development of a self-managed virtual news environment model seeks to meet the demand of readers and authors, immersed and based on the use of new information and communication technologies.

The complexity of this type of proposal demands new strategies in the development of systems and the 3C model of Collaboration (Communication, Coordination and Cooperation) has been an advance in the paradigms of development of systems of this nature.

The use of open technologies has added many different aspects to the environment, that is, an alignment with new proposals and software engineering methodologies, with adherence to the needs of deployment, maintenance and support of a multiplatform system and adapted to different devices.

As a suggestion of future work, we have included the inclusion of Machine Learning, through the implementation of artificial neural networks, with supervised learning to assist in the selection of news that compose the main time-lime.

The development of this system has a very relevant differential in the context of user interaction, as well as its proposal to meet new demands of news production and consumption in an increasingly connected society.

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Information and Communication Technologies (ICTS), Dance, and Interdisciplinary: Laconics Notes

Priscilla Gonçalves de Azevedo[1], Larissa Salarolli Ruis[2], Cristiana Barcelos da Silva[3] , Joane Marieli Pereira Caetano[4], Carlos Henrique Medeiros de Souza[5] and Fabrício Moraes de Almeida[6]

[1] Mestranda em Cognição e Linguagem na Universidade Estadual do Norte Fluminense Darcy Ribeiro (UENF)
prigoncalves78@gmail.com
[2] Mestranda em Cognição e Linguagem na Universidade Estadual do Norte Fluminense Darcy Ribeiro (UENF)
larissa.salarolli@pq.uenf.br
[3] Doutoranda e mestre em Cognição e Linguagem na Universidade Estadual do Norte Fluminense Darcy Ribeiro (UENF)
cristianabarcelos@gmail.com
[4]Doutoranda e mestre em Cognição e Linguagem na Universidade Estadual do Norte Fluminense Darcy Ribeiro (UENF)
joaneiff@gmail.com
[5] Doutor em Comunicação e Mídia
Universidade Estadual do Norte Fluminense Darcy Ribeiro (UENF)
chmsouza@gmail.com
[6]PhD in Physics (UFC), with post-doctorate in Scientific Regional Development (DCR/CNPq). Researcher of the Doctoral and Master Program in Regional Development and Environment (PGDRA/UNIR). Leader of line 2 — Technological and Systemic Development, and Researcher of GEITEC — Federal University of Rondônia, Brazil. E-mail: dr.fabriciomoraes001@gmail.com

Abstract**—** *From the intensification of the use of various Information and Communication Technologies (ICTs), in different social contexts that touch postmodernity, contemporary dance has undergone some changes within the artistic scenario. With this, the interdisciplinary dialogue that the dance establishes with the technology becomes the target of academic studies and possible cultural practices in different approaches. Given this scenario, this research aims to investigate the possible and recent interdisciplinary practices between contemporary dance and technology under different scenes and different forms of artistic appropriation. The present article adopted the bibliographic research methodology and is configured in a qualitative nature investigation. Therefore, the periodicals published between the years of 2015 and 2017 were analyzed in the Scholar Google search system. The obtained results indicated an ephemeral number of researches that explore the following themes: contemporary dance, technologies, and interdisciplinary. In the analyzes of the studies, it was possible to verify that the artistic practices surpassed the corporal sense, being classified hybrids, from the point of view of a virtual body, indicating the notion of presence and the connection between the "being" and "being" in the world.*

Keywords**— Interdisciplinary; Contemporary dance; ICT's.**

I. INTRODUCTION

When it's given light to dance as a cultural and artistic manifestation, as well as a form of language, it is possible to consider it one of the expressions which the body exerts multiple communications. In this context, contemporary dance, in its turn, is contextualized by inscribing itself in time and space, establishing relationships with the environment which it belongs, appropriating, perhaps, a dialogue understood as being interdisciplinary through the use of Information Technologies and Communication as a strategy for the construction of innovative artistic languages.

In this perspective, Information and Communication Technologies (ICTs) gain space in contemporary dance, as well as it propagated rapidly in different segments that touch the postmodern society. TICs have created new interactive interfaces providing different forms of communication between people, changing, consequently, the ways of cultural and artistic

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appropriation through cyberspace. Therefore, the dialogue that dance establishes with technological means happens through the creative and interdisciplinary flow, typical of contemporary art, which in McLuhan's view (1964, p.22) "the" message "of any way or technology is the change of scale, cadence, or pattern that this way or technology introduces into human things". This interference generates new artistic productions, whether in dance shows that bring in digital elements and virtual bodies; whether in school environments through artistic pedagogical practices mediated by the use of digital technologies, or even from the production of choreographic videos for Youtube channels.

Based on the above, this study aims to investigate the latest interdisciplinary practices between contemporary dance and technology under different scenarios and different forms of artistic appropriation. In this way, it is intended to establish new relations with the language, the public, time, space and the dance itself under a postmodern perception.

II. METHODOLOGY

The present article implied an indirect bibliographical research methodology of qualitative nature. The work consisted in the use of theoretical references and collection of information already published for analysis and discussion of the subject. For Gil (2002), the bibliographical research is developed from material already published, consisting, mainly, of books, periodicals and other materials available on the Internet. The theoretical basis of the article, composed by the second and third sections, was carried out using books and periodicals. The collection of data about the theme of contemporary dance and cyber dance, present in the fourth section of the article, was made through the Scholar Google database.

It is worth mentioning that the interest of the research is centered on the exploration of the dialogue that the contemporary dance establishes with the ones next to the technological means. Therefore, the journals published between 2015 and 2017 were searched using the Scholar Google. The development of the results found in the bibliographic research, as well as the discussion about them, from the point of view of this research, will be highlighted in topic 4 of this article.

III. FROM THE ORIGIN OF DANCE TO CONTEMPORANEITY

The concept of the word dance has countless possibilities of understanding. In the context of the Portuguese Language, according to Ferreira (1999: 604), dance is "[...] a sequence of body movements performed in a rhythmic way, usually to the music sound". The authors Houaiss and Villar (2009: 594) define dance as "art and/or technique of dancing [...], style, genre or a particular way of dancing ...". However, in the specific literature of the artistic language, dance historian Annie Suquet (2008) conceptualizes dance as "[...] transference of body weight in time and space" (SUQUET, 2008, page 528). Compacting with the polysemic idea of the term, Neves (1987, p.7) presents an understanding of dance in the following way:

> The dance has several faces and is seen in several ways. Some people are interested in psychological and emotional aspects; others, with a more mechanical view, emphasize the functional elements; there are still those who seek to analyze the basic and universal elements that constitute the dance. Hence, to the date, it is difficult to find a sufficiently comprehensive and complete definition of dance.

Dealing with dance by a contemporary bias, dance is considered an art in constant transformation and growing popularity for not being bound to esthetic standards, such as classical ballet. In this bias, as Trindade (2011, p. 136) states:

> Contemporary dance does not have an established unique technique, all kinds of people can practice it. Its technique is so comprehensive that it does not delimit styles of clothing, music, spaces or movements. There are no mechanisms defined, there are, in advance, processes and forms of creation. A new notion of corporality emerges, seeking a more experimental meaning, less stratified. There is no ideal body but a multicultural body that has several references. What matters is the transmission of feelings, ideas, and concepts.

The researcher San José (2011), in a study about Contemporary Dance, highlights how his development began, mentioning choreographer Merce Cunningham. According to the author, this artist was considered the pioneer of "postmodern dance", which in the 1940s started this new dance genre from experimentations with different ideas and "body vocabularies". Its intention, at the time, was to move from a modern structural dance, turning the dance into something innovative, developing a new concept of movement. The choreographer considered that any movement could be a material for the construction of choreography, that is, any corporal procedure would become, in this way, a method for dancing.

One of the main characteristics of Contemporary Dance is that it does not have a specific dance technique, nor there is a specific costume, that is, there is no dress that exemplifies dance. This modality values the innovation and gives importance to the concepts and ideas that its choreographies propose, allowing the creation and

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the choreographic composition, transforming it into a unique and revolutionary manifestation. This type of dance also includes other artistic elements, such as video, photography, the visual arts, and digital culture, allowing real movements to become virtual and vice versa (Matos, 2012).

Referring to the studies of San José (2011), it came to the conclusion that from the 50's, there were new "looks" about dance, combined into the good mood, the musical genres mixing and using improvisation. In this way, the dance began to be associated with physical actions and everyday gestures.

Also from the chronological point of view from the 70's when Steve Paxton[1]created "Contact Improvisation", a technique that sought the stimulation of an inner sensation through movement, proprioceptive properties and synesthetic sensations that stimulated its creation. Contact dance is a "technique widely used as research and didactic material for improvisation and as content for the composition of contemporary works of art" (SÃO JOSÉ, 2011). In this period the dialogue and the interaction between different artistic and physical languages are initiated through the insertion of interdisciplinary and performance, mixing dance with music and theater, constituting a style.

For Sá (2013) between the 50s and 60s, some foreign artists settled in Brazil due to tours and the wars. Thus, Brazilian artists came into contact with this new experience, with their ideas and influences, consolidating the Contemporary Dance in the country. The choreographer Klauss Vianna, stood out creating his own method of physical destruction, body awareness, and variations of rhythm, besides a work aiming a greater spatial organization.

Following a historical perspective, Louppe (2000, p. 31) points out that in the early 80s there was a loss of lineages, that is, the dancer's formation was no longer happening by a single practice. From this, hybridization arises, which for the author "[...] is the destiny of the body that dances, a result both of the demands of choreographic creation and of the elaboration of its own formation."

In the same way, in Brazil, there are great contemporary Dance companies, such as the Black Swan Cia. De Dança and Cia. Déborah Colker, which continue to this day. In Brazil, there is a great influence of classical and modern dance in contemporary dance. However, nationally, there is a great interference of the national folklore, with elements characteristic of Brazilian popular dances (Guarato, 2016).

IV. DANCE AND TECHNOLOGICAL MEDIATION

From the advance of the ICTs, one notices in our postmodern society a progressive movement of a redefinition of the relations and reorganization of the diverse sectors that touch the contemporaneity. In this sense, it is possible to perceive that the distances and chronologies are no longer the same. These, on the other hand, underwent changes as ubiquity brought the immersion of the virtual connection into our daily life, resulting in new speeds, spaces, and rhythms through cyberspace. This, according to Lévy (2001), is characterized as a projection and representation of social relations in the network, a virtualization of reality, from the real world to a world of virtual interactions through the global interconnection of computers. The term cyberculture, however, specifies the set of techniques (materials and intellectuals), practices, attitudes, and ways of thinking and valuesthat develop along with the growth of cyberspace.

In the artistic scope of dance, exposed to the locus of cyberspace, the various forms of language associated with digital technologies, such as interfaces, software, videos, and apps, enable the syncretic language to perceive different spatialities and imaginary temporalities (Diniz, 2015).

In his research, Santana (2006, p.33) deepens the debate between dance and technology, reporting the expression "technoculture". The author explains that "techno" is part of the culture as the mind is part of the human body since technology carries the thinking and the various conceptual systems. However, the above-mentioned author considers that:

> [...] dance with technological mediation should not be considered as a stylistic innovation of a dance that uses the new media indiscriminately and naively, in the form of facilitating or decorative tools. Technological mediation dance is an artistic manifestation that emerged from a 'hopelessly' random world [...] that allows us to understand the environment-individual relationship as a mutual implication. An implication that consolidates the presence of the computer in the daily life and, therefore, modifies the body that deals with him during the time of that conviviality. Hence, one should not lose the connective specificity implied in it, under the risk of trivializing what distinguishes it.

1 Phoenix, Arizona, USA. Dancer, teacher, and choreographer. His initial training was gymnastics, modern dance and classical ballet. He danced for three years in the Company of Merce Cunningham (1961-1964). In 1972 gravity and inertia to explore the relationship between two dancers.

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In this way, cyber dance[2] or web dance goes beyond mere use as an end in itself, capable of understanding sociocultural knowledge under the influence of new technologies and languages inserted (DINIZ, 2017). Therefore, dance with technological mediation can add thought and reflection to the body, allowing to go beyond the "choreographic construction, technical performance of the interpreters, lighting, costumes, fruition and other known technical attributes" (FARIAS; ROMERO; GODOY, .9). It is essential in the XXI century to modernize dance to advance and discuss "discuss editing of images, computer programs, representation, simulation, biomechanics, supernumerary body, absence of body, subjectivity and other issues that emerge from the relationship of dance with cyberculture "(FARIAS; ROMERO; GODOY, 2016, p.9-10).

Given the above, it is inferred that technology-mediated dance is embodied in virtual relationships and technical innovations that must be adopted in a critical way, giving rise to new languages and plural assumptions of the body of dance mediated by digital technologies.

V. RESULTS AND DISCUSSIONS: INTERDISCIPLINARY PRACTICES BETWEEN CONTEMPORARY DANCE AND TECHNOLOGY.

As a result of this article's bibliographical research - which intends to investigate the latest interdisciplinary practices between contemporary dance and technology under different scenarios and different forms of artistic appropriation - the following keywords were searched in Scholar Google: "Contemporary Dance" + "Technology" + "Interdisciplinary". The temporal cut used was limited to the most recent periodicals published in the last three years, that is, from 2015 to 2017. From this, 6 results were found, considering the keywords in any part of the article. In this search, were discarded the articles that, although present to the three keywords, only deal, effectively, with one of the themes, as well as articles that are not related to the objective proposed by this research. From this, only 3 articles were considered.

Table.1: Presents: i) the three selected articles; ii) the purpose of the research; iii) the scenario; iv) artistic appropriation.

2 The concept of cyber dance unites cyberspace and dance (BENEDIKT, 1992 apud PIMENTEL, 2000).

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Table.1: Selected articles based on the objective of this research.

ARTICLES	RESEARCH'S OBJECTIVE	SCENARIO	ARTISTIC APPROPRIATION
Studies of an interactive digital interface in PIBITI-Dança (REGO, LACERDA, 2017)	Create a choreographic work using software Isadora programming to develop interactive environments and describe new teaching-learning processes in Dance.	Applied practice in the initial training of teachers in the Higher Diploma in Dance Course of the Federal Institute of Education, Science and Technology of Brasília (IFB) through the Institutional Program of Technological Initiation Grants (PIBITI / CNPQ).	Through the software Isadora[3] was created a choreographic work from the interventional projection and motion capture.
The varieties of the presence of expanded dance and telematic dance as a case study (SANTANA, 2016)	The article aims to reflect on the notion of presence in configurations of the expanded dance, that is, the dance mediated by the digital technologies. In this way, the objective is to investigate how these various presences of physical and virtual bodies are perceived in dances composed in real time.	Three contemporary dance shows were analyzed: "Versus" (2005), "e_Pormundos Afeto" (2009/2011) and "Embodied in Various Darmstadt" 58 "(2013/2014)	**"Versus" (2005)**: the music danced by the dancers was created in real time, the dancers, in turn, danced from different places, to be known, Salvador and Brasilia, in other words, attended "presence states" coupled through technological mediation. **"E_Pormundos Afeto" (2009/2011)**: the Internet public had the possibility to participate in the performance through the virtual environment in which it entered as a n avatar **"Embodied in Various Darmstadt58" (2013/2014)**: the environment was projected in one of the cities - Barcelona - and the final image, which was composed in real time and displayed on the Internet, showed the integration between all the places including the virtual platform with the public (Brazilian city with image of the local stage and of Spain in the background).

3 Choreographic tool that provides "[...] interactive control over digital media in endless possibilities to the creative process. It allows the editing of scenes and movements in real time, constructing dialogues between dancers, public and virtual images (REGO; LACERDA, 2017, p.03).

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			(SANTANA, 2016)
Augmented reality systems as environments for contemporary dance (MISI, 2015)	To propose the possibility of implementing Reality Systems (RA) as environments for Contemporary Dance.	Creation of experiments of this nature developed by the Graduate Program in Dance of the Federal University of Bahia, between 2014-2015 years.	Sharing an experiment on the creation of experiments of this nature, in order to present the interactive installation in increased spatial reality *IsthisBrazil*?

Source: Elaborated by the authors, 2018.

As identified in the previous table, contemporary dance is developed in varied ways and styles, presenting texts, creations, analyzes, studies and own methods influenced by numerous sociocultural actions from technological mediation.

In the study of Rego and Lacerda (2017, p.9) in the scope of training future dance teachers, formative stages were developed for the adoption of software Isadora as a didactic and creation tool of a choreographic work. The graduating registered the experience through articles, reviews, and logbooks, in order to associate the theory with the practice, besides recording all the steps of adoption of the proposed software by a tutorial. The different interactive interfaces of Isadora were explored to develop their own programming, with the help of a mobile projection screen as a background for the interventional projection and motion capture for later programming in the software. With the study, it was possible to perceive that the software Isadora can be considered a powerful digital artifact for the artistic and pedagogical production of choreographic works, besides proposing a "new discussion about choreography, subject and work, environment, body-image, creation in real time, interactivity and digital culture "(REGO; LACERDA, 2017, p.9).

In the analytical study of Santana (2016, p.75) the following artistic performances of contemporary dance were approached by the author: i) "Versus" (2005); ii) "e_Pormundos Afeto" (2009/2011); (iii) "Embodied in Various Darmstadt58" (2013/2014). It should be noted that these shows are considered expanded dances, the author explains that:

> In the friction with digital acculturation, it was confronted with other aspects and forms of exploration of intermodality, finding unprecedented possibilities of occurrence and existence. The interactivity, the coupling of sensors, the construction, and exhibition by audiovisual support, the relation with robotics, among other articulations, are part of this intermodality in dance that makes it, like the cinema, an Expanded Dance. Its exhibition, diffusion, and reception were also modified due to technological mediation.

The main purpose of the "Versus" show was to create strategies for exchanging dancers based on the imagistic construction of narratives produced by means of video dances or in their image shows (pre-recorded or captured in real time). This experience resulted in the formulation of a storyboard[4] that recorded all participants' remote movements and inputs and outputs from cameras and projection media. In addition, Versus' artistic experience served as support for the creation of the software Arthon[5], created by the Digital Video Laboratory of the Federal University of Paraíba, for the transmission of telematic dance shows.

"E_Pormundos Afeto" explored time with one of the main aspects of network art. This show was the first project to adopt the international network as technological mediation. In the same direction, the "Embodied in Various Darmstadt58" also adopted the international

4 The storyboard in its essence is basically a visual guide narrating the main scenes of an audiovisual work.

5 We suggest reading the article by Melo et al (2010) "ARTHRON 1.0: A tool for remote transmission and management of media streams". Available at: http://sbrc2010.inf.ufrgs.br/anais/data/pdf/salao/st02_01_salao.pdf. Accessed on: 01 Jul. 2018.

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network. However, the major focus was the interaction of the dancers through the sonority and not the visuality, crossing borders. Santana (2016, p.81) points out that:

> The image, which previously served as an articulating element between all the remote points and followed the structure of layers to construct the narrative in real-time, was now helping to give place to a meeting of sonorities. The visuality was then at the service of this relationship between the organic, acoustic and synthetic sonorities explored in this work.

As a result of this experience, it was inferred that it was possible to maintain the organic, acoustic and synthetic body as elements for the construction of the narrative in real time. In addition, the relationship with the musicians of each city became more integrated and cohesive in the aesthetics of the choreographic work.

Finally, Misi (2015, p.12) brings up the discussion about digital dance, as a "choreographic thinking different from the traditional way of composition in dance and its modes of enjoyment, which do not contemplate their technical specificities, nor their practices and poetic." In this way, the author emphasizes that contemporary dance through its choreographies encompasses new spatial dimensions, as well as sculptures, lights, video projections, sensors and interactive digital signal processing in real time.

The researcher appropriates of Augmented Reality (RA)[6] as an instrument for contemporary dance. For her, RA promotes a "hybrid space constructed between the real and the virtual, in which ideas are intermediated" (MISI, 2015, p.17). Facing this, the above-mentioned author presents a practical experiment of RA as an environment for dance, Is this Brazil?. This software enables artistic interaction with different Brazilian scenarios, in order to know the dances of each region. Misi (2015, p.17-23) points out that the software:

> It is an environment built on Augmented Space Reality (RAE), also known as projection mapping. The technique for this type of work is to map the three-dimensional surface, defining the lines of the objects' contours, and, on these delineated surfaces, to apply textures with a light projection or video images, in order to modify the colors and patterns of the original objects. [...] Interactivity in the installation Is this Brazil? happens in the artist / programmer-computer relationship, in the process of creating the RAE system, in the planning of the communication form between the synthesis images and the physical space, through video capture and the use of animation and editing software.

After several procedures of test and configuration of *Is this Brazil?*, it was possible to conceive movements seeking different angles and, exchanging comments among the interactive public, which divides this space, communicating their ideas and interpretations, creating a relational and performative space. The public needs to move around the place to discover the hidden spaces and unveil possible sociocultural and artistic contexts produced in the virtual environment, mixing dances, gestures, reality, and virtuality (Misi, 2015).

Thus, the three articles analyzed bring contemporary dance artistic experiences from technological increments. All three surveys bring to the surface, directly or indirectly, the condition of being here-and-now, implying the notion of presence. This has been much studied nowadays by virtue of the development of virtual and augmented reality, simulations, among others. According to Obana and Tori (2010, p.3), the concept of presence has two categories: presence (feeling of someone) and social presence (feeling of someone with another person). These two categories involve the real or virtual environment, emphasizing that the greatest perception of presence is when one is physically and psychologically in a place in the real world, since

> [...] presence is considered as a psychological state that occurs independently of the use of technology and the execution of actions between technological or real objects or entities. It is clear, however, that features such as virtual environment verisimilitude and medium response time improve the perception of presence.

From the perspective of dance, Gumbrecht (2010) emphasizes space as the main dimension of the culture of presence among human bodies, a relationship that can be constantly transformed. In this sense, the author establishes associations with time as a condition of presence in real time.

Therefore, it is possible to infer that contemporary studies of contemporary dance are directly related to the experiments that have connections with the ICT's. Consequently, the presented works have in common the interdisciplinary, since they associate in their

6 Brian Mullins and Gaia Dempsey, in the introduction of the book: Understanding Augmented Reality, of Allan Craig (2013, p. 15), affirm that the "augmented reality é an environment, composed by a set of combined technologies combined with a set of content convention. The way that the people experiment augmented reality is different from everything that came before and, therefore, requires new ways of thinking and production processes.

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projects the art, the dance, the performance, and the technology.

VI. FINAL CONSIDERATIONS

The results obtained by this study indicate that the current panorama of research related to contemporary dance, technologies, and interdisciplinary are still little explored by academic studies. In this prospect, the need to build foundational bases that allow the orientation or the more accurate discussion regarding the contributions and forms of adoption of the ICTs as an artistic appropriation in the diverse contexts and scenarios of the contemporary dance was evidenced. It should be highlighted that ICTs in their different interfaces associated with artistic performances, more precisely with contemporary dance, allow interdisciplinary approaches, since they make interconnections between communication, art, and even education, enabling a branching of experiences beyond their own gestures.

Lastly, the contemporary dance from technological and digital increments allows us to reflect on the ideas of time and space, potentializing dance as a cultural manifestation capable of inciting the construction of innovative and diversified forms of language, surpassing the common body sense of the real state, and transforming itself into a virtual body, to favor the notion of presence and its connection between being and being in the world.

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The Extension of Graph Convolutional Neural Network with Capsule Network for Graph Classification

Jean de DIEU TUGIRIMANA[1*], Janvier RULINDA[2], Antoine NZARAMBA[3]

[1,2]Master's Student in computer science at Central South University, Changsha, China.
[3]PhD Student in computer science at Central South University, Changsha, China.
* Corresponding author. Tel.: +8615773172105; email: titijado@gmail.com

Abstract*— *In this paper we extend a graph convolutional neural network (GCNNs) which is the one of the existing state-of-art deep learning methods using the notion of capsule networks for graph classification. Through experiments, we show that by extending GCNNs using capsule networks can significantly overcome the challenges of GCNNs for the task of graph classification.
Keywords*— *Capsule Network, Graph Convolutional neural networks.

I. INTRODUCTION

Many real-world problems are represented as graphs, such as social networks, molecular graph structures, biological protein-protein networks, all of these domains and many more can be readily modeled as graphs, which capture interactions (i.e., edges) between individual units(i.e., nodes).

In many of these problems, the input data is in the form of graphs, and the graph convolutional neural networks task is to do node classification and graph classification. Graph classification, or the problem of identification of class labels of graphs in a dataset, is an important problem with practical applications in a diverse set of fields. Data from bioinformatics [1], chemoinformatics [2], social network analysis[3], urban computing[4], and cyber-security [5] can all be naturally represented as labeled graphs.

The standard graph convolutional neural networks model commonly used in existing deep learning approaches on graphs, especially when it applied to the graph classification problem it face some limitations :

- Loss of information due to the basic graph convolution operation.
- Graph convolutional neural network model are equivariant because of this it cannot apply directly to graph classification problem, since it cannot provide any guarantee that the outputs of any two isomorphic graph graphs are always the same.
- Graph convolutional neural networks model are limited to exploiting global information for the purpose of graph classification

II. RELATED WORK

Many different techniques have been proposed to solve the graph classification problem. One popular approach is to use a graphkernel to measure similarity between different graphs [6]. This similarity can be measured by considering various structural properties like the shortest paths between nodes [7], the occurrence of certain graphlets or subgraphs [8], and even the structure of the graph at different scales [9].

Recently, several new methods which generalize over previous approaches have been introduced. These methods use a deep learning framework to learn data-driven representations of graphs [10, 11, 12]. In [10], a method is introduced that generalizes the Weisfeiler-Lehman (WL) algorithm by learning to encode only relevant features from a node'sneighborhood during each iteration. Interestingly, [11] proposes a method that processes a section of the input graph using a convolutional neural network. However, for this to work for graphs of arbitrary sizes the method relies on a labeling step that ranks all the nodes in the graph which means it still processes the entire graph initially

III. PROPOSED MODEL AND CONTRIBUTION

The main contributions of our paper can be summarized as follows:

1. Proposing a novel Graph Convolution neural network with Capsule Networks (GCNN-CapsNet) model which is based on the capsule idea of capturing high information output in a small vector instead of scaler output which is current used on GCNN models.

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2. Replacing the max pooling and node aggregation which is current methods used to achieve the graph permutation invariance by developing a novel graph permutation invariant layer which is based on computing the covariance of the data to solve graph classification problem.
3. Designing GCNN-CapsNet which will exploit the global graph structure features at each graph node.

3.1 Proposed model

Our proposed model has Capsule networks as core idea behind is to capture more information in local node pool beyond what captured by max pooling and by aggregation, which graph convolution operation is used in a standard GCNN model. The new information is encapsulated in so called instantiation parameters described in [13] which form a capsule vector of highly informative output

3.2 GCNN general model

For the basic notations let consider a graph $G = (V, E, A)$ of size $N = |V|$ Where V is the vertex set, E the edge set and $A = [a_{ij}]$ the weighted adjacency matrix. The standard graph Laplacian is defined by $L = D - A \in \mathbb{R}^{NxN}$, where D is the degree matrix. Let $X \in \mathbb{R}^{Nxd}$ be the node feature matrix, where d is the input dimension.

Before describing our model GCNN-CapsNet let start by describing a general GCNN model. Let G be a graph with graph Laplacian Land $X \in \mathbb{R}^{Nxd}$ be a node feature matrix. then general form of a GCNN layer output function $f(X, L) \in \mathbb{R}^{Nxh}$ given by $f(X, L) = \delta(\sum_{k=0}^{K} L^K X W_K)$ (1)

Where $L^k X$ is graph convolution filter of polynomial form with degree k. while W_k are learning weight parameters.

3.3 Capsule graph function

Capsule graph function is described by considering an i^{th} node with x_0 value and the set of its neighborhood node values as $N(i) = \{x0, x1, x2..., xk\}$ including itself. In the standard graph convolution operation, the output is a scalar function $\mathbb{R}^k \rightarrow \mathbb{R}$ which take k input neighbors at the i^{th} node and yields an output given by $\mathrm{fi}(\mathrm{x0}, \mathrm{x1}, \mathrm{x2}, .., \mathrm{xk}) = \frac{1}{|\mathrm{N(i)}|} \sum_{\mathrm{k \in N(i)}} \mathrm{a_{ik}}\ \mathrm{x_k}$ (2)

Where a_{ik} represents edge between nodes i and k .

Our capsule graph network, we replace $f(x0, x1, \ldots., xk)$ with a vector valued capsule function $f: \mathbb{R}^k \rightarrow \mathbb{R}^p$. for example, consider a capsulea capsule function that capture higher order statistical moments as follows , we omit the mean and standard deviation for simplification

$$fi(xo, x1, \ldots, xn) = \frac{1}{|N(i)|} \begin{bmatrix} \sum_{k \in N(i)} a_{ik} x_k \\ \sum_{k \in N(i)} a_{ik} x_k^2 \\ . \\ . \\ . \\ \sum_{k \in N(i)} a_{ik} x_k^p \end{bmatrix} \quad (3)$$

3.4 Graph Capsule Vector Dimension

In the first layer of graph capsule network receives an input $X \in \mathbb{R}^{N*d}$ and produces a nonlinear output $f(X, L) \in \mathbb{R}^{N*h1*p}$. since the graph capsule function produce a vector of p dimension, the feature dimension of the output in subsequent layers can quickly blow up to an unmanageable value. For keeping checking, we restrict the feature dimension of the output $f^{(L)}(X, L)$ to be always $\in \mathbb{R}^{N*h1*p}$ at any middle l^{th} layer of GCNN-CapsNet. This was accomplished by flattening the last two dimension of $f(X, L)$ and carrying out graph convolution in usual way (for example see equation 4 for flattening).

3.5 Graph Capsule function with statistical moments

Considering higher-order statistical moments as instantiation parameters because they are permutation-ally invariant and can nicely be computed through matrix-multiplication operations in a fast manner. To do this let $f_p(X, L)$ be the output matrix corresponding to p^{th} dimension. Then we can compute $f_p^l(X, L)$ containing statistical moments as instantiation parameters as follows

$$f_p^{(l)}(X, L) = \delta(\sum_{k=0}^{k} L^k (f_F^{(l-1)}(X, L) \odot \ldots\ldots \odot f_F^{(l-1)}(X, L)) W_{pK}^{(l)} \quad (4)$$

Where $\odot$ is a hadamard product. Here to keep the feature dimension in check from growing, we flatten the last two dimension of the input as $f_{Flat}^{(l-1)}(X, L) \in \mathbb{R}^{N\ x\ h_l\ -1p}$

And perform usual graph convolution operation followed by a linear transformation with $W_{p^k}^{(l)} \in \mathbb{R}^{h_l\ x\ h_l\ -1p}$ as the learning weight parameter. Where p is used to denote both the capsule dimension as well the order of statistic moments.

3.6 Graph permutation invariant layer

The permutation invariant feature in GCNN-CapsNat model of computing the covariance of $f(X, L)$ layer output is given as follows,

$$C(f(X, L)) = \frac{1}{N} (f(X, L) - \mu)^T (f(X, L) - \mu) \quad (5)$$

Here μ is the mean of of $f(X, L)$ output and $C(.)$ is a covariance function. Since covariance function is

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differentiable and does not depend upon the order of row elements, it can serve as permutation invariant layer in GCNN-CapsNet model. And it is also fast in computation due to a single matrix-multiplication operation. Here we flatten the last two dimension of GCNN-CapsNet layer output of $f(X,L) \in \mathbb{R}^{Nxhxp}$ in order to compute the covariance.

In addition, covariance provides much richer information about the data by including shapes, norms and angles (between node hidden features) information rather than just providing the mean of data. In fact in multivariate normal distribution, it is used as a statistical parameter to approximate the normal density and thus also reflects information about the data distribution. This particular property along with invariance has been exploited before in [14] for computing similarity between two set of vectors. One can also think about fitting multivariate normal distribution onof $f(X,L)$ but it involves computing inverse of covariance matrix which is computationally expensive.

Since each element of covariance matrix is invariant to node orders, we can flatten the symmetric covariance matrix $C \in \mathbb{R}^{hp\,x\,hp}$ to construct the graph invariant feature vector $f \in \mathbb{R}^{(hp+1)hp/2}$. other positive note , here the output dimension of f does not depend upon N number of nodes and can be adjusted according to computational constraints.

It is quite straightforward to see that the feature dimension order of a node does not depend upon the graph node ordering and hence the order is same across all graphs. As a result, each element of $f1$ and $f2$ are always comparable. To be more specific, covariance output compares both the norms sand angles between the corresponding pairs of feature dimension vectors in two graphs.

3.7 GCNN-CapsNet Global Features

Another desired characteristic of graph classification problem is to capture global structure of graph. For instance, by considering only node degree (as a node feature) is a local information and is not much helpful towards solving graph classification problem. Also by considering spectral embedding as a node feature it takes global piece of information into account and has been proven successful in serving as a node vector for problems dealing with graph semi-supervised learning. We define a global feature that takes full graph structure into account during their computation. While local features only depend upon some k-hop node neighbors.

Unluckily, the basic design of GCNN model can only capture local structure information of the graph at each node.

Let G be a graph with $L \in \mathbb{R}^{N*N}$ graph laplacian and $X \in \mathbb{R}^{N*d}$ node feature matrix. let $f^{(l)}(X,L)$ be the output function of a l^{th} GCNN layer equipped with polynomial filters of degree k. Then $[f^{(l)}(X,L)]i$ output at i^{th} depends upon "only" on the input values of neighbors distant at most "kl-hops" away.

Mathematical we can proof the above statement, it is easy to see that the base case $l = 1$ holds true. Let's assume it also holds true for $f^{(l-1)}(X,L)$ i.e., i^{th} node output depends upon neighbors distant up to $k\,x\,(l-1)$ hop away. Then in

$$f^{(l)}(X,L) = \delta(g(f^{(l-1)}(X,L),L)W^{(l)}$$

We focus on term,

$$g(X,L) = [f^{(l-1)}(X,L), \dots, L^k f^{(l-1)}(X,L) \quad (6)$$

Particularly the last term involving $L^k f^{(l-1)}(X,L)$. Matrix multiplication of L^k with $f^{(l-1)}(X,L)$ will result in i^{th} node to include all node information which are at most k-hop distance away. But since a node in $f^{(l-1)}(X,L)$ at a distance $k\,x\,(l-1)$ hops, we have i^{th} node containing information at most $k + k(l-1) = kl$ hops distance away.

GCNN model with l layers can capture only kl-hop local-hood structure information at each node. Thus employing GCNN for graph classification with say aggregation layer can capture only average variation of kl-hop local-hood information over the whole graph. To include more global information about the graph one can either increase k (i.e, choose higher order graph convolution filter) or l (i.e, the depth of GCNN model). Both these choice make the model complex and require more data sample to reach satisfying result. However among the two, we prefer increasing the depth of GCNN model because the first choice leads to increase in the breadth of GCNN layer and based on the current understanding of deep learning theory, increasing the depth is favored more over the breadth.

For cases where graph node features are missing, like social network datasets, it is a common practice to take node degree as a node feature. Such practice can work for the problems like graph semi-supervised where local structure information drives node output labels (or classes). But in graph classification global features governs the output labels and hence taking node degree is not sufficient. Of course, we can go for a very deep GCNN model that requires higher sample complexity to achieve satisfying results.

We propose to incorporate FGSD features in our GCNN-CapsNet model computed at each node. FGSD features capture global information about the graph and can also be computed in fast manner. Specifically, at each i^{th} node FGSD features are computed as histogram of

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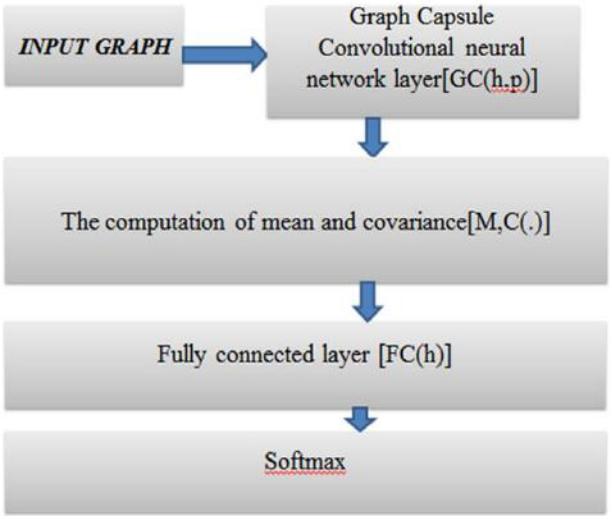
the multi-set formed by taking the harmonic distance between all nodes and the i^{th} node. It is given by,

$$S(x,y) = \sum_{n=0}^{N-1} \frac{1}{\lambda n}(\emptyset n(x) - \emptyset n(y))^2 \quad (7)$$

Where $S(x,y)$ is the harmonic distance, x, y are any graph node and $\lambda n, \emptyset n(.)$ is the n^{th} eigenvalue and eigenvector respectively.

IV. GCNN-CAPSNET MODEL CONFIGURATION



Here GC(h,p) is a graph capsule CNN layer with h hidden dimensions and p instantiation parameters. As mentioned earlier, we take the intermediate tensor which is subsequently pass through [M,C(.)] layer which computes means and covariance of the input. Output of [M,C(.)] layer is the passed to two fully connected FC layers with h output dimensions and finally connect to a softmax layer for computing calss probabilities.

4.1 Dataset

Evaluating the GCNN-CapsNet model we perform graph classification task on variety of benchmark datasets. In first round we used bioinformatics datasets namely: PROTEINS, NCI109,NCI1 and ENZYMES. In the second round we used social netrork datasets namely: COLLAB,IMDB-BINARY,REDDIT-BINARY and REDDIT-MULTI5K.

4.2 Experimental setup

All experiments were performed on a single machine loaded with 2xNVIDIA TITAN VOLTA GPUs and 64 GB RAM. And we compare our method with both deep learning models and graph kernels.

Our experiment, we employ these features only for datasets where node feature are missing. Although this strategy can always be used by concatenating FGSD features with original node feature values to capture more global information. Finally our whole end to end GCNN-CapsNet learning model is guaranteed to produce the same output for isomorphic graphs

For deep learning approaches, we adopted 3 recently proposed state-of-art graph convolutional neural network namely: PATCHYSAN (PSCN)[15],Diffusion CNNs(DCNN)[16], Dynamic Edge CNN(ECC)[17].
For graph kernel we adopted 4 state-of-art graphs kernels for comparison namely: Random Walk(RW) [18], Shortest Path Kernel(SP)[19] , Graphlet kernel (GK)[20], Weisfeiler-Lehman Sub-tree Kernels(WL)

4.3 Graph Classification Results

From table 1, it is clear that our GCNN-CapsNet model consistently outperforms most of the considered deep learning methods on bioinformatics datasets with a significant margin of **1% -6%** classification accuracy gain on NCI1 datasets. Again ,this trend is continued to be the same on social network datasets as shown in Table2. Here we were able to achieve up to **4%** accuracy gain on COLLAB dataset and rest were around **1%** gain with consistency when compared against other deep learning approaches.

Our GCNN-CapsNet is also very competitive with state-of-art graph kernel methods. It again show a consistent performance gain of **1% -3%** accuracy on many bioinformatics datasets when compared against with strong graph kernels. While other considered deep learning methods are not even close enough to beat graph kernels on many of these datasets. It is worth mentioning that the most deep learning models are also scalable while graph kernels are more fine-tuned towards handling small graphs.

For social network datasets, we have a significant gain of at least **4% -9%** accuracy(highest being on REDDIT-MULTI dataset) against graph kernels as observed in Table 2. But this is expected as deep learning methods tend to do better with the large amount of data available for training on social network datasets. Altogether, our GCNN-CapsNetmodel shows very promising result against both the current state-of-art deep learning methods and graph kernels.

Dataset	PROTEINS	NCI109	NCI1	ENZYMES
No.Graphs	1113	4127	4110	600
Max.Graph Size	620	111	111	126
Avg.Graph Size	39.80	29.60	29.80	32.60

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Deep Learning Methods				
PSCN[2016]	75.00±2.51	-	76.34±1.68	-
DCNN[2016]	61.29±1.60	57.47±1.22	56.61±1.04	42.44±1.76
ECC[2017]	-	75.03	76.82	45.67
GCNN-CapsNet	**76.40±4.17**	**81.12±1.28**	**82.72±2.38**	**61.83±5.39**
Graph Kernels				
RW[2003]	74.22±0.42	>73.00±0.21	>1Day	24.16±1.64
SP[2005]	75.07±0.54	73.00±0.21	73.00±0.24	40.10±1.50
GK[2009]	71.67±0.55	62.60±0.19	62.28±0.29	26.61±0.99
WL[2011]	74.68±0.49	**82.46±0.24**	82.19±0.18	52.22±1.26
GCNN-CapsNet	**76.40±4.17**	81.12±1.28	**82.72±2.38**	**61.83±5.39**

Table 1.Classification accuracy on bioinformatics datasets. Result in bold indicates the best reported classification accuracy. Top table compares results with various deep learning approaches while bottom half compares results with graph kernels. '>1day' represent that the computation exceed more than 24hrs

Dataset	**COLLAB**	**IMDB-BINARY**	**REDDIT-BINARY**	**REDDIT-MULTI5K**
No.Graphs	5000	1000	2000	5000
Max.Graph Size	492	136	3783	3783
Avg.Graph Size	74.49	19.77	429.61	508.5

Deep Learning Methods				
PSCN[2016]	72.60±2.15	71.00±2.20	86.30±1.58	49.10±0.70
DCNN[2016]	52.11±0.71	49.06±1.37	OMR	OMR
GCNN-CapsNet	**77.71±2.51**	**71.69±3.40**	**87.61±2.51**	**50.10±1.72**
Graph Kernels				
GK[2009]	72.84±0.28	65.87±0.98	77.34±0.18	41.01±0.17
GCNN-CapsNet	**77.71±2.51**	**71.69±3.40**	**87.61±2.51**	**50.10±1.72**

Table 2.Classification accuracy on social network datasets. Result in **bold**indicates the best reported classification accuracy.Top table compares results with various deep learning approaches while bottom half compares results with graph kernels. '>1day' represent that the computation exceed more than 24hrs. 'OMR' is out of memory error.

V. CONCLUSION

In this paper, we present a novel Graph convolutional neural network with capsule network (GCNN-CapsNet) model based on the fundamental capsule idea to address some of the basic weaknesses of existing GCNN models. Our GCNN-CapsNet model design captures more local structure information than traditional GCNN and can provide much richer representation of individual graph nodes or for the whole graph. For our purpose we employ a capsule function that preserves statistical moment's formation since they are faster to compute.

We propose a novel permutation invariant layer based on computing covariance in our GCNN-CapsNet architecture to deal with graph classification problem which most GCNN models find challenging. This covariance can again be computed in a fast manner and has shown to be better than adopting aggregation or max pooling layer. We also propose to equip our GCNN-CapsNet model with FGSD features explicitly to capture more global information in absence of node features. We finally show GCNN-CapsNet superior performance on many bioinformatics and social network datasets in comparison with existing deep learning methods as well as strong graph kernels and set the current state-of-art.

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Rocky Grains Storehouses Located in Kafari Strait on the Banks of Seimareh River

Lily Niakan

Member of the Scientific Committee of the Archeology Research Institute of Cultural Heritage and Tourism, Tehran, Iran.

Abstract**—** *The Kafiri Strait has been is one of the most important human habitats in terms of topographical and environmental conditions in the southeastern province of Ilam. The present study was conducted to provide preliminary information for introducing and identifying a set of indicators from rock formations as a collection of warehouses and silos in the geographic region of the studied strait. Desirable spaces in this type of architecture are created by removing rocky masses through reducing their main bed, and they form that space with the material of the canvas. An example of these rocky warehouses in Kafari Strait is located on the margin of this strait with average height of 35-40 meters and the width of 500 meters, dominating about 1.5 kilometers in this geographical area. The research method was descriptive-analytic. The results of this study showed that the remnants left of these warehouses and their formation on the rocky bed of limestone, which had been affected by thousands of years due to the existence of seasonal sprawl and other natural factors, make this rock wall a hole with small, medium and large dimensions with various shapes and depths. The aboriginal inhabitants of these areas were able to use these materials to make changes to these holes, using them as structures in accordance with their needs as warehouses for storing supplies. Also, surveys carried out in the perimeter of these warehouses show remnants of mills that have been used to distort the water of the Kulmriver. The collection of reservoirs and water mills represents a clever and complete system of grains storehouses formed by the people of these areas; additionally, the results showed that the inhabitants of these areas could have mined, stored and used grains in these rocky warehouses.*

Keywords**—** ***Kafiri Strait, Rocky Grains, Storehouses, Seimareh River, Ilam.***

I. INTRODUCTION

Remnants of mountain and rocky warehouses have constantly been found along Zagros Mountains and valleys in the province of Ilam, including Kafari Strait that can be identified as a kind of architecture the rules of which follow the regulations of nature. This kind of architecture can be regarded as a kind of domination of human art on the rock, with a clever human being able to form the rocks in order to meet their needs the way they want in their lives. This type of architecture has functioned as a rocky sanctuary in the highlands from the ancient times; valleys with the potential ofcultivation and sheltering sanctuaries that can maintain the irritation, heat, and predators. Recognizing this kind of native architecture is associated with historical cultural values that are rooted in the ancient culture and traditions of each region; additionally, such an architecture ismanifested in different parts of Iran with huge variety and difference. This is important for each region due to its climatic and environmental conditions, with its unique features formed in the context of its cultural, political, security, social and economic conditions.The present research describes the features and characteristics of this handmade structure and the way it was used to meet the basic needs of the natives of the region for long or short term maintenance of their crops and grains.

Geographical location of SeimareKafari Strait manmade rocky warehouse

Manmade rocky supplies warehouseswere identified in the geographical area of KafiriStrait on the banks of the Seimare River in Seimare Archeology Board Survey in 2015. The Seimare River is located in the southwest of Iran on the border between two provinces of Ilam and Lorestan in Zagros. This is a water catchment basin which starts from the intersection of two rivers of Gamasiab and GharehSouh in Kermanshah and continues until the KashkanRiver crosses to Seimare. This area is geologically considered part of the wrinkled Zagros, which is often in its path parallel to the general trend of the main structures (northwest-southeast)(Fig. 1). However, it interrupts the anticline, which results in the formation of transverse straits such as Chia Green Straits, Lalar, Kafari and Soban within the lime. The metamorphic sequence of the region consists of Cretaceous to Polyoplistocene, a sequence consisting of limestone, dolomitic limestone, marlite, sandstone and conglomerate with a thickness of 1500 meters (1, 2).

Man-made-Cave architecture

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Man-made-Cave is derived from the term 'Troglodytic'; this term is originally Greek and consists of two parts: "Trogle" meaning "pit and hole" and Dynien means penetrating into something. Consequently, the term Troglodytic-Architecture refers to a type of architecture in which things penetrate into one another. In Man-made-Cave, no materials are used for space production, and unlike conventional architectural principles, static issues are not discussed in this kind of architecture. This type of architecture can be considered as a kind of space production through the creation of negative spaces in the mountains and rocks, which is composed of blended and empty spaces, and is more responsive to human climatic needs. Desirable spaces in this type of architecture are created by removing the rock mass with the method of reducing its original bedding, thus forming the required space; so, the space in question can be created in different forms. There is no difference to the place from which expansion starts, either from the floor or the ceiling in manmade architecture, or it does not have to be seen in the creation of an entire body of compulsory spaces in the field of space production. So, to create the necessary space in the backbone architecture, only cutting the rocks and unpacking the masses creates space. In fact, the technique of producing space in this kind of architecture is simple, but its implementation is very difficult. The main tool used in this method is a hinged, hammer and Kraft or Kraft and sledgehammer. Major materials combined with this type of puzzle have been widely found in the original samples of dispersed rocks in the mountains and the volcanic eruptions in the river bed, in addition to the completion of spaces made from canvas.

Grain storage rocky structures

Nomadic life or migration from the countryside to gypsum and vice versa, which has been around for several thousand years, is one of the main factors of the birth and development of the life of the nomads as a model for adaptation to climate change and exploitation of natural resources. Regarding the role and importance of agriculture in semi-subsistence life and given the short distance between the countryside and the grassland, the conservation and maintenance of cereals obtained from agricultural activities is an important issue in this way of life; this point has obligated Zagros Mountains sub-indigenous residents to build storage facilities for their cereals. In fact, a collection of caches and mills is well illustrated by a clever and complete system of storing grains, so that the inhabitants of these areas could grind and use the salt and grains stored in the warehouse. Therefore, the nomads of these areas did not have to carry all their annual stores in transit by storing cereals with other methods mentioned above (Fig. 2).

Introduction, Identification, and analysis of the case study

The geographic location of a structure and using rocky architecture requires the existence of specific and appropriate natural and human geographical perspectives that can emphasize the importance of describing a work from different scientific perspectives, such as archeology, anthropology, and cultural environments. In the geographical area under study, four types of warehouses known with local names of Amara, Tapo, Conbu and Chalar, are built on the slopes of the mountains and hilly valleys; warehouses existing in the Lalar, Zarangoush, Zayed, Darband and Ganjeh strait are some examples (3, 4). This rock complex is located in a rocky valley with an average depth of 35-40 meters and a width of about 500 meters and a length of about 1.5 kilometers, which is located along a narrow strait that is surrounded by long rocky walls. The formation of this structure in the natural rocky bed of this mountain has been preserved as a remnant of the remains of silos and warehouses, which preserved a part of the history of the region from the point of view of agriculture. These architectural structures, in form of spaces or chambers and storage silos, can serve as a collection of management for the maintenance of the food of a small village of nomadic people. The historical and archaeological background of the area showed that several settlements have been set up on the banks and edges of the Seimare River due to the environmental conditions in the straits of this tumultuous and large river, such as the Straits of Lar and Kafari. This type of warehouse architecture can be a reflection of the accurate planning and management of its inhabitants in a period of history in order to protect themselves and families within this geographical area. The selection and construction of warehouses and silos in this place helps hiding this space from the reach of enemies and animals due to the existence of a long rocky wall and its natural holes. On the other hand, the calcareousness of these walls has formed large holes in various forms and created multiple divisions during thousands of years with the penetration of water within this rock. Functioning like solid boxes, each one of these holes provides the potential of storing grain. These architectural structures were also made up of chambers of various dimensions and shapes, some being circular, some otheroval or rectangular; these chambers were connected with simple materials, such as river rocks and gypsum plaster, providing the capacity of storing and protecting food (Fig. 3-4).

Various Styles of Supply Stores:

A: These warehouses and silos are made in the foothills of the valleys, with the natural rocks of the valleys and the slab of rocks and using materials such as stone carvings, wood, cob and gypsum plaster. These handmade structures are constructed using natural cliffs whose walls and slabs are used as support for pear-shaped cereal caches such as quadrangles or polygons. Some of these

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warehouses are made up of two or more floors, with connecting passages from one to the other, all of which are open to the east and to the rising sun. Remnants of white plaster on these structures reflect the sunlight, and the downsizing of these warehouses function both as a cover for the outer wall and for balancing the air inside the grain storage. On the other hand, it will protect the influence of moisture and the loss of atmospheric precipitation in the warehouses. It has also been tried to use sun-drenched areas. Preventing moisture penetration is a constant principle in choosing the location and making these warehouses (Fig. 5).

B: Another part of these warehouses and silos has different shapes and designs in comparison with handmade rocky ones. The architectural form of these warehouses is a plan of foursquare planted with a vault entry and debris from the roof of the trench made of wood and foliage. These quadrangular, rectangular or polygonal structures were constructed both in one and two floors; a regular grid system was created among them similar to that of the hive, with 8 to 10 supply stores sticking vertically together. The interfaces of these silos have access corridors. In the upper part of the silos, cavities of approximately a circular size varying from 50-60 centimeters were created to form a grain. They blocked the holes after filling the silos with little stones. Cereal evacuations from the inside of the silo in the lower part of the cavity were performed by the valve-like hole; some of these warehouses had exterior walls; some of these walls had niche and shelves around the silos and storage bins were, also, considered. Others had a pillar attached or free inside the structures. These silos were located in rectangular square rooms; only remains of the walls of the rooms survived and the ceilings were gone (Fig.6).

II. DISCUSSION

The study of mountain storages and silos of the Strait is actually aimed at preserving agricultural products and keeping them intact and away from insects and animals. The choice of the place for the construction of these small warehouses in the mountains and valleys was an attempt to conceal the item against would be predators and enemies who might get in action to loot the assets of the peoples of these areas. Studying this collection of grain warehouses, which turned out to have regular and complex plans and the desirable use of nature for the storage and construction of silos using natural materials such as rocky walls and materials, is of paramount significance and priority. The use of indigenous materials, rocks, and natural walls, which function protect materials stored in silos against heat and the possible danger of mice or other vermin, and the use of shingles for the outer coating of structures to balance the air inside the silo are some points to consider in the construction of these warehouses in Kafari Strait. These warehouses usually contain grains used by nomads such as wheat, barley, rice and legumes such as chickpea, lentils, mushrooms, as well as salt and oak. Considering that some of these warehouses were bigger and larger in size and were built close to the ground I order to provide easier access, wheat, barley, rice and oak, which were most used in these areas, were kept in stores with smaller size and volume and located in higher floors which made accessing them quite difficult. Legumes, such as peas, lentils, mushrooms, and salt were usually preserved and stored by spraying salt on them in the warehouses.

III. CONCLUSION

Considering the fact that Kafari Strait storehouses are located close to Kolum and Jaber rivers and agricultural land, and given the remains of Chartoot water mills near them, it seems that, using the potential of the river water, this collection of warehouses and water mills well represents a clever and complete system of storing cereals and grains conducted by the people of these areas so that the residents of these areas could have mined the salt and grains stored in the warehouse. Therefore, the nomads of these areas did not need to carry all their annual stores in transit, because they stored the cereals through the methods mentioned above. It is also important to consider the time during which these warehouses were constructed and used. Given the unique features of this complex of architectural artwork, it seems that it is difficult to determine the initial time of constructing a collection without using written documents; given the pottery found in Chartoot mail, which is about 500 away from the study area, one can date the construction of such warehouses back to the Islamic era.

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Fig.1: The location of the Kolum River and the warehouse of food supplies in Kafari narrow strait around Seimare River

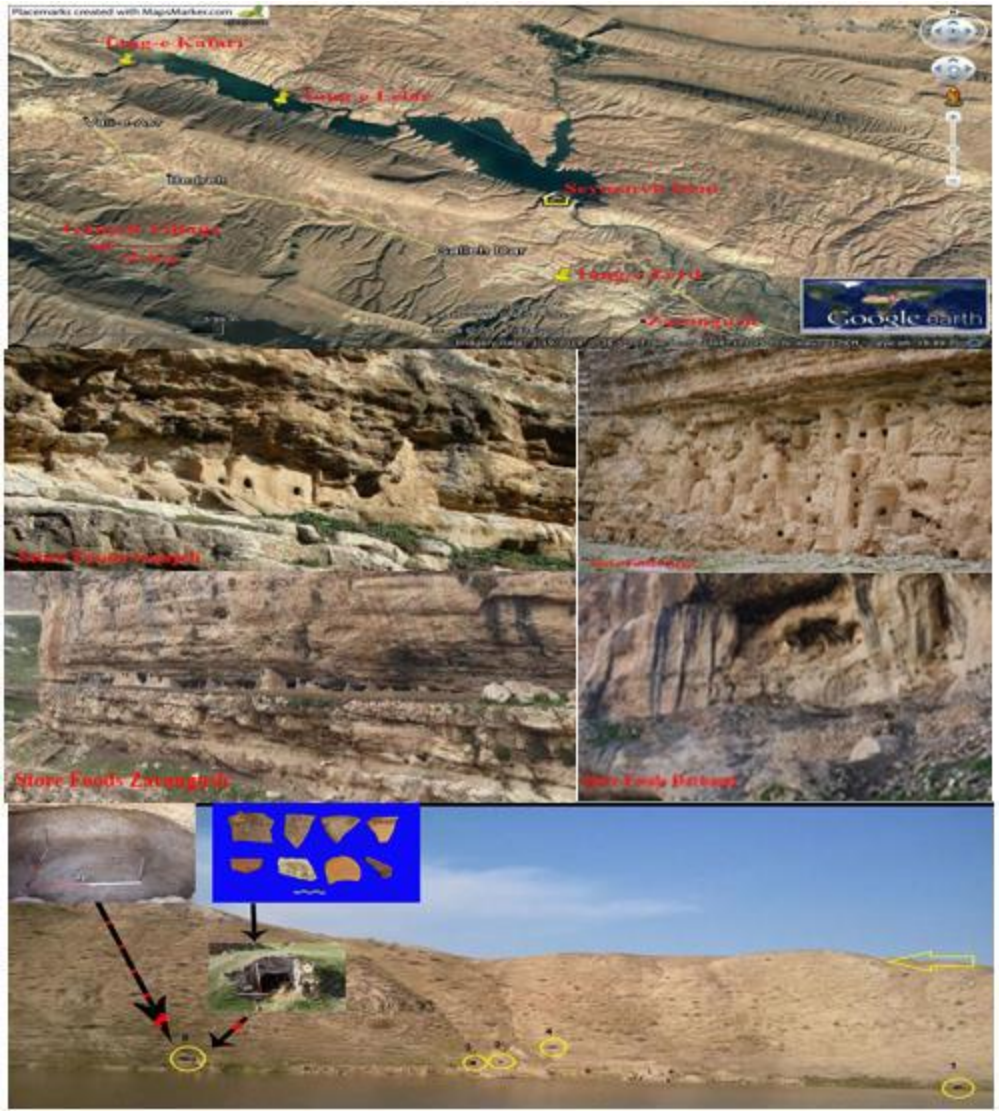

Fig.2: Foothills warehousesin the geographic area of the Seymareh River.

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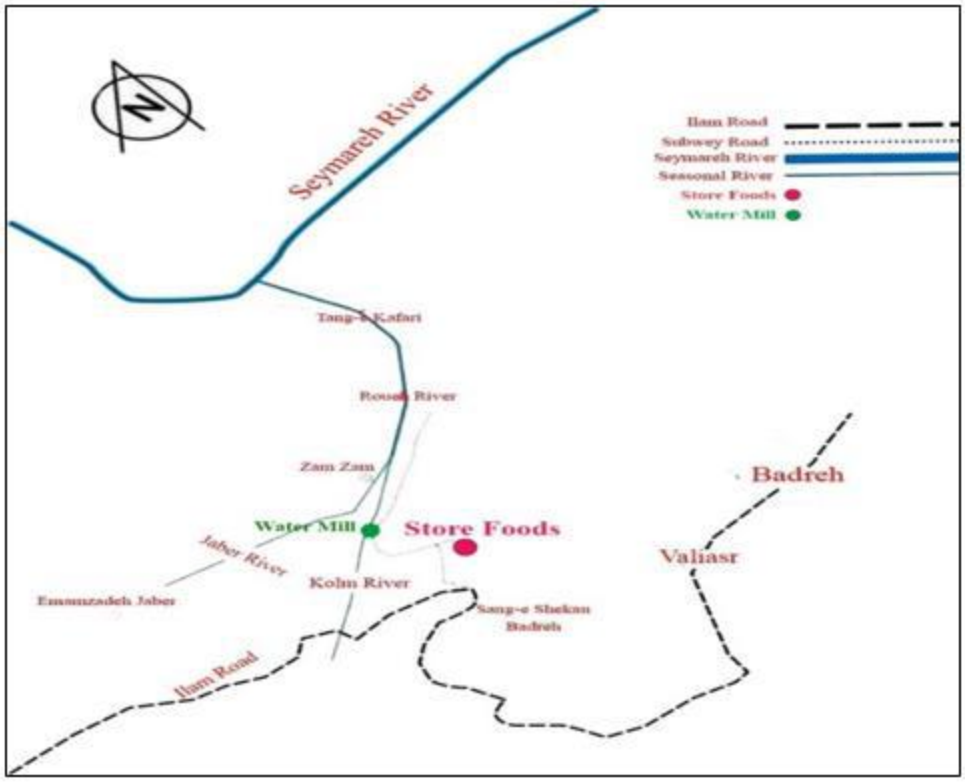

Fig.3: Map of access road to the mill, storage facilities and storage silos

Fig.4: A view of the western side of the Strait, the entrance of the Strait and a sample of supply storages constructed using stone and gypsum materials with the support of the cliff wall gap

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Fig.5: Aerial view of storage silos

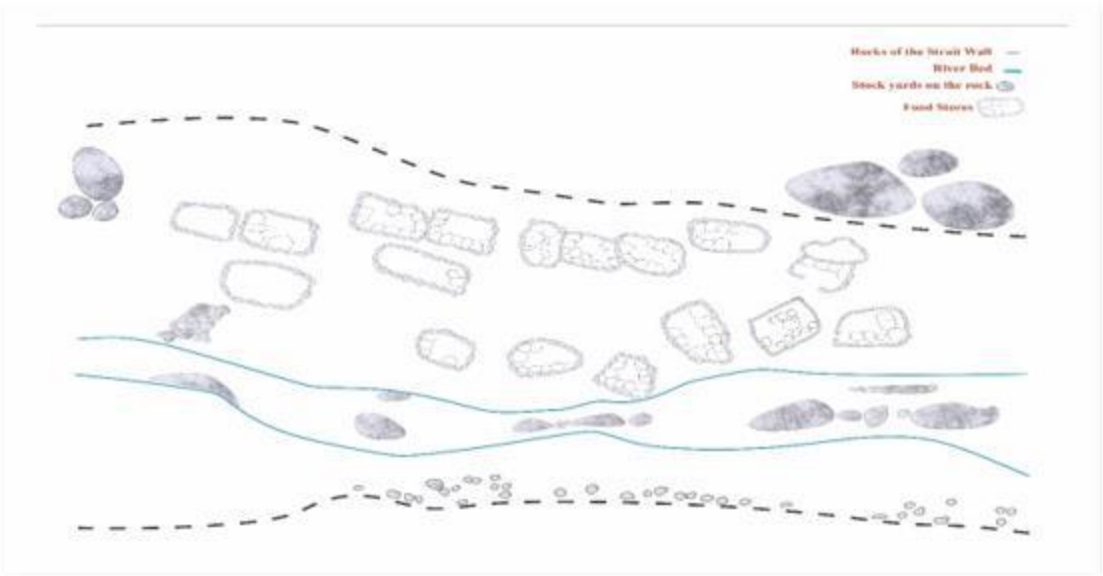

Fig.6: Plans from the western side of the Strait and structures of storehouses

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Face Recognition using Content Based Image Retrieval for Intelligent Security

Sri Karnila[1], Suhendro Irianto[2],and Rio Kurniawan[3]

[1] Department Information System, Darmajaya Informatics and Business Institute
Jalan. Z.A. Pagar Alam, No. 93, Lampung, Indonesia
srikarnila@darmajaya.ac.id
[2] Department Informatics, Darmajaya Informatics and Business Institute
Jalan. Z.A. Pagar Alam, No. 93, Lampung, Indonesia
suhendro@darmajaya.ac.id
[3] Department Informatics, Darmajaya Informatics and Business Institute
Jalan. Z.A. Pagar Alam, No. 93, Lampung, Indonesia
suhendro@darmajaya.ac.id

Abstract**—** *This paper try to construct an intelligent security system based on face recognition. The data used in this research are frontal face images and without obstacles, and facial images with obstacles. In this research, we used Content Based Image Retrieval or CBIR method. Approximately 10,000 images used in this work which is collected from internet, police department office, and shooting directly as primary data. Facial image data are stored in the database object-based files through process of identification and facial recognition. Consequently, facial images are retrieved using facial similarity techniques. In this stage of identification , an application can specify shape of the front face, performs feature extraction, and running intelligent Similarity (matching face data) which open the door automatically . This system can be used to minimize the occurrence of criminality occurs nowadays. This system can be used such as for house door security, office doors, and airport gates. The experiments result show that our algorithm quite good in face detection and recognition to open the door.*

Keywords**— Face recognition; CBIR; intelligent: security system; criminal; similarity.**

I. INTRODUCTION

. The development of face recognition techniques is quite difficult because human faces are complex, multidimensional, and often change according to circumstances and situations. Therefore, the creation of an automatic facial recognition and / or facial expression system is a challenge for experts to date. Biometrics is a self-recognition technology using body parts or human behavior. Some of them are fingerprint, retina, iris, patterns of the face [1]. One of the most widely used in recently research face detection and face recognition [2],[3]. Meanwhile [4] states that face recognition systems been recognized almost 50 years ago, it is a branch of the field of pattern recognition and computer vision. Face recognition is also a branch of the nature of human biometrics. [5] ,[6] . Recently, higher number of criminal occurs, causing the security system to be absolute tightly applied. It is required a security system device that keep full time protection for assets and privacy. Therefore, with this security system application able to provide a sense of safety and comfort for us. In addition to this it may reduces criminal rates which occur in the community.

Door is an example of the utmost importance in home security, company, government offices, and other important buildings and houses. The existence of door security systems installation is an automation as a positive impact of technology developments. Automation will replace of the human role by a tool or machine, since basically the gate will open itself when a password is entered correctly. In the future a door should not be kept constantly by humans because the system is also equipped with alarms when the door is forcibly opened by unauthorized person. An Intelligent system was built in this research using Content Based Image Retrieval method. This intelligent system is targeted to replace a text-based conventional security system that is so easy to be "hacked" by unauthorized people.

In this paper will explore face recognition to build intelligent system to access and open doors or gate automatically. In section 2 will present related works of the research, section 3 provides methods of the work, while section 4 will provide the results as well as discussion of it, finally section will provide the conclusion and future works of the research,

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II. RELATED WORKS

2.1. Face recognition

According to [7] face recognition system is a computer application for automatically identifying or verifying a person from a digital image or a single frame from a video source. This can be carried out by comparing selected facial characteristics of the likeness and a facial database. It performs that by matching the face of the retrieving user with a database of faces formerly stored in memory. Face recognition offerings a interesting issues in the area of image analysis and computer vision, and it has acknowledged a great deal of interest over the last few years since of its applications in different areas. There are many issues occur due to many factors that can affect the images. When processing images one must take into account the variations in frivolous, image quality, the individuals pose and facial expressions along with others. Whilst, [8] stated that different types of facial images are taken for face detection. The images that are collected in a semi-controlled situation are used as a query. Images were taken in uncontrolled indoor location and different facial expressions (such as open / closed eyes, smiling / not smiling) or formations (such as w/glasses, center-light, happy, left-light, normal, right-light, w/no glasses, unhappy, sleepy, surprised, and flash). The images are taken by changing the lighting and facial minutiae (glasses / no glasses) at different times and are used as input. It showed different results and performance algorithm.

An essential problem in image recognition and computer vision is defining the distance between two images. Significant efforts have been made to outline image distances that provide automatically reasonable results [4, 16, 1, 10]. Among others, two representative measures are the tangent distance [16] and the generalized Hausdorff distance [4]. Tangent distance is locally invariant with reverence to some chosen alterations, and has been extensively used in handwritten digit recognition. The generalized Hausdorff distance is not only robust to noise but also allows portions of one image to be compared with another, and has become a typical tool for comparing shapes. [11].

Face recognition is one of the challenging aspect in the field of image analysis and computer vision. The focus towards the face recognition has been increased in the last few years leads to encouraging results but still we are unable to find the face recognition technique which is able to perform efficiently in the various situations commonly encountered in daily due to its enormous applications in different domains. The research conducted in this field for the past four decades life. The algorithms related to face recognition technique are thoroughly studied taking a number of test images and varying the conditions and variables. Proposed Genetic algorithm based method is applied on three different benchmarked databases: ORL (Olivetti Research Laboratory), UMIST and Indbase. The ultimate objective of the research work is to improve the recognition rate. The proposed method gives better recognition rate as com-pared to existing PCA and LDA methods. It has been observed that the proposed Genetic algorithm based method has achieved the 98.57 % face recognition rate with ORL database, 100 % recognition rate with UMIST database and 98.33 % recognition rateIndbase database which is far better than the existing techniques PCA and LDA. The proposed work can further be improved using other optimization algorithms and can also be applied on other benchmarked databases [9]. The main goal of face recognition technology is to match a given face image against the stored database of images. Face recognition technique uses several other disciplines such as image processing, computer vision, pattern recognition, neural networks and psychology. With the current perceived world security situations, governments as well as businesses require reliable methods to accurately identify individuals, without overly infringing on rights to privacy or requiring significant compliance on the part of the individual being recognized.

2.2. Content Based Image Retrieval

Stated by [10] that Content Based Image Retrieval (CBIR) is the process of searching and retrieving images from a database on the basis of features that are extracted from the image themselves. In this paper image classes are used such as Africa, beaches, buildings, buses, dinosaurs, elephants, flowers, foods, horses and mountains. Features are extracted from the entire image database and the feature vectors have been stored. Furthermore they said that a new hybrid feature scheme is proposed for efficient CBIR in this paper based on spatial, frequency, CEDD and BSIF feature descriptors. In addition to spatial features such as color auto-correlogram, moments, and HSV histogram features and frequency domain features like SWT moments, Gabor wavelet transform features, CEDD and BSIF features are used to increase precision of the presented approach. Using spatial domain features lowest precision results were obtained whereas frequency domain features resulted in better precision as compared to spatial domain features. Finally, in order to improve the precision we extracted CEDD and BSIF descriptors, which resulted in highest precision. Both global and local features are combined to obtain higher retrieval rate. Experimental results obtained using the proposed approach are better compared to existing methods. Currently we are working

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on techniques for reducing the feature vector size which will further reduce the execution time.

2.3. Content Based Image Retrieval

New approach has been proposed for an image retrieval system based on region growing segmentation on DCT compress domain. It is presented as a different way to develop image indexing by using of DCT descriptors. The method has been carried out for compressed images database to verify its performance in JPEG standard stream line.

The proposed method of region growing segmentation on DC images offers huge storage and time saving for Image indexing and retrieving. From this work, it could be concluded that segmentation, while imperfect, is an essential step and very useful in building indexing keys. In summary, this indexing key method is a promising method for image retrieval on segmented image on compress domain. This new approach could be used for image indexing by other segmentation methods. For the near future, it will be used another segmentation approaches such as Support Vector Machine, Fuzzy logic, and Split Merge to improve speed of image indexing and Retrieval [12].

According to [10] stated that semantics in general terms describe about the denotation of something. In programming, semantics tells about the meaning and format of syntaxes written in the program code, in the same manner when discussed in the field of image processing, semantics tells about the interpretation of images from the user level perspective. In CBIR features are extracted which do not justify the user's perspective and his critical thinking properly. This loophole is called semantic gap as discussed earlier in the starting of paper. So to bridge this gap, researchers proposed methods by which retrieval based on High Level semantics was possible.

Meanwhile [14] gives a comprehensive summary about content based image retrieval, semantic gap, Low Level features and High Level semantics. A literature review of work done in CBIR is also given. CBIR is still an immature technique which needs more enhancements for better retrieval results. Researchers are still working on the main issue of CBIR which is the reduction of semantic gap. Though a lot of work has been done in this domain, but still a generic approach is not yet developed for image retrieval which uses High Level semantic parameters. As there is no proper technique available which reduces semantic gap fully, future research directions are suggested

2.3 Intelligent System

Recently, the necessity of home surveillance security system is turning out to be extremely important and it is oftentimes utilized in the house or residence [3], business firms [4- 6], robotics [7-9] and also for traffic monitoring systems [10]. The purpose of home surveillance security system is essentially used to screen the activities, behavior or other changes in information in order to manage or protect personal belongings. These days, this surveillance system is being installed at home to monitor and avoid any unwanted activities to occur. Thus, the owner can quickly take necessary actions in case of any aggravations [13]. As house break-in cases increasingly rapidly, there is multiple intelligent home security system that is being developed with many necessary features. Moreover [13] defined that one of the fundamental reasons that bring about the increase in the rate of this case is the failure in intruder confirmations. In fact, these failures lead to prolonged crimes. A smart alarm system is developed in this paper to be installed in the locker to overcome the intruder confirmation issues. The development works in a way that when an object's movement or action passes through infrared radiation and blocks it.

III. METHODS

3.1. Research Steps

Research is conducted in two phases, first phase involves the collection of facial image of more than 10,000 facial images. In this first phase, activities will be focused on activities and face features extraction. Figure 1 describes the flow of activities which constitute the face extraction. To stage face recognition , this works use to implement image retrieval by image query into the system, which an implementation of image retrieval based on face detection feature. Database used in this study is a combination or mixture of some facial expressions such as facial was mediocre, angry face, smiling, shouting, and laughing, while also used illumination (some variation of radiation from the left side, right side, and radiation from both sides).

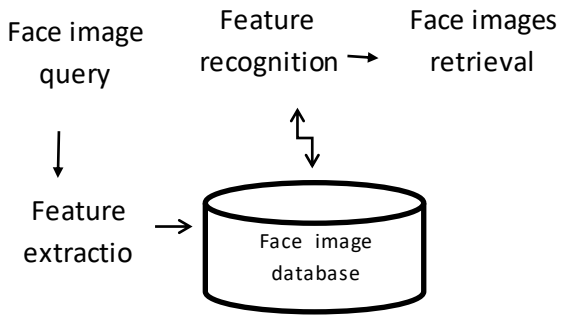

Fig.1: Diagram of face recognition retrieval system

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Database used in this study is a combination or mixture of some facial expressions such as facial was mediocre, angry face, smiling, shouting, and laughing, while also used illumination (some variation of radiation from the left side, right side, and radiation from both sides). As for calculating effectiveness (effectives) of facial images used search precision and recall parameters that can be written as follows [8].

$$\text{Precision} = \frac{\sum \text{relevant images retrieved}}{\sum \text{images retrieved}}$$

$$\text{Recall} = \frac{\sum \text{relevant image retrieved}}{\sum \text{relevant image in category in the database}}$$

The greater the value of precision and recall, the more effective methods or techniques used by search, precision has a maximum value 1 and minimum 0.

3.2. Face Searching Algorithm

The algorithm of the method applied in this study is to explore the features available in the DCT coefficients, where each coefficient is a vector containing the energy to build a histogram in the process of matching during the search process and the introduction of facial images from the database. Sequence or algorithm of this technique can be explained as follows:

1. *Input face image*

2. Convert RGB Image into YCbCr and HVS component, get face candidate

Generate Key Indexing from DCT coefficient of 2D matrix image calculate

I(query Image) as follow:

H(i)= {h0,h1,…,h63), and hi=

Q(u,v) is DCT coefficient at row u, and column v

Similar step 3 for iamge in the database.

H(i) = { h0,h1,h2,…,h63},andn

hi = d(u,v) is DCT coefficient at row u and column v.

2. *Calculate similarity between image query and image in the database using this formula:*

Have

$$D(Iq, Id) = \sum_{i=0}^{N} \frac{(I_{qi} - I_{di}).(I_{qi} - I_{di})}{N}$$

where D is distance between Iq vector Id vector (face in the database). Whilst N is number of block of related face image. D value has range 0 and 1, if D=0 then image query is exactly the sane to image retrieved from the database.

4. Range face image retrieved based D value calculated as ascending order.

For Number_of_block = 1 to N

For u = 0 to 63

For v = 0 to 63

D((Iq(u,v),Id(u,v)));

End

End

End

5. Display 20 images similar retrieved

6. For next image query, repeat steps 1 to 6.

3.3. Evaluation of Face Image Searching

To measure the similarity or degree of similarity between the query face image (the reference face) with facial image is in the database, then used the Euclidean distance formula which can be defined as follows [9]:

$$\Delta d = \sqrt{\sum_{i=1}^{n} (|Q_i - D_i|)^2}$$

The method of application development used in this work is Waterfall model. It includes implementation, testing, and maintenance [10]. Whilst, for process system model is described in with form of system development life cycle. It consists of requirements, analysis, design, and flowchart of general process model. [11], [12] stated that analysis is done to determine the problems occurred ,and an automatic security on the door by recognizing the face through the technique of Content Based Image Retrieval (CBIR).

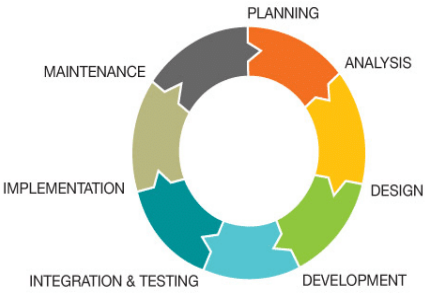

Fig.2: System development steps

The system development system as illustrates in figure 2 can be explained as follow, [12]:

- Planning step deliveries estimating as well as scheduling and tracking the application,
- Analysis step, face image data analysis and design of face recognition and application

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- Development step , in this step coding application and was carried out as well as feed back also be finished
- Integration and testing step , integration each modul such as face detection , recognition, graphics user interface were integrated,
- Implementation, as all steps carried out the application system is ready to deploy in real word.

3.4. Application System Design and Development

The development of intelligent doors system by using CBIR method can be described at figure 3.

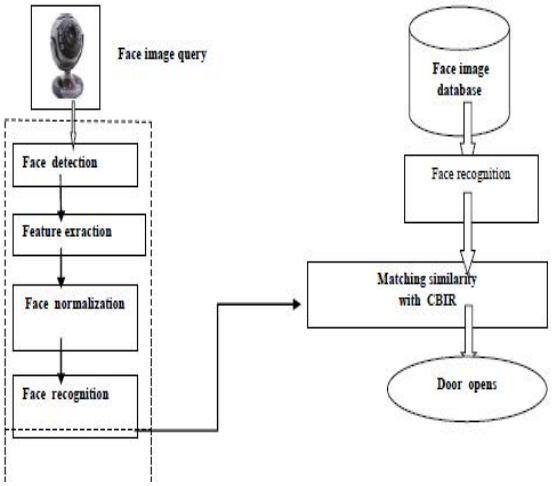

Fig.3: Face recognition to open the doors automatically using CBIR method

In this step we applied ground truth not less than 10,000 face images with variant pose and expression. The database consist of face with normal pose or without obstacles forward at front and face with obstacles such as wearing hat, glasses, and hijab. Face images were collected from many sources such as from: internet, police office, county offices, and from the site.

3.5 Haar Classified Facial Tracking method

Haar Cascade is considered as technique using square features which identify particular object on image. Haar algorithm using statistical method to detect a face. It used statically model in face detection, the method carried out by using Haar-like features sample. Value of Haar –like feature can be considered as the difference between grey scale level pixel values and white box regions. The formula of Haar-like feature might be written as f(x) = SumBlack rectangle - SumWhite rectangle, where f(x) is Haar-like value, SumBlack rectangle is number of black pixel gray level and SumWhite rectangle is the sum of white pixel on gray level [13-16], .

3.6 Evaluation of Color, Texture, and Shape

To calculate the Euclidean distance between color g histogram and color histogram h were carried out by using this formula [9].

$$d^2(h,g) = \sum\sum\sum (h(a,b,c) - g(a,b,c))^2$$

Searching and matching image query and image in the database, we used method proposed by [9]) namely Markov Random Field method (MRF). MRF method has been characterized by geometry structure and power of interaction between pixel neighbors, in this method texture can be considered as linier function as follow.

$$g(x,y) = \sum_{(m.n)\in N} a(m,n)g(x+m, y+n)sw(x,y)$$

.

Where N is the number of structure characteristic similarity measure parameter each pixel or DCT coefficients, (x,y) is signal probability in each pixel. Whilst, to calculate the similarity can carried out using this formula:

$$D(g,p) = \sum_{t=1}^{T} f_{g,t} \log \frac{f_{g,t}}{f_{q,t}}$$

Where D(g,q) as the different of two function distribution , fg = (fg,t: t=1, .., T) dan fq = (fq,t : t=1,.., T), The similarity can be obtained from average of D(g,q) and D(q,d).

The similarity based on structure, in this work uses SSIM method, in this method similarity can be measured based on relationships between two objects, structure function similarity and content function. Structure similarity measured based on structure two objects [10] stated that to calculate by structure based was carried out by using this formula:

$$SSIM(X,Y) = \left(\frac{2\mu_x\mu_y + C_1}{\mu_x^2 + \mu_y^2 + C_1}\right).\left(\frac{2\sigma_x\sigma_y + C_1}{\sigma_x^2 + \sigma_y^2 + C_1}\right).\left(\frac{\sigma_{xy} + C_3}{\sigma_x + \sigma_y + C_3}\right)$$

Where μx is mean of x and μy is mean of y, σx and σy are x and y standard, whilst σxy is covariant of x and , C1,C2 and C3 are constant. SSIM is Structure Similarity Measure or a measurement of curve slope based on structure feature.

2.7 Matching of the similarity

Similarity between image query and face image in the database is very expensive in term algorithm as well as very complex and takes time. To solve this problem, this work was carried out in 3 steps to match images: i). First searching the similarity of query face image topology of compare to image in database ;ii). Second, using information to improve image candidate retrieved; iii).

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Third, calculate the similarity between image query and image in the database. Whilst, to measure the effectiveness of image searching, precision and recall was used. Precision is the number relevant images retrieved divided by the number of images retrieved. Recall is the number of relevant images retrieved divided the number of images in category in the database[10].

$$p = \frac{a}{z} \qquad r = \frac{b}{y}$$

Where p is precision and r is recall, a is the number of relevant images retrieved, z is the number of all images, and y is the number relevant images in the database . The general system design illustrated in figure of the unobstructed face recognition system is illustrated by the system form, and described in Figure 2..

IV. RESULTS AND DISCUSSION

In this work we also did preprocessing to the images, it is carried out by following steps: i). Image cropping to 64 bit x 64 bit, ii). Cropping, segmented face image from original image by calculating maximum ratio of extracting image feature, iii), extracting image feature by taking face pose of 640/IV x 480/4 Pixels, iv). Use green, red, blue colors. When pre-processing was carried out completely, we did face recognition and built face database.

The work shows that all face image stored in database and indexed based on image retrieving. Retrieval process was delivered by matching query image and image in database. Snapshot of Face recognition without obstacles can be illustrated on fig 4, 5, and 6. Face images are stored in the database and images facing frontal forward without obstacles. This work deployed recognition method by matching similar face image used previously. When similarity result exactly the same or fully 100 percent recognize by system, otherwise face image not recognizable .

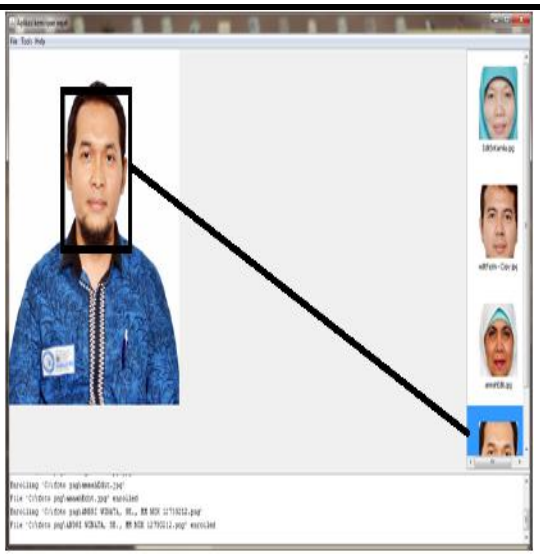

Fig.4: Snapshot of normal face recognition.

Before processing the images into our system, pre-processing was carried out by extraction face image using the maximum ratio, face image extraction was taken by using picture of face with size of 640/IV x 480/4 pixels, and RGB was used in pre-processing. After doing pre-processing, then this work deployed face recognition taken from previous step, and put into database to create an array of face pose position mage database. In here, all images stored and been rank as images retrieved, and face images were detected as mask. Retrieval process was carried out by matching face image with face detected. The algorithm of image detection and recognition can be described as java coding. In this work image position retrieved should be match to previous image similar, if image similar result exactly 100 % equal it can be considered that “identified person”. Otherwise, the person “Unidentified person” [18].

3.1 Facial detection and recognition Algorithms

In this work algorithm used to explore DCT coefficients features which the coefficients is considered as vector. The vector consists of energy to build a histogram in matching process of face recognition into image database. From figure 1, it can be concluded that the greater precision, it will be followed also by increasing the value of recall. Rate of facial images retrieval from the directory depends on the computer, the faster the processor, then the process will also be faster. Figure 3 and 2 display results of the face detection and face recognition of our algorithm.

```
image query
get pixel color
    for i= 0 to img
    for i= 0 to img
        Y= imgYUV
```

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```
        U=imgYUV
          If U >150 U<200 then U=255
          Else U=0
          V= imgYUV
          End
          If V > 140 and V <170 then V=255
          Else V=0
          End
    End
    End
\\ Edge detection
  For YYY = 1 to picY.Heigh-1
  For XXX = 1 to  pic.Width -1
```

From figure 5 , it can be shown that the average accuracy of face detectio of 25 testing is quite good which is more 60% or 0.60.

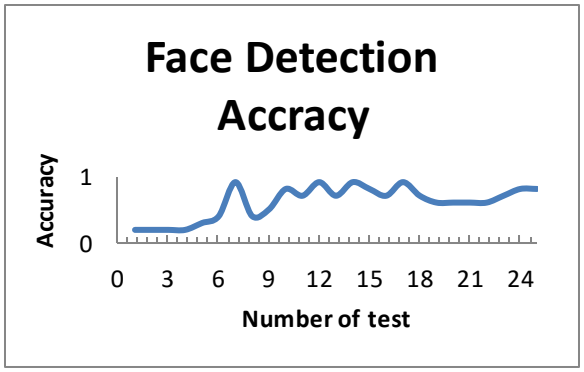

Fig.5: The accuracy of face detection

3.2 Calculating the effectiveness retrieval

From around 25 queries made in this work shows that the effectivity of retrieval is quite good in tern of precision and recall which are 0.75 or 75% and 0.05 or 5% respectively. Table 1 shows and illustrates precision recall of image retrieval. The precision and recall can be used to measure the performance of image retrieval system. Therefore our algorithm demonstrates performance the face retrieval algorithm of 75%. Before calculating precision and recall, the similarity of image query and image in the database. In order to get good result, the work rank images retrieved from the most relevant image, and the irrelevant images appear after.

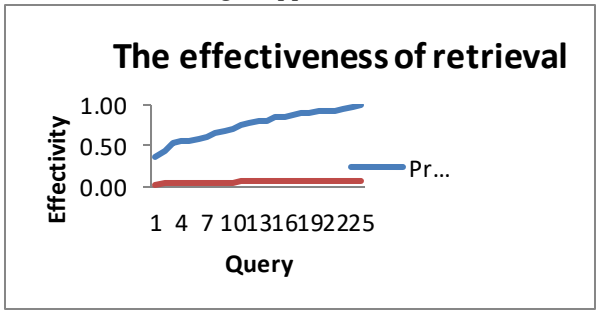

Fig.6: The effectiveness of retrieval in term of precision and recall

From Figure 6, can be described that the effectively of image retrieval is quite good. Consequently can be said that our algorithm is good to open the doors automatically.

Table 1. The effectivity of image retrieval

Query to	*Precision*	*Recall*
1	0,35	0,03
2	0,42	0,03
3	0,52	0,04
4	0,55	0,04
5	0,55	0,04
6	0,58	0,04
7	0,60	0,04
8	0,65	0.04
9	0,68	0,05
10	0,70	0,05
11	0,75	0,05
12	0,77	0,06
13	0,79	0,06
14	0,80	0,06
15	0,84	0,06
16	0,85	0,06
17	0,88	0,06
18	0,89	0,06
19	0,90	0,07
20	0,91	0,07
21	0,92	0,07
22	0,93	0,07
23	0,95	0,07
24	0,97	0,07
25	1,00	0,07

The algorithm of face detection and recognition was written in java, from table 1 we can explain that the application shows good performance in term of precision and recall. The user interface of our application not so good and user friendly, however it already and proved that the effectiveness of algorithm is above average.

V. CONCLUSION AND FUTURE RESEARCH

Intelligent face recognition application using content based image retrieval and Real Time Face Recognition. Application design was carried out quite good since the accuracy of detection fairly good. When face has been searching is not in the database the system that face data is not found. The accuracy of face detection is quite good

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which from 25 test produce the average of more than 75%.

Many works should be carried out in the future in order to improve the effectivity of retrieval. Future works may be used CBVR method which use walking style as key to open doors autometically. This can be carried out by building video clip database consists of 500 – 1000 video clips with 30 second to 60 second duration each clip.

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Nitrate Concentration (NO3-) in Groundwater of the Urban Area of Nova Mamoré - Rondônia in the Brazil / Bolivia Border

Vitor Arika Uesugui Costa[1], Carlos Alberto Paraguassú-Chaves[2], Luciana Rezende Alves de Oliveira[3], Edilson Carlos Caritá[4], Charlles da Silva Barata[5], Fabrício Moraes de Almeida[6], Lenita Rodrigues Moreira Dantas[7], Izan Fabrício Neves Calderaro[8] and Leonardo Severo da Luz Neto[9]

[1]Master in Environmental Technology from the University of Ribeirão Preto – UNAERP, São Paulo, Brazil. Professor of Federal Institute of Education of Rondônia

[2]PhD in Health Sciences - University of Brasília - UnB, Brazil; PhD in Science - University of Havana (Cuba); Post-Doctor in Health Sciences - UnB and Degli Studi D'Aquila University - IT. Professor at the Federal University of Rondônia - Brazil. E-mail: carlos.paraguassu@gmail.com

[3]PhD in Chemistry from FFCLRP - University of São Paulo/USP; Full Professor and Coordinator of the Masters and Doctoral Program in Environmental Technology of the University of Ribeirão Preto – UNAERP, São Paulo, Brazil.

[4]Doctor of Medical Sciences (Biomedical Research) from the University of São Paulo; Full Professor at the University of Ribeirão Preto - UNAERP; Professor of the Master's and Doctoral Program in Environmental Technology of the University of Ribeirão Preto – UNAERP, São Paulo, Brazil.

[5]Master in Geography - Federal University of Rondônia. Researcher at the Higher Institute of Health Sciences and Environment of the Amazon – AICSA

[6]PhD in Physics (UFC), with post-doctorate in Scientific Regional Development (DCR/CNPq). Researcher of the Doctoral and Master Program in Regional Development and Environment (PGDRA/UNIR). Leader of line 2 — Technological and Systemic Development, and Researcher of GEITEC — Federal University of Rondonia, Brazil. E-mail: dr.fabriciomoraes001@gmail.com

[7]Specialist geographer and lawyer. Researcher of the Group of Socioenvironmental Studies and Research and Public Policies - GEPCAP. E-mail: lenita_dantas@gmail.com

[8]Master in Regional Development and Environment (PGDRA/UFRO). TI Analyst of Federal University of Rondônia Foundation, Porto Velho, Rondônia (Brazil). Member of GEITEC/UNIR/ CNPq. Brazil. E-mail: izancalderaro@gmail.com

[9]Master in Education - Autonomous University of Barcelona, Spain. Master in Psychology - University of São Paulo. Master in Religious Studies - Faculty of Theological Education Logos of São Paulo. Bachelor of Nusring. Professional Physical Education. Bachelor in Theology. Professor at the Federal University of Rondonia, Brazil - Department of Collective Health, Researcher at the GEITEC and GEISC of the Federal University of Rondonia, Brazil. Email: lluz@unir.br

Abstract**—** *Objective: To analyze the concentration of N nitrate (NO3 -) in the urban groundwater of Nova Mamoré on the Brazil / Bolivia border. Method: Data were collected from 40 water samples according to Standard Methods for the Examination for Water and Wasterwater along with the methodology proposed in the Water Sample Collection and Preservation Guide of the Environmental Sanitation Technology Company (CETESB). The sites were georeferenced using the Global Positioning System (GPS). For nitrate measurement, the spectrophotometry method was used, using Spectrophotometer, brand Micronal B495. The chemical reagents used were manufactured by Alfatecnoquímica and made available in two vials called reagents 1 and 2 (nitrate reagent). Results: The urban groundwater used by the population of Nova Mamoré for human consumption and other utilities is impacted by high levels of N nitrate (NO3-). Seventy - three percent (73%) of the sample presents levels> 10 mg/L of nitrate. These sites constitute urban areas of high environmental risk to human health, a public health issue. Only 17% presented levels <10 mg/L of nitrate. Only 7.5% of the samples are less than 3 mg/L of nitrate. Conclusions: The high concentration of nitrate in urban groundwater in cities in*

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the Brazilian Amazon puts at risk the health of a large part of the population that supplies this type of water resources for human consumption. It alerts itself to a public health issue.

Keywords— N Nitrate Concentration, Urban Groundwater, Environmental Risk for Human Health.

I. INTRODUCTION

Water for human consumption can be obtained either in surface water springs or underground springs. The underground spring is a resource widely used by a portion of the Brazilian population, mainly in the Amazonian cities. Groundwater can be collected in the confined or artesian aquifer, located between two relatively impermeable layers, which makes it difficult to contaminate. Groundwater collected in the unconfined or free aquifer, which is close to the surface, is more susceptible to contamination. According to Varnier and Hirata [1] due to the low cost and ease of drilling, free water abstraction, even though more vulnerable to contamination, is more frequently used in Brazil.

In Rondônia, in the Western Amazon, groundwater represents an important resource in human supply. Of the total water that the Water and Sewage Company of Rondônia (CAERD) produces, 35% originates from the underground source [2]. According to Campos [3], groundwater, because it is a low-cost alternative, is accessible to all, especially the low-income population, both in daily supplementation and in the total replacement of water provided by the public and private service.

Portaria No. 2,914 of the Ministry of Health of Brazil establishes that water for human consumption is drinking water intended for ingestion, food preparation and personal hygiene, regardless of its origin, and treated water, is water submitted to physical processes, chemical or a combination of these, in order to meet the drinking standard [4]. The potability standard is defined as the set of values allowed as a parameter of water quality intended for human consumption. The Health Legislation System relates to the physical, organoleptic and chemical characteristics of water; their maximum permissible values (MPV) and the microbiological and radioactive quality characteristics. Add to this relationship the minimum contact times to be observed for disinfection by chlorination, as a function of temperature and pH of the water; and the minimum numbers of samples and frequency for water quality control of the supply systems, for various purposes [5].

Brazilian legislation is exhaustive: "Water containing concentrations greater than 10 mg/L of nitrogen (N) in the form of nitrate (NO3-) is unfit for human consumption". Concentrations above 3 mg/L of nitrogen in the form of nitrate (NO3-) are indicative of contamination due to anthropogenic activities, also indicators of bacterial contamination and fertilizers. A safety alert for the health of people who are subjected to such a situation.

According to Campos and Rohlfs [6] nitrite and nitrate are found naturally in water and soil in low concentrations. The deposition of organic material in the soil increases drastically the amount of nitrogen. This nitrogen is biochemically transformed and finally becomes nitrate that has great mobility in the soil reaching the underground spring and depositing there. Melo Junior et al [7] point out that the contamination of urban groundwater by nitrate results from the inefficiency of basic sanitation services and the lack of sanitary sewage in the urban area. The inefficiency of these services forces the local population to build black and septic tanks for effluent disposal within the immediate vicinity of their land, which in practice, this process translates into contamination of groundwater.

According to Barbosa [8], nitrate occurs naturally in groundwater, but its presence in high concentrations is a result of human activities, mainly to the use of in situ sanitation systems the nitrogenous substances of the organic residues are oxidized by chemical and biological reactions and the result is the presence of nitrate in the soil. Nitrate is extremely soluble in water and can move easily and contaminate the aquifer at long range due to its persistence and mobility. It is observed the power of contamination present in this chemical agent, once present in the soil or directly in the water has very easy to contaminate the groundwater. For these authors nitrate (NO3-) is a colorless, neutral, strong, oxidizing and water soluble ion, corresponding to the final biological stabilization ratio of the organic nitrogenous matter.

For Foster; Ventura and Hirata [9] nitrate is the most common contaminant found in groundwater and its concentration rarely exceeds 5 mg/L in non-polluted waters and concentrations above 10 mg/L represent a strong indication of water contamination. In addition to the use of agricultural fertilizers and livestock, in situ sanitation systems, whether by septic tanks or rudimentary pits, are another important source of nitrate in groundwater. Due to the hazardous nature of this chemical agent, the lack of planning in the construction of each individual sanitation system (well x pit), allows the contact of the effluent from the well with the well water. Drinking water sources containing high concentrations of nitrate present a great risk to public and animal health [6]. Waters used for supply, contaminated with nitrate, have caused problems for both animals and man. Children under three months of age are more sensitive than adults because they consume more water compared to their body weight; and by the pH of their stomach is favorable to the development of bacteria that reduce nitrate to nitrite, which does not normally occur in adults [10].

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Nitrogen as nitrogen is the main form of nitrogen found in waters, and is the last stage of nitrogen oxidation, which originated in organic or inorganic nitrogen and underwent several transformations until reaching nitrate. Nitrate is harmful to health, even if it does not exceed the VMP set forth in Administrative Rule 2,914 of the Ministry of Health and requires the attention of the public health authorities and the supervisory agencies [5]. Where nitrate values exceed PMV, there should be continued monitoring of the amount of nitrate in the water, as well as monitoring of the specific health for this population, with special attention to the pathologies associated with excessive nitrate consumption, mainly in children which are more susceptible to diseases caused by nitrate in water [5].

In several studies by Paraguassú-Chaves et al [11]; [12] have already pointed to a safety alert for the health of people who are subjected to such situation in the majority of the cities of the Amazon with sanitation and sewage services precarious or practically nonexistent. That the population of these cities consume water with concentrations higher than 3 mg/L of nitrogen in the form of nitrate (NO3-) which in itself is indicative of contamination due to anthropogenic activities, also indicators of bacterial contamination and fertilizers.

Lima [13] had already considered that, in the presence of nitrate in the water, even in low concentrations, besides indicating that the contamination is old in the environment, it reveals the presence of organic matter associated with bacteria, viruses and parasites, alive or in some of the stages of decomposition. These agents cause various diseases, mainly acute diarrhea and, in the form of nitrate, is a carcinogenic indicator. The main constraints are as sources of contamination to the anthropic and multi-point action of the in situ sanitation system, type septic tank and black cesspits, exposure and precariousness of the wells, exposure of solid waste, sewage discharge of all nature. Thus nitrate (NO3-) contamination occurs in urban areas in the Amazon region and on the border with Bolivia [14]. Allied to all these conditions the flooding / flooding of the abundant water courses in the region are determinant to aggravate the contamination of the water table. The population is consuming water with a high degree of nitrate contamination. It alerts itself to a public health issue [14].

According to Barata [15] the municipality of Nova Mamoré lies between the parallels 09º 30 'S and 11º00' S, and Meridians 63º30'W and 65º30'W, located about 270 km southwest of the capital of Porto Velho, State of Rondônia. It has an area of the territorial unit of 10,071,643 km2, the population of the municipality of Nova Mamoré is 22,546 inhabitants, with a demographic density of 2.24 hab/km2 [16]. The water supply is in charge of the Water and Sewage Company of Rondônia, which has 10,280 meters of installed water distribution network serving 3,457 inhabitants [17]; [18]; [19]. Sanitary sewage is practically nonexistent in the municipality. Depletion is effected only by black or septic cesspits or irregularly in the streams that cut the urban area, a fact that compromises the quality of local water resources.

The basic sanitation, specifically, water supply and sewage collection of the municipality is coordinated by the Water and Sewage Company of Rondônia (CAERD). The number of households with access to the general network of treated water is still very low: only 16.88% of the households. While 83.91% are supplied by wells or spring on the property, only 4.84 are located outside the property. The proportion of households with adequate sanitation was only 1.13%, well below the state proportion (11.62%), while 49.08% was semi-adequate and 49.79% inadequate. Indicating, therefore, that the basic sanitation of the municipality is still very precarious.

In the municipality of Nova Mamoré, there is no sewage collection system according to the EBITDA data from January to December of the year 2014 [19].

Deficiency in basic sanitation can lead to public health problems, as water pollution can generate diseases such as: basilar dysentery, dengue fever, yellow fever, leptospirosis, hepatitis A, and others. The lack of basic sanitation in the municipality becomes even more aggravating due to the fact that the vast majority of households in the municipality are supplied by wells or spring without due environmental concern. Therefore, the local culture of basically using the open wells in their properties for human consumption is extremely dangerous, requiring more in-depth studies as an evaluation of the socio-environmental impacts resulting from this practice on human health [15]. Another implication of the lack of sanitation is environmental damage, such as flooding, silting of watercourses (due to deforestation and occupation of the banks), disappearance of green areas, collapse of slopes, garbage and sewage channels [15]. In Nova Mamoré, there are no storm drainage systems in the city.

The objective of this study was to analyze the concentration of N nitrate (NO3-) in the urban groundwater of Nova Mamoré on the Brazil / Bolivia border and to verify the degree of contamination of the water consumed by a large part of the population of this Amazonian city.

II. METHOD

Data and water samples were collected according to the Standard Methods for the Examination for Water and Wasterwater (APHA) [20] along with the methodology proposed in the Water Sample Collection and

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Preservation Guide of the Sanitation Technology Company Environmental - CETESB [21]. Wells and water collection points were registered and some important variables such as collection date and time, well age, depth, hygiene conditions, cesspools, nearby sewage, presence of animals, rainfall in the last 24 hours .

The sites were georeferenced using the Global Positioning System (GPS). For nitrate measurement, the spectrophotometry method was used using the Spectrophotometer, brand Micronal B495, the chemical reagents used were made by Alfatecnoquímica and available in two vials called reagents 1 and 2 (nitrate reagent). The analyzes were carried out in laboratories of private higher education institution as well as private laboratory.

The points of water collection for analysis were given in the urban area of Nova Mamoré, Rondônia, on the border with Bolivia. 40 samples were taken. The owners or real estate agents, in the sites of the selected wells, were registered and signed the Term of Free and Informed Consent - TCLE.

III. RESULTS AND DISCUSSION

The collection of 40 samples of groundwater occurred in two stages in urban locations of Nova Mamoré. The first stage of the random sampling, stratified in the urban area of Nova Mamoré, was selected 20 cacimba or Amazonian wells, located in the districts Centro, São José, Santa Luzia, Nossa Senhora de Fatima and Chacareiro. The second stage was the sampling in 20 cacimba or Amazonian wells, located in the districts Planalto, Novo Horizonte, João Francisco Clímaco and Cidade Nova.

First Sample Group. In the sample survey of the districts of Centro, São José, Santa Luzia, Nossa Senhora de Fatima and Chacareiro, 100% of the samples were detected high levels of N nitrate (NO3-), above 10 mg/L, characterizing a large area of the population of the city of Nova Mamoré that consumes water taken from these wells of residential (residential) and commercial supply.

As shown in Table 1, high levels of N nitrate (NO3-) were detected in 100% of the samples. Being that> 10 mg/L were detected in 100% of the wells and collection points. All 5 neighborhoods have their groundwater with a high degree of N nitrate contamination (NO3-), that is, water that is unfit for human consumption.

In the Centro district, the levels of N nitrate (NO3-) are extreme. The seven (7) sampling points range from 42,298 mg/L to the highest value and 12,123 mg/L the lowest value, with a mean of> 27 mg/L. The APs (sample points) 1, 2, 3, 4 and 5 respectively present the levels of 42,298 mg/L, 41,335 mg/L, 35,145 mg/L, 24,011 mg/L and 23,086 mg/L respectively. The lowest levels were found in AP5, 16,441 mg/L and AP7 12,123 mg/L.

In the São José neighborhood, the levels of N nitrate (NO3-) present a high risk for human health. 100% are higher than 10 mg/L, with an average of> 19 mg/L. In an extreme situation are the AP14 with 26,067 mg/L and AP10 with 25,899 mg/L.

Of the two samples collected in the Santa Luzia neighborhood, AP8, 45,779 mg/L and AP9, 36,065 mg/L nitrate were found in the neighborhood of> 40 mg/L. In the neighborhood of Nossa Senhora de Fátima, the average found average of> 22 mg/L. In the Chacareiro neighborhood the average content was> 11 mg/L.

After the high levels of N nitrate (NO3-) found in the sample points, it was decided to extend the sample to the other occupied districts of the urban area of Nova Mamoré.

Second Sample Group. According to table 2, the neighborhoods Planalto, Novo Horizonte, João Francisco Clímaco and Cidade Nova were part of this sample. The samples detected showed high levels of N nitrate (NO3-), above 10 mg/L, characteristic of waters with a high degree of contamination.

In the Planalto neighborhood, 100% of the samples showed high levels of N nitrate (NO3-), above 10 mg/L, with a mean of> 21 mg/L. The APs 21, 22, 23, 24 and 25 respectively were found to contain 28.466 mg/L, 22.079 mg/L, 23.780 mg/L, 20.332 mg/L and 15.198 mg/L nitrate.

In the Novo Horizonte neighborhood, unlike the other districts of the city, only 20% of the samples present levels> 10 mg/L. The others, 80% of the samples presented levels lower than 10 mg/L of nitrate.

In the João Francisco Clímaco neighborhood, 60% of the samples presented levels higher than 10 mg/L of nitrate. The average found was> 12 mg/L. However, there were marked differences such as AP 31, 19.665 mg/L and AP 34, with 2.166 mg/L nitrate.

In the Cidade Nova neighborhood, 80% of the samples present N nitrate (NO3-) levels higher than 10 mg/L. The average N nitrate (NO3-) content found was> 11 mg/L.

In the first analysis it can be affirmed that the groundwater used by the population of Nova Mamoré for human consumption and other utilities, are impacted with high levels of N nitrate (NO3-). 73% of the samples present levels> 10 mg/L of nitrate. These sites constitute urban areas of high environmental risk to human health, a public health issue. Only 17% presented levels <10 mg/L of nitrate. Only 7.5% of the samples are less than 3 mg/L of nitrate.

The high concentration of nitrate in urban groundwater in cities in the Brazilian Amazon puts the health of a large part of the population that supplies this type of water resources for human consumption.

Among the conditions that exacerbate the situation of water contamination by N nitrate (NO3-) in the urban

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area of Nova Mamoré is the inefficiency of the basic sanitation (water supply and sewage collection) of the municipality. The number of households with access to the general water network is still very low, only 10.88% of the households, while 83.91% of the households (residences) are supplied by wells or spring on the property and only 4.84% or spring off the property. The inefficiency of basic urban infrastructure is intrinsic to the quality of life of residents of any neighborhood in the city of Nova Mamoré.

Regarding sanitary sewage, the predominant type of sanitary sewage is the rudimentary septic tank with a percentage of 80.73%, followed by the septic tank with 9.02% and only 0.10% has access to the general sewage network or rainfall [22].

The proportion of households with adequate sanitation was only 1.13%, well below the proportion of the State of Rondônia (11.62%), while 49.08% was semi-adequate and 49.79% inadequate, thus indicating that the sanitation is still very precarious.

Deficiency in basic sanitation can lead to public health problems, as water pollution can lead to diseases such as: basilar dysentery, dengue fever, yellow fever, leptospirosis and others. The lack of sanitation in the municipality, still becomes more aggravating due to the fact that the great majority of the households (residences) of the municipality are supplied by wells or spring. Another implication of the lack of sanitation concerns environmental damage, such as flooding, silting up of watercourses (due to deforestation and occupation of the banks), disappearance of green areas, collapse of slopes, impairment of watercourses that have seen garbage dumps and sewage channels [22].

A study by Paraguassú-Chaves et al [14] in the region of the Brazil / Bolivia border had already found that in the first large pre-flood / flooding area of the Madeira River and its tributaries in 50% of samples, high levels of N nitrate (NO3-), above 10 mg/L, characteristic of waters with high degree of impaction. Water not suitable for human consumption. 40% had a content> 3 mg/L, at 50%> 10 mg/L, the total contamination of the aquifer becomes evident. After the flood / flooding of the area, the degree of contamination increased in a frightening way, where 100% of the samples detected high N nitrate (NO3-)> 10 mg/L contents. 80% of the wells and collection points with contents> 10 mg/L were detected. Extreme situation of contents were found as 156.74 mg/L; 70.08 mg/L; 67.36 mg/L; 63.27 mg/L and 56.67 mg/L nitrate. All characteristic of waters with high degree of impaction.

In other points of collection of water that did not have direct influence by the flood / flood the nitrate levels did not undergo significant variations. In this area in 30% of the samples were detected content of (NO3-) greater than 10mg/L. Water not suitable for human consumption. In 70% of the samples, a content higher than 3 mg/L was detected, which characterizes water with a high degree of impaction, although it is not close to the results found in the areas of situation I, an area impacted by flooding / flooding of the Madeira River. [14].

The precarious infrastructure conditions, the use of Amazonian well water and tubular wells without maintenance and close to the septic and black wells are conditioning and / or determinant for this scenario [14].

Table.1: Nitrate Concentration (NO3-) detected at sampling points of water collection in the First Sampling Group.

AMOSTRAL POINT	NEIGHBORHOOD	AMOSTRAL POINT	NEIGHBORHOOD
AP	**Downtown**	AP	**São José**
AP 1	42.298	AP 10	25.899
AP 2	41.335	AP 11	19.300
AP 3	35.145	AP 12	19.766
AP 4	24.011	AP 13	18.555
AP 5	23.086	AP 14	26.067
AP 6	16.441	AP 15	12.445
AP 7	12.123	AP 16	16.600
AP	**Santa Luzia**	**AP**	**N. Sra. de Fátima**
AP 8	45.779	AP 17	35.575
AP 9	36.065	AP 18	10.019
		AP	**Chacareiro**
		AP 19	12.080
		AP 20	10.119

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Table.2: Nitrate Concentration (NO3-) detected at sampling points of water collection in the Second Sampling Group.

AMOSTRAL POINT	NEIGHBORHOOD	AMOSTRAL POINT	NEIGHBORHOOD
AP	**Planalto**	**AP**	**J. Francisco Clímaco**
AP 21	28.466	AP 31	19.665
AP 22	22.079	AP 32	17.019
AP 23	23.780	AP 33	15.223
AP 24	20.332	AP 34	2.166
AP 25	15.198	AP 35	8.458
AP	**N. Horizonte**	**AP**	**Cidade Nova**
AP 26	13.655	AP 36	12.498
AP 27	4.788	AP 36	13.917
AP 28	0.332	AP 38	12.045
AP 29	3.336	AP 39	9.566
AP 30	2.145	AP 40	11.002

In Rondônia, Brazilian Amazonia, other researches have presented results that demonstrate elevated levels of nitrate in urban and rural groundwater. Lima [13] in his research in the Jaci-Paraná Free Aquifer, in zone 3 of the city of Porto Velho, found him partially contaminated by nitrate. In 68% of the water samples, contents higher than 3 mg/L were identified, which indicates alteration in the chemical composition of the water by anthropogenic activities. The sampling points, the shallow wells, used in this study, 100% have depth up to 12 meters [14]. In 33% of the water samples nitrate levels were detected above or very close to the limit of 10 mg/L, the maximum value allowed in Brazil for water intended for human consumption, according to Ordinance no. 518 of March 25, 2004 from the Ministry of Health.

Campos [23] in research in the municipality of Mirante da Serra in Rondônia found high levels of nitrate (NO3-) in the most densely populated urban areas. For Lima [13], it is important to consider that, even in low concentrations, the presence of nitrate in the water, besides indicating that the contamination is old in the environment, reveals the presence of organic matter associated with bacteria, viruses and parasites, alive or in some stages of decomposition. These agents cause various diseases, mainly acute diarrhea and, in the form of nitrate, is a carcinogenic indicator.

Excess nitrate ion in drinking water is worrisome because of its potential link to stomach cancer, but the research done is still unsatisfactory to clarify this relationship. Baird and Cann [24] state that published studies show that women who drank water from the public supply with a high level of nitrate (> 2.46 mg/L) are three times more likely to be diagnosed with breast cancer than the least exposed (<0.36 mg/L in drinking water).

Health hazards such as diarrheal diseases and gastroenteritis are commonly reported and recorded in the health care system of the counties surveyed. Attention is drawn to the studies of Alaburda & Nishihara [25] regarding the health concern of the population, especially the health of children and the elderly, as they are more susceptible to the development of methemoglobinemia due to exposure to high nitrate concentration and in adults the stomach cancers.

The research of Barata [15] in the urban groundwater of Nova Mamoré, the results presented a heterogeneous distribution, varying in the behavior of the contamination plume in which 37.5% of the samples presented levels <10 mg/L of Nitrate and 62.5% of the samples. samples presented levels> 10mg/L of Nitrate (NO3-) [15].

The highest levels of nitrate (NO3-) were present on the lateritic residual plateau, which covers a large part of the urban area of Nova Mamoré. These values are associated to the periods of occupation of the urban space considered older, since the central area of the urban center, called "Center", was the first to be occupied, as demonstrated. The oldest population density in the municipality is associated with Nitrate levels ranging from 21.51 mg/L to 45.77 mg/L, with a gradual decrease in the most recent occupation areas [15].

The extreme values of 42.0 and 45.8 mg/L were observed in the urban area of the oldest human occupation, as opposed to the minimum values of 0 and 2 mg/L, located outside the central area of the city and associated with with low population density.

Still based on the existing districts in New Mamore: Cidade Nova; Chacareiro; Novo Horizonte and Ambrósio, Nitrate levels (NO3-) were found below 9.70 mg/L and, therefore, below the maximum limit of 10 mg/L determined by Ministry of Health Ordinance No. 2,914 / 2011 [15].

Barata [15] analyzed the isoprobability of occurrence values above 10 mg/L, and found that the area with the highest occurrence of nitrate levels and with probability of occurrence in a percentage between 70 and 100% is that of the central urban center of Nova Mamoré , cut by BR-364, which acts as an agent facilitating the occupation

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and urban transformation of the city, the consequences of this urban concentration motivated by the BR, resulted in the contamination of the groundwater of the place studied.

The values of low probability of contamination, in general, range from 0 to 53% in areas farther from the central axis with urban influence. A transition band with a probability of up to 53% and greater than 72% of occurrence was observed, above 10 mg/L, which, in this case, is associated with the presence of drainage of the Ambrósio canal and the Olaria stream.

Figure 1 shows the neighborhoods where the samples were collected and Figure 2 shows the nitrate concentration (NO3-) map with a cut-off level> 10mg/L by Barata [15] confirming the high nitrate levels. Much of the population of Nova Mamoré is consuming water with a high degree of contamination, that is, water that is unfit for human consumption. An eminent public health problem.

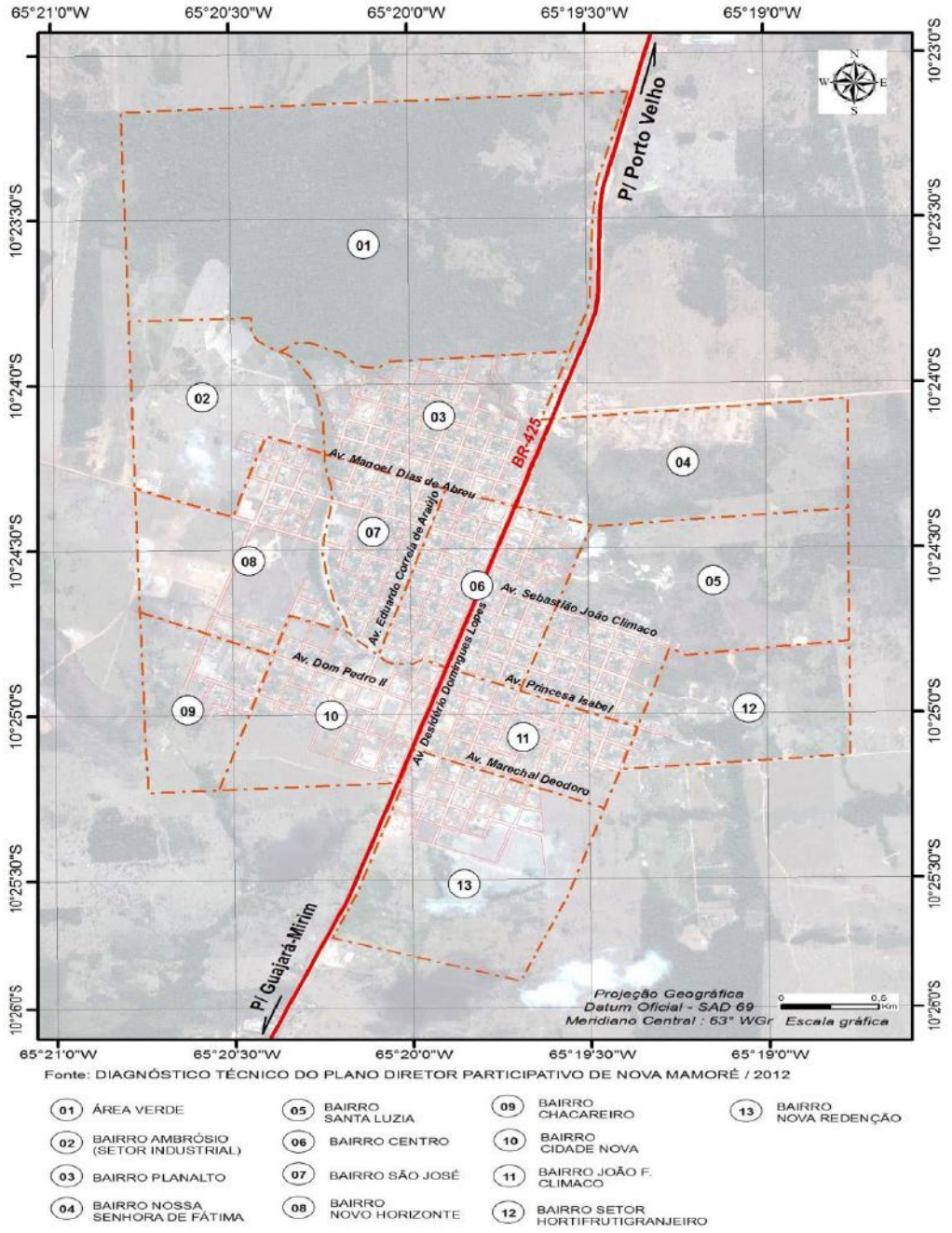

Fig.1: Map of the administrative division of the urban area of Nova Mamoré

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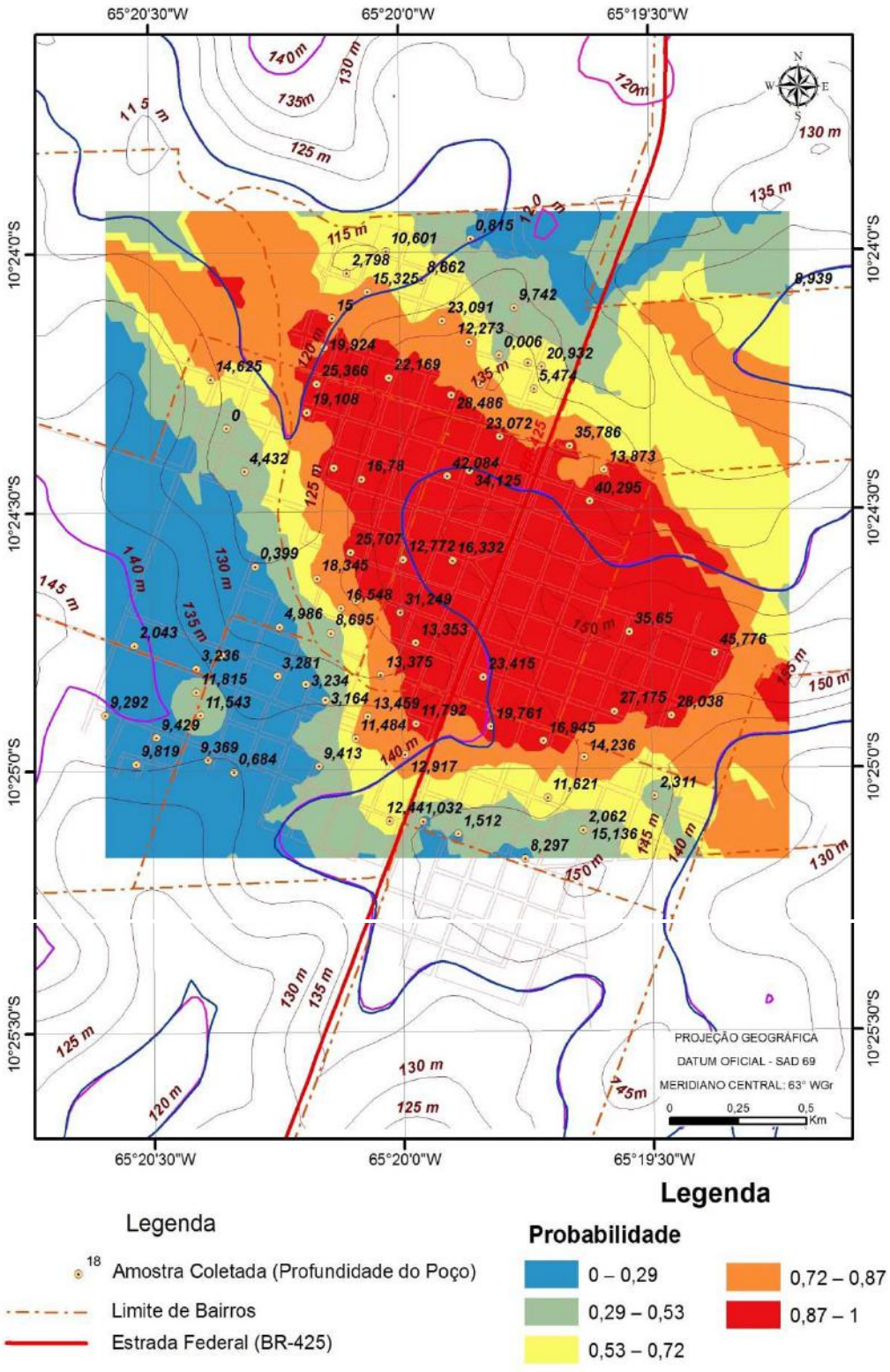

Fig.2: Map of nitrate concentration (NO3-) with cut level> 10mg/l

IV. CONCLUSIONS

The urban groundwater used by the population of Nova Mamoré for human consumption and other utilities are impacted by high levels of N nitrate (NO3-).

Seventy - three percent (73%) of the samples presented levels> 10 mg/L of nitrate. These sites constitute urban areas of high environmental risk to human health, a public

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health issue. Only 7.5% of the samples are less than 3 mg/L of nitrate.

The high concentration of nitrate in urban groundwater in cities in the Brazilian Amazon puts at risk the health of a large part of the population that supplies this type of water resources for human consumption. Among the conditions that exacerbate the N nitrate (NO3-) contamination in the urban area of Nova Mamoré, there is the inefficiency of basic sanitation (water supply and sanitary sewage collection, predominance of rudimentary and septic fossa in a precarious state).

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High PSNR based Image Steganography

Namrata Singh

Department of IT, R.C.E.W. Jaipur, Rajasthan, India
Email: namritayadav07@gmail.com

Abstract**—***Steganography is a method for inserting digital data within a different digital medium like text, pictures, sound signals, or film signals, while not exposing its occurrence in the medium. Information safekeeping is an essential necessary domain in correspondence medium over the web system. In this paper, working for improve the performance of Image Steganography. Results are showing comparison in between DCT-SVD and LWT-DCT-SVD. PSNR of proposed methodology is high as compare to DCT-SVD.*

Keyword—-Steganography, DCT, LSB-DCT, threshold, PSNR, Chaos, PWLCM, FLD, LWT-DCT-SVD.

I. INTRODUCTION

Today, overall need for the purpose of protecting all the digital information had becomes a very essential topic. Steganography is a work which is a combination of work steganos and graphos which means hidden writing. This is the secret of information with other carriers such as videos, images, graphics and documents for the purpose of getting the stego object as it won't be affected after the insertion. By this method, only receivers will understand if there is any secret message and can get it back. Steganography can be divided into two domains, frequency and spatial [1]. For first domain, modifications can be made for the pixels of the real image. Secret image is added directly in the pixels. Second domain, will have the carrier image which can be transformed from spatial domain into the frequency domain with the help of the techniques like domain transformation. The hidden message is then put into all these pixels. Second domain, in which all the carrier images are transformed with the coefficient with cover for forming the stego image [1,2]. Frequency domain can have different advantages, as it's more robust than the spatial technique, it can tolerate the shrinking, cropping, image manipulation etc. [1,2,3]. As there are different transformation which are used in the map for signaling it into frequency domain. [3] all the top methods which are used in literature are DFT or Discrete Fourier Transform, DWT or Discrete wavelet Transform or DCT Discrete Cosine Transform. [1,3]

Many metrics are there which are used for the purpose of evaluating the steganography method, which are MSE or Mean Square Error, PSNR or Peak Signal to Noise Ratio, SSIM or Structural Similarity Index, and the capacity along with the robustness and securities. [1,2] Robustness is ability of the stego image which is hidden against different attacks with security as the inability of the adversary for detecting the hidden image which are accessible only for the authorized users. [5] Steganalysis can be used for the purpose of detecting all the secret information [5]. Images which are digital can be mostly transmitted with the help of the internet along with multimedia information. This is why the importance is for the purpose of protecting them. There are many different types of images which can be easily covered with Bitmap File Format (BMP), Graphics Interchange Format (GIF), Joint Photographic Experts Groups (JPEG) images. All the research are mostly about the BMP images. It can also be studied that steganopraphic ways which embed message in LSB or Least Significant Bit of the DCT coefficient. All the embedding can be completed by two methods, random and sequential. Problems with sequential is the vulnerability, secret messages can be very easily detected. Another proposed improvement is of the technique that is applied in the literature of LSB and DCT with the threshold, it can also hide the data at random location which are based on threshold. [7] Problem with limited capacity which is related to taken threshold. It can also be broken without any problem as you discover this threshold. This is why the overall purpose of these paper is to provide a very novel image DWT way for the high embedding capacity and provide more security for the purpose of using the chaotic generator for the Piece Wise Linear Chaotic Map or PWLCM.

For the purpose of hiding any hidden data in the image, which is present in the big variety of steganography technique some of the available data is a lot more complex if compared with others and they have their own respective weak and strong points. Other application are there which can need complete invisibility for the secret information, there are some others which can need a big secret for the hidden data. In such cases Steganography will exploit human precipitation, most of the human senses are not worked for looking for the files which have the required information for the secret data which in in them, as there are some programs available which can do Steganalysiswhich is detecting the use of the

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Steganography. Most common uses of Steganography is for hiding a file inside some another file. When all the information of the file is secret in the carrier file, then data can be normally encrypted with the help of password.

Steganography can be usually confused by cryptography as there are two which are very same in a way that you need both to be protected for all the necessary information. The real difference in between the two is that Steganography will consist of hiding of data which is why it will appear in a way that no information is hidden in it. If any one sees the object in the hidden information, when the person will have absolutely no idea about the secret information, this is why the person will not use the decrypt information. In the image steganography, hidden communication can be achieved when you embed any message in the cover of the image which is used like a career for embedding the message in it and for generating the stego-image which is generated image which can be carrying the hidden message. It can also be very high security technique for any long data transmission.

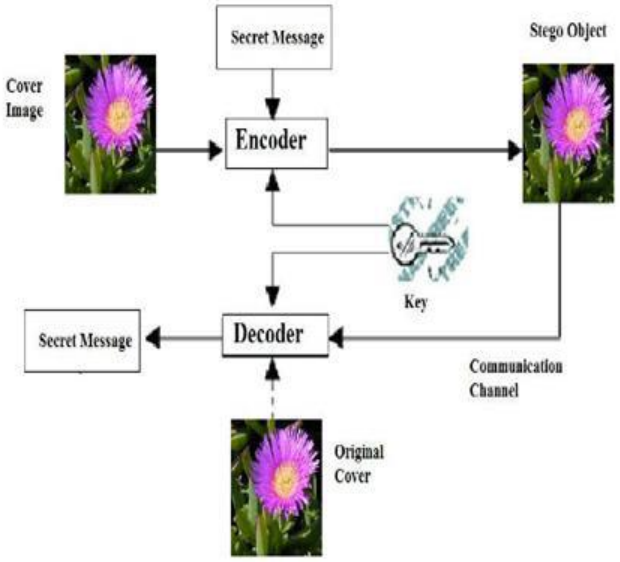

Fig 1:- Model of image Steganography

With the advancement of the computers and the expanding it can use in various area of work and life, all the issues of the information security can turn out to be very essential. One of the areas which are talked in the information security are the exchange of information with the help of cover media. In the end, there are many different methods like steganography, cryptography, coding and many more which can be used. Such methods of steganography are among the methods which has received a lot of attention in last few years. Main purpose of steganography is in the form of methods for converging all the media which is why other person will not have to notice the presence of this information. This are some of the main distinctions in middle of this method and some of the other methods which can convert exchange of data for example, when we consider cryptography, people can notice all the information by looking at the coded data as they are not be able to take this information.

II. LITERATURE REVIEW

Steganography has gained increasing importance, and haveattracted lots of researchers 'attention. Many techniques havebeen developed. Deshpande et al., [8] explained the LeastSignificant Bit (LSB) embedding technique and presented theevaluation results for 2, 4 and 6 LSBs for a .png file and a .bmp file. The authors in [6] proposed a novel high capacity data embedding scheme that hides secret information in Discrete Cosine Transform Coefficients based on Average Covariance algorithm. The cover image covariance is computed to consider number of Most Significant Bits (MSBs) of payload to be embedded based on DCT coefficients. Kafri and Suleiman [9] have utilized the idea of the spatial steganography approach SSB-4 introduced by Rodrigues, Rios and Puech in 2003 [10] to propose a novel method which embed message bits in the 4^{th}bit of the successive non zero DCT coefficients of the low frequency region and modify the 1st, 2nd, 3rd and/or 5th bits to minimize the difference between the cover and the stegoimages. The 4th bit was chosen because it is the most significant bit which provides the minimum change in the pixel values. Since this approach uses significant bit, the hidden message resides in more robust areas and provides better resistance against the steganalysis [9, 10]. The authors in [5] proposed an image steganography technique based on combination of two transforms Integer Wavelet Transform and Discrete Cosine Transform. It used an assignment algorithm to select the best embedding locations of cover image to increase the visual quality of stego image and the system security. Recently, the idea of using chaotic systems has been noticed. Many chaos based steganographic methods have been discussed. MazharTayel et al., [3] proposed a new chaos steganography algorithm for hiding the confidential data based on discrete chaotic dynamic system. A logistic map chaotic generator is used to encrypt the secret message then embed the message randomly into the pixels least significant bits of the original image. [4] Presented Chaos based Spatial Domain Steganography using Most Significant Bit (MSB) that hides secret information in the spatial domain using LSB and MSB with a chaotic approach.

III. DWT BASED STEGANOGRAPHY

Steganographic technique for hiding multiple images in a color image based on DWT. The cover image is

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decomposed into three separate color planes namely R, G and B. Individual planes are decomposed into sub bands using DWT.DWT is applied in HH component of each plane. Secret data are dispersed among the selected DWT coefficients using a private key. PSNR, capacity and correlation are major aspects in steganography. More specifically PSNR is demanded high, but it depends application to application. PSNR is inversely proportional to capacity, and directly proportional to correlation and vice-versa. During the study we found a problem that is of a proper combination of PSNR, capacity and correlation is required so that data can be sent through unsecure channel without fear of third party access. The results in the steganography mainly depend on secrete data. The larger value of the secrete data; affect more to the quality of stego image rather than smaller value of secret data.

A. Embedding Process both Cover Image&Secret Data by using DWT

During the proposed embedding process, perform DWT on both the cover image and the secret data by using the fusion process we get fused image. Apply IDWT on fused image to get a stego image. 1) Algorithm for proposed embedding process:

- Step 1: Read the cover image (i.e.Video) as C and segment the frame based on video file. Convert the pixel values Of cover image into a gray scale image as CG.
- Step 2: Apply image pre-processing and correction process to get a gray scale cover image.
- Step 3: Read the secret data(i.e. Text) as S. Apply image pre-processing and correction process to get a gray scale image as SG.
- Step 4:Apply transforms domain technique into cover gray scale image and secret gray scale image.
- Step 5: By applying 2D-DWT extract the approximation coefficients of matrix LL1 and detail Coefficients matrices LH1, HL1, HH1 of level 1 of the cover image as CG1.
- Step 6: By applying DWT extract the approximation coefficients of matrix LA1 and detail coefficient matrices LH1,HL1, HH1 of level 1 of the secret image as SG1.
- Step 7: Apply fusion operation on an image CG1 and SG1 and get merged image. Finally perform fused image with 2-DWT to form the stego image as ST.

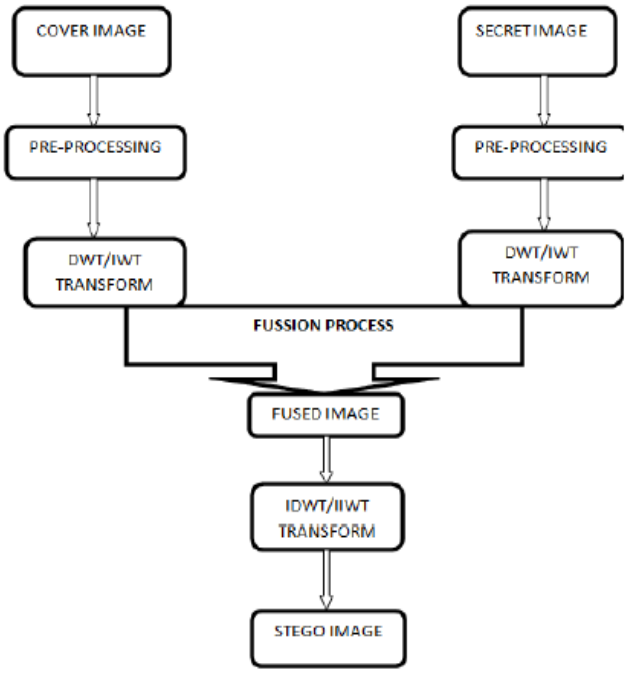

Fig 2:- Block Diagram of Embedding.

➢ *Extraction of Secret Image*

During the proposed extracting process, the recover stego image and known cover image were reconstructed with DWT transform domain and followed by the fusion process. Next, inverse transform IDWT was performed to rebuild the secret data. Finally the secret data is obtained, which is similar to the original secret image.

- Step 1: Receive the stego image. Perform a 2-D DWT at the level of both stego image and known cover image.
- Step 2: Apply fusion process on both stego image and cover image to get fused image.
- Step 3: Separate the wavelet coefficients and take inverse IDWT of the fused image to reconstruct the secret image.
- Step 4: Select the 4 bit privacy key to decrypt the secret information.
- Step 5: Calculate the statistical parameters such as Mean square Error (MSE), Peak signal to noise ratio (PSNR),Capacity, Entropy Mean of the stego image.

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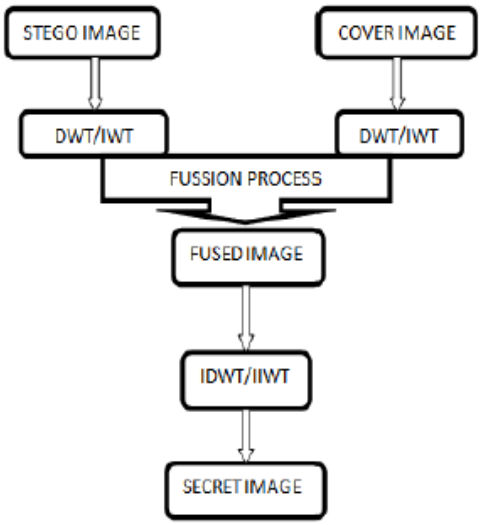

Fig 3:- Block Diagram of Extraction

➢ *DCT – SVD based Image Stegaography*

❖ *Embedding Process*

The steps of embedding process are as following:

- Read the cover and the secret image.
- Convert the secret image to 1-D binary vector.
- Divide the cover into 8□8 blocks and working from left to right, top to bottom, apply the 2D DCT transformation to each block.
- Use the described chaotic generator to provide a long sequence of l bits.
- Extract from the generated sequence the coordinates (X,Y) that represent the locations of the transformed DCT coefficients in which the secret image will be embedded as illustrated in the example below. The first k bits represent X, the following k bits represent Y and so on.

.....1010.....1110.....1101.....010.....

X Y X Y

- Replace the LSB of these defined coefficients with the MSB of the secret data.
- Apply 2D Inverse DCT to get the final stego image. Sharing the initial conditions of the chaotic generator and the secret image size with the receiver, he will generate the same random sequence, and apply the extraction algorithm.

B. Extraction algorithm

The steps of the secret image extraction applied by the receiver are:

- Read the stego image.
- Divide the stego image into 8□8 blocks and apply 2D DCT on each block.
- Generate the same random sequence from the chaotic generator and extract the positions of DCT coefficients that hide the secret data.
- Extract the LSB of the defined coefficients.
- Construct the secret image.

IV. PROPOSED METHODOLOGY

Introduce a novel video steganography algorithm in the wavelet domain based on the KLT Ourproposed steganography is divided into the following four phases.

A. Lifted Wavelet Transform (LWT)

LWT is lifted DWT. It simply lifts the coefficients of DWT. DWT contains the up and down sampling. So through filtering attacks there is a possibility of loss of information. While in LWT there is no up and down sampling [1] it contains Split, Predict and Update so there is no loss of information. It also overcomes the problem of rounding of DCT and DWT [3] because of split, predict and update stages of LWT. LWT decompose the image into four sub bands as shown in the figure 1. They are called as an approximation component (LL), vertical component (LH), horizontal component (HL) and diagonal detail (HH). Where the first letter indicates whether it is the low pass (L) or high pass (H) filtered along the columns (vertically) and second letter represents whether it is low pass (L) or high pass (H) filtered along the rows (horizontally). In decomposing, row wise and column wise down sampling is done so image is divided into two bands and again two bands respectively and finally decompose into four bands.

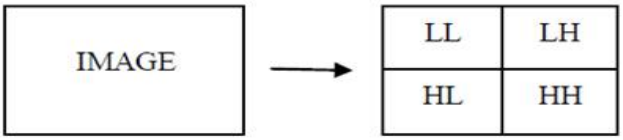

Fig 4:- Decomposing of Image by LWT

In comparison with other wavelet transforms reconstruction of the image by LWT is good, because it is increases the smoothness and reduces aliasing effect. It requires less memory and less computational cost almost half of DWT. LWT reduces loss in information, increases intactness of embedded watermark in the image and helps to increase the robustness of watermark [3].

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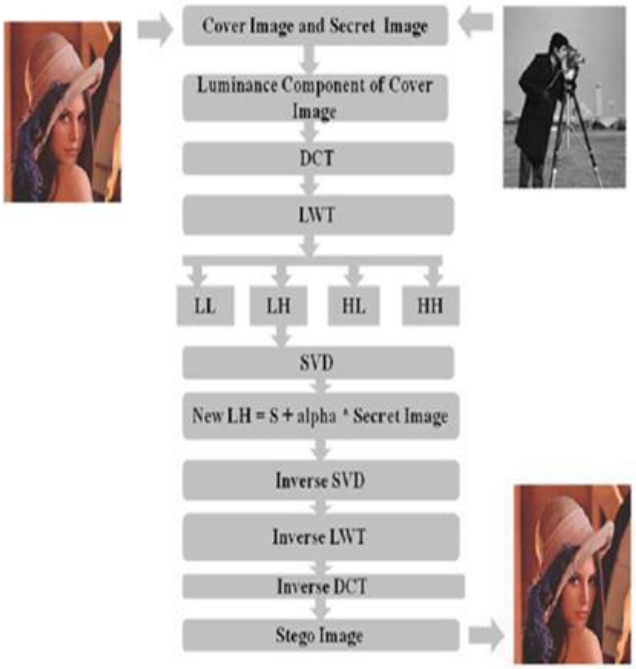

Fig 5:- Embedding Model

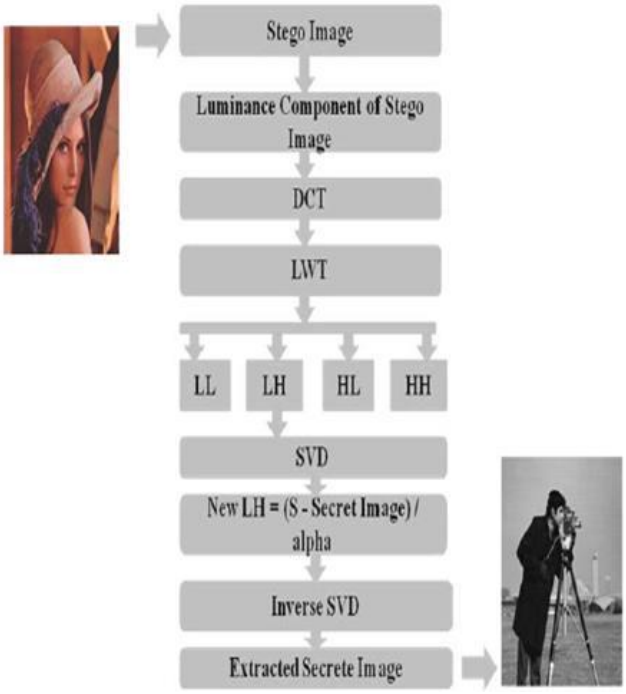

Fig 6:- Extraction Model

V. RESULTS

In the Result session, comparing the performance of the results. In this chapter, compare the Steganogrpahy method.

A. DWT-SVD Based Image Steganography

For hide the secret message DCT-SVD based Image Steganography method is using. Figure 7 is showing the Original cover Image in which secret image will hide.

Fig 7:- Original Cover Image

Fig 8:- Secret Image

Figure 8 is showing the Secret Image which we have to hide in the Original Cover Image . For image hiding , use DCT-SVD method.

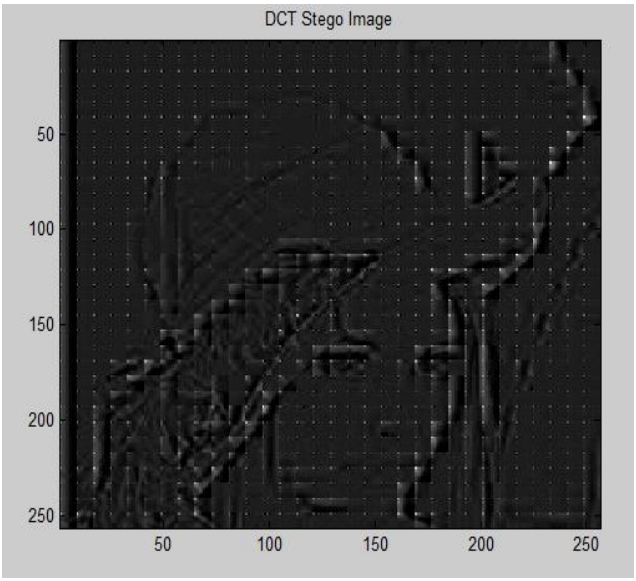

Fig 9:-Stego image

Figure 9 is showing the Stegoimage, which is receive by apply DCT-SVD based methodology. Stego image hide the secret image.

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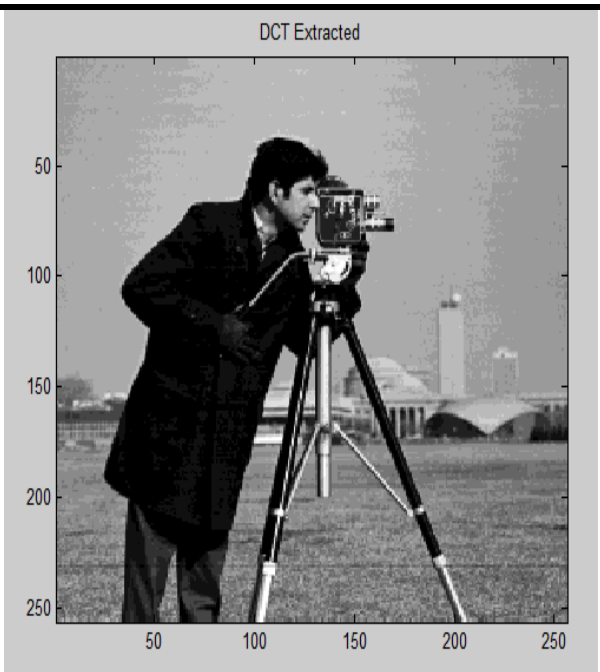

Fig 10:- Reconstruct Secret image

Figure 10 is showing the Reconstructed Secret image by apply DCT-SVD based Image Steganography.

B. Comparison Table

Table.1: Comparison Table

	PSNR
DCT-SVD	42.71
LWT-DCT-SVD	51.93

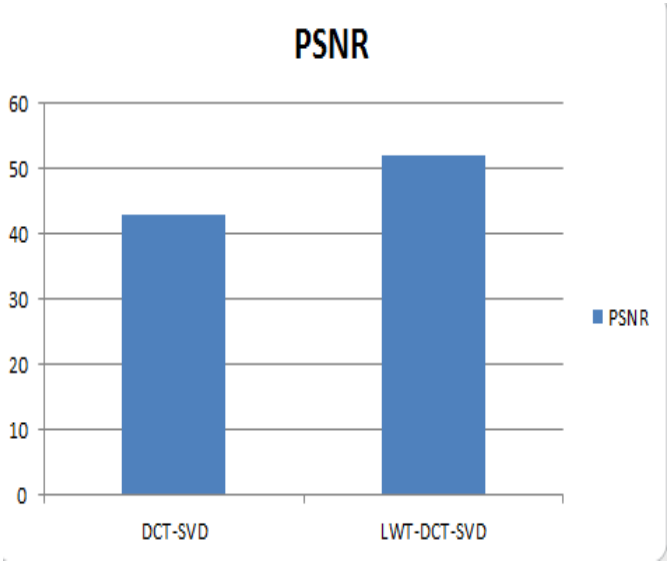

Fig 11:- For hide the secret message DCT-SVD based Image

Steganography method is using. Figure 11 is showing the Original cover Image in which secret image will hide.

VI. CONCLUSION

Image steganography technique is useful for security of confidential data over Internet. In this proposed work a new concept of Steganography has been introduce. Previous method will create difficulty for an unauthorized person to determine presence of secret massage. For improve the performance, show three parameters PSNR , MSE and NCC . PSNR ,NCC is getting increase and MSE is getting decrease for the Proposed Methodology as compare to DWT-SVD Methodology .

VII. FUTURE WORK

In the future, we can work for the Research Limitation. According to the limitations , we are working only for Image Steganography. In the Future we can work at Audio and Video based Steganography. According to the Second limitation, we are working for PSNR, Correlation and Contrast parameters only. In the future we can work for the MSE parameter also. According to the third limitation, in this Research we are working only at gray Scale image. In the Future, we can work for the Color images also.

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Complete Breaker Analysis using Velocity Potential of Linear Wave Theory

Syawaluddin Hutahaean

Ocean Engineering Program, Faculty of Civil and Environmental Engineering,-Bandung Institute of Technology (ITB), Bandung 40132, Indonesia
syawaluddin1@ocean.itb.ac.id

Abstract**—** *In this research, breaker equations were developed to conduct breaker height, breaker depth and breaker length calculations. Wave number conservation equation and mass/energy conservation equation are extracted from velocity potential equation to be used in the formulation of breaker equations. Breaker depth equation is obtained from wave number conservation equation, breaker steepness equation is obtained from kinematic free surface boundary condition and using energy conservation equation of linear wave theory, relation between breaker height and breaker depth is obtained.*

Keywords— wave number conservation equation, mass/energy conservation and energy conservation.

I. INTRODUCTION

Linear wave theory has been highly recognized and used by researchers as well as engineers in conducting water wave analysis. In addition, this wave theory is relatively easy, in terms of its application and analyses, considering the equations are in relatively simple form. Therefore, in this research, breaker equations are formulated using velocity potential of linear wave theory. This linear wave theory was first developed by Airy (1841), therefore this equation is also called Airy wave theory, whereas the latest one was developed by Dean (1991) where this research uses several equations from linear wave theory contained in Dean (1991).

Velocity Potential equation of linear wave theory is formulated based on flat bottom. Hutahaean (2010) formulated velocity potential equation by completing Laplace equation using variable separation method, for sloping bottom, produces equal form of equation with velocity potential of linear wave, with a little difference, i.e. only at its hyperbolic function which shows that the role of bottom slope at the velocity potential equation is relatively small. Therefore, velocity potential of linear wave theory can be done at the sloping bottom. By doing velocity potential at the sloping bottom and based on the nature of the function of variable separation method, wave number equation is obtained where the multiplication between water depth and wave number is constant. Then, by doing particle velocity equations at the continuity equation, mass/energy conservation equation is obtained. Substituting particle velocity equations and water surface equation to kinematic free surface boundary condition produces wave amplitude equation and then critical wave steepness equation is obtained by differentiating amplitude equation against horizontal-x axis where breaking occurs when the first differential of wave amplitude is equal to zero.

Working on kinematic free surface boundary condition along with surface momentum equation of Hutahaean and Hendra A. (2017) produces wave dispersion equation where there is an influence of wave height on wave number. This dispersion equation is used to calculate wave number at the deep water.

The breaker depth that is developed consists of three equations. The first equation is the relation between wave number and wave height at the breaker location with wave number and wave height at deep water depth that is formulated using wave number conservation equation. The second equation is critical breaker steepness equation which is the relation between breaker height and breaker wave number, obtained by differentiating kinematic free surface boundary condition equation against horizontal-x axis. The third equation is obtained from wave conservation equation of linear wave theory, Dean (1991). This equation is also the relation between wave number and wave height at breaker location with wave number and wave height at deep water depth. These three equations are in the form of simple explicit equation, simple in its calculation.

The result of the proposed equation is compared with the result of the existing breaker index. Breaker height is compared with average breaker heights from various

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breaker height indexes. Whereas breaker depth is compared with the result of the calculation of breaker depth using SPM method (1984), breaker length is compared with the result of breaker steepness of Miche (1944).

II. VELOCITY POTENTIAL OF LINEAR WATER THEORY

Velocity potential of linear wave theory as the result of the completion of Laplace equation (Dean, 1991) is:

$$\Phi(x,z,t) = G\cos kx \cosh k(h+z)\sin\sigma t \quad \text{.....(1)}$$

x is horizontal axis, z is vertical axis where $z=0$ at still water level surface, t time, G wave constant, k wave number, $\sigma = \frac{2\pi}{T}$, angular frequency, T wave period and h still water depth.

The equation is formulated at the flat bottom condition, however, Hutahaean (2010) obtained that the influence of slopping bottom on velocity potential is small which is only on its hyperbolic term only, i.e.

Flat bottom :

$$\cosh k(h+z) = \frac{e^{k(h+z)} + e^{-k(h+z)}}{2}$$

Slopping bottom :

$$\beta(z) = \alpha e^{k(h+z)} + e^{-k(h+z)}$$

where α is a coefficient that is the function of bottom slope (2). It shows that α is a relatively small number (close to 1). Therefore, (1) can be done at sloping bottom where there will be the values of $\frac{\partial k}{\partial x}$ and $\frac{\partial G}{\partial x}$.

$$\alpha = \frac{1}{2}\left(\frac{1+\frac{\partial h}{\partial x}}{1-\frac{\partial h}{\partial x}} + \frac{1-\frac{\partial h}{\partial x}}{1+\frac{\partial h}{\partial x}}\right) \quad \text{.....(2)}$$

$\frac{\partial h}{\partial x}$.is bottom slope

2.1. Wave Number Conservation Equation

Velocity potential equation (1) is obtained using variable separation method, where velocity potential is considered as the multiplication of 3 (three) functions, i.e. $\Phi(x,z,t) = X(x)Z(z)T(t)$, $X(x)$ is just an x function, $Z(z)$ is just a z function and $T(t)$ is just a time function. At (1), $Z(z) = \cosh k(h+z)$. If (1) is done on sloping bottom $\frac{\partial Z(z)}{\partial x} = \frac{\partial \cosh k(h+z)}{\partial x} = \sinh k(h+z)\frac{\partial k(h+z)}{\partial x} = 0$, in this equation the one with the value of zero is

$$\frac{\partial k(h+z)}{\partial x} = 0 \quad \text{.....(2)}$$

for all z value. Therefore, the value of $k(h+z) = c$, where c is constant, that is the same for all flow field where the wave moves. For a wave to move from deep water to shallower water, (2) applies. If (2) is done at $z = \frac{H}{2}$, then for a wave moves from water depth h_0 to shallower water depth h_1, the following relation applies: $k_0\left(h_0 + \frac{H_0}{2}\right) = k_1\left(h_1 + \frac{H_1}{2}\right)$. Then from water depth h_1 to water depth h_2 the following relation applies $k_0\left(h_0 + \frac{H_0}{2}\right) = k_1\left(h_1 + \frac{H_1}{2}\right) = k_2\left(h_2 + \frac{H_2}{2}\right)$ or $k_0\left(h_0 + \frac{H_0}{2}\right) = c$. Therefore, for $z = \frac{A}{2}$ the relation between wave number and wave amplitude is obtained at the breaking location with wave number and wave amplitude at the deep water, i.e.,

$$k_b\left(h_b + \frac{A_b}{2}\right) = k_0\left(h_0 + \frac{A_0}{2}\right) \quad \text{.....(3)}$$

k_b is breaker wave number, h_b breaker depth, A_b breaker amplitude, k_0 deep water wave number, h_0 deep water depth and A_0 deep water amplitude.

Using (2), the derivative of wave number k. can be formulated. If (2) is done at $z=0$, then $\frac{\partial k h}{\partial x} = 0$ or,

$$\frac{\partial k}{\partial x} = -\frac{k}{h}\frac{\partial h}{\partial x} \quad \text{.....(4)}$$

Using (4), the derivative equations that are higher than wave number can be formulated, for example for $z=0$, by ignoring $\frac{\partial^2 h}{\partial x^2}$,

$$\frac{\partial^2 k}{\partial x^2} = -\frac{2}{h}\frac{\partial h}{\partial x}\frac{\partial k}{\partial x} = \frac{2k}{h^2}\frac{\partial h}{\partial x} \quad \text{.....(5)}$$

Henceforth in this article, the calculation of $\frac{\partial k}{\partial x}$ and $\frac{\partial^2 k}{\partial x^2}$ refers to $z=0$. Using (5), the third differential can be obtained, and so forth. .

Based on (2), the following relations also apply,

$$\tanh k(h+z) = \tanh k_0(h_0+z) \quad \text{.....(6a)}$$
$$\cosh k(h+z) = \cosh k_0(h_0+z) \quad \text{.....(6b)}$$
$$\sinh k(h+z) = \sinh k_0(h_0+z) \quad \text{.....(6c)}$$

Therefore, using (6a-b-c), equations which contain those three elements are elements that are known, i.e. similar to the value at the deep water.

2.2. Energy Conservation Equation

From velocity potential (1), horizontal–x velocity equation is obtained,

$$u = -\frac{\partial \Phi}{\partial x} = \left(Gk\sin kx - \frac{\partial G}{\partial x}\cos kx\right)\cosh k(h+z)\sin\sigma t \quad \text{...(6)}$$

$$\frac{\partial u}{\partial x} = \left(Gk^2\cos kx + G\frac{\partial k}{\partial x}\sin kx + 2\frac{\partial G}{\partial x}k\sin kx - \frac{\partial^2 G}{\partial x^2}\cos kx\right)$$

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$coshk(h+z)sin\sigma t$ .....(7)

and vertical $-z$ velocity equation,

$w(x,z,t) = -\frac{\partial \phi}{\partial z} = -Gkcoskxsinhk(h+z)sin\sigma t$

.....(8)

$\frac{\partial v}{\partial z} = -Gk^2 coskxcoshk(h+z)sin\sigma t$ .....(9)

Equations (7) and (9) are substituted to continuity equation $\frac{\partial u}{\partial x} + \frac{\partial v}{\partial z} = 0$ and are done at the condition $coskx = sinkx = cos\sigma t = sin\sigma t = \frac{\sqrt{2}}{2}$ and then the equation is divided by $coshk(h+z)$, to obtain equation,

$G\frac{\partial k}{\partial x} + 2k\frac{\partial G}{\partial x} - \frac{\partial^2 G}{\partial x^2} = 0$ .....(10)

Considering that (10) is formulated using continuity equation that is a mass conservation equation, it can be called mass conservation equation. However, considering that G is the speed of energy transfer, then (10) can be called energy conservation equation. The relation between G and $\frac{\partial G}{\partial x}$ can be formulated using (10). The simplest way is by doing the assumption of longwave where $\frac{\partial^2 G}{\partial x^2}$ can be ignored, which in this case the following equation is obtained

$\frac{\partial G}{\partial x} = -\frac{G}{2k}\frac{\partial k}{\partial x}$, ...(11)

(10) can be written as,

$\frac{\partial^2 G}{\partial x^2} = G\frac{\partial k}{\partial x} + 2k\frac{\partial G}{\partial x}$ .....(12)

(12) is differentiated against horizontal-x axis and substituted to (12) at the term $\frac{\partial^2 G}{\partial x^2}$

$\frac{\partial^3 G}{\partial x^3} = \left(\frac{\partial^2 k}{\partial x^2} + 2k\frac{\partial k}{\partial x}\right)G + \left(3\frac{\partial k}{\partial x} + 4k^2\right)\frac{\partial G}{\partial x}$ ....(13)

If $\frac{\partial^3 G}{\partial x^3}$ is considered as small number and zero, the following relation is obtained: $\frac{\partial G}{\partial x} = \alpha_G G$ where

$\alpha_G = -\frac{\left(\frac{\partial^2 k}{\partial x^2} + 2k\frac{\partial k}{\partial x}\right)}{\left(3\frac{\partial k}{\partial x} + 4k^2\right)}$ .....(14)

Substitute (4) and (5) to (14) to obtain

$\alpha_G = \mu k$ .....(15)

$\frac{\partial G}{\partial x} = \mu k G$ .....(16)

$\mu = -\frac{2\left(\left(\frac{\partial h}{\partial x}\right)^2 - kh\frac{\partial h}{\partial x}\right)}{\left(-3kh\frac{\partial h}{\partial x} + 4(kh)^2\right)}$ .....(17)

A relation with higher degree of accuracy can be obtained by differentiating (13), and then the procedure that has been done before is executed. The relation between G and $\frac{\partial G}{\partial x}$ is needed in various other analyses, whereas $\frac{\partial k}{\partial x}$ and $\frac{\partial^2 k}{\partial x^2}$ are obtained from (4) and (5).

III. STUDY OF KINEMATIC FREE SURFACE BOUNDARY CONDITION

The execution of kinematic free surface boundary condition $3\frac{\partial \eta}{\partial t} = w_\eta - u_\eta\frac{\partial \eta}{\partial x}$ (the coefficient 3 will be discussed in the next paper) at sloping bottom where there are values $\frac{\partial G}{\partial x}$ and $\frac{\partial k}{\partial x}$, with horizontal velocity u from (6) and vertical velocity w from (8), and $\eta = Acoskxcos\sigma t$ and the equation is executed at $coskx = sinkx = cos\sigma t = sin\sigma t = \frac{\sqrt{2}}{2}$, to obtain

$3\sigma A = Gksinhk\left(h+\frac{A}{2}\right) - \left(Gk - \frac{\partial G}{\partial x}\right)coshk\left(h+\frac{A}{2}\right)\left(\frac{kA}{2}\right)$..

....(18)

Substitute (16)

$3\sigma A = Gk\left(\tanh k\left(h+\frac{A}{2}\right) - (1-\mu)\left(\frac{kA}{2}\right)\right)coshk\left(h+\frac{A}{2}\right)$

.....(19)

(19) is differentiated against x axis. Differentiation is done considering (2), $\left(\frac{kA}{2}\right)$ at the second term on the right can be considered as the multiplication between wave number with water depth A, then $\frac{\partial}{\partial x}\left(\frac{kA}{2}\right) = 0$, wave amplitude change equation is obtained, i.e.

$3\sigma\frac{\partial A}{\partial x} = Gk\left(\mu k - \frac{1}{h}\frac{\partial h}{\partial x}\right)\left(\tanh k\left(h+\frac{A}{2}\right) - (1-\mu)\left(\frac{kA}{2}\right)\right)coshk\left(h+\frac{A}{2}\right)$

Breaking occurs at $\frac{\partial A}{\partial x} = 0$, then breaking occurs if $\left(\tanh k\left(h+\frac{A}{2}\right) - (1-\mu)\left(\frac{kA}{2}\right)\right) = 0$, hence

$\frac{kA}{2} = \frac{\tanh k\left(h+\frac{A}{2}\right)}{(1-\mu)}$ .....(20)

At a shallow water where the profile of the wave is cnoidal (Hutahaean (2010)), $H_b \cong A_b$. From (6a), then $\tanh k\left(h+\frac{A}{2}\right) = \tanh k_0\left(h_0+\frac{A_0}{2}\right)$. If as h_0 deep water depth is used where $\tanh k_0\left(h_0+\frac{A_0}{2}\right) = 1$, and bearing in mind that $k = \frac{2\pi}{L}$, then $\frac{H_b}{L_b} = \frac{\pi}{(1-\mu)}$. This equation shows a breaker correlation with bottom slope as shown by Galvin (1968) and Goda (1970).

IV. DISPERSION EQUATION

Surface momentum equation of Hutahaean and Hendra Achyari (2017) is,

$\left(\frac{\partial u}{\partial t}\right)_{z=\eta} = -\frac{\partial}{\partial x}\left(u_\eta u_\eta + w_\eta w_\eta\right) - g\frac{\partial \eta}{\partial x}$

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By studying the formulation of total acceleration equation using Taylor series, coefficient $\frac{1}{3}$ for right side. The formulation will be written in the next paper and the momentum equation becomes,

$$\left(\frac{\partial u}{\partial t}\right)_{z=\eta} = -\frac{1}{3}\left(\frac{\partial}{\partial x}\left(u_\eta u_\eta + w_\eta w_\eta\right) - g\frac{\partial \eta}{\partial x}\right)$$

Bearing in mind that in this research the dispersion equation will only be used at the deep water, where the wave profile is still flat, the convective acceleration can be ignored.

$$\left(\frac{\partial u}{\partial t}\right)_{z=\eta} = -\frac{g}{3}\frac{\partial \eta}{\partial x} \quad \text{.....(21)}$$

With horizontal velocity of u from (6) and $\eta = Acoskxcos\sigma t$ and the equation is executed at the condition of $coskx = sinkx = cos\sigma t = sin\sigma t = \frac{\sqrt{2}}{2}$, $G = \frac{gkA}{3\sigma(k-\alpha_G)coshk\left(h+\frac{A}{2}\right)}$ is obtained.

Substitute (15) to α_G

$$G = \frac{gA}{3\sigma(1-\mu)coshk\left(h+\frac{A}{2}\right)} \quad \text{.....(22)}$$

The kinematic free surface boundary condition (19) can be written as an equation for G.

$$G = \frac{3\sigma A}{k\left(tanhk\left(h+\frac{A}{2}\right)-(1-\mu)\left(\frac{kA}{2}\right)\right)coshk\left(h+\frac{A}{2}\right)} \quad \text{..... ...(23)}$$

Equalizing G at (22) with G at (23), produces,

$$(1-\mu)\sigma^2 = \frac{g}{9}ktanhk\left(h+\frac{A}{2}\right) - \frac{gk^2A}{18} \quad \text{.....(24)}$$

This equation is a dispersion equation where there is wave amplitude A as its variable, or in other words wave number k obtained from (24) is a wave number influenced by wave amplitude. Kortweg de Vries (1895) and Stokes (1847) stated a wavelength equation (dispersion equation), where there is wave height as its variable. This (24) equation will be used to calculate wave number at the deep water. At deep water where $tanhk_0\left(h_0+\frac{A_0}{2}\right)=1$, for $k_0\left(h_0+\frac{A_0}{2}\right)=\alpha$, SPM (1984) uses $\alpha=\pi$, with $tanh(\alpha)=0.996272$ where $\frac{h_0}{L_0}=0.5$, in this research $\alpha=1.1\pi$ is used with $tanh(\alpha)=0.998009$. Therefore, (24) becomes quadratic equation for wave number k.

$$(1-\mu)\sigma^2 = \frac{g}{9}\left(k-\frac{k^2A}{2}\right) \quad \text{.....(25)}$$

V. ENERGY EQUATION OF LINEAR WAVE THEORY

The energy equation of linear wave theory (Dean (1991)), i.e. total energy wave per unit width is

$$E_L = \frac{1}{8}\rho g H^2 L \quad \text{.....(26)}$$

ρ is water mass density. For a wave moving from deep water depth to shallower water depth, by assuming that there is no energy loss in its way then the following relation applies:

$$H^2L = H_0^2L_0 \quad \text{.....(27)}$$

VI. SUMMARY OF EQUATIONS FOR BREAKING ANALYSIS

Equations at breaking analysis are as follows.

$$\mu = -\frac{2\left(\left(\frac{\partial h}{\partial x}\right)^2 - kh\frac{\partial h}{\partial x}\right)}{\left(-3kh\frac{\partial h}{\partial x}+4(kh)^2\right)} \quad \text{.....(17)}$$

From (20)

$$\frac{kA}{2} = \gamma \quad \text{.....(28)}$$

$$\gamma = \frac{tanhk_0\left(h_0+\frac{A_0}{2}\right)}{(1-\mu)} \quad \text{.....(29)}$$

Actually $tanhk_0\left(h_0+\frac{A_0}{2}\right)=1$, can be used. Substitute (28) to (27), where at breaker depth $A_b = H_b$,

$$k_b = 2\left(\frac{4\gamma^2k_0}{H_0^2}\right)^{1/3} \quad \text{.....(30)}$$

From (28),

$$H_b = \frac{2\gamma}{k_b} \quad \text{.....(31)}$$

Substitute (28) to (3),

$$h_b = \frac{\left(k_0\left(h_0+\frac{A_0}{2}\right)-\gamma\right)}{k_b} \quad \text{.....(32)}$$

VII. THE STEP OF BREAKER CALCULATION

With an input of deep water wave height H_0 $\left(A_0=\frac{H_0}{2}\right)$, and wave period T, where $\sigma=\frac{2\pi}{T}$, deep water wave number k_0 is calculated using (21), where at deep water $\alpha_G=0$, see (4), (5) and (15). Deep water depth h_0, is calculated using the following equation: $h_0 = \frac{1.1\pi - \frac{k_0A_0}{2}}{k_0}$

A. Initial calculation

k_0 is calculated using, $\sigma^2 = \frac{g}{9}\left(k_0 - \frac{k_0^2A}{2}\right)$ equation

If it is requested, after k_0 is obtained μ is calculated with (17), and k_0 is re-calculated with

$$(1-\mu)\sigma^2 = \frac{g}{9}\left(k_0 - \frac{k_0^2A}{2}\right)$$

B. The calculation of breaker wave number k_b and breaker depth h_b

a. $(kh) = (k_0h_0)$,

b. $\mu = -\frac{2\left(\left(\frac{\partial h}{\partial x}\right)^2 - (kh)\frac{\partial h}{\partial x}\right)}{\left(-3(kh)\frac{\partial h}{\partial x}+4(kh)^2\right)}$ ....(17)

c. $\gamma = \frac{tanhk_0\left(h_0+\frac{A_0}{2}\right)}{(1-\mu)}$ .....(29)

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d. $k_b = 2\left(\frac{4\gamma^2 k_b s^2}{H_b^2}\right)^{1/3}$ ...(30)

e. $h_b = \frac{\left(k_b\left(h_b+\frac{A_b}{2}\right)-\gamma\right)}{k_b}$ ...(32)

C. Calculate: $H_b = \frac{2\gamma}{k_b}$ ....(31)

VIII. THE RESULT OF THE EQUATION

As a comparator, the previous breaker index equations will be used

a. Breaker height comparator.

As a comparator for the breaker height calculation result, average value of six breaker height equations are used, i.e.:

Komar and Gaughan (1972)

$\frac{H_b}{H_0} = 0.56\left(\frac{H_0}{L_0}\right)^{-\frac{1}{5}}$ .....(32)

Singamsetti and Wind (1980)

$\frac{H_b}{H_0} = 0.575m^{0.031}\left(\frac{H_0}{L_0}\right)^{-0.254}$ .....(33)

Larson and Kraus (1989),

$\frac{H_b}{H_0} = 0.53\left(\frac{H_0}{L_0}\right)^{-0.24}$ .....(34)

Smith and Kraus (1990),

$\frac{H_b}{H_0} = (0.34 + 2.74m)\left(\frac{H_0}{L_0}\right)^{-0.30+0.88m}$ .....(35)

Gourlay (1992),

$\frac{H_b}{H_0} = 0.478\left(\frac{H_0}{L_0}\right)^{-0.28}$ .....(36)

Rattana Pitikon and Shibayama (2000) :

$\frac{H_b}{H_0} = (10.02m^3 - 7.46m^2 + 1.32m + 0.55)\left(\frac{H_0}{L_0}\right)^{-\frac{1}{5}}$

.....(37)

b. Breaker depth comparator

As a comparator of the result of breaker depth calculation, breaker depth index from SPM (1984) is used, with breaker height as input that is obtained from a.

$\frac{h_b}{H_b} = \frac{1}{b-\left(\frac{aH_b}{gT^2}\right)}$ atau $h_b = \frac{H_b}{b-\left(\frac{aH_b}{gT^2}\right)}$ .....(38)

$a = 43.75(1 - e^{-19.0m})$ $b = \frac{1.56}{1+e^{-19.5m}}$

c. Breaker length comparator

As breaker length comparator, breaker steepness equation from Miche (1944) is used:

$\frac{H_b}{L_b} = 0.142tanh\left(\frac{2\pi h_b}{L_b}\right)$ .....(39)

This equation uses breaker height input from a and breaker depth from SPM (1984), and breaker length L_b is calculated.

Table (1) presents the calculation results of breaker height H_b, breaker depth h_b and breaker length L_b. The calculation is done using bottom slope $m = 0.005$ or $\frac{dh}{dx} = -0.005$. The wave period varies from 7 – 10 seconds, with deep water wave height of 0.6 – 1.80 m. Table (1) also shows that breaker height H_b is quite close with average values of H_b from 6 breaker height indexes. Breaker depth h_b is quite close between the two methods. Breaker length differs large enough with (39). Since the differences in breaker depth is not too large, the differences at this breaker length is assumed that (39) was formulated based on the wavelength of linear wave theory which resulted in a long wavelength.

Table.1: The comparison of H_b, h_b and L_b

H_o (m)	H_b (m)		h_b (m)		L_b (m)	
	Model	(a)	Model	SPM	Model	Miche
Wave Period T : 7 second						
0,6	0,95	0,92	1,17	1,14	2,98	12,85
0,9	1,2	1,25	1,48	1,55	3,78	17,22
1,2	1,37	1,56	1,69	1,94	4,33	21,15
1.5	Breaking at deep water					
Wave Period T : 8 second						
0,6	1,05	0,98	1,29	1,21	3,3	13,81
0,9	1,34	1,34	1,66	1,65	4,23	18,55
1,2	1,58	1,66	1,95	2,06	4,99	22,83
1,5	1,77	1,97	2,17	2,45	5,56	26,77
1.8	Breaking at deep water					
Wave Period T : 9 second						
0,6	1,14	1,04	1,41	1,28	3,6	14,68
0,9	1,47	1,41	1,82	1,74	4,64	19,77
1,2	1,75	1,76	2,16	2,17	5,52	24,36
1,5	1,99	2,08	2,45	2,58	6,27	28,61
1,8	2,18	2,39	2,69	2,97	6,88	32,59
Wave Period T : 10 second						
0,6	1,23	1,09	1,52	1,34	3,88	15,48
0,9	1,6	1,48	1,97	1,83	5,02	20,87
1,2	1,91	1,85	2,35	2,28	6,01	25,75
1,5	2,18	2,19	2,69	2,7	6,87	30,28
1,8	2,42	2,51	2,98	3,11	7,62	34,53

Note : (a) Average of 6 breaker height indexes

Table(2) is the value of breaker depth index $\frac{H_b}{h_b}$ and breaker steepness $\frac{H_b}{L_b}$, for H_b, h_b and L_b in Table(1). Both the model

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and (38) produces $\frac{H_b}{h_b}$ that is constant against deep water wave height and wave period.

The model produces constant breaker steepness $\frac{H_b}{L_b}$, against deep water wave as well as wave period at the value of $\frac{H_b}{L_b} = 0.318 = \frac{1}{\pi}$. (39) also produces $\frac{H_b}{L_b}$ which is constant, i.e. $\frac{H_b}{L_b} = 0.07$. The difference is assumed caused by the use of a too long wavelength at (39).

Table (2) Comparison of $\frac{H_b}{h_b}$ and $\frac{H_b}{L_b}$

H_o (m)	H_b (m)		h_b(m)		L_b(m)	
	Model	(a)	Model	SPM	Model	Miche
Wave Period T : 7 second						
0.6	0.95	0.92	0.81	0.81	0.32	0.07
0,9	1,2	1,25	0,81	0,81	0,32	0,07
1,2	1,37	1,56	0,81	0,81	0,32	0,07
1.5	Breaking at deep water					
Wave Period T : 8 second						
0,6	1,05	0,98	0,81	0,81	0,32	0,07
0,9	1,34	1,34	0,81	0,81	0,32	0,07
1,2	1,58	1,66	0,81	0,81	0,32	0,07
1,5	1,77	1,97	0,81	0,81	0,32	0,07
1.8	Breaking at deep water					
Wave Period T : 9 second						
0,6	1,14	1,04	0,81	0,81	0,32	0,07
0,9	1,47	1,41	0,81	0,81	0,32	0,07
1,2	1,75	1,76	0,81	0,81	0,32	0,07
1,5	1,99	2,08	0,81	0,81	0,32	0,07
1,8	2,18	2,39	0,81	0,81	0,32	0,07
Wave Period T : 10 second						
0,6	1,23	1,09	0,81	0,81	0,32	0,07
0,9	1,6	1,48	0,81	0,81	0,32	0,07
1,2	1,91	1,85	0,81	0,81	0,32	0,07
1,5	2,18	2,19	0,81	0,81	0,32	0,07
1,8	2,42	2,51	0,81	0,81	0,32	0,07

Note : (a) Average of some breaker height indexes

The proposed analysis breaker parameter method is quite simple and easy to use. However, if requested, a calculation can be done using simpler method, i.e.

a. Breaker height H_b is calculated with one of the persamaan breaker height index equations or using average value from some breaker height indexes.
b. Breaker depth h_b is calculated with the equation: $\frac{H_b}{h_b} = 0.81$
c. Breaker length L_b is calculated with $\frac{H_b}{L_b} = \frac{1}{\pi}$

IX. CONCLUSION

Breaking elements, i.e. breaker height and breaker depth are quite close with the result of breaker index equations. There is a significant difference at breaker length, which is assumed due to breaker steepness equation as well as breaker depth that are formulated based on the wavelength of linear wave theory which produces a too long wavelength. In addition, it is already known that that dispersion equation of linear wave theory cannot be executed at shallow water. Therefore, further research is needed on wavelength analysis method at shallow water and deep water as well.

From the result of the study, a conclusion can be drawn that velocity potential of linear wave theory possesses breaking characteristic, where the breaking equations can be formulated using the velocity potential. With the presence of breaking characteristic at the velocity potential, it is estimated that wave transformation analysis method can be developed where breaking can occur automatically using velocity potential of linear wave theory.

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On the Joint Symbol and Channel Estimation for Three-Hop MIMO Relaying Links

Leandro R. Ximenes

School of Technology, State University of Campinas (UNICAMP), Limeira, Brazil
Email: leandro@ft.unicamp.br

Abstract*—There is a consensus that cooperative communication is a key technology for the upcoming generations of mobile communications. Whether under the Coordinated Multipoint (CoMP), Device-to-Device (D2D) communication or Internet of Things (IoT) scopes, there is little doubt that a more decentralized network, where several communicating agents smartly cooperate to improve data rate and reliability, is fundamental to cope with the always scarce resources of energy and bandwidth. When relaying stations are deployed to increase signal coverage and to provide cooperative diversity, the concatenation of two or more point-to-point MIMO channels impose a restriction on conventional algorithms for channel estimation. Although single-relay, two-hop Amplify-and-Forward (AF) systems have been reasonably investigated, there are enough evidences that more transmission hops will be a common scenario in the next years. This work proposes a semi-blind receiver for the task of joint symbol and channel estimation in a three-hop AF MIMO system. Resorting to a Nested PARAFAC tensor model, new estimating equations were derived, along studies on the uniqueness and identifiability conditions concerning the aforementioned receiver. Simulations corroborate the validity of the receiver as an effective option.*

***Keywords*—Amplify-and-Forward , Cooperative communications, Relaying, Tensor decomposition.**

I. INTRODUCTION

In wireless communications, relay stations havebeen extensively deployed to increase the signal coverage in a broadcast transmission [15]. In recent years, relaying also has been used to provide digital receivers with what is called cooperative diversity, where a relay might work with single-antenna transmitters to emulate a virtual array of antennas. In this sense, the benefits of spatial transmit diversity could be obtained without a increase of the number of transmit antennas.

The simplest of the relaying protocols is called Amplify-and-Forward (AF) As its name suggests, the incoming signals are amplified, and then forwarded to the intended destination. The main advantage of this non-regenerative process is that no complex decodingis performed at the relay, so its hardware and software complexities arereduced with comparison to the so-called regenerative protocols, such as the Decode-and-Forward (DF), favoring its mass implementation [15-16]. As a drawback, due to its simple operation, noise and interference are also amplified, limiting the benefits of relaying.

Another disadvantage of the AF protocol is related to the task of channel estimation. Besides the usual need of the Channel State Information (CSI) for symbol detection, many system optimization techniques demand the knowledge of the various channels that compose a relaying network [1, 8-10]. The absence of a powerful processing unit at the relay leaves all this work to the destination node, which is usually inapt to dissociate the cascaded *source-relay* and *relay-destination* channels under conventional transmission protocols.

The issue of channel estimation in two-hop AF MIMO systems have been addressed in few state-of-the-art works [5-7,14] by using training sequences and by [11, 12] in a semi-blind fashion. However, when it comes to the multi-hop systems, with more than one serial relay in the communication link, there is usually a lack of related works. This is particularly concerning since the future of wireless communications points towards ever more decentralized networks, such as Device-to-Device (D2D) communications technologies, where longer chains of connected relaying devices can be expected. For a three-hop (two relays) link, [2] have resorted to the combination of PARAFAC and Tucker tensor models to estimate the channel. However, [2] resorts once again to the use of pilot symbols, disregarding the benefits of the joint estimation of symbols and channels.In [18] the authors generalized the works of [11,12] for any number of hops.

This work proposes a three-hop AF MIMO system, where both relays and the source node applies a Khatri-Rao Space-Time (KRST) coding over the signals prior to their transmission. In this way, the receiver can arrange the signals into a 5^{th}-order tensor following a Nested PARAFAC model, from which the three-hop

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channels and symbols can be estimated by a closed-form algorithm. Notably, this proposed tensor model is an expansion of the 4^{th}-order model ,holding similar properties/advantages. Studies on the uniqueness of the proposed model and and on identifiability conditions for the proposed receiver are also carried out, along the presentation of its computational complexity and performance in terms of Bit Error Rate (BER) and channel Normalized Mean Square Error (NMSE).

The main contributions are:

1. Derivation of new unfolded equations for the three-hop system, for both signals and noise terms;
2. Proposal of a theorem on the essential uniqueness of the system model;
3. Discussion on the computational complexity and on the achievable spectral efficiency of the proposed method.

1.1 Notations and fundamentals of tensors

Scalars, column vectors, matrices, and tensors are denoted by lower-case (x), boldface lower-case ($\mathbf{x}$), boldface capital ($\mathbf{X}$), and calligraphic ($\mathcal{X}$) letters, respectively. $\mathbf{X}^T$, $\mathbf{X}^*$, $\mathbf{X}^\dagger$, $\mathbf{X}_{l.}$ and $\mathbf{X}_{.m}$ are the transpose, the conjugate, the pseudoinverse, the l^{th} row, and the m^{th} column of $\mathbf{X} \in \mathbb{C}^{L\times M}$, respectively. $D_n(\mathbf{X})$ stands for the diagonal matrix formed from the elements of $\mathbf{X}_{n.}$. Given a third-order tensor $\mathcal{X} \in \mathbb{C}^{I\times J\times K}$, with entry $x_{i,j,k}$, the matrices $\mathbf{X}_{JK\times I}$, $\mathbf{X}_{KI\times J}$ and $\mathbf{X}_{IJ\times K}$ denote tall mode-1, mode-2 and mode-3 unfoldings, with $x_{i,j,k} = [\mathbf{X}_{JK\times I}]_{(k-1)J+j,i} = [\mathbf{X}_{KI\times J}]_{(i-1)K+k,j} = [\mathbf{X}_{IJ\times K}]_{(j-1)I+i,k}$. The *vec(.)* and *unvec(.)* operators are defined by

$$\mathbf{x}_{JKI} = \text{vec}(\mathbf{X}_{JK\times I}) \in \mathbb{C}^{JKI\times 1}$$
$$\leftrightarrow \mathbf{X}_{JK\times I} = \text{unvec}(\mathbf{x}_{JKI}).$$

1.2 PARAFAC and Nested PARAFAC decompositions

A PARAFAC decomposition [4,13] of a third-order tensor $\mathcal{X} \in \mathbb{C}^{I\times J\times K}$, with rank-$R$ and matrix factors $(\mathbf{A}, \mathbf{B}, \mathbf{C})$, will be noted $[\![\mathbf{A}, \mathbf{B}, \mathbf{C}; R]\!]$. Tall and flat mode-1 matrix unfoldings of $\mathcal{X}$ are respectively given by

$$\mathbf{X}_{JK\times I} = (\mathbf{C} \diamond \mathbf{B})\mathbf{A}^T = (\mathbf{X}_{I\times JK})^T,$$

where $\diamond$ denotes the Khatri-Rao product. Similar mode-2 and mode-3 unfoldings can be obtained by permuting the factor matrices.

A 4^{th} Nested PARAFAC model [17,18] can be seen as a generalized model w.r.t.the PARAFAC. In this model a 4^{th}-order tensor can be reduced to two3^{rd}-order tensors that follows a PARAFAC model, by associating two of their original modes into a single one. The matrix factors related to the associated modes are

$$\mathcal{X} = [\![\mathbf{A}, \mathbf{B}, \mathbf{C}; R_1]\!],$$
$$\mathcal{C} = [\![\mathbf{D}, \mathbf{E}, \mathbf{F}; R_2]\!].$$

where $\mathbf{C}$ can be any matrix unfolding of $\mathcal{C}$.Note that $\mathbf{C}$ in (2) is any unfolded form of $\mathcal{C}$ represented in (3).

II. THREE-HOP SYSTEM

A one-way three-hop relay system is depicted in Fig. 1. The source (S) node wants to transmit its signal to the destination (D) node with the aid of unidirectional relays R_1 and R_2. The communication channels $\mathbf{H}^{(SR_1)} \in \mathbb{C}^{M_1\times M_S}$, $\mathbf{H}^{(R_1R_2)} \in \mathbb{C}^{M_2\times M_1}$ and $\mathbf{H}^{(R_2D)} \in \mathbb{C}^{M_D\times M_2}$ are considered to flat-fading and time-invariant during a transmission block

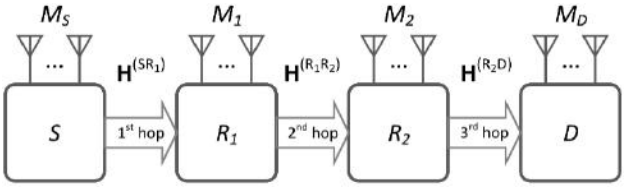

Fig.1: Three-hop one-way communication

Prior to the transmisstion, the source node applies a Khatri-Rao Space-Time (KRST) coding on its symbol matrix $\mathbf{S} \in \mathbb{C}^{N\times M_S}$ using the code matrix $\mathbf{C}^{P\times M_S}$. Just like in , N is the data-stream (number of symbol vectors) and P is the spreading source code length. Thus, in the first hop of Fig.1, the signals transmitted from S to R_1 become

$$\mathbf{W}^{(R_1)}_{M_1\times PN} = \mathbf{H}^{(SR_1)}(\mathbf{S} \diamond \mathbf{C})^T.$$

In the second hop, R_1 applies the Khatri-Rao ST coding over J, and R_1 transmits its signal to R_2. The signals arriving at this second relay are

$$\mathbf{W}^{(R_2)}_{M_2\times JPN} = \mathbf{H}^{(R_1R_2)}\left(\mathbf{W}^{(R_1)}_{PN\times M_1} \diamond \mathbf{G}^{(R_1)}\right)^T.$$

Equation (5) is intentionally written in the form of (4), such that there is a correspondence between the matrices that compose both signal models. For one, $\mathbf{G}^{(R_1)}$ has equivalent role of $\mathbf{C}$ on the R_1's side, while $\mathbf{W}^{(R_1)}_{PN\times M_1}$ and $\mathbf{S}$ represent the signals prior to the ST coding at the first relay and at source, respectively. The entris of $\mathbf{W}^{(R_2)}_{M_2\times JPN}$ could be stored in the 4^{th}-order tensor $\mathcal{W}^{(R_2)} \in \mathbb{C}^{M_2\times J\times P\times N}$ such as

$$w^{(R_2)}_{m_2,j,p,n} = \sum_{m_1=1}^{M_1} h^{(R_1R_2)}_{m_2,m_1} g^{(R_1)}_{j,m_1} \sum_{m_S=1}^{M_S} h^{(SR_1)}_{m_1,m_S} c^{(1)}_{p,m_S} s_{n,m_S}$$

that follows a Nested PARAFAC decomposition However, without needing to store the data, R_2 forwards the signals to the destination node (last hop of Fig. 1).

Before the forwarding process by R_2, this relay applies a new orthogonal KRST coding (similarly to (4) and (5)) with a code length K, such that after the transmission through $\mathbf{H}^{(R_2D)}$ we have

$$\mathbf{X}_{M_D\times KJPN} = \mathbf{H}^{(R_2D)}\left(\mathbf{W}^{(R_2)}_{JPN\times M_2} \diamond \mathbf{G}^{(R_2)}\right)^T. \quad (2)$$

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Due to the third hop (third KRST coding), with the addition of the dimension of length K, the signals arriving at the destination node can be arranged in a 5^{th}-order tensor $\mathbf{X} \in \mathbb{C}^{M_D \times K \times J \times P \times N}$. Using (6), the scalar form of this tensor can be given by

$$x_{m_D,k,j,p,n} = \sum_{m_2=1}^{M_2} h^{(R_2D)}_{m_D,m_2} g^{(R_2)}_{k,m_2} w^{(R_2)}_{m_2,j,p,n}$$
$$= \sum_{m_2=1}^{M_2} h^{(R_2D)}_{m_D,m_2} g^{(R_2)}_{k,m_2} \times \sum_{m_1=1}^{M_1} h^{(R_1R_2)}_{m_2,m_1} g^{(R_1)}_{j,m_1} \times \sum_{m_S=1}^{M_S} h^{(SR_1)}_{m_1,m_S} c_{p,m_S} s_{n,m_S}. \quad (8)$$

Contrasting (8) with (6), the nesting nature of the Nested PARAFAC is kept at a higher-order due to the sequential KRST coding at each relay station. For the 4^{th} order model, the data can be processed directly from the 4^{th}-way tensor or through the two nested 3^{th}-order tensors, being the latter the best in terms of computational burden. Among different forms of processing the (received) 5^{th}-order tensor described (8), the data can be arranged to conform to three PARAFAC models, $\mathcal{X}^{(Z)} \mathbb{C}^{M_D KJ \times P \times N}$, $\mathcal{Z}^{(R_2)} \in \mathbb{C}^{M_D K \times J \times M_S}$ and $\mathcal{Z}^{(R_1)} \in \mathbb{C}^{M_D \times K \times M_1}$, i.e.

$$\mathcal{X}^{(Z)} = [\![\mathbf{Z}^{(R_2)}_{M_D KJ \times M_S}, \mathbf{C}, \mathbf{S}; M_S]\!],$$
$$\mathcal{Z}^{(R_2)} = [\![\mathbf{Z}^{(R_1)}_{M_D K \times M_1}, \mathbf{G}^{(R_1)}, (\mathbf{H}^{(SR_1)})^T; M_1]\!],$$
$$\mathcal{Z}^{(R_1)} = [\![\mathbf{H}^{(R_2D)}, \mathbf{G}^{(R_2)}, (\mathbf{H}^{(R_1R_2)})^T; M_2]\!],$$

where $\mathcal{X}^{(Z)}$ is obtained through the order reduction of $\mathcal{X}$ by associating its three first indices . The predilection for working with 3 these 3^{rd}-order tensors rather than directly with5^{th}-order tensorcomes from the fact that established tools and theorems dedicated to third-order PARAFAC models are well-established and could be more easily applied.

2.1 Noise terms

The additive noise terms on relays R_1 and R_2 can be respectively given by

$$\mathbf{V}^{(R_2)}_{M_2 \times JPN} = \mathbf{H}^{(R_1R_2)} (\mathbf{V}^{(R_1)}_{M_2 \times PN} \diamond \mathbf{G}^{(R_1)})^T,$$
$$\mathbf{V}^{(R_D)}_{M_D \times KJPN} = \mathbf{H}^{(R_2D)} (\mathbf{V}^{(R_2)}_{M_2 \times JPN} \diamond \mathbf{G}^{(R_2)})^T.$$

These forms follow the same unfolding order of (5) and (7). The matrices $\mathbf{V}^{(R_1)}_{M_2 \times PN}$, $\mathbf{V}^{(R_2)}_{M_2 \times JPN}$ and $\mathbf{V}^{(R_D)}_{M_D \times KJPN}$ are unfolded forms of the noise tensors $\mathrm{V}^{(R_1)} \in \mathbb{C}^{M_1 \times P \times N}$, $\mathrm{V}^{(R_2)} \in \mathbb{C}^{M_2 \times J \times P \times N}$ and $\mathrm{V}^{(\mathrm{D})} \in \mathbb{C}^{M_\mathrm{D} \times K \times J \times P \times N}$, that affect the inputs of R_1, R_2 and of the node D, respectively.

Note that $\mathrm{V}^{(R_2)}$ and $\mathbf{V}^{(R_D)}_{M_D \times KJPN}$ also follow Nested PARAFAC decompositions, and thus, its matrix factors, such as the channel and code matrices, might be uniquely identified. That is a interesting approach, as it would not require symbol transmission for the task of CSI retrieval.

III. TRIPLE KRF (TKRF) SEMI-BLIND RECEIVER

The objective of the semi-blind receiver installed at the destination is not only to decode the symbols transmitted by the source, but also to jointly estimate all channels of the 3-hop link. The use of the 4^{th}-order Nested PARAFAC decomposition employed by [?, 12] enabled the development of 3 semi-blind receivers in total, although others could have been presented for the same mdodel. Perhaps the most interesting of those receivers is the one called DKRF, composed by two non-iterative, sequential Khatri-Rao Factorizations (KRF), which presented the same performance as the others, but with less computational complexity . The same idea can be extended from the two-hop systemto the three-hop one by adding up a third KRF factorization.

Let one write the mode-2 unfoldings of the tensors $\mathcal{X}^{(Z)}$, $\mathcal{Z}^{(R_2)}$ and $\mathcal{Z}^{(R_1)}$ respectively as

$$\mathbf{X}_{NM_D KJ \times P} = (\mathbf{Z}^{(R_2)}_{M_D KJ \times M_S} \diamond \mathbf{S}) \mathbf{C}^T, \quad (9)$$
$$\mathbf{Z}^{(R_2)}_{M_S M_D K \times J} = (\mathbf{Z}^{(R_1)}_{M_D K \times M_1} \diamond (\mathbf{H}^{(SR_1)})^T) (\mathbf{G}^{(R_1)})^T, \quad (10)$$
$$\mathbf{Z}^{(R_1)}_{M_1 M_D \times K} = (\mathbf{H}^{(R_2D)} \diamond (\mathbf{H}^{(R_1R_2)})^T) (\mathbf{G}^{(R_2)})^T. \quad (11)$$

The basic KRF factorization consists of reshaping each column of a Khatri-Rao product into a matrix, and then approximating such rank-one matrix as the outer product of two column vectors . The KRF algorithm is in Alg. 2

Here we admit the principle that the estimation of the symbols is indispensable, while the estimation of the channel is optional. This makes the TKRF receiver more flexible, since some of the steps for the estimation of individual channels can be neglected, resulting in the reduction of the global complexity and a relaxation of the identifiability conditions. The three (sequential) KRF of the TKRF receiver are called KRF-1, KRF-2 and KRF-3, and they basically differ in the inputs and outputs. The fluxogram of the TKRF receiver is shown in the Fig. 2, and the description of its inputs and outputs are given by:

- KRF-1: Symbol estimation (mandatory)
  - *Inputs*: $\mathbf{X}_{NM_D KJ \times P}$ and $\mathbf{C}$;
  - *Outputs*: $(\mathbf{Z}^{(R_2)}_{M_D KJ \times M_S}, \mathbf{S})$
- KRF-2 (optional)
  - *Inputs*: $(\mathbf{Z}^{(R_2)}_{M_S M_D K \times J}, \mathbf{G}^{(R_1)})$;
  - *Outputs*: $(\mathbf{Z}^{(R_1)}_{M_D K \times M_1}, \mathbf{H}^{(SR_1)})$
- KRF-3 (optional)
  - *Inputs*: $(\mathbf{Z}^{(R_1)}_{M_1 M_D \times K}, \mathbf{G}^{(R_2)})$;
  - *Outputs*: $(\mathbf{H}^{(R_2D)}, \mathbf{H}^{(R_1R_2)})$

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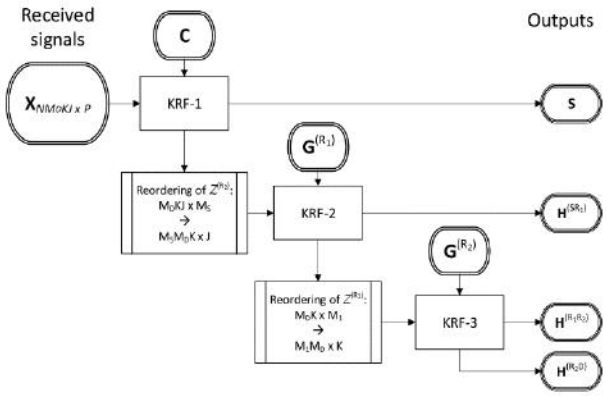

Fig.2: TKRF algorithm

3.1 Identifiability and Uniqueness Conditions

In this section, identifiability and uniqueness conditions are derived to the case where all matrices (symbols and channels) are to be estimated.

Theorem 1 (Identifibiality) *Let the source code matrix* $\boldsymbol{C}$ *and the relay code matrices* $\boldsymbol{G}^{(R_1)}$ *and* $\boldsymbol{G}^{(R_2)}$ *have full-rank. Necessary and sufficient identifiability condition to jointly estimate symbol* ($\boldsymbol{S}$) *and channel* ($\boldsymbol{H}^{(SR_1)}$, $\boldsymbol{H}^{(R_1R_2)}$ *and* $\boldsymbol{H}^{(R_2S)}$) *matrices are that*

$$P \geq M_S, \quad J \geq M_1 \text{ and } \quad K \geq M_2.$$

Proof. From the KRF algoritm (Alg. 2(c)@), the necessary (and only) condition to apply the column factorization is that $\mathbf{G}^T(\mathbf{G}^T)^{\dagger} = \mathbf{I}_R$. For the existence of the right inverse of $\mathbf{G}^T$, if $\mathbf{G}$ is full-rank, then it is necessary that $\mathbf{G}$ be also full column-rank. Once the TKRF receiver calls the KRF algorithm three times (i.e. KRF-1, KRF-2 and KRF-3), using one of three different correspondences at a time, i.e. $\mathbf{G} \Leftrightarrow \left(\mathbf{C}, \mathbf{G}^{(R_1)}, \mathbf{G}^{(R_2)}\right)$, then the necessary and sufficient identifiability condition, given that all code matrices are full-rank by Theorem 1, is simply (15).

Theorem 2 (Uniqueness) *Assume the following hypotheses: (a) the entries of the channel matrices are drawn from stochastic processes with continuous Gaussian distribution; (b) the identifiability hypotheses and conditions from Theorem 1 are met; (c) Symbol matrix is composed of random symbols, and the number of data-stream N is much greater than the number of source antennas* M_S*. Under such hypotheses, a sufficient but not necessary condition to ensure with very high probability the uniqueness solution at the output of the TRKF receiver is*

$$min\,(M_D, M_S, M_1, M_2) \geq |M_2 - M_1| + 2.$$

Proof. Model equations (10) and (11) belongs to a 4^{th}-order Nested PARAFAC decomposition of the data fully stored in $\mathcal{Z}^{(R_2)}$, so by using Theorem 2 from [12] with due correspondences, it is possible to ensure the essential uniqueness of matrix factors in (10) and (11) if the entries of $\mathbf{H}^{(R_1,R_2)}$ are drawn from a continous Gaussian distribution. Once this is the case, as stated by the hypotheses of Theorem 2 in this paper, then from [12] the uniqueness of the estimates of $\mathbf{H}^{(SR_1)}$, $\mathbf{H}^{(R_1R_2)}$ and $\mathbf{H}^{(R_2S)}$ are guaranteed if

$$k_{\mathbf{G}^{(R_1)}} + k_{\left(\mathbf{H}^{(SR_1)}\right)^T} \geq \max(2M_1 - M_2, M_2) + 2,$$

$$k_{\mathbf{G}^{(R_2)}} + k_{\mathbf{H}^{(R_2D)}} \geq \max(2M_2 - M_1, M_1) + 2,$$

where $k_{\mathbf{A}}$ is the Kruskal rank of $\mathbf{A}$.

Once $\mathbf{G}^{(R_1)}$ and $\mathbf{G}^{(R_2)}$ are full column-rank to satisfy the identifiability condition of Theorem 1, then $k_{\mathbf{G}^{(R_1)}} = M_1$ and $k_{\mathbf{G}^{(R_2)}} = M_2$. Given the hypothesis on the channels, we have that $k_{\left(\mathbf{H}^{(SR_1)}\right)^T} = \min(M_S, M_1)$ and $k_{\mathbf{H}^{(R_2D)}} = \min(M_D, M_2)$. Eqs. (17) and (18) respectively become

$$\min(M_S, M_1) \geq \max(M_1 - M_2, M_2 - M_1) + 2,$$

$$\min(M_D, M_2) \geq \max(M_2 - M_1, M_1 - M_2) + 2.$$

Finally, combining (19) and (20) leads to the condition (16).

Proven the uniqueness of the fourth-order model comprising the two three-order models (10) and (11), what is left is the need to find the uniqueness condition regarding (9). This third-order tensor model has the following Kruskal condition: (15)

$$k_{\mathbf{Z}^{(R_2)}_{M_DKJ \times M_S}} + k_{\mathbf{C}} + k_{\mathbf{S}} \geq 2M_S + 2.$$

From hypotheses (b) and (c) from Theorem 2, $\mathbf{C}$ and $\mathbf{S}$ (with very high probability) have full column-rank. Thus, $k_{\mathbf{C}} = M_S$ and $k_{\mathbf{S}} = M_S$, reducing (21) to $k_{\mathbf{Z}^{(R_2)}_{M_DKJ \times M_S}} \geq 2$. This is always true if $\mathbf{Z}^{(R_2)}_{M_DKJ \times M_S}$ does not have any zero column or any pair of linearly dependent columns . Since channel matrices are randomly drawn from Gaussian distributions, and $\mathbf{G}^{(R_1)}$ and $\mathbf{G}^{(R_2)}$ are full-rank, then this condition is satisfied with probability close to one.

3.2 Computational complexity

The KRF algorithm consists of multiples rank-one approximations using SVD. Apart from other eventual operations, such as buffering and memory allocation, one may count those SVD's as the cost-dominant process for each KRF routine. The cost of the algorithms in floating-point operations that compose the TKRF receiver are displayed in Table 1. Note that for a matrix of dimensions $I_1 \times I_2$, the complexity of its SVD computation is around $O(I_1 I_2 min(I_1, I_2))$ [3].

Table.1: TKRF's Computational complexity in floating operations (16)

	Condition	Complexity
KRF-1	$P \geq M_S$	$min(M_D KJ, N) M_D KJN M_S$
KRF-2	$J \geq M_1$	$min(M_D K, M_S) M_D K M_S M_1$
KRF-3	$K \geq M_2$	$min\,(M_D, M_1) M_D M_1 M_2$

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It is noteworthy that KRF-1 tends to be more complex than KRF-2, while the latter is likely more complex than KRF-3. One of the reasons is that there is likely reduction of the input data volume after each Khatri-Rao Factorization.

IV. PERFORMANCE EVALUATION

For the assessment of the functionality of the proposed receiver, Bit Error Rate (BER) and channel Normalized Mean Square Error (NMSE) are evaluated . The coding matrices $\mathbf{C}$, $\mathbf{G}^{(R_1)}$ and $\mathbf{G}^{(R_2)}$ are (truncated) DFT matrices, and we assume $\mathbf{H}^{(SR_1)} \sim \mathcal{CN}(0,1/M_S)$, $\mathbf{H}^{(R_1R_2)} \sim \mathcal{CN}(0,1/M_1)$ and $\mathbf{H}^{(R_2D)} \sim \mathcal{CN}(0,1/M_2)$. Symbol energy is given by E_S, and the additive noise samples at relays and destination nodes are complex standard normal random variables wih variance equal to one. The Bit Error Rate (BER) and Channel Normalized Mean Square Error (NMSE) curves are evaluated using 10^7 runs of Monte Carlo simulations.

The impact of the code length P and J, put in practice by the source and by the first relay station, has already been investigated in two-hop systems , so it is adequate to assume – and it was verified – that the KRST coding at R_2 also adds a new coding gain on the outcome of symbol estimation in function of K. Therefore, perhaps it is more interesting to evaluate how the TKRF receiver behaves when the size of cooperative network increases. In the proposed model, it means when M_S, M_1, M_2 and M_D increase. Fig. 3 demonstrates the BER curves for $M = M_S = M_1 = M_2 = M_D = \{2,3,4\}$. M_S is set to 2 to allow the same number of information symbols to be sent in all simulations. Coding spreading lengths obey the minimum values to satisfy identifiability condition in (15), and with $N = 50$, the uniqueness condition in Theorem 2 is also complied. For two modulations (4-PSK and 16-PSK), the TKRF receiver responded in a expected manner for a MIMO system: more antennas meant a greater diversity order and lower BER figures as E_S increase, while the higher the modulation order, the higher the BER value. According to Table 1, the estimation complexity from $M = 2$ to $M = 4$ increased almost 50 times. This huge increment came mostly from the KRF-1 routine, which corresponded to more than 98% of the overall complexity. Whilst this number does seem elevated, there is still a valuable energy gain to achieve a target BER (e.g. ≈ 10 dB at BER $= 10^{-4}$ for both 4-PSK and 8-PSK). Moreover, the decision to let the receiving node do all the work allows the use of the AF protocol at the relays, saving them from heavy power-consuming decoding processes. Finally, since channel estimation (KRF-2 and KRF-3 routines) offers very little complexity overall, a more frequent CSI feedback to the transmitting nodes would undoubtedly allow further power optimization.

The channel NMSE for the same set of simulation parameters is shown in Fig. 4, but only for the 4-PSK simulation. Besides, the curves for $M = 3$ is ommitted to facilitate the visualization.

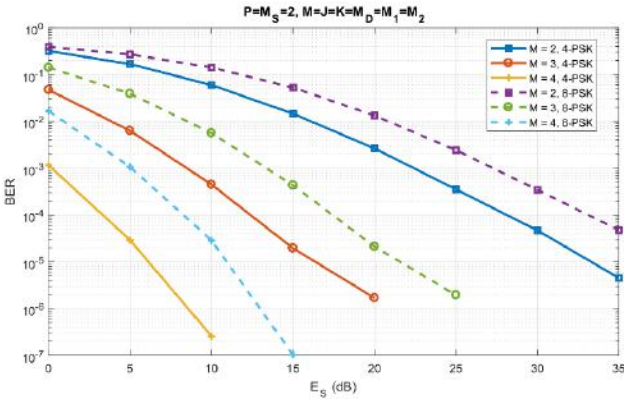

Fig.3: Bit Error Rate (BER)

The slopes of the curves indicate that CSI recovery responds differently for KRF-2 and KRF-3 in function of E_S – KRF-1 is responsible for symbol estimation. For $\mathbf{H}^{(SR_1)}$, approximately an order of magnitude of the error is reduce per decade, while for $\mathbf{H}^{(R_1R_2)}$ and $\mathbf{H}^{(R_2D)}$ the KRF-3 algorithm reduces the NMSE in two orders of magnitude per decade.

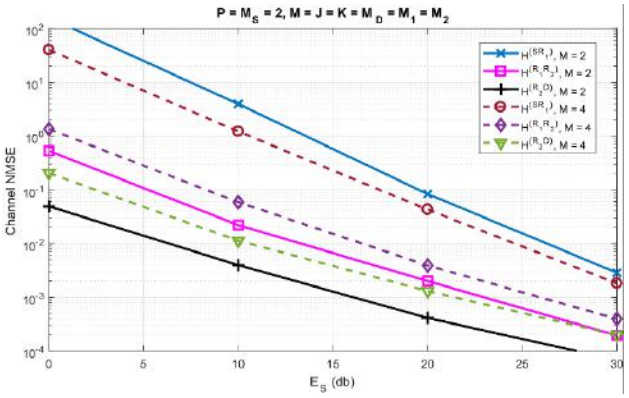

Fig.4: Channel NMSE

V. CONCLUSION

This article brought a solution for the issue of blind (symbol and channel) estimation in one-way, three-hop non regenerative relaying systems. Based on - the nesting concept of the 4^{th}-order Nested PARAFAC decomposition, this work extends this idea to 5^{th}-order tensors, allowing the leap from two-hop system to a three-hop system. Alongside the proposition of the new equations for this new derived tensor decomposition, this work brings an effective non-iterative semi-blind receiver. Computational simulations validate the proposed receiver and bring its performance in terms of symbol and channel estimation, as well as complexity and transmission rate.

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It is important to regard the three-hop system (and its receiver) as an intermediate step between the two-hop system and a generalized multi-hop scenario. There is a clear pattern that indicates that several expressions presented in this paper (as the identifiability and uniqueness conditions) can be further generalized to any number of hops. However, there are few loose ends that need to be addressed in the next works: one is the complexity one, since greater number of hops also means a much larger volume of data; another one, now appreciated, is the expressive variety of possibilities that opens up to deal with the data and to solve the issue of joint symbol and channel estimation in a multi-hop scenario.

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Analysis of the Efficiency of Auditory Protectors used in the Civil Construction industry in the City of Manaus in Brazil

Francisco Carlos Tavares Amorim[1], Edinaldo Jose de Souza Cunha[2], David Barbosa de Alencar[3], Jorge de Almeida Brito Júnior[4],Manoel Henrique Reis Nascimento[5],Carlos Alberto Oliveira de Freitas[6],

[1]Postgraduate Program in ProcessEngineering, Instituto de Tecnologia da Universidade Federal do Pará– UFPA, Belém, PA, Brazil.
Email: amorim.mao17@gmail.com
[2]Postgraduate Program in ProcessEngineering, Instituto de Tecnologia da Universidade Federal do Pará – UFPA, Belém, PA, Brazil.
Email:cunhaed@ufpa.br
[3]Research department, Institute of Technology and Education Galileo of Amazon - ITEGAM, Manaus, AM, Brazil
Email: david002870@hotmail.com
[4]Research department, Institute of Technology and Education Galileo of Amazon - ITEGAM, Manaus, AM, Brazil
Email:jorge.brito@itegam.org.br
[5]Research department, Institute of Technology and Education Galileo of Amazon - ITEGAM, Manaus, AM, Brazil
Email: hreys@itegam.org.br
[6]Research department, Institute of Technology and Education Galileo of Amazon - ITEGAM, Manaus, AM, Brazil
Email: carlos.freitas@itegam.org.br

Abstract*—The construction sector provides occupational risks to construction workers at the building site. Despite the obligation of the use Individual Protection Equipment (IPE), the noise is one of the occupational risks, which persist as one of the most injury to workers. The causes may be inherent in the control, but also the inappropriate choice of the methods of implantation of hearing protectors as an individual control measure. This paper aims to analyze the efficiency of hearing protectors, taking into account the octave band spectrum at the sound pressure levels of the main equipment used in the civil construction sector in the city of Manaus in Brazil, following the limits defined in the Brazilian standard.*

Keywords*—Construction, occupational hazards, noise, octave band, PPE.

I. INTRODUCTION

Civil Construction in a little more than 150 years, has achieved a growing evolution in the industrial area, through the modernization of processes that were previously done manually. From the mechanization and automation of the production processes and the use of machine tools, the types of occupational hazards were mainly ergonomic began to have the noise not as a new problem, but there was the intensification, due to the use of mechanized equipment.

Andrade (2004) says that since then, techniques aimed at reducing noise levels and vibrations typical of this industry have been disseminated, although levels of hearing damage have been raised by unprotected and continuous exposure to them at the construction site.

Technological advances bring undisputed benefits to the construction industry, so that the workers are benefited, the concern with the risks arising should be made according to specific technical standards.

Through this scenario, it became indispensable to demonstrate the types of noise, to discern it from a term almost always used as its synonym: the sound (DIAS, 2015). Sound is used for pleasurable sensations such as music or speech, while noise is used to describe an undesirable sound such as horn, blast, traffic noise and machines (SANTOS, 1996). This annoying aspect of noise is then treated as aggressive, as noise pollution, causing "hypo acoustics and deafness in adults" (AZEVEDO 1993).

In addition to the loss in the worker's working life, Medeiros (2011), endorse in his work, based on the data costs of Social Security and the relevance of occupational noise induced hearing loss - NIHL, the legal and ethical

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necessity of the careful adoption of effective measures by companies that guarantee the health and integrity hearing. This work arises from the need to meet these criteria applied to workers in the Civil Construction industry.

II. LITERATURE REVISION

The construction industry presents particular characteristics that build a dynamic structure, complex and with a high degree of risk inherent in the activities developed(ANDRADE, 2004). Construction workers, in most activities, do not find adequate protection for their health and physical integrity. Dias (2015), JORGE highlights among the main problems reported in the sector are the effects caused by the excessive noise of equipment that is routinely used in the construction sites.

2.1 SOUND AND NOISE

The sound or noise is formed by the variation of the atmospheric pressure audible to the human ear. For Mateus (2008), the distinction between sound and noise is subjective, not only depends on frequency and amplitude, but the sound is associated with pleasant sensations (music and voice) and noise associated with unpleasant sensations.According to BISTAFA (2011), sound is a sensation produced in the auditory system, and noise is a sound without harmony, usually of negative connotation.

For Iida (2005), physically, the noise is a mixture of vibrations, measured on a logarithmic scale, in a unit called decibel (dB). The human perception of sound occurs in the range of frequency and amplitude of fluctuation that characterize the threshold of hearing. Frequency is the full rate of change of pressure that generates sound, determined by cycles of a second and known worldwide by Hertz (Hz).According to Gerges (2000), the threshold of human hearing is between 20 Hz and 20 kHz. Above the threshold of painful perception can damage the hearing aid. The frequencies below the hearing threshold are called infrasound; the frequencies above the threshold of hearing are called as ultrasonic.

2.2 Sonorous spectrum

The sonorous spectrum is an approach little explored in general terms of the concern with the selection of hearing protectors, the characteristic that distinguishes between serious sounds and acute sounds is called height, which is a function of frequency. High frequencies generate high sounds, and low frequencies generate bass sound. For Bistafa (2011), sounds with a frequency of less than 200 Hz may be considered serious; average sounds between 200 and 2000 Hz; and treble ones above 2000 Hz.Generally noise sources generate sounds that are not considered pure.According toBistafa (2011), sounds at a single frequency are known as pure tones, but commonly heard sounds are almost never pure tones. For Medeiros (2011), what you hear are usually combined sounds of pure tones at various frequencies.

The identification of the frequency of each tone that composes the sound applies to the direct Fourier transform to extract the sound spectra. The sonorous spectrum provides the effective value of the sound pressure for each frequency present in the sound.The pure tone is a single frequency sound. According to Mateus (2008), the human ear does not respond linearly to frequency variations, the difference between a sound of 250 Hz and a sound of 125 Hz is close to the difference between a sound of 2000 Hz and a d 1000 Hz. frequency representation, in the form of octaves. In the octave bands, the upper limit of each frequency band is approximately double the frequency of the respective lower limit, it is generally associated with the octave band at its central frequency, given by the square root of the final product.ForBistafa (2011), the total pressure level of a noise frequency spectrum can be obtained by a decibel meter with 1/1 octave band filter, equation 2.1 represents the log sum formula.

$$NPSt = 10log_{10}[10^{(NPS125Hz/10)} + 10^{(NPS250Hz/10)} + 10^{(NPS500Hz/10)} + 10^{(NPS1kHz/10)} + 10^{(NPS2kHz/10)} + 10^{(NPS4kHz/10)} + 10^{(NPS500Hz/10)} + 10^{(NPS1kHz/10)} + 10^{(NPS2kHz/10)} + 10^{(NPS31,5Hz/10)}] \quad (2.1)$$

The result is extracted directly from the decibel meter to a computer program via the USB cable, these results are used in the various analyzes.

Leq represents the continuous (stationary) level equivalent in dB (A), which has the same potential for hearing loss as the varied level considered.

2.3 Total Sound Pressure Level

Corresponds to a simple global measure, disregarding the frequency bands, the equipment that helps to obtain this measure is the simple decibel meter. There are two variables that determine the potential for harm to human hearing. The relationship of different NPS with varying exposure times is given by Equivalent Noise Level - Leq.The Equivalent Level represents the integration of sound over a period of time, is defined by the equation2.2

$$Leq = 10 \log (1/T) \int_0^T [P^2(t)/P_0^2]dt \quad (2.2)$$

where:

T is the time of integration;

P(t) is the instantaneous acoustic pressure;

P0 is the reference acoustic pressure ($2x10^{-5}$ N/m^2);

Leqrepresents the continuous (stationary) level equivalent in dB(A), which has the same potential for hearing loss as the varied level considered.

2.4 Noise dose

The Annex n° 1 of Regulatory Norm NR-15 of Portaria 3214/78 of Brazil that defines unhealthy activities and

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operations, shows the tolerance limits table for continuous or intermittent noise.

The noise dose represents the percentage of noise to which the worker was exposed during the period of his working day.The dose is obtained through the dosimeter, an equipment composed of a microphone to be installed near the worker's hearing zone, and that integrate the noise levels on the journey, offering the noise dose, which should not exceed 100%.

According to item "b" paragraph 9.3.6.2 of regulatory standard9 of Brazilian legislation, which deals with the Environmental Risk Prevention Program (PPRA), for a dose above 50% equivalent to 80dB (A) for 8h, minimizes the probability, that the exposure will exceed the exposure limits.

If no dosimeter is available, the calculation of the dose can be carried out by means of the instantaneous readings of a common decibel meter using the following equation:

$$D= C_1/T_1+ C_2/T_2+ C_3/T_3+... C_n/T_{nvvvv} \quad (2.3)$$

where:

$C_n$is the actual time of exposure to a specific NPS;

$T_n$is the total time allowed for that NPS.

2.5 Occupational Noise-Induced Hearing Loss

According to MEIRA et al 2013, PAIRO is a gradual decrease in auditory acuity due to prolonged occupational exposure to high sound pressure levels (> 85 dB (A) for 8 hours / day).For Maia (2001a perdaauditivainduzidapeloruído de origemocupacional, conhecidacomo noise-induced pernianent threshold shift (NIPTS), can be defined as a cumulative, bilateral, sensorineural loss that manifests over the years.It results from chronic exposure to noise from sound pressure levels of 80 to 120 dB(A) in the workplace. It is possible to prevent PAIRO and for this, preventive programs should include actions to eliminate noise, effective actions are shown by (TAK; DAVIS; CALVERT, 2009). In their impossibility, the exposures can be controlled initially from collective and / or individual measures that help to reduce the levels of noise that reach the worker (EL-DIB, 2007; MEIRA, 2012; NELSON et al., 2005; CONCHA-BARRIENTOS et al., 2004). The protection measures should have, as a matter of priority, a collective nature, based on the control of the emission at the main source of exposure, the propagation of the agent in the work environment and actions at the administrative level. However, the most common measure has been that of an individual character, which refers to the use of hearing protection equipment (KIM et al, 2010; EL-DIB, 2007).

2.6 Personal Protective Equipment (PPE)

It is considered as the last option in the actions taken to reduce occupational noise to levels acceptable according to the regulatory standard 6 (NR-6), PPEis any device or product, of individual use used by the worker, intended to protect against risks that may threaten safety and health at work.The NR-6 also has a list of PPE; among them is the PPE for hearing protection, which can be of three types: circum-auricular hearing protector; ear protector; semi-auricular ear protector(BRASIL, 2010).

2.7 Noise Reduction Rating (NRR)

Obtained for the PPE are provided by the manufacturers in accordance with the regulations of the standards bodies. However, the actual value of noise attenuation resulting from the use of the PPE depends on the interaction of three elements: user, types of protector and working environment (CIOTE; CIOTE; HABER, 2005). Currently, the NRR is obtained through laboratory studies based on the ANSI standard (American National Standards Institute) S12.6-1997 (SAMELLI; FIORINI, 2011; CIOTE; CIOTE; HABER, 2005). This norm has brought advances in relation to the previous ones, however, it still distances itself from the reality, once the average of the values obtained with a group of individuals in the laboratory does not always correspond to the performance of the user in professional environment. The ideal condition would be the individual assessment from the placement of the PPE by the users in their work environment (SAMELLI; FIORINI, 2011).

2.8 Hearing Protectors

Various types, brands and models of hearing protectors are available in the market. According to Gerges (2000), the selection of a particular type of hearing protector should consider the type of noisy environment, comfort, user acceptance, cost, durability, possible communication problems, safety and hygiene.

The selection of Hearing Protectors should take into consideration the following requirements: the environment and work activity, the necessary noise attenuation, the Certificate of Approval - CA of the Ministry of Labor and Employment, comfort of protector for the user, medical disorders, and compatibility with other PPE's, such as helmets, glasses, etc.

Each type of hearing protector has a characteristic noise attenuation. This attenuation is generally associated with reduced data such as mean attenuation and standard deviation in dB per 1/1 octave band and a simple number on global attenuation, such asNoise Reduction Raiting - NRR, o Noise Reduction Raitingsf – NRRsfou o Single Number Rating – SNR supplied by manufacturers and importers of equipment.

O NRR, o NRRsf e o SNR are based on exposure to a pink noise spectrum in a standard environment that does not cover all users.According to BISTAFA 2011, he pink noise is characterized by presenting the drop of 3dB to each octave.An example of pink noise is the noise emitted by TVs out of tune. According to GERGES 2000, these

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reduced values should not be used to accurately calculate attenuator attenuation in other environments. The same author recommends for the evaluation of the efficiency of the hearing protectors the use of the long method.

2.9 Long method

The Long Method tests the average attenuation levels of sound pressure in dB by frequency bands of1/1 octave, from 125Hz to 8kHz, provided by the hearing aid manufacturer with the frequency band spectra obtained in the working environment, through a decibel meter with 1/1 octave band filter.According toGerges (2000), this method provides the total ear level protected by a particular ear protector and the total attenuation provided by this equipment in a particular working environment. To obtain the total noise to which the workers are exposed one must realize the logarithmic sum of the NPS. In order to obtain the total attenuation of a given ear protector, with 98% confidence, the total noise subtracted by the logarithmic sum of the mean attenuation of NPS in the frequencies of 125Hz, 250Hz, 500Hz, 1kHz, 2kHz, 4kHz, 8kHz, discarded from two standard deviations, obtained in the EPP Certificate of Approval.

III. MATERIALS AND METHODS

3.1 TypeandNatureofResearch

This work has a descriptive, exploratory and comparative nature, since it was done a survey of the legislation and techniques of risk recognition related to occupational noise, then collected the data in the field through equipment and standardized techniques and after comparing the data collected with the specifications.

3.2 Data collect

The data collection was performed through a direct application to the construction site by the author himself with the aid of a decibel meter with octave band filter, and dosimetry with dosimeter equipment, all equipment owned by the company JFR Engenharia de Segurança do Trabalho.

3.3 Collection point

Data collection was carried out at the construction site of the company Construtora ETAM Ltda, construction is the construction of the level crossing of the Avenue Governador José Lindoso (Av. das Torres) with AvenueTimbiras, no bairro da Cidade Nova I, Manaus-Am-Brazil.

3.4 Collection period

Data collection was carried out between May 15 and 18, 2017, the collection was performed during the work 8:00hs e 17:00hs.

3.5 Noise sources

The selected noise sources were the ones that generated the most noise in the work, the activity was the completion of a retaining wall which received projected concrete blasting, for that activity was used a breaker hammer Wacker Neuson EH9, a compressor XAS 420 Atlas Copco, a designed concrete pump CP6 and a concrete mixer truck and concrete projection nozzle, these items will be illustrated below.

In figure 3.1 shows the complete system of the concrete projection set in the work studied, the application as explained above was performed in a retaining wall on the sideof the work.

Fig.3.1: Concrete projection system.
Source: Author.

In this system the designed concrete pump is fed concrete by the truck mixer and fed air by the compressor, the pump projects the concrete that passes through the mangrove and exits through the concrete projection nozzle.

The air compressor, whose basic feature is to convert mechanical movements generated by electric energy, or

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possibly some other form of energy such as diesel and gasoline engines in compressed air.

The projected concrete consists of a continuous process of projecting concrete or mortar under pressure (compressed air) which, through a hose, is led from a mixing equipment to a projector nozzle, and launched with great speed on the base.

In the study the pump used is dry. In the nozzle projector there is a water inlet that is controlled by the operator. The dry concrete is brought under pressure to the nozzle where it receives the water and the additives.

The truck mixer is responsible for receiving the machined concrete from the metering plant and transporting it to the application site at the works. However, the function of the concrete mixer truck is not unique and exclusive to transport the concrete. In addition, the concrete mixer trucks are also responsible for mixing the materials (water, stone, sand, cement, sand and additives) to transform them into concrete. In the study system as a whole the concrete mixer truck feeds the concrete projection pump.

The standard specifying the projected concrete is DNIT 087/2006 – ES, that deals with the Execution and finishing of the projected concrete - Specification of service.

3.6Processing of collected data

The results of the data collected through the equipment described in item 3.2, were downloaded to a portable computer used to perform the experiments has the following configurations: processor Intel i7 Core™ i7-3632QM, 2.20 GHz, 4 Gb de RAM e 1 Tb de HD. The operating system was the Windows 10 64-bit in Portuguese language, through the SmartdB Software analysis of Chrompack.

3.7Data Analysis Factors

In order to perform the interpretation and evaluation of the results, the Occupational Hygiene Standard – (NHO 01 In Brazil)more conservative tolerance limits, which guarantee a higher level of protection, since it is in line with the technical principles of ACGIH.

The factors used in this study are: Lavg, leq, twa and nen. The NHO 01 defines the abbreviations and main test items relationships.

LEQ - means Equivalent Level, is defined by the expression:

$$LEQ=80+10 * \log (0,16 * Dose\% / T\ horas) \quad (3.1)$$

It represents the average level of noise during a certain period of time, using the increment of dose doubling "3".The rule of equivalence principle for noise assessment considers that whenever the acoustic energy in a given environment doubles, there is three decibels increase in noise level.

The equivalent continuous audio pressure level is widely used around the world as an index for noise. It is defined as "The weighted level of audio pressure of a noise fluctuating within a period of time, expressed as the average amount of energy."The result is expressed in db (A), which represents a reasonable approximation of the human perception of sonority.

LAVG - The term means Average Level, is defined by the expression:

$$LAVG=80+16,61 * \log (0,16 * Dose\% / T\ horas) \quad (3.2)$$

It represents the mean of the noise level during a certain period of time, using any increase in dose doubling, except for the "3". Annex 1 of NR - 15 does not specify the increase in dose doubling used for the calculation of established tolerance limits, but after analyzing the table, it is verified that whenever there is an increase of 5 decibels

TWA - Time Weighted Average, represents the weighted average of the sound pressure level for a day of 08 hours. It is important to note that the TWA can only be used if the measurement time is exactly 08 hours, and always using the dose doubling increment "5". If the measurement time is higher or lower than 08 hours, there will be an overestimated or underestimated result, respectively. When we find the acronym TWA (08h), it means that the original TWA formula has been changed to the same as the LAVG, and the results are both identical.

NEN - The term stands for Normalized Exposure Level and represents the Mean Level (LAVG, TWA, LEQ) converted to a standard 8-hour journey for purposes of comparison to the 85 dBA tolerance limit.The calculation of the NEN is requested by the INSS in its Normative Instructions only for purposes of launching in the PPP. If the average level of noise exposure refers to an eight-hour day, the resulting value, after applying the NEN formula, will be identical to the average level, and there is no change. If the working day is different from eight hours (six, twelve, twenty-four hours, etc.), the NEN should be calculated and the result compared to the tolerance limit of 85 dBA. An important reminder is that the calculation of NEN in Fundacentro's NHO-01 is presented for the increment of dose doubling "3". To use the NHO-01 formula it is necessary to correct it for the dose doubling increment "5".

IV. RESULT AND DISCUSSIONS

4.1 Evaluation of the noise of the martelete

4.1.1 Dosimeter configuration (Martelete)

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Dosimeter configuration 01		Dosimeter configuration 02	
Criterion Level:	85 dB	Criterion Level:	85 dB
Threshold level:	85 dB	Threshold level:	85 dB
Exchange rate:	3 dB	Exchange rate:	5 dB
Frequency weighting:	A	Frequency weighting:	A
Time weighting:	Slow	Time weighting:	Slow

Fig.4.1 – Noise meter settings for the marteleteprocess.
Source: Author.

The Figure 4.1 shows dosimeter configurations according to Regulatory Standard 15 (NR-15) and Occupational Hygiene Standard 01 (NHO-01). For dosimeter 01 (NR-15) the Criterion Level is set to 85dB, Threshold Level is 80dB, doubling rate is 3dB with frequency weighting A and time weighting Slow. For Dosimeter 02 (NHO-01), the Criterion Level with 85dB, Threshold Level of 80dB, doubling rate is 5dB with frequency weighting A and Slow time weighting, default is set for performing the noise evaluation.

4.1.2 Doimeterresults (Martelete)

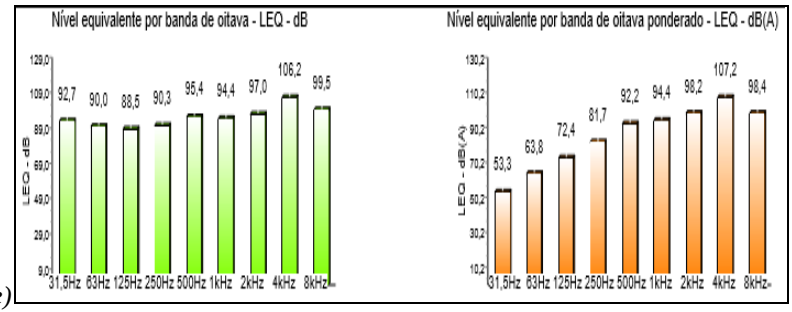
Resultados Dosímetro 01				Resultados Dosímetro 02			
LAVG:	108,3 dB(A)	LMAX:	120,1 dB(A)	LAVG:	105,4 dB(A)	LMAX:	120,1 dB(A)
LEQ:	108,3 dB(A)	$LMAX_{Time}$:	14:52	LEQ:	108,3 dB(A)	$LMAX_{Time}$:	14:52
TWA:	98,0 dB(A)	$Lpico_{>115dB}$:	133,1 dB(A)	TWA:	88,0 dB(A)	$Lpico_{>115dB}$:	133,1 dB(A)
NEN:	108,3 dB(A)	$Lpico_{Time}$:	14:59	NEN:	105,4 dB(A)	$Lpico_{Time}$:	14:59
DOSE:	2083,20%	Lmin:	70,9 dB(A)	DOSE:	159,70%	Lmin:	70,9 dB(A)
$DOSE_{8horas}$:	21777,10%	$DOSE_{p8hs}$:	21777,10%	$DOSE_{8horas}$:	1691,20%	$DOSE_{p8hs}$:	1691,20%

Fig.4.2 – Noise measurements according to NR-15 and NHO01 for the martelete process.
Source: Author.

In figure 4.2, the results of the noise measurement are presented. Of these results, what is most important in the evaluation is the NEN (Normalized Exposure Level) to compare with the tolerance limit of NR-15 and NHO-01. NEN with the NR-15 parameters presented a result of 108.3dB(A) that is above the tolerance limit of 85dB(A). The NEN with the NHO-01 parameters presented a result of 105.4dB(A) that is above the tolerance limit of 85dB(A). The exposure dose for 8 hours is 1691.2% of the acceptable, more than 16 times the maximum dose.
All indices are above the limit specified by the NR-15, which limits the worker's exposure to noise by 85dB.

4.1.3 Level ofequivalence per octaveband

Equivalent level per eighth Equivalent level per weighted



(Martelete)

Fig.4.3 – Equivalent noise level per octave band without weight and with weighting curve A for the martelete process.
Source: Author.

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In figure 4.3 the equivalent level is presented by weighted octave band the noise that the worker was exposed (31.5Hz, 63Hz, 125Hz, 250Hz, 500Hz, 1kHz, 2kHz, 4kHz, 8kHz). The equivalent level per octave band - LEQ-dB, in the illustration the green bar histogram, shows the actual noise the equipment collects. The equivalent level by weighted octave band - LEQ-dB(A), the histogram with orange bars, which gives a reasonable approximation of the human perception of sonority, that is, represents the perception of the human ear to the noise.

All noise values for the LEQ-dB frequency bands are above the 85 dB (A) threshold specified by the NR-15.

It is possible to note that the weighted octave band equivalent values LEQ-dB(A), corresponding to the frequencies of 500Hz, 1kHz, 2kHz, 4kHz and 8kHz, even with weighting, exceed the specified 85 dB (A) by NR-15. One mistake would be to calculate the noise output through a simple average, which would return a value of 84.62dB (A), which results in false compliance with the maximum exposure limits.

4.1.4 Result with use of EPP (Martelete)

Result with the use of EPP - Calculation by the long method ABNT NBR 16077

			Assumed protection							
Type of hearing protector	Nº CA	Validity	LEQ	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Shell type	29176	28/03/2021	87,9	68,4	71,7	78,2	70,4	69,2	86,2	79,4

Fig.4.4 – Calculation of the efficiency of the ear protector for the martelete process.
Source: Author.

In Figure 4.4, the efficiency of the ear protector is presented according to the long method of ABNT-NBR 16077 that used the octave band frequencies for the calculation.

In this case it is possible to note that the CA 29176 ear protector is not sufficient to let the noise below the 85dB(A) threshold as soon as the LEQ is 87.9dB, so the worker is exposed to noise that is harmful to the both regarding NR-15 and NHO-01.

In this case the actions suggested according to NR-15 is the application of the rest interval for the worker.

4.2 Evaluation of compressor noise

4.2.1 Dosimeter Configuration (Compressor)

Dosimeter configuration 01		Dosimeter configuration 02	
Criterion Level:	85 dB	Criterion Level:	85 dB
Threshold level:	85 dB	Threshold level:	85 dB
Exchange rate:	3 dB	Exchange rate:	5 dB
Frequency weighting:	A	Frequency weighting:	A
Time weighting:	Slow	Time weighting:	Slow

Fig.4.5 – Noise meter settings for the compressor process.
Source: Author.

In the figure 4.5 shows dosimeter configurations according to Regulatory Standard 15 (NR-15) and Occupational Hygiene Standard 01 (NHO-01). For dosimeter 01 (NR-15) the Criterion Level is set to 85dB, Threshold Level is 80dB, 3dB doubling rate with frequency weighting A and time weighting Slow. For Dosimeter 02 (NHO-01), the Criterion Level with 85dB, Threshold Level of 80dB, 5dB doubling rate with frequency weighting A and Slow time weighting, default is set for performing the noise evaluation.

4.2.2 DosimeterResults(Compressor)

Result dosimeter 01

Result dosimeter 02

Resultados Dosímetro 02

LAVG:	89,1 dB(A)	LMAX:	114,5 dB(A)	LAVG:	87,2 dB(A)	LMAX:	114,5 dB(A)
LEQ:	89,2 dB(A)	$LMAX_{Time}$:	10:40	LEQ:	88,9 dB(A)	$LMAX_{Time}$:	10:40
TWA:	84,7 dB(A)	$Lpico_{>115dB}$:	127,8 dB(A)	TWA:	79,7 dB(A)	$Lpico_{>115dB}$:	127,8 dB(A)
NEN:	89,1 dB(A)	$Lpico_{Time}$:	10:40	NEN:	87,2 dB(A)	$Lpico_{Time}$:	10:40
DOSE:	92,40%	Lmin:	59,4 dB(A)	DOSE:	48,30%	Lmin:	59,4 dB(A)
$DOSE_{8horas}$:	259,30%	$DOSE_{p8hs}$:	259,30%	$DOSE_{8horas}$:	135,50%	$DOSE_{p8hs}$:	135,50%

Fig.4.6 – Noise measurements according to NR-15 and NHO01 for the compressor process.
Source: Author.

The noise measurement results are shown in Figure 4.6. In these results, what is most important in the evaluation is the NEN (Normalized Exposure Level) to compare with the tolerance limit of NR-15 and NHO-01. The NEN with the NR-15 parameters presented a result of 89.1 dB(A) that is above the tolerance limit of 85dB(A). The NEN with the NHO-01 parameters presented a result of 87.2 dB (A) that is above the tolerance limit of 85db (A).

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The exposure dose for 8 hours is 135.5% of the acceptable dose.

The indices are above the limit specified by the NR-15, which limits the worker's exposure to noise by 85dB.

4.2.3 Equivalence level per octave band (Compressor)

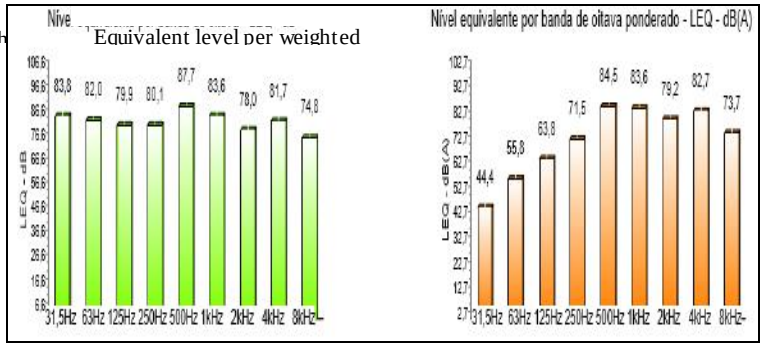

Fig.4.7 – Equivalent noise level per octave band without weight and with weighting curve A. for the Compressor process.
Source: Author.

In figure 4.7 is presented the equivalent level by weighted octave band the noise that the worker was exposed (31.5Hz, 63Hz, 125Hz, 250Hz, 500Hz, 1kHz, 2kHz, 4kHz, 8kHz). The equivalent level per octave band - LEQ-dB, in the illustration the green bar histogram, shows the actual noise the equipment collects. The equivalent level by weighted octave band - LEQ-dB(A), the histogram with orange bars, which gives a reasonable approximation of the human perception of sonority, that is, represents the perception of the human ear to the noise. For the equivalent level values per octave band - LEQ-dB. Only the respective noise values of the 500Hz frequency bands are above the 85 dB (A) threshold specified by the NR-15.

It is possible to note that all values of the equivalent level per weighted octave band - LEQ-dB(A), corresponding to the frequencies are below the limit of 85 dB(A) specified by the NR-15. For the analyzed process, it is not necessary to use the ear protector, but the one on the construction site is exposed to indirect noises from noise sources that normally exceed the limit, and it is always mandatory to use the ear protector in the premises of the site. work.

4.2.4 Result with use of EPP's (Compressor)

Result with the use of EPP - Calculation by the long method ABNT NBR 16077

			Assumed protection							
Type of hearing protector	Nº CA	Validity	LEQ	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Shell type	15624	07/05/2020	65,8	55,8	58,5	61,5	59,6	52,2	52,7	41,7
Shell type	27971	05/11/2018	69,9	60,8	60,5	65,5	64,6	57,2	56,7	46,7
Preformed type	13027	28/02/2018	76,6	56,8	61,5	73,5	71,6	61,2	67,7	50,7

Fig.4.8 – Calculation of the efficiency of the ear protector for the compressor process.
Source: Author.

In figure 4.8, it is presented to the efficiency of the ear protector according to the long method of ABNT-NBR 16077 that used the frequencies of octave band for the calculation. In this case it is possible to notice that all ear protectors analyzed are efficient, since the noise was already below the tolerance limit with regard to NR-15 as with respect to NHO-01.

4.3 Evaluation of concrete mixer truck

4.3.1 Dosimeter configuration (truck mixer)

Dosimeter configuration 01		Dosimeter configuration 02	
Criterion Level:	85 dB	Criterion Level:	85 dB
Threshold level:	85 dB	Threshold level:	85 dB
Exchange rate:	3 dB	Exchange rate:	5 dB
Frequency weighting:	A	Frequency weighting:	A
Time weighting:	Slow	Time weighting:	Slow

Fig.4.9 – Noise gauge settings for truck mixer process.
Source: Author.

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The figure 4.9 shows dosimeter configurations according to Regulatory Standard 15 (NR-15) and Occupational Hygiene Standard 01 (NHO-01). For dosimeter 01 (NR-15) the Criterion Level is set to 85dB, Threshold Level is 80dB, 3dB doubling rate with frequency weighting A and time weighting Slow. For Dosimeter 02 (NHO-01), the Criterion Level with 85dB, Threshold Level of 80dB, 5dB doubling rate with frequency weighting A and Slow time weighting, default is set for performing the noise evaluation.

4.3.2 Dosimeterresults (Concrete mixertruck)

Result dosimeter 01

Resultac	Result dosimeter 02			Resultados Dosímetro 02			
LAVG:	100,1 dB(A)	LMAX:	117,6 dB(A)	LAVG:	95,6 dB(A)	LMAX:	117,6 dB(A)
LEQ:	100,1 dB(A)	$LMAX_{Time}$:	09:57	LEQ:	100,1 dB(A)	$LMAX_{Time}$:	09:57
TWA:	92,4 dB(A)	$Lpico_{>115dB}$:	134,1 dB(A)	TWA:	82,8 dB(A)	$Lpico_{>115dB}$:	134,1 dB(A)
NEN:	1^^ 6 dB(A)	$Lpico_{Time}$:	10:11	NEN:	96,4 dB(A)	$Lpico_{Time}$:	10:11
DOSE:	569,20%	Lmin:	70,4 dB(A)	DOSE:	74,80%	Lmin:	70,4 dB(A)
$DOSE_{8horas}$:	3274,70%	$DOSE_{p8hs}$:	3684,10%	$DOSE_{8horas}$:	434,60%	$DOSE_{p8hs}$:	489,00%

Fig.4.10 – Noise measurements according to NR-15 and NHO01 for the truck mixer process.
Source: Author.

In figure 4.10, the results of the noise measurement for the truck mixer process are presented. Of these results, what is most important in the evaluation is the NEN (Normalized Exposure Level) to compare with the tolerance limit of NR-15 and NHO-01. The NEN with the NR-15 parameters presented a result of 100.6 dB (A) that is above the tolerance limit of 85dB (A). The NEN with the NHO-01 parameters presented a result of 96.4 dB (A) that is above the tolerance limit of 85db (A). The exposure dose for 8 hours is 434.6%, well above acceptable.

4.3.3 Level of equivalence per octave band (Mixer truck)

Equivalent level per eighth band - LEQ dB

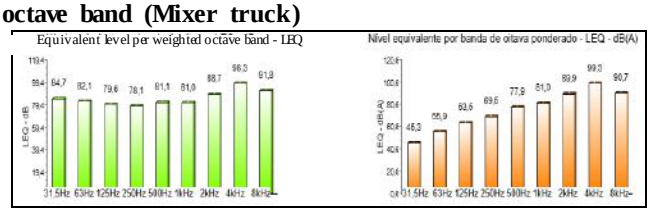

Fig.4.11 – Equivalent noise level per octave and without weight and with A. Weighting curve for thetruckmixerprocess.
Source: Author.

The figure 4.11 shows the equivalent level by weighted octave band the noise the worker was exposed (31.5Hz, 63Hz, 125Hz, 250Hz, 500Hz, 1kHz, 2kHz, 4kHz, 8kHz). The equivalent level per octave band - LEQ-dB, in the illustration the green bar histogram, shows the actual noise the equipment collects. The equivalent level by weighted octave band - LEQ-dB(A), the histogram with orange bars, which gives a reasonable approximation of the human perception of sonority, that is, represents the perception of the human ear to the noise. For values of the equivalent level per octave band - LEQ-dB(A), the noise values of the respective 2 kHz, 4 kHz, 8 kHz frequency bands are above the 85 dB(A) threshold specified by the NR-15.

The equivalent level values per weighted octave band - LEQ-dB(A), corresponding to the frequencies 2kHz, 4kHz, 8kHz are above the 85 dB(A) threshold specified by the NR-15. If the sound pressure result was calculated arbitrarily, the value would be 74.77 dB(A), which would generate a false result and would harm the worker.

4.4.4 Result with use of EPI's (Concrete Mixer Truck)

Result with the use of EPP - Calculation by the long method ABNT NBR 16077

			Assumed protection							
Type of hearing protector	Nº CA	Validity	LEQ	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Preformed type	5745	31/01/2019	84,6	54,5	56,5	63,9	65,0	68,9	84,3	68,7
Preformed type	19578	07/02/2018	89,9	59,5	65,5	70,9	72,0	76,9	89,3	76,7

Fig.4.12 – Calculation of the efficiency of the ear protector for the truck mixer process.
Source: Author.

The figure 4.12 shows the results of the efficiency of the ear protectors according to the long method of ABNT-NBR 16077 that used the octave band frequencies for the calculation. In this case it is possible to note that the CA 19578 Pre-Insertion Insert Earphone, the LEQ shows 89.9 dB(A), and the 4 kHz frequency has 89.3 dB(A), both are

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above the limit of tolerance with respect to NR-15 as with respect to NHO01.

In this analysis it is important to verify that for two protectors of the same type of pre-insertion, different results were obtained, one of the practices used in the companies is to standardize the use of auricular protector by separate function by color, or a specific color for visitors, which often ends up exposing the worker or visitor to noise above the tolerance limit.

4.4 Evaluation of the noise of the concrete projector nozzle

4.4.1Dosimeterconfiguration (concrete projection)

Dosimeter configuration 01		Dosimeter configuration 02	
Criterion Level:	85 dB	Criterion Level:	85 dB
Threshold level:	85 dB	Threshold level:	85 dB
Exchange rate:	3 dB	Exchange rate:	5 dB
Frequency weighting:	A	Frequency weighting:	A
Time weighting:	Slow	Time weighting:	Slow

Fig.4.13 – Noise meter settings for concrete projection.
Source: Author.

In the figure 4.13 shows dosimeter configurations according to Regulatory Standard 15 (NR-15) and Occupational Hygiene Standard 01 (NHO-01). For dosimeter 01 (NR-15) the Criterion Level is set to 85dB, Threshold Level is 80dB, 3dB doubling rate with frequency weighting A and time weighting Slow. For Dosimeter 02 (NHO-01), the Criterion Level with 85dB, Threshold Level of 80dB, 5dB doubling rate with frequency weighting A and Slow time weighting, default is set for performing the noise evaluation.

4.4.2 Dosimeterresults (concrete projection)

Result dosimeter 01

Result dosimeter 02

Resultados Dosímetro 02

LAVG:	103,8 dB(A)	LMAX:	117,4 dB(A)	LAVG:	100,9 dB(A)	LMAX:	117,4 dB(A)
LEQ:	103,8 dB(A)	$LMAX_{Time}$:	15:00	LEQ:	103,8 dB(A)	$LMAX_{Time}$:	15:00
TWA:	97,8 dB(A)	$Lpico_{>115dB}$:	130,8 dB(A)	TWA:	90,9 dB(A)	$Lpico_{>115dB}$:	130,8 dB(A)
NEN:	103,5 dB(A)	$Lpico_{Time}$:	15:00	NEN:	100,4 dB(A)	$Lpico_{Time}$:	15:00
DOSE:	1959,40%	Lmin:	59,4 dB(A)	DOSE:	228,40%	Lmin:	59,4 dB(A)
$DOSE_{8horas}$:	7699,30%	$DOSE_{p8hs}$:	7218,10%	$DOSE_{8horas}$:	906,30%	$DOSE_{p8hs}$:	849,60%

Fig.4.14 – Noise measurements according to NR-15 and NHO01 for the concrete projection process.
Source: Author.

In Figure 4.14, the results of the noise measurement for the truck mixer process are presented. Of these results, what is most important in the evaluation is the NEN (Normalized Exposure Level) to compare with the tolerance limit of NR-15 and NHO-01. The NEN with the parameters of the NR-15 presented a result of 103.5 dB (A) that is above the tolerance limit of 85dB (A). The NEN with the NHO-01 parameters presented a result of 100.4 dB (A) that is above the tolerance limit of 85db (A). The exposure dose for 8 hours is 906.3%, well above acceptable.

4.4.3 Level of equivalence per octave band (concrete projection)

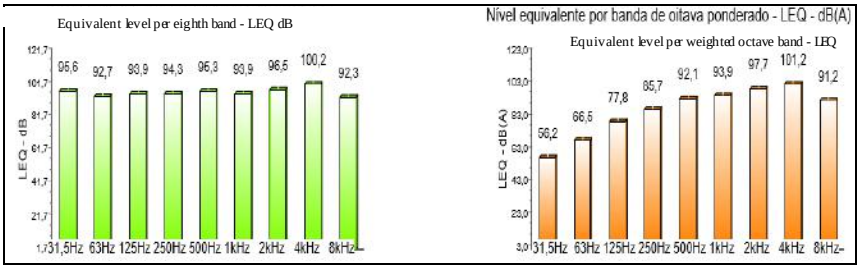

Fig.4.15 – Equivalent noise level per octave band without weight and with A-weighting curve for the concrete projection process.
Source: Author.

In the figure 4.15 shows the equivalent level by weighted octave band the noise the worker was exposed (31.5Hz, 63Hz, 125Hz, 250Hz, 500Hz, 1kHz, 2kHz, 4kHz, 8kHz). The equivalent level per octave band - LEQ-dB, in the illustration the green bar histogram, shows the actual noise the equipment collects. The equivalent level by weighted octave band - LEQ-dB (A), the histogram with orange bars, which gives a reasonable approximation of the human perception of sonority, that is, represents the perception of the human ear to the noise.

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For the equivalent level values per octave band - LEQ-dB, all noise values in respective frequency bands are above the limit of 85 dB(A) specified by the NR-15.

The LEQ-dB (A) weighted octave band equivalent values at the frequencies 250Hz, 500Hz, 1kHz, 2kHz, 4kHz, 8kHz are above the 85 dB (A) threshold specified by the NR-15. If the sound pressure result was calculated arbitrarily, the value would be 84.77 dB (A), which would generate a false result and would harm the worker.

4.4.4 Result using PPE's (concrete projection)

Result with the use of EPP - Calculation by the long method ABNT NBR 16077

			Assumed protection							
Type of hearing protector	Nº CA	Validity	LEQ	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Shell type	27971	05/11/2018	82,6	74,8	74,7	73,1	74,9	75,7	75,2	64,2
Preformed type	13027	28/02/2018	89,3	70,8	75,7	81,1	81,9	79,7	86,2	68,2
Tipo concha	15624	07/05/2020	78,6	69,8	72,7	69,1	69,9	70,7	71,2	59,2
Shell type	5745	31/01/2019	88,0	68,8	72,7	78,1	77,9	76,7	86,2	69,2

Fig.4.16 – Calculation of the efficiency of the ear protector for the concrete projection process.
Source: Author.

In figure 4.16 shows the results of the efficiency of the ear protectors according to the long method of ABNT-NBR 16077 that used the octave band frequencies for the calculation.

In this case it is possible to note that the CA 13027 pre-inserted insert earphone, the LEQ has 89.3 dB (A), and the 4 kHz frequency has 86.2 dB (A), the ear preformed insert No. CA 5745, the LEQ shows 88.0 dB (A), and the 4 kHz frequency shows 86.2 dB (A), both protectors present results above the tolerance limit with respect to NR -15 as with respect to NHO01.

Shell protectors are indicated in this process as they meet all criteria and frequency bands.

V. CONCLUSION

In this work, four of the main noise sources of a construction site were presented, the selected processes were the operations with the Wacker Neuson EH9 breaker, the XAS 420 Atlas Copco compressor noise source, the CP6 designed concrete pump noise, the truck concrete mixer and the concrete projection nozzle, these processes are commonly used in medium and large construction works.

Measurements of noise at source were made using the octave band filter decibelimeter, sound pressure level and octave band spectrum of noise sources, which provided sufficient information to perform the study.

The hearing protectors adopted at the studied construction site were mainly the shell type ear protector N ° CA 15624 and N ° CA 29176, which were efficient for most of the results analyzed, all the operators in the areas of the construction site are instructed to wear the shell-type earpiece, visitors are offered the CA 5745 Pre-Inserted Insert Ear Protector, and all persons are required to wear protective helmet and goggles. The work has a work safety technician and a work safety engineer.

Regarding the evaluation of the efficiency of hearing protector models by the long method, used in the processes of the analyzed construction site.

For the hammer process, the attenuation found with the shell type ear protector No. CA 29176, was above the tolerance limits of both standards, which is unhealthy. Risks have been presented and, according to item 6.6.1.1 Daily dose of NHO-01, where the daily dose of exposure to noise determined is greater than 100%, the exposure limit will be exceeded and will require the immediate adoption of measures, the process presented 159.7%. Also observing item 6.6.1.2 Normalized exposure level, based on the criterion presented in item 5.1.2, when the normalized exposure level (NEN) is greater than 85 dB (A), the exposure limit is exceeded and will require immediate adoption of control measures, the NEM exposure level for the martelete process was 105.4dB (A). In case the action taken is the use of ear protection that meets the level of attenuation and still not meeting, will be applied to the operator rotation according to NR-15.

According to the studies, the noise of the compressor did not exist the characterization of the insalubrity by noise and also met the NHO-01. The daily dose is below 100% for item 6.6.1.2 Normalized exposure level, based on the criterion presented in item 5.1.2, when the normalized exposure level (NEN) is greater than 85 dB (A), the exposure limit will be exceeded and will require the immediate adoption of control measures, the NEM exposure level for the compressor process was at 87.2dB (A), the immediate action is the use of the efficient ear protector. An observation in this process regarding the insalubrity criterion is that the operator who works close to the compressor is exposed to the noise coming from the cement mixer truck and the projection by blasting the concrete, is still exposed to dust and heat, items that were not analyzed in this study.

With the same analysis of the concrete mixer truck and concrete blasting operations, items 6.6.1.1 Daily dose of

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NHO-01, whenever the daily dose of determined exposure to noise exceeds 100%, the limit of exposure will be exceeded and will require the immediate adoption of control measures, both processes presented above 100%, and also observing the item 6.6.1.2 Normalized exposure level, based on the criterion presented in item 5.1.2, whenever the level NEN - is greater than 85 dB (A), the exposure limit is exceeded and will require the immediate adoption of control measures, both processes also show higher than acceptable results.

Even if some protectors show results with attenuation levels within the limit specified in regulatory standards NR-15 and NHO-01 and other specific standards, it is important to note the set of action of the construction site as the sources of environmental risks in a process dynamic and complex and can not be worked in isolation.

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Social Technology and Incubation in Solidarity Economy and Creative Economy in Brazil

Diego Santos Vieira de Jesus, Henrique de Oliveira Santos Vieira de Jesus

[1]Executive Master of Science in Creative Economy, Superior School of Advertising and Marketing, Rio de Janeiro, Brazil.
dvieira@espm.br
[2]InterdisciplinaryNucleus for Social Development, Federal Universityof Rio de Janeiro, Rio de Janeiro, Brazil.
oliveirahenrique2005@gmail.com

***Abstract*—** *The aim is to examine the relations between solidarity economy and creative economy, as well as social technology and the principles for incubation in solidarity economy and creative economy in Brazil. The main argument indicates that one of the main linkages between solidarity economy and creative economy comes from the stimulus both economies can give to the idea of "social technology", which disseminated the concern with the technological bases of a process that would enable the recovery of the citizenship of the most penalized segments, the interruption of the trajectory of social fragmentation and internal economic strangulation of the country and the construction of sustainable development. The incubation of solidarity-based and creative enterprises can be seen asa process connected to social technology, since the development of science and technology can be associated with workers. It can also bring opportunities for pedagogical acts of formation and knowledge building through the practical and educational process of organization of these enterprises and be a university's extension practice, which expresses the bond of the academic community with society. The incubation of solidarity-based and creative enterprises can also be a part of development strategies for impoverished territories. However, it faces constraints, such as lack of resources and personnel.*

***Keywords*— Social technology; incubation; solidarity economy; creative economy; Brazil.**

I. INTRODUCTION

The capitalist economy is characterized by a logic of competition, in which the winners accumulate advantages and the losers have disadvantages for the future disputes. To achieve a society in which equality among all members might prevail, it would be necessary for the economy to be solidary rather than competitive. The "solidarity economy" can only be implemented if it is organized equally by those who associate to produce, trade, consume or save. The key to this proposal is the association between equals rather than the contract between unequals. In the prototype of a solidarity economy enterprise, there is no competition among the partners and, if the initiative progresses and accumulates capital, everyone wins equally. The idea of solidarity economy is connected to making society less unequal. It is an alternative mode of production whose basic principles are the collective or associated property of capital and the right to freedom (Singer 2002).

Another transformation takes place at the same time in which solidarity economy develops. The capital generated in the society is gradually based on people's intellectual resources (Bendassolli et al. 2009), which can be seen in a set of diverse activities based on individual and collective talents or abilities, such as crafts, fashion, audiovisual and music, for example (Miguez 2007). These activities can be included into what can be called "creative economy", which refers to activitiesthat encompass the production, distribution and fruition of goods and services based on texts, symbols and images and activities guided by creativity, talent or individual ability (Jesus &Kamlot 2016). Creative economy highlighted the need for collaborative networks and models, as well as the development of new technologies to produce creative goods and services and generate creative content. These changes created possibilities for the generation of income and jobs, the extension of access to cultural goods and services and the promotion of social inclusion, especially in underdeveloped and developing countries (Reis 2008). It is possible to imagine that solidarity economy and creative economy have intersections regarding the promotion of socioeconomic development. Many enterprises in both economies sometimes need the support from incubators, based in principles such as cooperation, solidarity, respect for the environment and self-management.

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In the Brazilian case, incubators which act in solidarity economy and creative economy allow the expansion of the relationship between political, economic and social actors to meet the population demands. Such incubators assist enterprises because they can provide support to self-organizing processes of socially marginalized groups and produce inputs for research, which builds learning processes and mobilizes multiple areas of knowledge and professional fields. They are distinguished from conventional technological incubators because they are based on principles such as social inclusion and popular participation. They do not only refer to the planning and management instruments designed by traditional companies. The incubation process encompasses economic, political, social and cultural aspects with the aim of developing more democratic and participatory forms of management that focus on workers' well-being (Addor et al. 2018).

The aim of the article is to examine the relations between solidarity economy and creative economy, as well as social technology and the principles for incubation in solidarity economy and creative economy in Brazil. The main argument indicates that one of the main linkages between solidarity economy and creative economy comes from the stimulus both economies can give to the idea of "social technology", which disseminated the concern with the technological bases of a process that would enable the recovery of the citizenship of the most penalized segments, the interruption of the trajectory of social fragmentation and internal economic strangulation of the country and the construction of sustainable development. The incubation of solidarity-based and creative enterprises can be seen asa process connected to social technology, since the development of science and technology can be associated with workers. It can also bring opportunities for pedagogical acts of formation and knowledge building through the practical and educational process of organization of these enterprises and be a university's extension practice, which expresses the bond of the academic community with society. The incubation of solidarity-based and creative enterprises can also be a part of development strategies for impoverished territories. However, it faces constraints, such as lack of resources and personnel.

II. METHODS

The bibliographic research consisted of reading, selecting and organizing topics on the concepts of social technology, solidarity economy and creative economy and their intersections; the principles for incubation in solidarity and creative economies in Brazil and the main opportunities and challenges presented by this process. The analysis of the results focused on the ways capacities for solidarity and creative economy are developed and stimulated by incubators and the main challenges they face in the process of incubation.

III. RESULTS AND DISCUSSION

Social technology, solidarity economy and creative economy

Dagnino (2004) defines "technology" as the result of the action of a social actor on a work process that he/she controls. However, due to the characteristics of the context of the social agreement and the productive environment in which this social actor operates, the generated product may be appropriated by someone else other than this social actor. According to Feenberg (1999), technology is not neutral and it shapes or conditions lifestyles. It is also selected from a process permeated by the correlation of social and political forces that delimit the space of its consolidation (Feenberg1999).The author proposes a subversive rationalization of technology to democratize the process of development, control and use of technologies and give greater human control over means and ends. This would be a way of extending democracy to the technical domain, democratizing the process of technological conception and application and going beyond the search for profit.

The concept of "social technology" disseminates the concern with the technological bases of a process that would enable the citizenship recovery of the most penalized segments, the interruption of the path of social fragmentation and internal economic strangulation of the country and the construction of sustainable development. Social technology is connected to a process of social innovation, which refers to the provision of some new good or service that results from knowledge – intangible, embedded in people or equipment, tacit or codified – whose objective would be to increase the effectiveness of processes, services and products related to the satisfaction of social needs (Dagnino et al. 2004). In opposition to conventional technology, social technology starts from a critique of the neutrality of science, and its construction considers the need to adapt the current technology to the construction of a society with new social relations of production. Social technologyis characterized by social inclusion and the combat against exclusionary and segregating practices (Henriques et al. 2015).

The greater effectiveness and solidity of social technology can be attributed to a sociotechnical approach that takes into account the heterogeneous set of elements which are responsible for the transformation or

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consolidation of networks they create – inventors, researchers, engineers, managers, workers, government and consumers, for example (Latour 1992) – and the social construction of technology, to the extent that consumer groups and political interests, for example, are considered to influence not only the final form that technology takes, but its content and application (Bijker1995).

In this context, sociotechnical adequacy takes the form of a process of adaptation of scientific-technological knowledge not only to the requirements and purposes of a technical-economic nature, but to the set of socioeconomic and environmental aspects that constitute the relationship between science, technology and society. In defining a new sociotechnical code from which conventional technology would be deconstructed and redesigned in the direction of social technology, one can emphasize the democratic participation in the work process, the fulfilment of requirements related to the environment, the increase in the useful life of machines and equipment, the health of workers and consumers and their self-management training. In this "sociotechnical construction", technological artefacts have their characteristics defined through negotiation between relevant social groups. This can be done by changing the way in which the surplus generated by the adoption of traditional technologies is shared, increasing the worker's knowledge about the productive and managerial aspects and revitalizing and upgrading equipment, for example (Dagnino et al. 2004).

From this moment on, it is possible to see that one of the main linkages between solidarity economy and creative economy comes from the stimulus both economies can give to the idea of "social technology". The solidarity economy is an autonomous way of managing human and natural resources so that social inequalities are reduced in the medium and long term. Its advantage is the rethinking of the relation to profit, turning all the generated work to benefit society, not just a portion of it. In asolidarity-based enterprise, the members may receive no salary, buthave part of the financial benefits, which varies according to the income obtained. Members decide collectively in assembly how this can work, although there is a tendency to pay more for intellectual work than manual labor as a way not to lose the collaboration of more skilled workers. The assumption is that paying better technicians and administrators allows the enterprise to achieve larger gains that benefit all members, including those with smaller parts of the financial benefits. The extra money is usually placed in an education or investmentund (Singer 2002). The self-management may bring more conditions of possibility for social innovation and, with the participation of a diversity of members, the impact of these innovations may bring benefits for the society as whole.

The creative economy presents a broad sectorial aspect by bringing together to the new media and technologies elements of the solidarity economy that have relation with craft, arts and the traditional knowledge, for example. As a development strategy, creative economy recognizes the importance of human abilities and talent to foster the integration of sociocultural and economic goals and, in the light of the changing links between culture and economy with economic and technological transformations, it opens up a range of creative entrepreneurial opportunities, allows the formalization of small enterprises, promotes the generation of income and employment and increases the well-being of the population by stimulating the expression and participation of citizens in the cultural and political life. The intangibility of creativity can generate additional value to products by incorporating cultural characteristics inimitable by excellence and creating synergies between the lifestyle and the environment in which it flourishes. In addition, through social technology, creative economy broadens access to consumption and can define value-creating cultural niches that cross multiple networked sectors, such as handicrafts, antique shops and art fairs (Reis 2008).

Social technology and principles for incubation in solidarity economy and creative economy in Brazil

The incubation of solidarity-based and creative enterprises can be classified as a process connected to social technology, since the development of science and technology may be associated with workers (Dagnino 2010; Guimarães 2002). Solidarity-based and creative enterprises are, from this perspective, focused on the processes of production of goods and services as productive chains intertwine and become sustainable, and incubators can contribute to the modification of companies and groups of workers through technology. Forsuch initiatives to be successful, it would be necessary to train professionals with the support of professors, researchers and undergraduate and graduate students, who would use their potential to generate innovations at the service of solidarity-based and creative enterprises and increase their capacity to develop in a sustainable way in economic, cultural and environmental terms (Leal 2018).

This type of incubation can also be understood as a pedagogical act of formation and construction of knowledge through the practical and educational process of organization of solidarity-based and creative economic enterprises (Singer 2002). This perspective, inspired by the

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work of Freire (2013), points to the process of formation of working classes which are excluded from the market, so that incubation takes the form of a practical and educational process of organization and systemic monitoring of people interested in solidarity-based and / or creative entrepreneurship, generally in impoverished territories where they did not have access to institutions of academic and technical training for work. In this process, the knowledge accumulated by these people, as well as the fundamental knowledge about cooperative work and management and production techniques for insertion in productive chains and local arrangements, is valued. Incubators can mitigate their lack of training by providing technical support to incubated activities for the sustainability and autonomy of enterprises and qualifying the political, managerial, productive and commercial actions of these enterprises (Leal 2018).

In the Brazilian case, incubation may be a university extension practice, which expresses the link between the university and society in the fight against poverty and social exclusion and the interconnection between teaching, research and extension (Santos & Cruz 2008). The interdisciplinary of this process was emphasized by the Brazilian Ministry of Education, as well as by a strong link between the extension finance public notices and specific policies of public agencies. In this context, university extension activities began to be configured to articulate state and society through the higher education institutions (Leal 2018).

Incubation can also be conceived as a strategy for the development of impoverished territories (França Filho & Cunha 2009). In this perspective, incubation includes the territory of a given community as the place for intervention, in which multiple initiatives of an organizational, productive, environmental and cultural nature can be articulated and the flows of capital and income can be organized to regenerate the links and social solidarity and creative networks. In such networks, there are associative, cooperative and other experiences of collective and informal character that maintain more permanent relations with the market, articulate to public policies and construct autonomous exchange circuits. These circuits make possible the exchange of goods, services and knowledge among the enterprises. Cooperation enables the response to situations of insufficient access to productive resources and the fulfilment of market demands (Leal 2018).

The incubation of solidarity-based and creative enterprises can be based on the specialization of the fields of action. It can be directed to specific sectors in view of the institutional trajectory, the available resources and the field of action of each incubator, such as cooperatives of recyclable material collectors and associations of family farmers in solidarity economy and enterprises that bring together artisans, artists and cultural producers in creative economy. Incubation can also be based on the methodological approach. It may only focus on the enterprise itself – expanding its management, technology, production and training capacities – or create territorial networks, which emphasize the interrelations between political, economic and socio-cultural actors. Incubation can be based on training related to specific subjects, usually of short duration, and assume a more technical profile. A generation-based incubation is divided into stages of institutionalization: first-generation incubators are the pioneers, which served as a basis for later incubations; the second-generation ones carry out expansion or replication processes; the third-generation onesare those originating from public policies. Finally, incubation based on origin can be focused on the logic of the success of the enterprise itself; the fulfilment of a function of the university in terms of teaching, research and extension activities or the creation of a channel for access to public policies for socioeconomic development, which makes these incubators assume a more executive profile and have greater capacity to operate large-scale projects (Leal 2018).

Social technology and incubation in solidarity economy and creative economy in Brazil: main opportunities and limitations

The main part of creative and solidarity-based incubators in Brazil is located in the Southeastern region of the country.In the case of solidarity economy incubators, most are in the interior of the federal states (65%), while the rest is located in capitals or metropolitan regions (Addor et al. 2018). In the case of creative economy incubators, many are still located in large urban centers, especially where there is a better infrastructure for artistic and creative services and activities (Jesus &Kamlot, 2016).

Creative and solidarity economy incubators still have a great dependence on federal, state or municipal public resources. Some are supported by universities and private companies, particularly creative economy incubators. Older solidarity-based incubators are able to diversify sources and attract the support from the private and the third sector, but the interruption of funding or the non-continuity of public notices motivate the de-structuring of many actions. One of the main impacts is the demobilization of incubation teams, mainly technicians and students, as well as the logistic difficulty of keeping visits in

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the light of transportation and food expenses (Addor et al. 2018).

In the case of solidarity economy incubators, self-management continues as a horizon to be sought, since they provide collective functioning and decision-making experiences that enrich the trajectory of its participants. Self-management is created, tested, reformulated, and continuously improved. Among the most accomplished activities in the solidarity-based and creative incubation process, one can cite technical, professional and managerial qualification; advising on the planning and preparation and implementation of the business plan; technical and managerial assistance; project design and socio-political training. Other activities developed by the incubators include training courses, the organization of fairs and marketing spaces –which is very common for creative enterprises –, the production of pedagogical materials and technical manuals, the development of management tools and the support for political and institutional articulation (Addor et al. 2018).

In both solidarity-based and creative enterprises which are incubated, the work of incubators focuses predominantly on three points: the structuring of management and administrative practices; the development of productive processes aimed at improving their efficiency and the quality of life of workers; and the improvement of commercialization, fomenting spaces and articulations for the flow of the production of these enterprises. Much of this support is interrupted for lack of staff or resources; however, such incubators continue to be fundamental in the diffusion of solidarity economy and creative economy and the strengthening of support policies. This is because many of them have a range of institutional partners and become referrals in territories where they operate, fostering regional and local socio-economic development policies(Addor et al. 2018).

IV. CONCLUSION

For the development of incubation in solidarity and creative economy in Brazil to be more successful, more social research should be conceived and implemented in association with actions or solutions of collective problems, in which researchers and participants would be involved in cooperative and participative ways. This type of research could enhance the collective awareness of the participants throughout the entire productive process and show greater concern with participatory methods, in the light of the notion of "social technology". The practical objective would be to contribute to a better possible equation of the problem considered as central in the research, with the indication of solutions and the proposal of actions to help agents transform their actions. The goal in terms of knowledge would be to obtain information that would be difficult to access through other procedures and increase knowledge of certain situations (Addor&Alvear, 2015).

To promote the decent integration of workers into the labor market, it would be important to invest in polytechnic education, which seeks to provide the student with the acquisition of technical-operational knowledge and scientific and philosophical foundations that guide certain type of work. The notion of polytechnic education points to the overcoming between professional instruction and general education, in a way that contrasts with the traditional way through which capitalist society organized the educational process. Throughout the development of education in capitalist society, workers were limited to mastering the minimum of necessary knowledge to be efficient in the productive process, but without exceeding this limit. Vocational education had as its presupposition the fragmentation of work in autonomous specialties, so that workers must perform efficiently certain tasks required by the labor market, while scientific-intellectual education was intended for those who should design and control the process. In opposition to such a conception, the idea of polytechnic education postulates that the work process develops, in an indissoluble unity, the manual and intellectual aspects, in a way that indicates the contradiction that marks the capitalist society and the direction of its overcoming. Polytechnic education aims at putting the productive process at the service of the community in both solidarity and creative economies. When he/she dominates the foundations and principles of work, the worker would be able to develop the different working modalities and understand their character and essence (Saviani1989; Henriques et al. 2015).

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Hot corrosion Evaluation of Carbon Steel caused by Mixtures of Vanadium Oxide and Sodium Sulfate Simulating Ashes of Fuel Oils

Fernando B. Mainier[1], Alexandre Santos de Oliveira[2]

Escola de Engenharia, Universidade Federal Fluminense, Niterói, RJ, Brazil.
[1]fmainier@uol.com.br; [2] aoliabe.mestre@gmail.com

Abstract *— Ashes from the burning of fuel oils containing mixtures of vanadium, sodium, sulfur and chloride compounds in the form of molten salts or oxides can cause hot corrosion of the carbon steel tubes located in the furnace at high temperatures with extremely disastrous effects. In order to simulate the melting ash in the laboratory, mixtures of sodium sulfate and vanadium pentoxide were used in different proportions of Na_2O and V_2O_5 at temperatures of 500°C, 700°C and 800°C and in the exposure time of 12h, 24h and 36h using carbon steel coupons in the form of half-cane. The results were evaluated morphologically for the depth of the corrosive attack and the loss of mass using a confocal microscope where it was possible to evaluate the degree of corrosion caused by the action of the vanadate fluxes ($Na_2O.V_2O_5$).The deepest pitting occurred in the ratio $2Na_2O.V_2O_5$ at the three test temperatures. At the temperature of 800°C and in the time of 36 hours, the average thickness loss in the coupons was 11%.*

Keywords — Hot corrosion, vanadate, vanadium oxide, sodium sulfate, fuel oil.

I. INTRODUCTION

Hot corrosion in steam boiler tubes (furnace area) can be defined as the corrosion or degradation of carbon steel tubes resulting from the combined effect of oxidation and accelerated attack, at elevated temperatures, of ash from the burning of fuel oils containing mixtures of vanadium, sodium, sulfur and chloride compounds in the form of molten salts or oxides [1–3]. Rapp [4] considered that hot corrosion is associated with two temperature ranges. In the 650°C – 750°C range, it is of Low Temperature Hot Corrosion (LTHC), while a more severe corrosion is of High Temperature Hot Corrosion (HTHC) acting in the range 750°C – 950 °C.

The composition of boiler fuel oil consists of heavy hydrocarbons depending on the type of petroleum and the operations performed in the refineries, so that it meets the requirements of the specific standards for each type of steam boiler. Organics sulfurs are in the form of mercaptans, sulfides, polysulfides and thiophenes. Additionally, impurities such as organometallic compounds, salts and metal oxides are also present in fuel oils in small amounts. Failure to comply with the norms that regulate the maximum levels of these compounds as well as the burning of fuels outside the operating standards and at high temperatures can be considered the main parameters responsible for this type of corrosion. However, it should be clear that impurity contents within the limitations of the standards do not completely eliminate the risk of corrosion.

Sodium may originate from sodium chloride (NaCl) from the oil produced water while vanadium is found in the form of porphyrins. Combined burning (oxidation) of the sulfur compounds with sodium chloride can generate sodium sulfate (Na_2SO_4), and burning the porphyrin in vanadium produces oxides such as VO, V_2O_3, VO_2 and V_2O_5. The V_2O_5 is mainly obtained in the function of oxidizing conditions and elevated temperature.

Several researches have shown the formation of vanadates ($Na_2O.V_2O_5$) resulting from the reaction between sodium sulfate and vanadium pentoxide in the function of temperature, stoichiometric ratios and of oxidizing conditions. The formation of these compounds with low melting point may dissolve the protective iron oxide layer on the surface of carbon and then attack the surface of the carbon steel itself [4–8]. In general, it is valid to admit that the lower the melting point of the constituents of an ash, the greater the probability of this ash becoming a flux and attacking the carbon steel. The reactions between sodium sulfate and vanadium pentoxide are shown below:

$$Na_2SO_4 + V_2O_5 \rightarrow Na_2O.\ V_2O_5 + SO_3$$
$$Na_2SO_4 + 3\ V_2O_5 \rightarrow Na_2O.\ 3V_2O_5 + SO_3$$
$$Na_2SO_4 + 6V_2O_5 \rightarrow Na_2O.\ 6V_2O_5 + SO_3$$

Table 1 shows the low melting point of the vanadium and sodium compounds that can cause the attack on the carbon steel tubes, allowing the occurrence of catastrophic corrosion.

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Table.1 - Melting points of some constituents present in the ashes

Substance	Formula	Melting point (°C)
Sodium sulfate	Na_2SO_4	880
Vanadium pentoxide	V_2O_5	675
Sodium metavanadate	$Na_2O.V_2O_5$	630
Sodium pyrovanadate	$2Na_2O.V_2O_5$	640
Sodium orthovanadate	$3Na_2O.V_2O_5$	858
Ferric Oxide	Fe_2O_3	1565
Ferric orthovanadate	$Fe_2O_3.V_2O_5$	855
Ferric metavanadate	$2Fe_2O_3.2V_2O_5$	860

This type of corrosion has been observed in the inspections carried out on the carbon steel tubes of fire-tube boilers located in the furnace area (Figure 1). It is believed that this corrosion is associated with the burning of fuel oils.

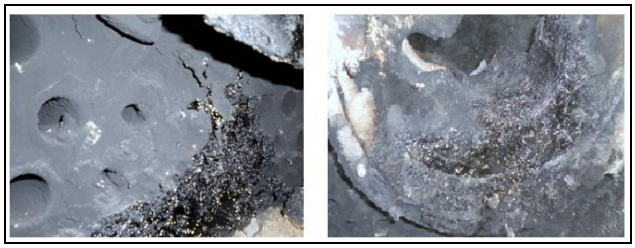

Fig. 1: Hot corrosion aspect of a fire-tube boiler

This work aims to present laboratory tests to evaluate the corrosion caused by mixtures of sodium sulfate and vanadium pentoxide at elevated temperatures on the carbon steel tube surface of fire-tube boilers.

II. MATERIALS AND METHODS

Coupons were prepared through a carbon steel boiler tube with 3.8 cm diameter and 3 mm of thickness that was cut into a 2 cm wide cane. The carbon steel analysis is presented in Table 2 and is in accordance with the specification of the ASTM A178 [9].

Table.2. The chemical composition of of carbon steel tube

C (%)	Mn(%)	Si(%)	S%	P%	Fe(%)
0.030	1.80	0.35	0.009	0.017	Balance

In order to simulate the corrosive action of the ashes, it was decided that mixtures of V_2O_5 with Na_2SO_4 would be used to better approximate the original composition of the ashes produced in a real boiler operation as a function of the presence of sulfur. The V_2O_5 and Na_2SO_4 used in the laboratory tests are anhydrous and have a purity of 99.90%.

The representative samples of Na_2O and V_2O_5 in the proportions of 2:1; 1:1 and 1:2 were made from the mixtures of Na_2SO_4 and V_20_5 macerated into a porcelain mortar and pestle. As much as 3 g of the representative sample of $Na_2O.V_2O_5$ was placed in a plastic syringe with nozzle, pressed with the plunger and later placed in the center of the half cane of the carbon steel tube and later placed in the electric furnace at the temperatures indicated. Test temperatures were 500, 700 and 800°C while the exposure times in the electric furnace were 12, 24 and 36 hours. Figure 2 shows the sequence of operations for performing the assay.

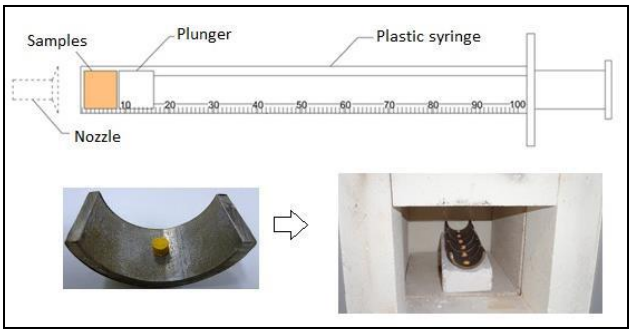

Fig. 2: Sequence of operations for carrying out the test with mixtures of Na_2SO_4 and V_20_5.

The coupons removed from the electric furnace were cleaned. Initially, the ash layers were removed by lightly using a small spatula. The coupons were then immersed in a solution with 5% hydrochloric acid and 1% propargyl alcohol as a corrosion inhibitor for 30 minutes. Then they were washed with distilled water, alcohol and dried with hot air.

In this research, the confocal optical microscope, model Olympus LEXT OLS 4000 Confocal Laser Microscope, was used to punctually identify the morphology of the corrosive attack on the metallic surface. The increase in the analysis of the images was limited to 420 times as a function of the geometry of the curve of the coupons, restricting the area of study in the dimensions 0.64 mm x 0.64 mm in the area of interest.

As shown in Figure 3, the pitting are identified by red circles in the micrograph, and by means of proprietary software installed in the confocal optical microscope, a rectangle triangle is generated that determines the depth of each pitting as shown in the 3D image.

In the evaluation of pitting corrosion, the concepts of the ASTM standard G46-94 [10] were used while measuring the deepest pitting and expressing the degree of corrosion in terms of maximum depth or the mean of the 10 pitting with the highest penetration.

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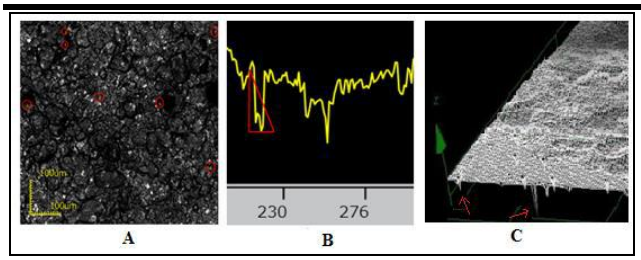

Fig. 3: A) Identification of pitting the micrograph; B) Profile of pitting with depth; C) Pitting in 3D.

III. RESULTS AND DISCUSSION

Figure 4 shows the appearance of the coupons after removal from the electric furnace. Considering that the fluxing mass (Na_2SO_4 and V_2O_5 mixture) was placed at the center of the cane-shaped coupon, it has been observed that the corrosion was localized and more intense, resulting in a depression and localized mass loss of carbon steel. Furthermore, the appearance of the molten mixture has also been observed.

Fig. 4: Appearance of the coupons after removal from the electric furnace

After cleaning the coupons, the thickness determination was performed by means of a digital micrometer in the centralized area of the coupon where the corrosive attack of the melt mixture of Na_2SO_4 and V_2O_5 occurred. The results are presented below:

a) at a temperature of 500°C and for 12 hours, there was an average thickness reduction of 1.8%;
b) at a temperature of 700°C and for 24 hours, there was an average thickness reduction of 4.6%;
c) at a temperature of 800°C and for 36 hours, there was an average thickness reduction of 11%.

The results of mass loss in the area of attack with the flux mixture tended to increase with increasing temperature and time of exposure. Consequently, the mass losses involve the reduction of thicknesses in the specimens.

In the micrographs shown in Figures 5, grooves, excavations, pitting and uniform corrosion on the surface of the exposed coupons at 500°C with mixtures of Na_2SO_4 and V_2O_5 were observed. Additionally, these observations were mentioned in the research studies conducted by Lai [11] and Khadom [12] as a characteristic of the dissolution of the oxidation film.

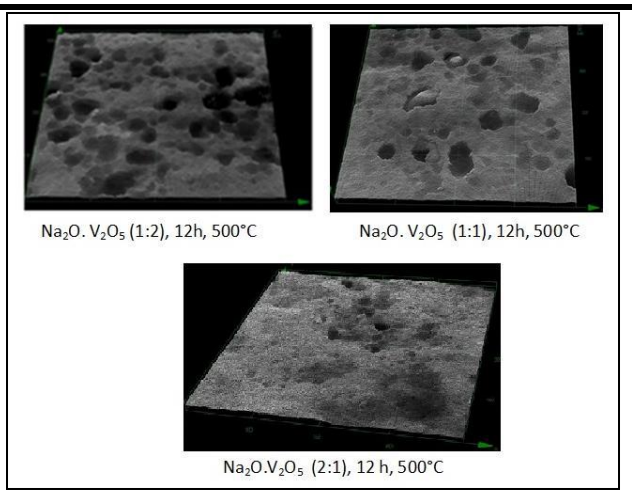

Fig.5: Aspect of surfaces in 3D after the tests at 500 °C and 12 h of exposure.

As the temperature increases from 500°C to 700°C and then to 800°C, there is a transformation of the corrosion located in uniform corrosion and consequently, there is a greater loss of mass of the carbon steel coupons as shown in Figures 6 and 7.

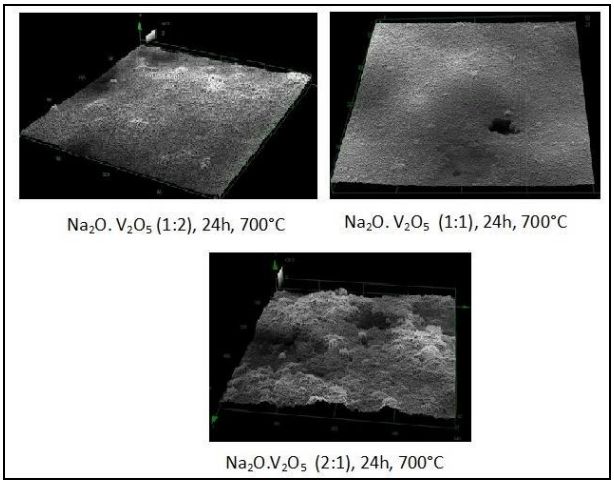

Fig. 6: Aspect of surfaces in 3D after the tests at 700 °C and 24 h of exposure.

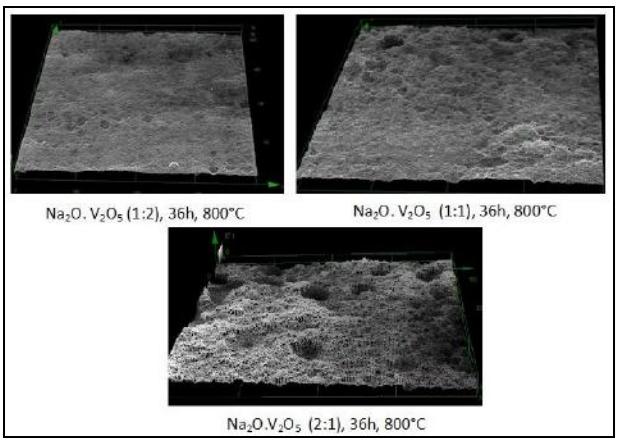

Fig. 7: Aspect of surfaces in 3D after the tests at 800 °C and 36 h of exposure.

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As shown in Table 3, at all the three test temperatures (500°C, 700°C and 800°C), it is noted that deeper pitting increases with temperature and with increasing Na_2O in the melt mixture, and pitting with greater depth (65.36 µm) occurred at 800°C.

Table 3: Maximum depth of pitting (µm)

Mixture Na_2O. V_2O_5	T,°C	Expo-sure time, h	Number of pitting	Maximum depth of pitting (µm)
1.1	500	12	7	35.94
1.2	500	12	11	20.64
2.1	500	12	2	64.63
1.1	700	24	8	24.76
1.2	700	24	7	37.00
2.1	700	24	8	52.46
1.1	800	36	13	34.11
1.2	800	36	13	25.48
2.1	800	36	7	65.36

Pitting corrosion in the presence of ash is cited by Singh et al.[1] and Khadom et al. [12]. Generally, the deposits of ash rich in Na_2O have a characteristic pitting attack [13]. With increasing temperature, the oxidation film tends to grow and fracture by increasing the diffusion of the sulfur present in the Na_2SO_4 rich fluxes. This results in a corrosive attack by sulphation, which may be pitting [11]. Such facts may indicate that pitting may be one of the initial stages that progresses toward generalized corrosion, as the oxidation film is dissolved over time and in the proportions of Na_2O and V_2O_5 in the tests.

IV. CONCLUSIONS

High temperature corrosion tests with mixtures of Na_2SO_4 and V_2O_5 simulate the ash action from the combustion of fuel oils, providing results in which the following conclusions can be drawn:

- The microscopic evaluation showed that the action of the vanadates fluxes on the surface of the carbon steel resulted in uniform corrosion and corrosion by pitting in rounded form (excavations) and deep pitting;
- The deepest pitting occurred in the ratio $2Na_2O.V_2O_5$ at the three test temperatures.
- Microscopic evaluation suggests that from 700°C, localized corrosion progresses to uniform corrosion.
- At the temperature of 800°C and in the time of 36 hours, the average thickness loss in the coupons was 11%.

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Analysis of the Factors Influencing the Employability of Recent Undergraduates

Juan Enrique Mares Ribeiro[1], Antonio Marcos de Oliveira Siqueira[2], Wagner dos Reis Marques Araújo[3], Gabriel Siqueira Silva[4]

[1]Department of Chemistry, Universidade Federal de Viçosa, Viçosa/MG, Brazil
Email: juan@estudar.org.br
[2]Chemical Enginering, Department of Chemistry, Universidade Federal de Viçosa, Viçosa/MG, Brazil
Email: antonio.siqueira@ufv.br
[3]Universidade do Estado de Minas Gerais, Carangola/MG, Brazil
Email: marquesreis@hotmail.com
[4]Food Enginering Course, Universidade Federal de Viçosa, Florestal/MG, Brazil
Email: gabrielsiqueira25@outlook.com

***Abstract*—** *The purpose of this study is to evaluate the main variables influencing the employability of young undergraduates alumni. The research comprehended the study of a database of 9753 young people, containing information on work styles, personal values, behavioral profile, logic level, proficiency in foreign languages, and also professional and extracurricular experiences. The analysis of this database shows is possible to identify the main variables adopted by organizations, as well as their relevance along the stages of the selection process. After such identification, a comparison was made between the profile of the successful candidates in a determined selection process and the students of the Chemical Engineering undergraduate course hosted by the Universidade Federal de Viçosa.*

Keywords*— *Employability, Newly undergraduate, Election, Processes, Chemical engineering.

I. INTRODUÇÃO

Segundo o relatório de indicadores da Pesquisa Nacional por Amostra de Domicílios Contínua do Instituto Brasileiro de Geografia e Estatística – IBGE [1], o nível de desocupação do Brasil atingiu 13,7% no primeiro trimestre de 2017. Esse número corresponde a mais de 13 milhões de brasileiros desempregados. Este indicador nunca havia alcançado tal marca antes, se tornando um recorde na história do país.

Analisando um contexto regional, onde a Universidade Federal de Viçosa se encontra, segundo o relatório de [2] que avalia mensalmente a taxa de criação de empregos formais no Brasil, a região sudeste é a que mais sofre com o aumento do desemprego proporcional a população local.

Uma análise mais profunda [2] mostra que em Minas Gerais o déficit de criação de empregos formais em dezembro de 2016 foi de 28 mil vagas, a segunda pior marca entre os estados brasileiros, ficando atrás apenas de São Paulo, e evidenciando que o desemprego atinge de forma incisiva a região geográfica abordada no contexto desse trabalho [2].

O grave cenário de desocupação no Brasil passa a justificar a busca do jovem por carreiras alternativas, afetando diretamente a evasão de cérebros do país e, principalmente, a insatisfação e frustração destes com sua carreira.

Uma recente pesquisa chamada Projeto 30 [3] realizou uma análise da expectativa versus realidade da carreira de jovem. Os resultados mostram uma dissonância enorme. Segundo a pesquisa, 52% dos jovens brasileiros chegam aos 30 anos de idade frustrados com a carreira [3]. A pesquisa Projeto 30 conclui que 64% dos entrevistados sentem que o que se tornaram foi fruto do acaso, ou seja, não tiveram muito controle sobre as escolhas; as coisas simplesmente aconteceram. Apenas 36% sentem que são frutos das escolhas feitas; planejaram efetivamente estar onde estão.

Uma pesquisa de [4] mostrou que 72% dos brasileiros estão insatisfeitos com o trabalho. De acordo com a pesquisa, a insatisfação em 89% dos casos tem a ver com reconhecimento, em 78% com excesso de tarefas e em 63% com problemas de relacionamento [4]. Já o trabalho de [5] realizou uma pesquisa similar e concluiu que 80% das pessoas estão insatisfeitas com seu trabalho.

Tal situação é mais evidente quando se analisa os efeitos colaterais - fisiológicos e psicológicos - relacionados à insatisfação e estresse no ambiente de trabalho. Segundo [6] a depressão pode ser caracterizada como uma doença do trabalho, advinda do fato de não encontrar na carreira sentido e valores fundamentais na sua formação como pessoa.

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Segundo [7] o Brasil é o país campeão mundial do transtorno de ansiedade e o quinto em número de pessoas com depressão; o que significa aproximadamente 11,5 milhões de brasileiros. Esses números são ainda mais agravantes quando se estabelece a relação entre depressão e casos de suicídio no Brasil, que de acordo com a pesquisa Mapa da Violência: Jovens do Brasil, entre os anos 2002 e 2012, o total de suicídios tem um aumento de 33,6% [7]. Esse aumento foi superior ao crescimento da população do país no mesmo período, que foi de 11,1% [6].

A dificuldade de inserção no mercado de trabalho, muitas vezes, força o jovem a buscar carreiras alternativas, acarretando em insatisfação pessoal, infelicidade na carreira e quadros clínicos de depressão e outras doenças ocupacionais. Embora existam trabalhos a respeito da empregabilidade de recém-formados em cursos superiores, a literatura científica [8-17], mostra que o estudo dos fatores que influenciam a empregabilidade ainda necessita de uma maior investigação. Diante destas questões, surge, a necessidade de conhecer e estudar os processos de seleção e admissão de jovens recém-formados no mercado de trabalho. Tal trabalho tem o intuito de facilitar a conexão de jovens recém-formados com uma carreira que permita a busca de realizações pessoais e profissionais.

II. METODOLOGIA

A metodologia de análise de dados consiste em trabalhar possíveis associações entre variáveis a fim de concluir a respeito da importância de cada uma delas, bem como possíveis padrões de previsibilidade. Esse tipo de metodologia é consistente com a Análise Descritiva [18]. Trabalhou-se apenas com as variáveis numéricas dispostas na base de dados, buscando entender apenas as relações lógicas exatas existentes entre fatores que promovem a empregabilidade. Segundo [18, 19], a pesquisa qualitativa enfrenta demasiados problemas no que diz respeito à contaminação dos dados, uma vez que a interpretação do pesquisador, embasada em suas crenças e valores pessoais, podem influenciar a coleta e análise dos dados, levando a conclusões equivocadas.

Utilizou-se o método dedutivo para se avaliar a importância de uma ou mais variáveis durante o processo de seleção. De acordo com [20, 21] o método dedutivo consiste em se extrair um comportamento lógico decorrente em um fenômeno social, possibilitando chegar a conclusões em virtude unicamente de sua lógica. Por fim, [22] também aborda a relação entre o tamanho da amostra estudada com a confiabilidade do resultado das análises descritivas. Segundo sua correlação construída para determinar a amplitude de uma amostra tirada de uma população finita de acordo com a sua margem de erro, pode se considerar que o presente trabalho, devido ao tamanho relevante da amostra, trabalha na menor margem de erro proposto.

2.1. O processo de seleção estudado

Segundo [22] dentre as diversas formas possíveis de se analisar um banco de dados quantitativo, é válido ressaltar dois meios de análise, os quais foram adotados ao longo do processo de análise de dados: amostragem estratificada e amostragem sistemática. O processo de seleção estudado no presente trabalho é caracterizado por possuir 5 etapas de seleção. As populações no início de cada etapa do processo são classificadas como Pré-inscrito, Inscrito, Semifinalista, Finalista e Aprovado. As empresas recrutadoras oferecem vagas para os setores empresariais e industriais. A base de dados foi fornecida pela companhia que oferece a estrutura do processo seletivo para todas as empresas, o que permite a padronização entre todos os processos de seleção.

2.1.1 Etapa 1 – Pré-inscrito

Haviam 9.753 pré-inscritos no processo. Para se avançar da etapa de pré-inscrito para inscrito, basta preencher os dados solicitados nessa etapa e as 4 provas de lógica e inteligência. Não se trata de uma etapa classificatória e sim eliminatória, onde aqueles que não realizarem o preenchimento do formulário acabam desclassificados.

2.1.2 Etapa 2 – Inscrito

Haviam 3.385 candidatos inscritos, ou seja, aptos para participarem do processo seletivo. Deve-se preencher os testes de perfil e a avaliação de inglês.

2.1.3 Etapa 3 – Semifinalista

Haviam 1.753 candidatos semi-finalistas no processo. Nesta etapa, os candidatos são avaliados pelos seus resultados nos testes de lógica, perfil comportamental e inglês. Essa etapa é classificatória, onde são eliminados aqueles que não completaram alguma etapa, bem como aqueles que tiveram desempenho insuficiente.

2.1.4 Etapas 4 e 5 – Finalista e Aprovado

Inicia-se a etapa final com 754 candidatos finalistas no processo. A última etapa consiste em uma entrevista presencial, por vídeo-transmissão ou, em alguns casos, por telefone. O resultado dessa etapa consiste nos aprovados dos processos, contratados pelas empresas e organizações. 85 foram aprovados.

2.2 Variáveis estudadas

O trabalho aborda a análise descritiva de 48 variáveis presentes nos Processos Seletivos convencionais para estágio e trainee, sendo elas: 12 relacionadas a dados cadastrais, 4 provas de inteligência lógica, 8 estilos de trabalho, 10 valores, 5 personalidades e 9 critérios de entrevista.

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III. RESULTADOS

Após a análise dos dados dispostos na base de dados coletada para pesquisa, foi possível identificar relações entre as variáveis estudadas com a empregabilidade dos candidatos do processo de seleção em questão. Para tal, o software estatístico, livre, não-proprietário foi utilizado.

Observou-se três comportamentos típicos entre as variáveis e a empregabilidade dos jovens, sendo elas "correlação positiva", "correlação negativa" e "indiferente. Dessa forma foi possível avaliar a influência de cada variável ao longo do processo, identificando quais tornam os candidatos mais promissores a serem aprovados, que possuem peso negativo no processo e também as que apresentam indiferença.

As relações de influência das variáveis estudadas com a empregabilidade dos candidatos foram plotadas na Tabela 1.

Tabela 1 - Resultados obtidos compilados

VARIÁVEIS		**INFLUÊNCIA (+, - ou ND)**	**CONCLUSÃO**
GRUPO	**SUBGRUPO**		
Estado de origem	Minas Gerais	+	Candidatos do estado de Minas Gerais tendem a serem selecionados para as etapas seguintes do processo de seleção.
Idade	23, 24 e 25 anos	+	Candidatos com 22, 23 e 24 anos de idade tendem a serem selecionados para as etapas seguintes do processo de seleção.
Universidade	Universidades federais	+	Candidatos de universidades federais tendem a serem selecionados para as etapas seguintes do processo de seleção.
Graduação	Engenharia	+	Candidatos graduandos ou graduados em cursos de engenharia tendem a serem selecionados para as etapas seguintes do processo de seleção.
Ano de conclusão de curso	2017 (ou ano de ocorrência do Processo de Seleção)	+	Candidatos com formaturas previstas para o ano de ocorrência do processo de seleção tendem a serem selecionados para as etapas seguintes.
Gênero	Masculino	+	Candidatos do gênero masculino tendem a serem selecionados para as etapas seguintes do processo de seleção.
	Feminino	-	Candidatos do gênero feminino tendem a não serem selecionados para as etapas seguintes do processo de seleção.
Pós-graduação	-	**ND**	Nenhuma correlação encontrada através das análises descritivas realizadas.
Mestrado	-	**ND**	Nenhuma correlação encontrada através das análises descritivas realizadas.
Doutorado	-	**ND**	Nenhuma correlação encontrada através das análises descritivas realizadas.
Pós-doutorado	-	**ND**	Nenhuma correlação encontrada através das análises descritivas realizadas.
Experiência extracurricular	Sem participação	-	Candidatos que não vivenciaram experiências acadêmicas extracurriculares tendem a não serem selecionados para as etapas seguintes do processo de seleção.
	Empresa Júnior, Clube de Consultoria, Enactus, Liga de Empreendedorismo, Aiesec e Centro Acadêmico	+	Candidatos que vivenciaram alguma das experiências acadêmicas citadas tendem a serem selecionados para as etapas seguintes do processo de seleção.
	Bateria, Pesquisa Científica, Roteract e TETO	-	Candidatos que vivenciaram alguma das experiências acadêmicas citadas tendem a não serem selecionados para as etapas seguintes do processo de seleção.

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Inteligência lógica	Prova de Analogia	+	Candidatos que obtêm maiores notas na Prova de Analogia tendem a serem selecionados para as etapas seguintes do processo de seleção.
	Prova de Matrizes	+	Candidatos que obtêm maiores notas na Prova de Matrizes tendem a serem selecionados para as etapas seguintes do processo de seleção.
	Prova de Resolução de Problemas	+	Candidatos que obtêm maiores notas na Prova de Resolução de Problemas tendem a serem selecionados para as etapas seguintes do processo de seleção.
	Prova de Sequências	+	Candidatos que obtêm maiores notas na Prova de Sequências tendem a serem selecionados para as etapas seguintes do processo de seleção.
Prova de inglês	-	+	Candidatos que obtêm maiores notas na Prova de Inglês tendem a serem selecionados para as etapas seguintes do processo de seleção.
Estilo de trabalho	Estabilidade	-	Candidatos que valorizam o Estilo de Trabalho "Estabilidade" tendem a não serem selecionados para as etapas seguintes do processo de seleção.
	Atenção a Detalhes	-	Candidatos que valorizam o Estilo de Trabalho "Atenção a Detalhes" tendem a não serem selecionados para as etapas seguintes do processo de seleção.
	Agressividade	+	Candidatos que valorizam o Estilo de Trabalho "Agressividade" tendem a serem selecionados para as etapas seguintes do processo de seleção.
	Foco em Resultado	+	Candidatos que valorizam o Estilo de Trabalho "Foco em Resultado" tendem a serem selecionados para as etapas seguintes do processo de seleção.
	Ênfase em recompensa	**ND**	Nenhuma correlação encontrada através das análises descritivas realizadas.
	Trabalho em Equipe	**ND**	Nenhuma correlação encontrada através das análises descritivas realizadas.
	Agilidade	**ND**	Nenhuma correlação encontrada através das análises descritivas realizadas.
	Informalidade	**ND**	Nenhuma correlação encontrada através das análises descritivas realizadas.
Personalidade	Curiosidade	-	Candidatos que possuem a Personalidade pautada em "Curiosidade" tendem a não serem selecionados para as etapas seguintes do processo de seleção.
	Extroversão	+	Candidatos que possuem a Personalidade pautada em "Extroversão" tendem a serem selecionados para as etapas seguintes do processo de seleção.
	Estabilidade Emocional	+	Candidatos que possuem a Personalidade pautada em "Estabilidade Emocional" tendem a serem selecionados para as etapas seguintes do processo de seleção.
	Diligência	**ND**	Nenhuma correlação encontrada através das análises descritivas realizadas.
	Agradabilidade	**ND**	Nenhuma correlação encontrada através das análises descritivas realizadas.
Valores	Tradicionalismo	-	Candidatos que pautam suas tomadas de decisão baseadas no valor "Tradicionalismo" tendem a não serem selecionados para as etapas seguintes do processo de seleção.

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	Conformidade	-	Candidatos que pautam suas tomadas de decisão baseadas no valor "Conformidade" tendem a não serem selecionados para as etapas seguintes do processo de seleção.
	Segurança	-	Candidatos que pautam suas tomadas de decisão baseadas no valor "Segurança" tendem a não serem selecionados para as etapas seguintes do processo de seleção.
	Ambição	+	Candidatos que pautam suas tomadas de decisão baseadas no valor "Ambição" tendem a serem selecionados para as etapas seguintes do processo de seleção.
	Estimulação	+	Candidatos que pautam suas tomadas de decisão baseadas no valor "Estimulação" tendem a serem selecionados para as etapas seguintes do processo de seleção.
	Autonomia	+	Candidatos que pautam suas tomadas de decisão baseadas no valor "Autonomia" tendem a serem selecionados para as etapas seguintes do processo de seleção.
	Universalismo	**ND**	Nenhuma correlação encontrada através das análises descritivas realizadas.
	Benevolência	**ND**	Nenhuma correlação encontrada através das análises descritivas realizadas.
	Poder	**ND**	Nenhuma correlação encontrada através das análises descritivas realizadas.
	Hedonismo	**ND**	Nenhuma correlação encontrada através das análises descritivas realizadas.
Entrevista	Energia	+	Candidatos bem avaliados no critério "Energia" durante a entrevista, tendem a serem selecionados para as etapas seguintes do processo de seleção.
	Projeção de voz	+	Candidatos bem avaliados no critério "Projeção de voz" durante a entrevista, tendem a serem selecionados para as etapas seguintes do processo de seleção.
	Postura	+	Candidatos bem avaliados no critério "Postura" durante a entrevista, tendem a serem selecionados para as etapas seguintes do processo de seleção.
	Objetividade	+	Candidatos bem avaliados no critério "Objetividade" durante a entrevista, tendem a serem selecionados para as etapas seguintes do processo de seleção.
	Coesão	+	Candidatos bem avaliados no critério "Coesão" durante a entrevista, tendem a serem selecionados para as etapas seguintes do processo de seleção.
	Coerência	+	Candidatos bem avaliados no critério "Coerência" durante a entrevista, tendem a serem selecionados para as etapas seguintes do processo de seleção.
	Background	+	Candidatos bem avaliados no critério "Background" durante a entrevista, tendem a serem selecionados para as etapas seguintes do processo de seleção.
	Resultados	+	Candidatos bem avaliados no critério "Resultados" durante a entrevista, tendem a serem selecionados para as etapas seguintes do processo de seleção.
	Storytelling	+	Candidatos bem avaliados no critério "Storytelling" durante a entrevista, tendem a serem selecionados para as etapas seguintes do processo de seleção.

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IV. DISCUSSÃO

4.1 Estado de origem

Ao se analisar os pré-inscritos residentes no estado de São Paulo em comparação aos de Minas Gerais, existe uma diferença significativa de 5736 para 940. Vale ressaltar que as vagas oferecidas nos processos de seleção estudados são para diversos estados brasileiros, porém as etapas presenciais acontecem em São Paulo. Esse fator influencia a discrepante proporção de candidatos de São Paulo e Minas Gerais na etapa de pré-inscritos. Por outro lado, quando se observa o comportamento do percentual de candidatos de São Paulo e Minas Gerais ao longo das etapas do processo de seleção, é possível identificar a valorização dos candidatos de Minas e um decaimento da taxa em São Paulo.

4.2 Idade

A quantidade de pré-inscritos por anos de idade segue o comportamento de uma função de distribuição de densidade de probabilidade, onde o maior volume de jovens inscritos se concentra nas idades de 22, 23 e 24 anos. Ao se comparar os pré-inscritos com os aprovados percebe-se que o comportamento da distribuição de contratados por idade apresenta um crescimento nas idades de 22, 23 e 24 anos. Além disso, existe um pico de aprovados para a idade de 24 anos, o que sugere ser o ponto ótimo para a variável do processo referente à faixa etária.

4.3 Universidade

Nas análises realizadas a respeito da universidade de origem do candidato, tem-se que o perfil das universidades mais valorizadas no processo de seleção são as IES públicas. Na primeira etapa, 25,8% dos candidatos inscritos no processo eram de universidades federais. Esse número dobra entre os aprovados.

Avaliando a empregabilidade dos candidatos da Universidade Federal de Viçosa, percebe-se que na primeira etapa haviam 159 candidatos da UFV, sendo a 8ª universidade com maior número de pré-inscritos. Constata-se 8 aprovados da universidade, sendo a 2ª com mais aprovados, atrás apenas da Unicamp com 12 aprovados. É possível interpretar que candidatos que cursaram sua graduação em IES públicas são bem avaliados em todas as etapas de seleção, representando metade dos universitários contratados pelas organizações. Além disso, realizando uma análise específica para a UFV, entende-se que candidatos dessa universidade são bem avaliados, aumentando suas chances de aprovação.

4.4 Graduação

Na primeira etapa do processo os cursos de engenharia correspondiam a 35,9% de todos os candidatos. Esse número dobrou para os contratados pela empresa, alcançado a marca de 70,2% dos aprovados. Essa análise demonstra a importância da variável curso no processo se seleção. Outros cursos bem quotados no processo são: Administração e Ciências Econômicas.

Avaliando apenas a Engenharia Química, tiveram 382 candidatos na primeira etapa, representando 4,5% dos pré-inscritos e sendo o 5º curso com maior número de candidatos, atrás apenas da Administração (1º), Engenharia de produção (2º), Engenharia civil (3º) e Direito (4º). Já entre os aprovados, os graduados e graduandos da Engenharia Química totalizam 12 entre os 85 contratados, representando 14,1% desse grupo e sendo o segundo com maior número de aprovações, atrás apenas da Engenharia de Produção, com 18 contratados.

Avaliando o grupo específico de graduados e graduandos de Engenharia Química da UFV é possível identificar uma forte valorização deste grupo por parte dos recrutadores. Inicialmente, este grupo representava apenas 0,5% dos inscritos e já entre os aprovados este número sobe para 4,7%, representando 4 contratados. Além disso, esse grupo representa 50,0% de todos os jovens aprovados da Universidade Federal de Viçosa. Essa análise permite concluir que os agentes de tomada de decisão do processo em questão valorizam esse grupo.

No que diz respeito a influência de títulos acadêmicos como Pós-graduado, Mestre, Doutor ou Pós doutor, as análises realizadas por este trabalho foram inconclusivas, não encontrando padrões ou preferências de seleção para esses públicos.

4.5 Gênero

Na amostra dos 9.753 pré-inscritos no processo seletivo, temos 4.243 candidatos que declararam seu gênero como “masculino”, 4.809 como “feminino” e 701 que optaram por não declararem seu gênero. Ou seja, inicialmente, dos candidatos que declararam gênero, 46,9% são homens e 53,1% são mulheres. Entre os aprovados no processo seletivo 64,7% são homens, enquanto 35,3% são mulheres. A partir da análise é possível identificar que a variável gênero possui contribuição dentro do processo. Além disso, nenhum dos candidatos sem declaração de gênero chegaram à etapa de finalista.

4.6 Experiências extracurriculares

A grande maioria dos pré-inscritos no processo de seleção (66,85%) não possuem experiência com alguma organização estudantil ou experiência extracurricular. Quando se compara o percentual desse grupo por etapa do processo de seleção observa-se uma desvalorização desse público por parte dos recrutadores. Esse fenômeno pode ser justificado pelo fato de muitos jovens desse grupo não possuírem vivências no meio acadêmico que são fundamentais para justificar sua candidatura para uma determinada área. Dessa forma, por falta de experiência, o candidato acaba por ser eliminado do processo.

Por outro lado, é possível identificar algumas experiências bem valorizadas pelos recrutadores, que

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proporcionam aos candidatos vantagens competitivas em relação aos demais. Uma dessas experiências é a participação no Movimento Empresa Júnior. Essa valorização dos jovens que tiveram passagem pelo MEJ pode ser justificada pelo fato de que em um ambiente corporativo simulado, é possível obter noções básicas de business, gestão e recursos humanos. Além desta participação, outras vivências são bem valorizadas pelos recrutadores: Clube de Consultoria, Enactus, Liga de Empreendedorismo, Aiesec e Centro Acadêmico. A participação em algumas organizações estudantis passa a ser desvalorizadas pelo presente processo de seleção. São elas: Bateria, Pesquisa Científica, Rotaract e TETO.

4.6 Inteligência lógica

É possível verificar que o ao longo de todo o processo os testes de lógica são utilizados como critério para tomada de decisão na seleção de pessoal e, portanto, é valorizada. Um ponto curioso também é observar o crescimento da lógica média da etapa de inscrito para semifinalista, uma vez que a aprovação nessa etapa depende apenas do preenchimento dos testes de perfil por parte do jovem. Ou seja, os jovens que completam o processo de inscrição tendem a ter resultados melhores nos testes de lógica do que aqueles que desistem durante o processo. Além disso, é importante ressaltar a prova de Resolução de Problemas como a mais exigida no processo, onde a média inicial corresponde a 32,5 pontos e a final a 57,0.

4.7 Proficiência em língua inglesa

O teste de inglês é valorizado ao longo das duas etapas restantes, porém de forma incisiva na transição de semifinalista para finalista, onde acontece a avaliação da prova de inglês, selecionando os jovens mais proficientes. Já na etapa de finalista para aprovado, a lógica é menos valorizada, permitindo concluir que a importância dessa variável é pouco significativa na etapa de entrevista (critério de avaliação utilizado nessa etapa).

4.8 Estilo de trabalho

Das oito variáveis independentes dentro do teste de perfil comportamental "Estilo de Trabalho", quatro foram consideradas relevantes para o estudo onde duas possuem relevância negativa (Estabilidade e Atenção a Detalhes) e outras duas influenciam positivamente o processo de admissão do jovem (Agressividade e Foco em Resultados).

Entendendo a "Atenção a Detalhes" como uma tendência a preferir ambientes onde a qualidade seja valorizada, e a "Estabilidade" como uma tendência por preferir ambientes organizados e onde as funções e processos são bem definidos, pode-se concluir que o mercado de trabalho busca profissionais capazes de exercerem diferentes funções, escalarem produtos sem a necessidade de processo rígidos e lidarem bem com imprevistos.

Através da valorização dos estilos de trabalho "Agressividade" (Preferência por um ambiente que valorize a competição e foco) e "Orientação para Resultado" (Preferência por ambientes voltados para execução), é possível perceber um padrão por parte dos recrutadores na busca de talentos para as companhias. Esse padrão pode ser representado pela preferência por jovens que querem se arriscarem na carreira, trabalharem duro e que lidam bem em ambiente competitivos e de alta pressão psicológica.

4.9 Personalidade

Das variáveis contidas no "big-five", conclui-se por meio da análise descritiva e dedutiva a influência de três delas, uma influenciando negativamente o processo de admissão dos jovens (Curiosidade) e outras duas positivamente (Extroversão e Estabilidade Emocional).

Entendendo a variável "Curiosidade" como tendência a ser adepto da criatividade e se envolver em discussões abstratas, pode-se deduzir o motivo dessa variável contribuir negativamente no processo de contratação para os jovens: empresas preferem profissionais pragmáticos, que resolvem problemas complexos com simplicidade, evitando idealismos e soluções abstrusas.

Analisando as variáveis bem-valorizadas no processo de seleção, observa-se a necessidade por parte das organizações contratarem profissionais com alto índice de energia e facilidade de engajar e motivar uma equipe. Além disso, observa-se novamente uma necessidade das companhias por candidatos com alta habilidade de trabalhar bem sobre pressão e reagirem de maneira calma a situações de ansiedade e risco.

4.10 Valores

Através da análise descritiva dos testes de valores é possível associar a influência de seis variáveis ao longo do processo de seleção. Três delas (Tradicionalismo, Conformidade e Segurança) possuem peso negativo para a contratação, enquanto as outras três (Ambição, Autonomia e Estimulação), positivo.

Observa-se que candidatos que tendem a tomar decisões baseadas em conformismo, baixo risco, seguir regras e valorização de ambientes estáveis enfrentam dificuldades em se projetar no mercado de trabalho. Essa análise descritiva permite inferir, novamente, uma forte busca do mercado de trabalho a candidatos que se disponham a enfrentar cada vez mais risco, lidar com ambientes e pessoas diversas e que possuem flexibilidade para assumir diferentes rotinas e funções.

Entendendo a Ambição como a tendência de valorizar o sucesso e prestigio profissional, a busca por candidatos que se enquadram nesse valor por parte dos recrutadores pode ser justificada pelo desejo das companhias encontrarem colaboradores que almejam trazer cada vez mais resultados para a organização. A valorização da

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Estimulação é explicada, novamente, pelo fato das organizações preferirem jovens que valorizam a tomada de riscos e desafios.

Um valor que merece uma atenção é a Autonomia. As organizações investem cada vez mais capital nas consultorias de recrutamento e seleção para contratar jovens autônomos, com grande capacidade de aprendizado e sensatos em elaborarem sua rotina de trabalho, sem necessidade de supervisores. Além de profissionais com essa característica trazerem mais agilidade para a companhia, as companhias conseguem cortar custos eliminando a necessidade de supervisores, deixando essa função para os gerentes de área.

4.11 Entrevista

O escopo da entrevista realizada pela empresa de recrutamento e seleção estudada nesse trabalho adota 9 critérios para avaliar, numericamente com notas, um candidato durante o tempo de conversa. Através da análise do comportamento de cada um dos critérios foi possível verificar que todos foram valorizados da etapa de finalistas para aprovados. Ou seja, torna-se necessário que os candidatos demonstrem energia e coesão ao se comunicarem, possuam postura e projeção de voz adequada, possuam experiências ricas e significativas para compartilhar e ainda demonstrem resultados inquestionáveis alcançados durante a graduação.

Observou-se também uma forte valorização para o critério "Orientação para Resultados", o que pode ser entendido como um critério-chave para a etapa de entrevista. Entendendo esse critério como a quantidade de experiências produtivas obtidas durante a graduação, surge uma forte necessidade dos jovens se engajarem em experiências acadêmicas e extracurriculares a fim de serem bem avaliados, facilitando a sua busca pelo primeiro emprego.

4.12 O Engenheiro Químico da UFV

Uma amostra de 271 estudantes e ex-alunos da Engenharia Química da Universidade Federal de Viçosa – ENQ UFV - foi entrevistada a fim de coletar dados comparáveis com os do processo de seleção estudado. Esse número, de acordo com a relação de confiabilidade do resultado das análises descritivas proposto por [22] também proporciona a minimização do erro. Por limitações da pesquisa, não foram coletados dados relativos ao nível de proficiência em língua estrangeira para que se pudesse comparar com os aprovados.

No que diz respeito à universidade de origem, pode-se concluir que universidades federais são bem quotadas nos processos de seleção, influenciando positivamente a projeção no mercado destes estudantes. Quando se leva em consideração a graduação cursada, percebe-se novamente uma valorização desses candidatos. De forma geral, pode-se dizer que estudantes da Engenharia Química da UFV são bem valorizados.

No que diz respeito às experiências acadêmicas e extracurriculares realizadas pelo grupo de estudo da Engenharia Química da UFV, pode-se dizer que os estudantes carecem de oportunidades de se envolverem com as atividades extracurriculares, onde 64,0% dos entrevistados não se envolveram com nenhuma experiência.

No que diz respeito ao nível de inteligência e lógica, pode-se dizer que a ENQ UFV possui padrões altos quando comparados com o grupo dos aprovados no processo de seleção. Isso pode ser justificado devido ao fato do curso de Engenharia Química fortalecer habilidades como análise de dados e raciocínio lógico. Quando se analisa o potencial de resolução de problemas, sugere-se a adoção de metodologias ativas de ensino aplicada ao curso de graduação, conforme [23].

Comparando os resultados dos testes de Estilo de Trabalho nota-se uma boa adequação para as variáveis Orientação para Resultados e Atenção a Detalhes. Por outro lado, a Estabilidade do grupo ENQ UFV é demasiada alta, se tornando um problema uma vez que esta variável influencia negativamente no processo. O resultado para Agressividade também foi negativo, uma vez que esta variável oferece contribuições positivas para a aprovação do jovem no processo.

Na análise descritiva dos resultados dos testes de Personalidade, os critérios Extroversão e Estabilidade Emocional apresentaram influência positiva, enquanto Curiosidade contribui negativamente no processo de seleção. Dessa forma a Engenharia Química da UFV apresentou bons resultados no que diz respeito à Curiosidade, enquanto possui espaço para melhorias nos critérios de extroversão e Estabilidade Emocional.

A análise comparativa entre a média de cada valor dos alunos e ex-alunos da Engenharia Química com os aprovados no Processo de Seleção estudado é a que apresenta resultados mais preocupantes. Nos valores que possuem peso negativo (Tradicionalismo, Conformidade e Segurança) a média dos alunos da ENQ UFV foi superior a dos aprovados, enquanto nas variáveis que possuem peso positivo (Ambição, Estimulação e Autonomia) a média do grupo foi inferior a dos jovens contratados. Porém, quando se compara a média dos valores dos estudantes que participaram de organizações estudantis dentro da UFV com média geral da ENQ UFV, é possível inferir que estudantes que participaram de atividades acadêmicas e extracurriculares tendem a possuir maior adequação ao perfil valorizado pelos recrutadores. Em outras palavras, o envolvimento de jovens acadêmicos em atividades que promovam formas complementares de ensino e aprendizagem tendem a

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enfrentarem menores dificuldades na busca pelo primeiro emprego.

A fim de entender o nível de preparação dos jovens recém-formados da UFV para a etapa de entrevista, foi realizada uma análise comparativa entre os Aprovados no Processo de Seleção estudado no presente trabalho com os 22 jovens da Engenharia Química da UFV que chegaram à etapa final do processo. O resultado mostra a existência de um baixo nível de preparo para a etapa de entrevistas para todos os critérios observados, destacando a variável "Resultados". Pode-se inferir que a análise descritiva apresentada é condizente com a realidade uma vez que, quanto menor for o nível de participação dos jovens nas atividades acadêmicas e extracurriculares, menor será sua capacidade de relatar suas conquistas apresentando informações concretas sobre os resultados alcançados.

V. CONCLUSÕES

Ao longo desse trabalho pôde-se evidenciar os principais critérios adotados no recrutamento e seleção de jovens formandos e recém-formados, bem como avaliar a influência de cada um. Observou-se, através das análises descritivas, os fatores que demonstraram relevância no processo de seleção estudado. As conclusões observadas de cada uma das variáveis foram compiladas, como já apresentadas na Tabela 1, bem o tipo de sua influência. Como limitação deste trabalho, não foi possível estabelecer níveis de importância entre as variáveis, sugerindo então a realização de uma Regressão Logística para se encontrar tais relações.

Foi possível perceber, através da avaliação do grupo dos 85 contratados pelo processo de seleção, que a persona do jovem aprovado tende a se tratar de um formando e/ou recém-formado, graduando em engenharia em uma instituição de ensino federal, com 24 anos de idade, com participação em atividades extracurriculares durante a graduação. Possui bons níveis de inteligência lógica, fluência em inglês e resultados significativos alcançados durante a sua formação acadêmica. Além disso, esse jovem tende a priorizar valores como Ambição, Estimulação e Autonomia, estilo de trabalho focado e baseado em resultados e personalidade pautada na extroversão e estabilidade emocional.

No que se refere ao diagnóstico traçado do perfil dos estudantes e graduados de Engenharia Química da Universidade Federal de Viçosa, pode-se concluir que o curso e a universidade em questão conseguem promover uma boa atração e desenvolvimento da capacidade analítica de raciocínio lógico dos estudantes. Além disso, esses dois fatores refletem em profissionais renomados no mercado e capazes de resolverem problemas complexos devida a qualidade de sua formação acadêmica. Por outro lado, observa-se uma oportunidade no que tange o desenvolvimento de habilidades cognitivas e sociais dos estudantes. O presente estudo constatou discrepância do perfil do jovem egresso da universidade com as habilidades requisitadas pelos recrutadores, evidenciando lacunas para melhoria da formação holística dos universitários.

Esse trabalho pioneiro, longe de ser um estudo exaustivo, traz algumas contribuições para o mercado de recursos humanos e contribui com análises descritivas relevantes para a construção de projetos pedagógicos que visam posicionar o ensino como forma de projeção de jovens no mercado e desenvolvimento de competências associadas ao potencial de liderança.

É importante salientar que o atual trabalho representa apenas um recorte do cenário de empregabilidade de jovens egressos no Brasil, evidenciando diversas oportunidades de futuras pesquisas a respeito do tema. Nesse sentido, sugere-se a realização de pesquisas a fim de investigar fenômenos complementares a esse projeto, tais como o peso do gênero, etnia e orientação sexual nos processos de seleção e a influência de técnicas de ensino que promovam o desenvolvimento de habilidades cognitivas valorizadas pelas companhias.

Por fim, sugere-se a criação de um grupo de preparo e estudos para processos seletivos, formado por estudantes do curso de Engenharia Química e supervisionado por um docente do curso, cujo objetivo será estudar a respeito de mais processos de seleção, coletar as oportunidades de estágio e trainee abertas e promover workshops e treinamentos de preparo para a comunidade discente. Dessa forma espera-se que, através de tal formação complementar à graduação de Engenharia Química, o nível de empregabilidade dos egressos se torne ainda mais relevante.

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A Preliminary Investigation on Teaching Styles in Higher Education
Uma investigação preliminar dos estilos de ensino docente no ensino superior

Antonio Marcos de Oliveira Siqueira[1], Soraia Aparecida Monteiro[2], Wagner dos Reis Marques Araújo[3], Gabriel Siqueira Silva[4], Aldair Oliveira de Andrade[5]

[1] Programa de Pós-Graduação em Engenharia Química (PPGENG), Universidade Federal de Viçosa, Viçosa/MG, Brazil
Email: antonio.siqueira@ufv.br
[2]SocialSciencesCourse, Universidade Federal de Viçosa, Viçosa/MG, Brazil
Email: soraia.monteiro@ufv.br
[3]Universidade do Estado de Minas Gerais, Carangola/MG, Brazil
Email: marquesreis@hotmail.com
[4]FoodEngineringCourse, Universidade Federal de Viçosa, Florestal/MG, Brazil
Email: gabrielsiqueira25@outlook.com
[5]Programa de Pós-Graduação em Ciências e Humanidades (PPGCH), Universidade Federal do Amazonas, Humaitá/AM, Brazil
Email:aldairandrade@yahoo.com.br

Abstract*—Several studies show that to the extent that the teacher knows the learning preferences of his students is able to promote quality in the teaching-learning process. However, the teacher must know and identify his own style of teaching. The aim of this study is to verify and analyze the diversity of teaching styles in a Brazilian federal public university, based on a widely known teaching model. The method of investigation used in this theoretical-empirical study is the quantitative, through the application of forms and statistical study of the data obtained, using the tool SPSS Statistics. It was observed that the Styles of Open Education and Functional Education are the most commonly found among the professors at the university analyzed. It can be observed that for a level of significance equal to 5%, the teaching styles do not vary significantly with the gender of the teacher, with his academic formation, with the time of activity in the university, that is, the styles presented independent of these factors. The results are different from those obtained in other studies, confirming that the educational environment, the strategies involved and the content of the subjects affect the teaching styles and what justifies the need for further investigation.*

Keywords*—*Teaching styles, Learning styles, Teaching strategies, Higher education, Cognition.

I. INTRODUÇÃO

Atualmente, ao pensarmos na diversidade de formas de aprendizagem é necessário atentarmo-nos para as individualidades pessoais no contexto da sociedade. Conforme destacam [1] "o estudo dos processos que envolvem as práticas de ensino e aprendizagem tem sido objeto de preocupação de pesquisadores e teóricos há várias décadas, tanto na busca de alternativas facilitadoras para o desencadear do processo de aprendizagem, quanto para o desvendar dos mecanismos e das práticas educativas que produzem o sucesso ou o chamado fracasso escolar". [1] observam ainda que "novas formas de ensinar e aprender vem acontecendo em função das constantes mudanças que estão ocorrendo no processo do conhecimento" e "a evolução tecnológica e a velocidade das informações fazem com que as necessidades pessoais e profissionais alterem-se com o passar do tempo". O professor é peça essencial na aprendizagem dos estudantes, portanto, é necessário que conheça a si mesmo e seu estilo de ensino para aperfeiçoar suas potencialidades e se adaptar às características dos alunos [2].

[3, 4] esclarecem que na medida em que o docente conhece as preferências de aprendizado de seus alunos é capaz de promover um ensino direcionado por estes

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parâmetros, utilizando estratégias capazes de promover um processo de aprendizado mais eficaz e duradouro. Compreender os estilos de aprendizagem dos estudantes [5-23] é de fundamental importância para se direcionar os métodos que funcionem e promovam estratégias para que o processo de ensino aprendizagem seja orientado às especificidades de um determinado tipo ou grupo de alunos. No entanto, conhecer os mecanismos de ensino do docente favorece o conhecimento dos estilos de aprendizagem dos estudantes, bem como o desenvolvimento de estratégias de ensino pelos docentes. A discussão proposta para esse trabalho, portanto, se faz cada vez mais necessária e urgente no meio acadêmico. Isto pode ser facilmente comprovado pelo grande número de pesquisas realizadas por professores (em todos níveis de ensino, inclusive o superior) e pesquisadores das demais áreas do ensino que veem as deficiências de ensino e buscam mudanças, alternativas para o ensino tradicional [24]. Assim, o trabalho tem como objetivo a verificação e análise da diversidade de estilos de ensino docente em uma universidade pública federal brasileira, fundamentada no Modelo de Martínez Geijo [25].

II. ESTILOS DE ENSINO

Os autores de [17, 18, 19] salientam que a educação é um processo que envolve intencionalidade, fundamentação, sistematização e consistência considerando as habilidades, atitudes, possibilidades, interesses e necessidades dos alunos. Para ser eficaz, o professor deve saber as possibilidades e limitações do aluno em relação ao contexto. Mas há outras variáveis que também influenciam a dinâmica da escola, fatores sociais e as características do professor. O primeiro refere-se ao clima da classe, o nível de comunicação existente, o grau de cooperação alcançado, o estado de coesão do grupo. O segundo refere-se a personalidade, autobiografia e desempenho. Não podemos esquecer que o fenômeno educativo, apesar de suas implicações sociais, é um fenômeno individual.

O professor é peça essencial na aprendizagem dos estudantes, portanto, é necessário que conheça a si mesmo e seu estilo de ensino para aperfeiçoar suas potencialidades e se adaptar às características dos alunos. O estilo de ensino diz respeito à "tendência docente de adotar um determinado modo de interagir com o aluno em função das demandas específicas da tarefa de perceber as necessidades, interesses, habilidades dos alunos e de pensar acerca de sua práxis educativa" [18, 19, 26].

Como vários estudossobre estilo cognitivo indicam, os professores são igualmente influenciados e guiados pelos seus estilos na hora de "ensinar" [27, 28]. Assim como os alunos que aprendem de diversas maneiras - vendo e ouvindo, refletindo e agindo, raciocinando lógica e intuitivamente, memorizando e visualizando, os professores também ensinam de modos variados. Alguns leem, outros demonstram ou discutem, alguns enfatizam a memorização e outros, a compreensão [29].

Ambos, alunos e professores tendem a operar suas atividades de ensinar e aprender segundo seus estilos de ensino e aprendizagem, que sempre podem divergir e/ou convergir em sala de aula.

[3] alerta para o fato de que o conceito de estilo de aprendizagem constituir um fator muito importante para consideração dos professores, pois é frequente estes ensinarem segundo as características mais adaptadas ao seu próprio estilo de aprendizagem. O estilo de ensinar do professor pode, embora inconscientemente, criar um certo favoritismo pelos alunos que tenham um estilo de aprendizagem idêntico ao seu, ao mesmo tempo que não favorece os alunos com estilos de aprendizagem diferentes.

[3] diz ainda que, é necessário que os professores tenham conhecimento dos processos predominantes de aprendizagem dos seus alunos e que este fator tenha influência nas opções que tomam em relação aos processos de ensino de forma a responder às características de todos os alunos.

Segundo [30] "o conhecimento dos mecanismos fundamentais da aprendizagem tem grande interesse porque permite aos professores uma melhor concepção do funcionamento dos seus alunos. No entanto, coloca em questão um outro fator importante, o de compreender as diferenças individuais no seio desse funcionamento com o fim de o integrar no ensino".

Os alunos têm diferentes níveis de motivação, diferentes atitudes sobre o processo de ensino e aprendizagem e respostas diferentes para ambientes específicos de aprendizagem e práticas de instrução. Quanto melhor for a compreensão dessas diferenças pelos docentes, melhores são as possibilidades de irem de encontro da diversidade e necessidades de todos os seus alunos. Foi demonstrado que as categorias que têm importantes implicações para o processo de ensino são: as diferenças entre os estilos de aprendizagem dos alunos - as características que possuem para a aquisição e processamento da informação, a abordagem do ensino e o nível de desenvolvimento intelectual dos alunos - atitudes acerca da natureza do conhecimento e como deve ser adquirido e avaliado [12].

Assim como os alunos têm preferências ou estilos de aprendizagem próprios, ao organizar suas aulas, os professores também têm. Por isso, estes organizam suas aulas, conscientemente ou não, tomando como base as suas próprias preferências. Com isso, acabam priorizando um tipo de saber em detrimento do outro [29].

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Desse modo, de acordo com [29] a escolha de uma abordagem metodológica de ensino implica na adoção de determinados procedimentos, técnicas e materiais didáticos apropriados. A adoção de procedimentos, tais como as intervenções no processo individual de aprendizagem do aluno, tem grande impacto em diferentes aspectos, pois direcionam a maneira como aluno deve aprender [29].

III. O MODELO MARTÍNEZ-GEIJO

Para [31] os estilos de ensino dos professores se sustentam na confluência de recursos pessoais e profissionais, significado do ensino e do contexto sócio educativo a que o docente está inserido. Temos então, a seguinte definição de estilo de ensino:

Estilos de Ensino são categorias de comportamentos de ensino que o docente exibe habitualmente em contextos determinados e em cada fase ou momento da atividade de ensino e que se fundamentam em atitudes pessoais que lhe são inerentes e outras abstraídas de sua experiência acadêmica e profissional [25, 32].Com base nessa definição e no modelo de Estilos de Ensino de Martínez Geijo[25, 32] tem-se que:

I. Estilo de Ensino ABERTO: Os docentes deste Estilo de Ensino planejam com frequência novos conteúdos, motivam os alunos com atividades inovadoras e/ou com problemas reais do dia a dia. Promovem o trabalho em equipe, a geração de ideias e mudam com frequência de metodologia. Buscam que os alunos não trabalhem muito tempo sobre a mesma atividade e dão liberdade no tempo e ordem de realização da atividade. Gostam de romper as rotinas e ir além do seu estado de ânimo e de trabalhar em equipe com outros professores. São bem informados da atualidade e abertos a discussão desses temas em sala de aula. São, em geral, ativos, criativos, improvisadores, inovadores, flexíveis e espontâneos.
II. Estilo de Ensino FORMAL: se encontram aqueles docentes que preferem um planejamento detalhado. Não gostam de improvisação e não gostam de dar um conteúdo que não esteja incluído no programa. Fomentam e incentivam nos estudantes a reflexão, a análise e que sustentem suas ideias racionalmente. Preferem o trabalho individual sobre o trabalho em grupo. Anunciam as datas das provas com antecedência e valorizam a exatidão das respostas, além da ordem e dos detalhes. Não gostam do trabalho em equipe com outros docentes e, se o fazem, solicitam que lhe atribuam a parte da tarefa a desenvolver. São responsáveis, reflexivos, cuidadosos e pacientes.
III. Estilo de Ensino ESTRUTURADO: professores que dão importância ao planejamento e dão ênfase à coerência, a estrutura e a boa apresentação. Transmitem os conteúdos de forma integrada, sempre em um marco teórico amplo, articulado e sistemático. A dinâmica da sala se desenvolve sob certa pressão com atividades complexas de relacionar e estruturar. Exigem demonstrações. Não gostam das respostas sem sentido e requerem objetividade. Não gostam de trabalho em equipe, quando o fazem, favorecem os agrupamentos homogêneos intelectualmente. Nas avaliações preferem que os alunos ao responderem os exercícios/perguntas, especifiquem e expliquem cada passo. Valorizam a descrição do processo sobre a solução. São objetivos, lógicos, perfeccionistas e sistemáticos.
IV. Estilo de Ensino FUNCIONAL: se encontram os docentes que gostam de planejamento, sua preocupação é como levar à prática. Suas explicações são breves e sempre incluem exemplos práticos. Gostam do trabalho em equipe e sempre orientam na execução das atividades para evitar que os alunos caiam no erro. Se a tarefa é realizada com êxito, reconhecem os méritos. Nas avaliações abusam dos exercícios práticos valorizando mais o resultado final que os procedimentos. Aconselha que as respostas sejam breves. O prático e o útil se antepõem as demais características. São práticos, realistas, concretos e com tendência a rentabilizar seus esforços.

IV. QUESTIONÁRIO DE ESTILOS DE ENSINO (CEE)

O questionário de estilos de ensino (CEE) [25, 32], foi validado por [31], através do Método Delphi [33]. O questionário CEE é sustentado nos Estilos de Aprendizagem de [7] e permite o tratamento estatístico dos dados.O questionário é baseado na escala tipo Likert[31]. O teste constitui-se de 71 questões, 18 para os estilos aberto, formal e estruturado e 17 para o estilo funcional. Cada questão tem apenas duas alternativas de resposta: A ou B. Ao final do teste, deve somar quantas alternativas A e B foram escolhidas em cada etapa. Assim, pode-se determinar os quatro estilos de ensino dos docentes e, ainda, o grau de preferência que ele apresenta.

V. HIPÓTESES PARA INVESTIGAÇÃO

O objetivo geral deste trabalhoé conhecer a diversidade dos estilos de ensino dos professores da Universidade Federal de Viçosa. Para analisar o perfil dos professores em relação as suas respostas no instrumento aplicado, os dados coletados forneceram respostas às seguintes questões: a) Existe diferença entre os estilos de ensino nos diferentes Centros de Ciências?; b) Existe diferença entre os estilos de ensino em relação ao sexo do discente; c) O conhecimento dos estilos de ensino permite fazer

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proposições para o ensino, em relação ao arranjo dos métodos instrucionais e das estratégias para a aprendizagem?

VI. INSTRUMENTOS

O levantamento de dados foi realizado na Universidade Federal de Viçosa, Campus Viçosa, situada na Zona da Mata Mineira. O total da amostra foi de 141 professores que atuam na mesma Universidade e integrantes dos quatro grandes Centros de Ciências: a) Centro de Ciências Agrárias – CCA: a este centro estão vinculados os departamentos de Economia Rural, Engenharia Agrícola, Engenharia Florestal, Fitopatologia, Fitotecnia, Solos e de Zootecnia; b) Centro de Ciências Biológicas e da Saúde – CCB: deste centro fazem parte os departamentos de Biologia Vegetal, Biologia Geral, Biologia Animal, Bioquímica e Biologia Molecular, Educação Física, Entomologia, Microbiologia, Medicina e Enfermagem, Nutrição e Saúde, Veterinária; c) Centro de Ciências Exatas e Tecnológicas – CCE: esse centro engloba os departamentos de Arquitetura e Urbanismo, Engenharia Civil, Engenharia Elétrica, Engenharia de Produção e Mecânica, Estatística, Física, Informática, Matemática, Química e de Tecnologia de Alimentos; d) Centro de Ciências Humanas, Letras e Artes – CCH: os departamentos vinculados são: Departamento de Administração e Contabilidade, Artes e Humanidades, Ciências Sociais, Comunicação Social, Direito, Economia, Economia Doméstica, Educação, Geografia, História e de Letras.

A coleta dos dados foi realizada por meio do aplicativo online especializado em pesquisas – o Protest. O instrumento foi escolhido em virtude da praticidade de sua aplicação, tabulação e diagnóstico, tendo em vista o tamanho da amostragem. A aplicação do teste foi realizada de forma voluntária pelos professores. Os dados coletados foram, posteriormente, transferidos para o SPSSStatistics (StatisticalPackage for Social Sciences), Versão 20 para a realização da análise dos dados/resultados.

Como técnica de coleta de dados foi utilizado a técnica de levantamento ou pesquisa survey. Utilizou-se o método de amostragem não probabilística - pode-se inferir que normalmente amostras não-probabilísticas são utilizadas em pesquisa quando há uma restrição de cunho operacional ao uso da amostragem probabilística, como, por exemplo, o fato de a população ser infinita ou de não se ter acesso a todos os elementos da mesma [34].

A análise quantitativa foi realizada a partir das seguintes abordagens estatísticas: a) Análise Exploratória dos Dados: para verificar a exatidão dos dados e identificar valores ausentes, de modo a garantir a confiabilidade dos dados, e também para identificar os dados relevantes para a pesquisa; b) Análise Descritiva: preparar e apresentar os dados de modo que seja possível interpretá-los de acordo dos objetivos da pesquisa; c) Análise Estatística das Hipóteses: as hipóteses formuladas são avaliadas com o teste estatístico apropriado, em que as possíveis correlações existentes entre os estilos de aprendizagem dos alunos e os estilos de ensino dos professores e, as variáveis propostas são comprovadas ou descartadas.

Dos 141 professores que responderam ao questionário, 65 (46,1%) são do sexo feminino e 76 (53,9%) do sexo masculino. Do total de professores entrevistados, 28% correspondiam ao CCB, 28% ao CCH, 24% ao CCE e, os restantes, 20%, correspondente a docentes lotados no CCA, conforme Tabela 1.

Estilos	CCA (20,29% do total)			**CCB** (28,26% do total)			**CCE** (23,91% do total)			**CCH** (27,54% do total)		
Aberto	50	42,9	7,1	53,8	43,6	2,6	33,3	60,6	6,1	50	34,2	15,8
Formal	7,1	17,9	75	2,6	7,7	89,7	0	9,1	90,9	2,6	7,9	89,5
Estruturado	14	46,6	39,3	5,1	56,4	38,5	6,1	60,6	33,3	16	47,4	36,8
Funcional	29	57,1	14,3	33,3	43,6	23,1	36,4	36,4	27,3	16	44,7	39,5
Intensidade	Alta	Moderado	Baixa	Alta	Moderado	Baixa	Alta	Moderado	Baixa	Alta	Moderado	Baixa

Tabela 1: Distribuição dos Estilos de Ensino por Centro de Ciência onde as frequências são: 1 =Alta. 2 = Moderada, 3= Baixa

VII. RESULTADOS

Observa-se pela Tabela 1 que o Estilo de Ensino Aberto predomina em docentes de todas áreas, na preferência alta, exceto entre os docentes de engenharia (CCE). Para estes docentes, ao contrário, predomina o estilo Aberto na preferência moderada. Já o estilo Funcional é o segundo estilo que apresenta maior preferência alta, exceto entre os professores das áreas de Humanas e Artes.

A predominância desses dois estilos indica que esses docentes, de um geral, se utilizam de uma variedade de estratégias metodológicas e segundo [31], esses docentes enfatizam os conteúdos do tipo Procedimental (que é

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preciso saber fazer), ou seja, os conteúdos de aprendizagem que se enquadram na definição de ser um conjunto de ações ordenadas e dirigidas para um fim. Os professores de Estilo de Ensino Aberto e Funcional favorecem a aprendizagem prática, concreta e inovadora.

Ao descrever os dados obtidos por gênero, pode-se conferir se homens e mulheres possuem diferentes formas de ensinar, características de seu gênero. A Tabela 2 mostra as porcentagens relativas a cada grupo, para cada estilo e com as suas respectivas intensidades.

Para o estilo aberto, as preferências "Alta" e "Moderada" se destacaram tanto para homens quanto para mulheres, apresentando uma pequena porcentagem de diferença. As mulheres apontaram para uma maior porcentagem na preferência "Alta" (49,2%) em relação aos 44,7% dos homens que se mostraram mais moderados nesse estilo.

No estilo Formal, ambos os sexos se identificaram, em sua maioria, com a Preferência "Baixa". Na Categoria Preferência Moderada, os homens se destacaram com o percentual de 13,2% contra 7,7% dos docentes do sexo feminino. Apenas uma ínfima parcela, se identificou com a preferência "Alta". Os resultados apontam que os discentes tendem, em sua maioria, às preferências "Moderada" e "Baixa". Sendo que mesmo que com pouca diferença no percentual, as mulheres se destacaram mais em relação à preferência "Alta". Este estilo é o mais marcado pela pluralidade. Porém, é clara a maior convergência de homens para as preferências "Alta" e "Moderada", enquanto as mulheres tenderam mais às preferências "Moderada" e "Baixa".

Outra observação da Tabela 1 é que os professores das Engenharias (CCE) apresentam baixa frequência (90,9%) com relação ao estilo de ensino formal. Neste Estilo de Ensino se encontram aqueles docentes que preferem um planejamento detalhado. Não gostam de improvisação e não gostam de dar um conteúdo que não esteja incluído no programa, algo que de certa forma, representaria uma mudança no paradigma quanto ao formalismo da área de engenharia, em prol da flexibilidade. Este resultado confirma a percepção que se tem no âmbito acadêmico, com relação ao ensino de engenharias e ciências exatas.

De acordo com [13], o quanto o aluno aprende em sala de aula é resultado em parte pelas suas habilidades inatas e preparo anterior e, em partes pela compatibilidade entre seu estilo de aprendizagem e o estilo de ensino do professor. Desse modo os professores de Estilo de ensino Aberto favorecem os alunos com os estilos de aprendizagem ativos, intuitivos, sequenciais e globais e, visuais e verbais. Por serem criativos, flexíveis, buscarem atividades inovadoras, promoverem o trabalho em equipe e trabalharem com problemas reais, estes professores favorecem os alunos ativos, pois estes, dentre outras características, gostam da experimentação, aplicando o conhecimento adquirido; trabalham bem em grupo e em geral preferem aulas que abordem problemas práticos.

Já os alunos intuitivos são beneficiados pois gostam de inovação; de lidar com novos conceitos, além da enorme criatividade que apresentam. Quanto à entrada de conhecimento, os professores de estilo aberto favorecem tanto alunos visuais quanto verbais, pois ao buscarem atividades inovadoras se utilizam tanto de discussões de textos (favorece os verbais), quanto de vídeos, figuras, demonstrações e outros favorecendo também os alunos visuais. Quanto à compreensão do assunto favorecem tanto alunos sequenciais quanto globais, justamente por suas aulas inovadoras os alunos podem acompanhar o passo a passo até ter uma visão global do assunto.

Estilos	HOMENS (53,97% do total)			MULHERES (46,1% do total)		
Aberto	44,7	47,4	7,9	49,2	40	10,8
Formal	2,6	13,2	84,2	3,1	7,7	89,2
Estruturado	9,2	53,9	36,8	10,8	50,8	38,5
Funcional	30,3	44,7	25	24,6	43,1	32,2
Intensidade	Alta	Moderada	Baixa	Alta	Moderada	Baixa

Tabela 2: Distribuição dos Estilos de Ensino por Gênero.

Estilo	Chi-Square	p-valor
Aberto	9,161	0,165
Formal	5,402	0,493
Estruturado	4,262	0,641
Funcional	8,816	0,184

Tabela 3: Índices Estatísticos – para Centros de Ciências, com α= 0,05.

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Já os professores de Estilo de ensino Formal, favorecem os alunos com os estilos de aprendizagem Reflexivo, Sensorial, Sequencial e Verbal. Por serem metódicos, valorizarem a reflexão, a analise, a racionalidade, terem preferência pelo trabalho individual e gostarem de planejamentos detalhados, estes professores favorecem os alunos reflexivos, pois estes, dentre outras características, preferem refletir sobre o conhecimento adquirido; trabalham melhor individualmente e em geral preferem aulas que abordam teorias. Já os alunos sensoriais são favorecidos por serem observadores e metódicos; preferirem resolver problemas pré-estabelecidos e não gostarem de surpresas, são atenciosos com os detalhes. Quanto à entrada de conhecimento, esses professores favorecem os alunos verbais, pois em geral se utilizam das discussões de textos, e mesmo quando utilizam gráficos e diagramas, são mais centrados na explicação do que na visualização destes. Quanto à compreensão do assunto, favorecem os alunos sequenciais pois apresentam os conteúdos de modo ordenado e detalhado.

Através do procedimento Qui-Quadrado, pode-se observar que, para um nível de significância igual a 5%, os estilos de ensino não variam significativamente com o gênero do respondente, com a formação acadêmica, com o tempo de universidade, com o tipo de escola durante o ensino médio, ou seja, os estilos apresentaram-se independentes destes fatores. Os mesmos resultados também revelam que os estilos se apresentam independentes do Centro de Ciências, ou seja, da área de formação.

Embora se tenha constatado que os estilos dominantes sejam Aberto e Funcional, as análises dos percentuais e das proporções obtidas nas correlações entre estilos de ensino comparados aos sexos, aos Centros de Ciências e ao Grau Acadêmico revelam diferenças que não devem ser desconsideradas.

VIII. CONSIDERAÇÕES FINAIS

A análise realizada mostrou que os Estilos de Ensino Aberto e Funcional são os mais comumente encontrados entre os docentes na universidade analisada, resultado este, bastante diferente daquele obtido por [19, 22], o que confirma que o ambiente educacional, as estratégias envolvidas e o conteúdo/tema das disciplinas afetam os estilos de ensino e que justifica a necessidade de maior investigação.

[29] propõe a integração entre os pontos de vista dos alunos e professores através de uma abordagem centrada nos estilos, de modo que a interação professor-aluno não se torne um campo de batalhas perdidas. Para tal, segundo [29] "é essencial uma postura de desvelo por parte dos alunos e principalmente pelo professor que é o líder da interação em sala de aula". O professor, por outro lado, deverá realizar sua atitude em sala de aula, que "deverá ser condizente com as reais necessidades de seus aprendizes". O docente deverá "procurar fazer uma reflexão sobre sua própria prática pedagógica, inclusive para poder, se for o caso, introduzir mudanças nesse cenário" [29].

Ressalta-se que a "identificação dos diferentes estilos e estratégias de aprendizagem de seus alunos, por um lado, permite ao professor ferramentas para um melhor aprendizado, contrariando a postura de um sistema educacional baseado na abordagem de 'transmissão' de conhecimento, na qual os professores simplesmente passam os 'bens' educacionais; por outro lado, possibilita aos alunos, a conscientização das estratégias cognitivas de aprendizagem mais apropriadas para cada situação" [35].

Para além dos estilos de aprendizagem e de ensino, os conhecimentos adquiridos, a inteligência e a motivação constituem fatores que fazem a toda a diferença [36].

De acordo com [31] "os estilos de aprendizagem evoluem e se dinamizam na medida em que existem os estilos de ensino, que efetivamente promovem a evolução". Neste sentido, conceitos devem ser repensados, e segundo [37] "o foco deverá mudar do ensino (instrução) para a aprendizagem, os objetivos formativos serão mais importantes que os informativos, o conhecimento será construído e não reproduzido e o aluno sairá de sua posição passiva e tomará uma posição ativa".Por isso, é importante que se proponham e adotem novos métodos e modelos de ensino que venham a enriquecer o processo educativo dos estudantes, "através da inserção da tecnologia, redefinição dos papéis de alunos e professores, proposição de novas formas de ensino" [38].

Segundo [11], a maior parte das aulas são passivas, portanto faz-se necessário abordar todos os estilos de ensino e não apenas um. Com base nessa afirmação são estabelecidas algumas recomendações aos professores, tais como [11]: a) Estabelecer relevância e aplicação para todos os assuntos da disciplina, de modo a apresentar o material teórico junto a exemplos gráficos ou figuras/imagens, ou mesmo multimídia, favorecendo assim estudantes sensoriais, intuitivos, globais e visuais; b) Equilibrar informações concretas/fatos e informações abstratas/teorias/modelos, favorecendo assim estudantes sensoriais e intuitivos; c) Dar um pequeno tempo para os estudantes pensarem sobre o que foi dito, favorecendo assim os estudantes reflexivos; d) Introduzir durante as aulas exercícios em pequenos grupos, desenvolvendo nos alunos características ativas e reflexivas; e) O uso de programas de computador também favorece tanto alunos sensoriais quanto alunos ativos.Para desenvolver nos alunos todos os estilos, são muito favoráveis atividades como: problemas e exercícios abertos que demandem raciocínio criativo e julgamento critico; tarefas que

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exigem cooperação e; problemas que estimulem soluções criativas.

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The Optical Tweezers and the Nobel Prize in Physics

Celso Luis Levada, Huemerson Maceti, Miriam Magalhães O.Levada, Ivan José Lautenschleguer

Science Teaching Group of the Herminio Ometto Foundation – Brazil
celsolevada@yahoo.com.br

Abstract**—** *The Royal Swedish Academy of Sciences awarded the Nobel Prize in Physics in 2018 to three scientists, Arthur Ashkin of Bell Laboratories, Holmdel, USA, Gérard Mourou of the École Polytechnique, Palaiseau, France, and University of Michigan, Ann Arbor, USA, and Donna Strickland of the University of Waterloo, Canada. Inventions that were distinguished with the award revolutionized laser physics. Extremely small objects and incredibly fast processes are now being seen by the incidence of light. These advanced and accurate instruments are opening up areas of research yet to be explored and can be used in many industrial and medical applications.*

Keywords**—** ***Nobel in Physics, Laser, Arthur Ashkin, Gérard Mourou, Donna Strickland.***

I. INTRODUCTION

The Nobel Prize in Physics is an award distributed annually by the Royal Academy of Sciences of Sweden to scientists from various fields of physics. It consists of one of five Prizes established by Alfred Nobel in 1895, revering notable contributions in physics. According to Alfred Nobel's aspiration, the award is administered by the Nobel Foundation and the laureates are chosen by a council of five members elected by the Royal Swedish Academy of Sciences. The awards usually take place in Stockholm on 10 December, the anniversary of Alfred Nobel's death.

In 2018, Arthur Ashkin, Gérard Mourou and Donna Strickland were the three researchers awarded the Nobel Prize in Physics for contributions made in the field of Lasers Physics. These works, although related to Physics, are multidisciplinary and have practical applications in many other branches of knowledge, including Chemistry, Biology and Medicine. A brief biographical and curricular summary will be made of each of the laureates, with the help of information obtained on the web.

Arthur Ashkin[(1)] was born in Brooklyn, New York, in 1922, into a family of Ukrainian Jewish origin. His parents were Isadore and Anna Ashkin. Ashkin met his wife, Aline, at Cornell University, and then they got married and had three children and five grandchildren. Ashkin graduated from the James Madison School of Brooklyn in 1940. He attended Columbia University and was a Columbia Radiation Laboratory technician responsible for building magnetrons for US military radar systems. Ashkin earned his Bachelor of Physics degree from Columbia University in 1947, received his Ph.D. from Cornell University in 1952, and then went to work for Bell Labs at the request and recommendation of Sidney Millman, who was Ashkin's supervisor at Columbia University.

Gérard Mourou[(2)] was born in 1944 in Albertville, France. Mourou graduated from the University of Grenoble, where he obtained his Master degree in Physics in 1967, and graduated in 1970 at the University of Paris with a specialization in optics. In 1973, he obtained a PhD in Sciences from Paris University, currently University of the Sorbonne, working with short-pulse lasers. He performed postdoctoral research at San Diego State University, USA. From 1979, he worked at the University of Rochester, New York and, in 1988, joined the University of Michigan. Mourou also served as Director of the Laboratory of Applied Optics at the École Polytechnique, where he set up a research group on ultrafast lasers, concomitant with his academic career in the United States from 1977 to 2005.

Donna Theo Strickland[(3)] is a physicist specialized in laser and academic who was born in Guelph, Canada, on May 27, 1959. Strickland is married to Douglas R. Dykaar, a consultant in Optics and Electronics. The couple has two kids. She graduated in Physics Engineering in 1981 from McMaster University. She then obtained a doctorate in optics, with the thesis based on the development of an ultra-fast laser with application in multi-photon ionization, where she was overseen by Mourou. From 1988 to 1991, Strickland was a researcher at the National Research Council of Canada. In 1992, she worked as a physicist in the laser division of Lawrence Livermore National Laboratory. She has worked in the ultra-fast laser division of Lawrence Livermore National Laboratory and has also been a member of the technical team at Princeton's Center for Advanced Technology for Photonics and Optical-Electronic Materials. In 1997, she

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joined the University of Waterloo as a teacher, where she currently works and leads a study group in high-intensity laser for optical investigations.

II. INFORMATION ABOUT OPTICAL TWEEZERS

According to DWIVEDI[4], the great development of biotechnology in the 1980s provided the arising of techniques capable of manipulating and extracting nanometric scale information from biological systems. Among them, it is possible to highlight the optical tweezers, which represent a tool that uses a beam of light to capture and move small particles. By exerting forces of the order of piconewtons on the captured particles, its main application is of interest microscopic, especially in the study of cells and biomolecules. The term "optical tweezers" was used by Arthur Ashkin in his article in the journal Science No. 235 in the year 1987.

This new tool meant the achievement of an ancient science fiction dream of using the radiation pressure of light to move physical objects. According to GOLLNICK[8], the German physicist Johannes Kepler (1571-1630) was the first to suspect that light had strength, and it was even able to push some objects. For him, the pressure of the sun's rays acted on the tail of the comets, sweeping them away, and always in the opposite direction of the Sun. Two centuries later, the Scottish physicist James Clerk Maxwell mathematically demonstrated that Kepler was right. The Kepler idea is confirmed, in 1873, by the Scot James Maxwell who creates the theory by which light is made of electricity and calculates the exact strength of the light rays. But light rays are usually rarefied and therefore very weak.

III. OPTICAL TWEEZERS

It is important to note that in the optical trap, (Figure 1), the capture occurs in a way in which the entrapped particle does not remain fixed, but oscillates around a position of equilibrium, that is, it behaves like a Hooke's spring[7], governed by the equation F = kx, generating forces on an object proportional to its displacement from the center of the trap. It is as if there is a spring connecting the center of the particle to the focus of the laser (figure 2), so that when the laser is moved, the particle accompanies its movement three-dimensional. According to ASHKIN[7], for force measurements, the trap of the particles is approximated by a harmonic well, whose force can be determined by Hooke's law. This requires a method to measure the displacements of the trapped object relative to the center of the trap during the interaction. For this, one can use the aid of another optical trap acting as a disturbing force. In various experimental situations, it is desired to measure the force in the radial dimension or in the axial dimension. The interaction between light and matter can be understood as a collision that occurs when the incident photon has its trajectory deflected by a particle, causing a retreat in the object that deviated it and several forces arise as a result of the photons clashing with the particle to be captured.

Briefly, one can say that the optical traps involve the equilibrium of two types of optical forces, the radiation pressure force in the dispersion form and the gradient force. The first force pushes the object along the direction of light propagation while the gradient force pulls the object along the spatial gradient of light intensity. According to ASHKIN[7], when the gradient force is greater than the radiation pressure force, the object is attracted by the point of greatest intensity formed by the focused light and so it can be entrapped. However, if the gradient force is less than the radiation pressure, the direction of the resulting force tends to push the center of the particle away from the laser focus, ejecting it rather than imprisoning it. The balance occurs when the two forces equal each other. The gradient force is proportional to the polarizability of the particle as well as to the gradient of the field, while the radiation pressure force is due to the transfer of momentum from the light to the particle. These two forces are applied by a beam of intensity I on a dielectric particle of radius r.

According to ASHKIN and DZIEDZIC[11], the gradient force is given by:

$$\vec{F}_{grad} = 2\pi \frac{n}{c} \alpha \nabla I \qquad (1)$$

In this equation, the term α represents the effective polarization of the spherical particle in the medium, ∇I symbolizes the luminous intensity gradient, c is the speed of light and n is the refractive index of the medium. On the other hand, the force due to the radiation pressure, according to ASHKIN and DZIEDZIC[11], is given by the following relation:

$$\overrightarrow{F_{pr}} = \frac{c}{n} P_{pr} \vec{u} \qquad (2),$$

where $\overrightarrow{F_{pr}}$ represents the force due to the radiation pressure, c is the speed of light in the middle, n is the refractive index of the medium, $\vec{u}$ is a unitary vector in the direction of light propagation and P_{pr} symbolizes the diffusion power of light.

The radiation force is the result of the reflection of the photons in the object, causing a separation force of the particle in relation to the light source. The force due to the gradient originates from the refraction of light through the sphere. For a spherical object, these forces are in equilibrium, causing the sphere to be positioned at the focal point of the laser beam. The problem of optical tweezers related to a microsphere of arbitrary radius is

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quite complicated. In view of this there are many works with limit theories, valid for microspheres representing the particle, very small or very large compared to the wavelength of the laser light used.

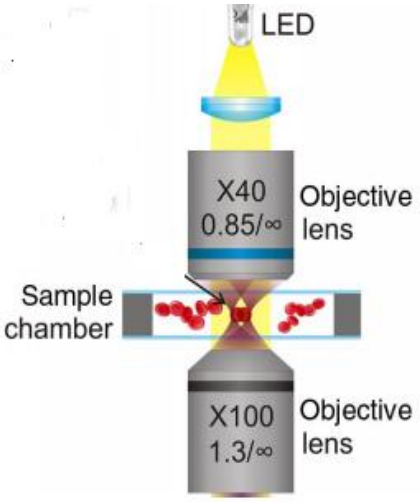

Fig 1- Optical trap / Source Lee et al., Journal of Biomedical Optics 21(3), 035001 (March 2016)

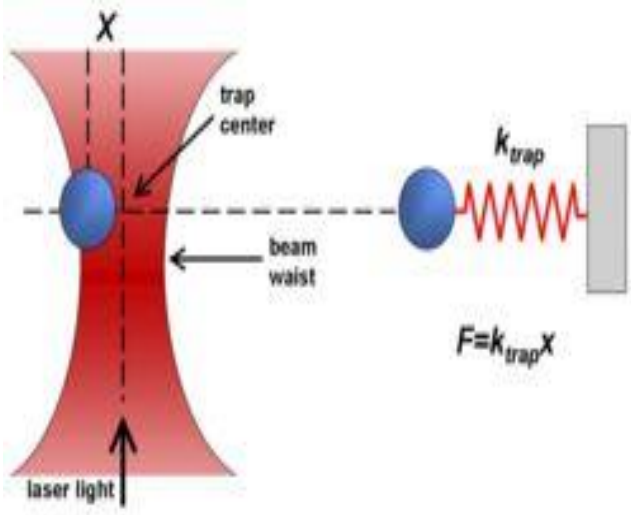

Fig. 2 Dielectric objects are attracted to the center of the beam obey Hooke law

Source:
http://image.sciencenet.cn/olddata/kexue.com.cn/upload/blog/file/2010/4/2010414145740528205.pdf

IV. PRACTICAL APPLICATIONS

Several aspects of the optical tweezers make it a very important tool in the life sciences, such as its non-destructive remote handling and measurement capable since it uses light only in real time. The optical tweezers have been used in two ways, direct manipulation of microorganisms and measures of mechanical properties. According to BUICAN[5], the acceleration of the particles by short and high intensity laser pulses has a great potential of use in medicine, as in the treatment of tumors, allowing a high precision and a higher repetition rate of pulses. These laser pulses are widely used in optical correction surgeries, since they are associated to energies that may not be as high.

The technique of optical tweezers allows, for example, studying biological systems, especially the DNA molecule and its interaction with some important drugs in medicine, widely used in the treatment of human diseases. According to GREULICH[6], optical tweezers are applied in several studies such as the research of interactions between proteins and DNA, involved in the organization, replication, transcription and repair of DNA, as well as the study of protein energy field and kinetics of molecular motor.

Regarding ultra-fast laser pulses, it can be said that the processing techniques can be used in the direct recording by photo-resistance laser and other transparent media, in the creation of three-dimensional photonic crystals, as well as micro-optical components, grids, tissue engineering structures and optical waveguides. These structures are useful for enabling telecommunications and bioengineering applications that rely on the creation of increasingly sophisticated miniature parts. The precision, the speed of manufacture and the versatility of the ultrafast laser processing make it well accredited to become an important industrial tool.

V. FINAL CONSIDERATIONS

According to EISBERG[9], the invention of the laser in the 1960s allowed access to a coherent source of light and was the beginning of many investigations into the properties of light and its interactions with matter. Laser has made it possible to exploit optical forces related to optical traps. Originally an acronym for Light Amplification by Stimulated Emission of Radiation. The way a laser works is by oscillating the electrons between two allowed states, causing them to emit a photon of a very particular energy when they fall from higher energy state to the lower. These oscillations cause the emission of light.

Since it was invented for the first time, there were other opportunities for scientists to develop techniques to make the laser better, more powerful and more efficient. When the laser was created, its beams were of low power because any attempt to amplify the light even more would destroy the device. However, using an ingenious approach, these nobelists were able to create ultra-short high intensity laser pulses without destroying the amplification material. Gérard Mourou and Donna Strickland paved the way for shorter and more intense laser pulses. Strickland is the third woman in history to win the Nobel Prize in Physics and the first in 55 years.

According to FIGUEIRA[10], until recently it was not possible simultaneously to create short and powerful pulses, since concentrating energy in a short time would

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imply creating distorted pulses or damaging the laser components. This inconvenience led us to believe that there would be no further innovations in the area and that laser research would have entered a process of stagnation. However, Mourou and Strickland were the first to recognize that the CPA technique, that is, Chirped Pulse Amplification, applied to the radars, could be used in optics. In the application of the CPA technique, it starts with a short laser pulse increasing its duration, and then amplifying this elongated pulse and, in the end, reduces the duration back to the original. Thus, the pulse is prevented from being short during the phase in which problems may occur. This type of laser produces extreme optical powers: very high energies concentrated in incredibly short durations, which today reach the thousandths of billionths of a second. These laser pulses characterize the shortest-lived phenomenon produced by mankind and consequently allow the study of other phenomena in incredibly short time and distance scales. These ultra-short lasers have numerous applications, including countless corrective eye surgeries that are performed every year. In addition to its practical applications, the method may open a new frontier of research in particle physics. On the other hand, scientists are already beginning to apply the technique to accelerate subatomic particles, which may in the future replace large accelerators such as the LHC.

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Investigating Web 2.0 Tools Use and Students Cognitive Engagement in Selected Tanzanian Higher Institutions: Preparing Towards 21st Learning

Issa Omar Malecela and Assoc. Prof. Dr. Sharifah Sariah Syed Hassan

International Islamic University Malaysia
E-mail:chapakazi2013@gmail.com; sharifahshahab@iium.edu.my

Abstract**—** *With the availability and affordability of computers and communication technology devices worldwide, teaching no longer centers around teachers. Students become autonomous learners, taking the ownership of learning where they no longer rely fully on teachers as the learning resources. This paves innovative intervention towards engaging the learners cognitively using Web 2.0 tools. Web 2.0 tools offer learners to engage in higher order thinking skills involving not just to understand and apply but also to analyze, evaluate and create through two-way communications and collaborations. Due to the pedagogical potentials of Web 2.0 tools, this study attempts to investigate how the students involve Web 2.0 tools in supporting classroom learning. This study employed a questionnaire survey among students at a Higher Learning Institution involving 100 samples. This is a preliminary study prior to the final study involving bigger populations from different universities. Interviews were also carried out among three students to gain in-depth understanding of learning that enables the researcher to derive a conceptual model. The related main ideas from each interviewee were gathered to get commonality of themes. And finally, main themes were generated. A systematic data analysis was done based on developing themes in an inductive way as directed by the content of data. The findings reveal that the majority of students use Web 2.0 tools for finding resources, communication and for both low and higher order thinking skills. Further findings show that Academic readiness contributed significantly on students cognitive engagement while Use of Web 2.0 tools did not contribute significantly. Implications of the study address the theoretical and practical aspects.*

Keywords— Web 2.0, cognitive engagement, 21st Century, higher learning institutions.

I. INTRODUCTION

Web 2.0 tools are defined as those digital tools that enable accessing and producing knowledge in ways that move beyond passive consumption to active construction **(**Beach, Hull & O'Brien, 2011). There are different types of Web 2.0 tools such as (i) social network sites which include Facebook, Twitter, WhatsApp. These are online tools that enhance collaboration, information sharing, communication and interaction of learners and lecturers in teaching and learning activities. (ii) Media sharing which include Moovely, Youtube, Google plus (+), Vimeo, Prezi (iii) Blogging like Blogspot.com, Wordpress, Website editor, Mozello.com, Wix.com, Weebly.com, Moovly (iv) Online library like ProQuest, Google scholar (v) Content management such as learning management system (LMS) which includes Moodle and Blackboard. Table 1.0 reveals the types and applications of Web 2.0 tools.

Table.1.0: Web 2.0 Tools and their functions in teaching and learning

Types of Tools	**Examples**	**Applications**
Social network sites	Facebook, Twitter, WhatsApp, MySpace	Enhances learner to interact with peers and lecturers. Enhance knowledge sharing, creative production, development of ideas and making reflection
Media sharing	Moovely, Youtube, Google plus (+), Vimeo,	Facilitate sharing videos, photos

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	Prezi, Flickr, Google drive, Wikipedia, Wikis	
Blogging	Blogspot.com, Wordpress, Website editor, Mozello.com, Wix.com, Weebly.com, Moovly	enables online-users to make regular postings to the Web, e.g., a personal diary or an analysis of current events
Online Databases	ProQuest, Scopus, Taylor & Francis, Science Direct, Google scholar	Helps to retrieve online resources for research and teaching and learning purposes.
Content management	Learning management system(LMS) which includes Moodle, Blackboard.	Facilitate to create, share, augment, tag, and upload content.
Wikis	Wikipedia,	assist users to post and edit one another's content/work. Enable users to make collaborative writing and can be used as a repository for the storage and retrieval of professional knowledge
Bookmarking	Delicious.com, tagging, folksonomies	enhance users to add, annotate, edit, and share bookmarks of web documents

Web 2.0 tools affordances are aligned with the technological pedagogical content knowledge (TPACK) model of Koehler and Mishra (2009). The model offers potential guidance for instructors to utilize when employing technology in teaching and learning. Thus, when these tools are properly integrated into instructional methods based on this model, they are assumed to foster collaborative and social skills among students in higher learning institutions.

To prepare learners for career readiness, lecturers can utilize Web 2.0 tools as they stimulate a dynamic discussion among the learners, enhance interaction and communication among learners to learners, learners to instructors, instructors to instructors as well as with parents (McLaughlin and Lee, 2007; Duffy, 2008; McLaughlin and Lee, 2008; Light and Polin, 2010). Web 2.0 tools are imperative for 21st century learners who need a variety of social skills to make them meet the requirements of a dynamic job market, place them to attain brilliant learning achievements and enhance them to serve the community (Newland and Byles, 2014; World Economic Forum, 2015).

ICT devices are now ubiquitous everywhere in Tanzania and affordable. ICT can raise the quality of education through supplement of traditional and modern pedagogical methods like inquiry and project-based and experimental learning techniques. As such, these technologies can be exceptionally utilized to enhancestudents' cognitive engagement. It will enhance the underprivileged students to access learning materials that will enable them to develop higher order thinking skills. As such, these skills will enhance them qualify for prospect jobs(Elzarka, 2012). Nowadays, employers claim that lack of skills among graduates is related to outdated curriculum in higher learning institutions(Williams, 2015). Thus, as the needs of the employers focus on the 21st century skills, the students' learning should change as well. This, requires higher learning institutions to redesign their curriculum in order to produce employable graduates.

Studentshave opportunities to use the readily available Web 2.0 tools to access online resources for academic purposes. Social learning, collaborative tools, interactivity and innovation are terms entangled to describe Web 2.0 tools or Web-based learning. As we are approaching to the year 2021 which is the blue print of Tanzania five year plan development, there is a need to know the extent and how higher learning institutions assist the government to reach its development plan. Additionally, as higher learning institutions increasing across the country, it is difficult to know whether or not Web 2.0 tools are employed in learning by the students to foster the 21st century skills among them. Thus, this study is aimed to establish the extent students integrate Web 2.0 tools in learning.

II. STATEMENT OF THE PROBLEM

Student cognitive engagement is among the most important phenomenon in the 21st century learning strategies that accelerate the skills needed in the job market (Robles, 2012). Williams (2015) studied the perceptions of students and employers on the employability skills. Findings show that both students and employers believe that the 21st century skills such as higher-order thinking, problem solving, critical thinking, communication, collaborative and social skills are among the key determinants for employment among prospective graduates.

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Many studies on the twenty-first century skills have been suggesting and recommending to reshape the curriculum to enable learners acquire the demanding skills (Walser, 2008; Trilling &Fadel, 2009; National Institute of Education, Singapore, 2009; Kereluik, Mishra, Fahnoe& Terry, 2013; Brown &Duguid, 2017).

Student cognitive engagement might be enabled by using Web 2.0 tools in learning. Nevertheless, the studies of how best to integrate the Web 2. 0 tools in learning to foster student cognitive engagement in Tanzania are minimal.So, the present study attempts to fill this gap. This present study will investigate the integration of Web 2.0 tools among students to foster their cognitive engagement.

Purpose of the Study and Research Questions

This study was carried out with the purposes of investigating the extent learners integrate the Web 2.0 tools in learningand to examine the influence of using Web 2.0 tools on the student cognitive engagement in learning. More specifically, the questions driving the current study were:

1. To what extent do students use Web 2.0 tools in learning?
2. How do students perceive their readiness in adopting 21st century learning activities?
3. Are there possible effects of Web 2.0 tools on the students' engagement in learning?

III. LITERATURE REVIEW

Usage of Web 2.0 Tools in Learning

Web 2.0 tools are defined as those digital tools that enable accessing and producing knowledge in ways that move beyond passive consumption to active construction (Beach, Hull & O'Brien, 2011).Uzunboylu, Bicen and Cavus (2011) conducted a case study on integrating Web 2.0 tools into education. The study also sought students' opinions on positive impacts of Web 2.0 tools in learning. findings of the study reveal that most students were excited by using Web 2.0 tools in learning.Salehe (2008) investigated the use of Web 2.0 tools for facilitating collaboration in higher education.. The study aimed at evaluating the usefulness of Web 2.0 tools in learning as perceived by learners of higher learning institutions. The study employed a questionnaire survey to collect data. The study shows that learners recognized and were aware about the benefits of Web 2.0 tools such as Wikis, Blogs and Podcasting as paramount tools in teaching and learning. Additionally, the findings reveal that some learners were lacking knowledge on how to utilize some Web 2.0 tools that are useful in learning.

Crook, Harrison, Farrington-Flint, Tomás and Underwood (2010) studied Web 2.0 technologies in and outside learning environment. The study aimed at investigating the use and impact of Web 2.0 technologies in teaching and learning. The study employed a mixed methods. A questionnaire survey and interviews were used to generate data. The findings show that students use Web 2.0 technologies in both in and outside classroom. The findings also show that Web 2.0 technologies motivate and engage students in teaching and learning activities. Furthermore, Web 2.0 technologies were found to establish a participatory, collaborative and creative attitude of inquiry among both students and lecturers. A study by Dell(2012) found that Web 2.0 tools enable student cognitive engagement if these technologies are used meaningfully, students communicate with their fellow students, learners become content creators and usage of diversity of learning experiences.

Web 2.0 tools are pedagogical affordances.McLoughlin and Lee (2007) define Web 2.0 affordances as an activity that one can possibly do in a particular setting with a given tool to accomplish a certain task. For instance, utilizing blogs to write a text, edit it and post it. In other words, Web 2.0 affordances means the assistance that can be enhanced using its applications to make learning take place smoothly.

Web 2.0 tools enhance two-ways interaction (between lecturers and students) and stimulate learner's participation through diversity of images, text, audio and video. For example Wikipedia allows users to generate their ideas and enables users to refer for definitions and details of objects and events. Using Wiki for instance, students can create a glossary to define a concept from their own words (Tynan& Barnes, 2012). Similarly, using Popplet for mind mapping, students can brainstorm views both asynchronously and synchronously. Similarly, using Popplet for mind mapping, students can brainstorm views both asynchronously and synchronously.Web 2.0 tools enhance collaborative learning**.**Collaborative learning is the students' ability to learn or complete a given project/task together (Gerlach, 1994 &Laal&Laal, 2012).. As such, both students and lecturers become co-content creators or co-authors.

Student Cognitive Engagement

Student cognitive engagement refers to the extent to which students are willing and able to take on the learning task at hand (Rotgans& Schmidt, 2011). Manwaring (2017) defines student cognitive engagement as an approach that extremely engages student in learning intrinsically (self-regulation).

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Student cognitive engagement enables students to interact with the content of the lesson in a deep and thoughtful manner. It is through student cognitive engagement process that learning can take place. This makes students who are the recipients of instruction to receive the information which is efficient and on target.

Student cognitive engagement is very crucial in learning environment. Solis (2008) contends that student cognitive engagement is a prerequisite of student learning. So, in order for learning to take place in conducive environments that accommodate the entire students, cognitive engagement is crucial. Student cognitive engagement enhances learning to be truly meaningful to the students. Solis (2008) listed the following potential benefits of student cognitive engagement: students feel being included and fairly treated; students demonstrate their ability when they are involved in successful tasks; students can make their choices and learner autonomy; students become more active in discovering, constructing ideas and creating content; students become busy; students listen, observe, notice and become mindful in learning; students can say, do, write and respond openly and after class, students look satisfied.

IV. METHODS

Research Design

This study employed a mixed method design using sequential explanatory approach. As such, the study relied mostly on quantitative approach as its major source of collecting data followed by qualitative method as to offer further explanations of quantitative data results.

PARTICIPANTS

This study consisted of a Higher Learning Institution in Tanzania involving (N=100) samples.**Data Collection Procedures**

The researchers used questionnaire survey and interview protocol among the Higher Learning Institution involving 100 samplesto collect data.The researchersadministered the distribution of the questionnaires and collected them back after a half an hour. The researchersalso used purposive sampling technique to identify three informants for the interview sessions. The researchers used hand phone (HP) and MP3 to record the interviews. The researchers were focusing on interview questions. However, they were flexible to allow the continuation of the interview and gain the feedback. The researchers were probing where necessary for tracing more information pertaining Research Question 2.

Data Analysis Procedures

Statistical Program for Social Sciences (SPSS) wasutilized to analyze the data. The demographic information of the respondents are provided through percentage and frequency. Descriptive statistics using mean scores and percentage wereemployed to address Research Questions 1. In addressing research question 3, Multiple Regression Analysis (MRA) were employed. The researchers also used thematic analysis of interviews for the qualitative findings.

V. RESULTS

Quantitative Demographic Information

The quantitative demographic data collected comprise gender, age, year of study, ICT knowledge's level and subject that integrated ICT most. The data from the questionnaires were statistically analyzed using SPSS version 20.The demographic information are shown in Table 1.

Table.1: Respondents' Demographic Information

		Frequency (n)	Percentage (%)
Gender	Male	24	24
	Female	76	76
Age	19-23	70	70
	24-28	26	26
	29 and above	4	4
Year of study	1st year	94	94
	2nd year	5	5
	3rd year	1	1
ICT knowledge	Beginner	39	39
	Intermediate	56	56
	Advanced	5	5
Subject integrating technology most	ICT related courses	1	1
	Non ICT courses	99	99

Note: Total respondents are 100.

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ICT-related courses in this study are referred to as courses that offer skills of functions of information and communication technologies such as retrieving, assessing, storing, producing, presenting and exchanging information by communicating and participating in collaborative networks via the Internet. **The non ICT-related courses** are related to courses that do not offer ICT skills which include social sciences like History, Political Sciences, Psychology, Linguistics etc.(Herman, 1999 &Lemeke, 2002).

Qualitative Demographic Information

Purposive sampling technique was utilized to identify 3 informants for the interview sessions in qualitative approach of this study from the selected higher learning institutions in Tanzania comprising a male and two females. See Table 1.1

Table.1.1: Informants Demographic Information

Informants	Gender	Year of Study	Age	ICT Skills	Course	Discipline
1	M	2nd	19-24	Advance	Electrical Engineering	Pure Science
2	F	2nd	19-24	Intermediate	Geography& History	Social Sciences
3	F	2nd	19-24	Intermediate	Geography& History	

WEB 2.0 TOOLS USAGE

This section presents the findings of Research Question 1 of this study. The responses to the items I to 11 which were about the usage of Web 2.0 tools among HLIs' students in learning were rated " agree and strongly agree" signifying a score above 50%. The findings show the highest agreement of 94% with item 4 (I use Social networks (e.g. Facebook, Twitter) to extend and share ideas with my friends).This item was followed by item 9 (I refer to resources from websites for research or writing assignments) constituted the agreement of 93%. Item 10 (I use email to send my documents/assignments to my lecturers/friends) has scored 89% of "agree and strongly agree).This indicates that in general, many students use Web 2.0 tools in learning.

With the reference to items 1(I give feedback in my friend's blog) with 64% of agreement, item 2 (I am able to work together with my colleagues to accomplish assignments through Google Docs or Google Drive) with 87% of agreement, item 3 (I am able to share educational video with my classmates via YouTube or Google plus (+), with 75% of agreement, item 5 (I use Learning management system (LMS) e.g. Moodle or Blackboard, to create, share or upload content) with 66% of agreement, item 6 (I use blogs to share reflective or academic writing) with 60% of agreement, item 8(I upload self-developed video hosting sites such as YouTube/Vimeo/Wix.com/other Websites) with 52%, item 11 (I collaborate with friends to design graphics using online apps (e.g.canvas)) with 53%, the findings signify that the majority of the students use Web 2.0 tools in higher order thinking. The findings are also in parallel with the definition of Lcloughlin and Lee (2008) on the usage of Web 2.0 tools in learning.

However, the items 4, 9 and 10 suggest that students also use Web 2.0 tools i.e. Facebook, Twitter, email and online resources in lower thinking activities. When prompted with the interview questions on how the students use Web 2.0 tools in learning, they responded with the key themes that include giving feedback, work together, share videos, share online learning resources, using blogs or websites and network use learning. (See Table 1.2).

Table.1.2: Mean, Standard deviation and Percentage of Agreement

	Mean	Std. Deviation	Strongly agree%	Agree %	I'm not sure%	Disagree%	Strongly disagree%
1) I give feedback in my friend's blog	3.89	1.24	19.3	44.7	12.0	13.4	10.5
2) I am able to work together with my colleagues to accomplish assignments through Google Docs or Google Drive.	4.20	.92	42.8	43.8	5.4	6.6	1.5
3) I am able to share educational video with my classmates via YouTube or Google plus (+).	3.89	1.05	30.8	44.5	9.5	12.0	2.2

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4) I use Social networks (e.g. Facebook, Twitter) to extend and share ideas with my friends	4.49	.72	58.2	36.2	2.7	2.2	.7
5) I use Learning management system (LMS) e.g. Moodle or Blackboard, to create, share or upload content.	3.67	1.14	24.9	40.8	16.4	12.5	5.4
6) I use blogs to share reflective or academic writing.	3.41	1.26	19.3	40.8	11.0	19.6	9.3
7) I create a website for the course/subject using Wix.com/Google sites/ online free Website templates	2.83	1.28	11.2	24.4	16.6	31.1	16.6
8) I upload self-developed video hosting sites such as YouTube/Vimeo/Wix.com/other Websites.	3.23	1.31	17.8	34.2	12.7	23.2	12.0
9) I refer to resources from websites for research or writing assignments	4.39	.84	53.1	39.6	2.9	2.0	2.4
10) I use email to send my documents/assignments to my lecturers/friends.	4.30	.93	50.9	37.9	4.2	4.6	2.4
11) I collaborate with friends to design graphics using online apps (e.g.canvas)	3.33	1.29	21.0	32.0	15.2	22.2	9.5

N=100

STUDENTS'S READINESS

To answer the Research Question 2, interviews data were used. All 3 informants were asked about their readiness in using Web 2.0 tools in learning activities. All informants replied that they have been integrating Web 2.0 tools in diverse learning activities. Moreover, the study found key words that include giving feedback, collaboration, video sharing, sharing online content learning resources, sharing ideas**,** and academic /reflective writing, All these learning activities are parallel with Research Question 1..

Giving feedback

Feedback is referred to as providing information in a manner that motivates the receiver to agree with it, reflect on it, produce improved learning, and adjust for the better learning outcomes (Hattie, 2011). In referring to the quantitative findings, students use email to send documents and assignments to their lecturers with 93% of agreement. In addition, when respondents were probed with the question: "how do you use Web 2.0 tools in learning"? they replied indicating email as a platform for feedback, awarding marks and communication. Students send their works to lecturers, then the lecturers give feedback to their students through email.

> Sometimes you can email the lecturers and they can also give you feedback through the same email. (I3, DU 94, 96).
>
> After communicating with our professors or with our teachers,by sending our works through email, we will receive the feedbackthat they have received our work. After that the teachers are sending our feedback through email.They also, send our marks through email. They give feedback at the same time. When you contact them immediately they reply.There is good communication with our lecturers. (I2, DU 116, I1, DU 91, 93, 95, 97, 99, 101, 103, 105, 113, 115).

Out of three informants, two agreed that email was used as online feedback. The other one did not use email to get feedback through online from the lecturers. Instead, he usesWhatsApp and text messages. However, it is not their culture to call their lecturers either through WhatsApp call or phone.

Collaboration

Collaborative learning is referred to as students work together to accomplish a given task through Web 2.0 tools such as Google docs. With the availability of technology affordances, collaborative learning allows students to engage in inquiry, discuss critically, reflect by creating knowledge, explore means to innovate, solve problems (Harasim, 2012). In the quantitative findings, students show that they work together with their friends to accomplish assignments through Google Docs or Google Drive with 86.6% of agreement. The qualitative findings show also students use social networks i.e. WhatsApp, Facebook, Twitter and Instagram for collaboration in learning

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activities. They discuss assignments, projects and question given to them by their lecturers:

> If I want to show fellow students, about what I have done. I always use WhatsApp call(video), to show him or her how about my project running generally.(I1, DU 53).
>
> Sometimes, we collaborate(discuss) while sitting separately and in different places. For instance, while chatting with WhatsApp, Facebook,Instagram. (I3, DU 74, 76, 80, 82).
>
> We are collaborating(discussing) with others using these tools. (I2, DU 63, 65).

However, the term 'collaboration' from students' perspective, does not correspond with its definition, which is working together to accomplish a given task. The word collaboration rather, here means discussion. In general, it can be concluded that most students use Web 2.0 tools in discussing different issues which are related to their courses.

Video sharing

Video sharing is defined as a process of knowledge sharing through Web 2.0 tools by uploading educational videos on You tube and blogs to facilitate learning process. Through this process, knowledge is shared between students and lecturers, students and experts, and between students and students. The potential of educational videos includes increasing student engagement, offering flexible learning, enabling remote learning opportunities, simplifying thinking and problem solving, assisting with mastering learning (Bijnens, Vanbuel, Verstegen& Young, 2006). With regard to quantitative findings, students share educational video with their classmates through YouTube or Google plus (+), with 75.3% of agreement. Qualitative findings reveal sharing educational video via Youtube:

> I always use.. use YouTube.So, I can share with my friends (I1, DU 40, 42).
>
> I almost use YouTube to find different videos. YouTube, I do use it.Yeah! (I2, DU 32, 98, 100).
>
> we use that for sharing materials during university exams, during assignments from the lectures, we try to share using some blogs. Some students write and use some blogs. Some students have their own blogs. So they can write materials and put in blogs. So you access to these blogs you find the answers for that. So you compare and you find the answer for that. So, students try to make a blog and create a blog and put some materials which will be better. (I3, DU 18, 28).
>
> There are some students from another colleges or another universities… we still share these through online groups.Yeah! And sometimes, even.. even when we are together. (I2, DU 66, 68).
>
> Yeah! And also I have got a link which used usually in YouTube. After making our own projects, we always try to.. to put it there on our link so that.. after that we supply to other students so that they can check there and look on how we progress and how we are doing. (I1, DU 57,59).

This indicates that the qualitative findings are parallel with the quantitative findings.

Sharing online content learning resources

Sharing online content learning resources is defined as textual, visual, aural, images, sounds, videos, animations that online learners use and share throughWeb 2.0 tools such as Moodle (Rosenfeld &Morville, 2002).Referring to quantitative findings, sharing online learning resources using Learning management system (LMS) e.g. Moodle or Blackboard, with 66% of agreement. The qualitative findings also show that students use Web 2.0 tools to share online learning resources:

> Thereare some discussions that we are conducting in this university. So, we need to have these Web 2.0 tools so that we can conduct our discussions. we still share these through online groups. (I2, DU 50, 52, 66).
>
> I always use YouTube. So, I can share (online) learning resources with my friends. (I3, DU 40, 42).
>
> I use these Web 2.0 tools in searching materials, in communicating. I use them for asking questions. I use them in searching. So, I search materials for different purposes in learning. (I1, DU, 16).

Thus, based on both quantitative and qualitative findings, it can be concluded that more than 50% students use Web 2.0 tools to share online content learning resources.

Sharing ideas

Share ideas is referred to as using social networks i.e. Facebook and Twitter which enable students to engage with friends, lecturers and experts in contributing educational thoughts in online learning environment i.e. online

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discussion forum (McLoughlin& Lee, 2008). Referring quantitative findings, students share ideas through social networks (e.g. Facebook, Twitter) with 94.4% of agreement. The qualitative findings indicate sharing educational ideas among students via social networks:

> There are some students from another colleges or another universities, but we still share these (online) learning resources through online groups(WhatsApps)! And sometimes, even when we are together (still) we can share. (I2, DU 66, 68).
>
> After making our own projects, we always try to put it there on our link. Afterthat we supply(share) to other students so that they can check there and look on how we progress and how we are doing (I1, DU 53,55,57,59).
>
> I always use YouTube.So, I can share with my friends (different contents) for learning. (I2, DU 40, 42).

In addition, YouTube used as platform for sharing educational materials with their friends:

> And also I have got a link which I use usually in YouTube. After making our own projects, we always try to put it there on our link so that we supply to other students so that they can check there and look on how we progress and how we are doing. (I3, DU 57,59).

Other students use You tube for searching video which related to their subjects/courses they take:

> I almost use YouTube to find different videos. (I1, DU 32, 98, 100).

With regard to sharing ideas, normally, people share videos online in order to get connected with others, to get more involved, to support issues that they care about, to get acceptance and recognition from others and to attain their potential in future. This is parallel with Maslow(1954)'s theory which suggests that human being is driven by 5 elements of needs notably, basic needs which include food, water, sex; safety which involves sheltered environment; belongingness which consists of love, affection; self-esteem which comprises self-respect, recognition from others; and self-actualization which encompasses attaining one's full prospective. So, from the findings of this study, students share ideas online based on their belongingness 'sharing with friends'; self-esteem 'showing their project to others'.

Academic /reflective writing

Academic reflective writing is defined as students writing reflectively academic papers or assignments given by their lecturers through Web 2.0 tools such as blogs, then they share with their friends and lecturers to meet their needs and those of others (McLoughlin& Lee, 2007).

The quantitative findings show that students use blogs as their platforms for academic writing to their lecturers and friends with 60.1% of agreement. Moreover, qualitative findings reveal blogs as platform for creating websites and writing academic materials. Students upload them and share with their friends. Some students use these blogs to write academic resources while others use blogs to get answers for their assignments:

> Some students write and use some blogs. Some students have their own blogs. So they can write materials and put in blogs. So you can access to these blogs you find the answers for that. So you compare and you find the answer for that. So, students try to make a blog and create a blog and put some materials which will be better. (I1, DU 18, 28).

Other students upload their contents on blogs as to share with friends:

> we use that blogs for sharing materials during university exams, during assignments from the lectures, we try to share using some blogs. Some students write and use some blogs. Some students have their own blogs. So they can write materials and put in blogs. So you can access to these blogs you find the answers for that. (I1, DU 18, 28).

As a conclusion, students use email to send documents and assignments to their lecturers and to get feedback from them. They use social networks (WhatsApp, Facebook, and Instagram) for interactive learning. They use You tube for sharing educational materials and searching videos. They use blogs for academic writing, getting answers, sharing materials. In general, students use Web 2.0 tools for giving feedback, collaborative learning, sharing academic videos, sharing online content learning resources, sharing ideas and academic/ reflective writing.

Influence of Using Web 2.0 tools and Academic readiness on Cognitive Engagement

This section answers Research Question 3(3.Are there possible effects of Web 2.0 tools on the students' engagement in learning)?Prior to MRA, correlation, ANOVA, mean scores were computed for each construct A

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Multiple Regression Analysis was carried out to estimate a model fit for its validation and prediction. Enter method was deployed to address research question 3. In this model, use of Web 2.0 tools and Academic readiness were independent variables while student cognitive engagement was dependent variable. R^2 = .211, which means that 21.1% of the variance in the data can be explained by the predictor variable. Table 1.3 shows the model summary.

Table.1.3: Model Summary

Model	R	R Square	Adjusted R Square	Std Error of the Estimate
1	.460[a]	.211	.195	.43227

a. Predictors: (Constant), Acad_readiness, Web2.0_use

Prior to MRA, the researcher must determine if the predicted model is significant via Analysis of Variance (ANOVA). The results indicate that the model is a significant predictor of student cognitive engagement F(2, 97) = 5.684, p = .000. (See Table 1.4).

Table.1.4: ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	4.855	2	2.428	12.992	.000[b]
1 Residual	18.125	97	.187		
Total	22.980	99			

a. Dependent Variable: Cog_engage

b. Predictors: (Constant), Acad_readiness, Web2.0_use

To determine the extent the individual predictor variables contribute to the model, the researchers used the coefficient Table. The results indicate that Academic readiness contributed significantly (β = .415, P = .000) while Use of Web 2.0 tools did not contribute significantly (β = .110, P = .249). So, the final predictive model is student cognitive engagement = 3.186+ (.077 Use of Web 2.0) + (.249 academic readiness). See Table 1.5.

Table.1.5: Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std Error	Beta		
1 (Constant)	3.186	.269		11.858	.000
Web2.0_use	.077	.067	.110	1.160	.249
Acad_readiness	.249	.057	.415	4.387	.000

a. Dependent Variable: Cog_engage

VI. DISCUSSION

. Web 2.0 tools offer learners to engage students in higher order thinking skills. Involving not just only to understand and apply but also to analyze, evaluate and create through two-way communications and collaborations. Due to the pedagogical potentials of Web 2.0 tools, this study investigated how the students involve Web 2.0 tools in supporting their classroom and out classroom learning activities.

The analysis results indicate that the majority of the students (93% to 94%) use Web 2.0 tools for learning.Regarding Research Question 1(investigating the extent use of Web 2.0 tools in learning), the quantitative findings show that the majority of students who rated between 52% and 94%, use Web 2.0 tools in learning activities which include higher order thinking.The qualitative findings are parallel with the quantitative findings. The majority of the students (82% to 89%) are either already using or are planning to use Web 2.0 tools in learning. Further findings indicate that students' academic readiness in learning, using Web 2.0 tools influences on students' cognitive engagement. Implications of the study show that students' academic readiness in learning through Web 2.0 tools engage their cognitive provided that they are both intrinsically and extrinsically ready, with a conducive learning environment.

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RECOMMENDATIONS

Based on the findings of this study, the researchers recommend the followings: (i) Higher Learning Institutions (HLIs) in Tanzania in particular, and in the globe at large, should shift from traditional learning to Web 2.0 tools learning environment which is more flexible and interactive. (ii) HLIs should introduce policies on incorporating Web 2.0 tools as to make the 21st century learning skills possible and viable.(iii) Internet connectivity should be upgraded so that students and other online users can access the Internet friendly.(iv) HLIs should introduce ICT training/course starting from the first year students as to enable students utilize the potential of Web 2.0 tools in learning activities.

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Comparative Study of Fruit Bioactivity of *Spondias*

Francinalva Cordeiro de Sousa[1], Luzia Marcia de Melo Silva[1], Inácia dos Santos Moreira[2], Deise Souza de Castro[2], Danielle dos Santos Tavares Pereira, Angela Matilde da Silva Alves

[1]Department of Agroindustry, professor at the Federal Institute of Alagoas, Murici Campus, Alagoas, Brazil. Correspondence Author: e-mail: francis_nalva@yahoo.com.br

[2]Doctorate student in Agricultural Engeneering, UFCG, Campina Grande-PB, inaciamoreira@ymail.com; deise_castro01@hotmail.com; dstpereira@gmail.com

Abstract**—** *Brazil has one of the biggest biodiversity of fruits of the world, with great potential to agricultural business. Among the fruits with agronomic potential the Spondias are evidenced by its characteristics of differentiated colors and flavors, besides being considered food rich in phytochemical compounds. This study aimed to evaluate the physicochemical characterization and bioactive compounds of Spondias fruit. The Cajá fruits, umbu-cajá, cajarana and seriguela were acquired in the local market of Campina Grande, PB. The fruits were selected, washed, sanitized and analyzed in the Food Engineering laboratory from the Federal University of Campina Grande. The analyzes performed were: water content, pH, soluble solids, ashes, redactor sugar, luminosity, yellow intensity, red intensity, water activity, anthocyanins, flavonoids and ascorbic acid. The bioactive compounds were extracted from the pulp in natura, using maceration with ethanol in the proportion of 1:10. The determination of the anthocyanins and flavonoids was based on the Francis (1982) method and the ascorbic acid according to Benassi e Antunes (1988). For the water content were found, pH, total soluble solids, ashes, redactor sugar, luminosity, yellow intensity, red intensity, aw, anthocyanins, flavonoids and ascorbic acid from cajá (87.56%, 1.99, 10.5 ºBrix, 0.79%, 4.00%, 55.45, 72.25, 15.78, 0.98, 0.15 mg.100g, 2.86 mg.100g and 36.75 mg.100g), umbu-cajá (90.43%, 1.50, 8.2 ºBrix, 0.28%, 2.46%, 47.35, 48.12, 4.05, 0.99, 0.28 mg.100g, 2.27 mg.100g and 15.83 mg.100g), cajarana (90.54%, 2.10, 8.5 ºBrix, 0.62%, 3.46%, 46.86, 77.54, 10.19, 0.14mg.100g, 3.13 mg.100g e 24.39 mg.100g) and seriguela (80.13%, 2.13, 17ºBrix, 0.63%, 3.75%, 55.77, 64.00, 8.79, 0.98, 3.45 mg.100g, 2.55 mg.100g and 22.67 mg.100g). The varieties of Spondias present reasonable values of soluble solids, pH, flavonoids, and ascorbic acid, characterizing itself as raw material with great potential to its commercial utilization which satisfies the market's current expectations.*

Keywords**— Spondias, characterization, bioactive compounds.**

I. INTRODUCTION

Brazil has the world's greatest biodiversity, making it possible to grow numerous fruit species. Many of them are virtually unknown and, for this reason, are very little exploited commercially. Among the fruits with high agroindustrial power, there are fruits of the *Spondias*, which have unique nutritional and organoleptic properties. The taste and the attractive aroma of these exotic fruits are responsible for the high acceptance, whose relation is related to its sensorial attributes.

According to Tiburski et al. (2011), in the Brazilian Northeast, there are several areas where the climate and soil characteristics are especially favorable for growing tropical fruits. Fruit production and processing in these areas represent important economic activities, not only due to the relevant regional marketing, but also due to the growing domestic and international market.

The growing demand for *Spondias* products confirms the potential socio-economic exploitation of this species. However, in the process of harvesting and marketing the fruit *in natura*, there is a great waste. After harvesting, the fruits are marketed in open fairs, greengrocers, supermarkets and on highways in buckets, sacks or sieves of unhygienic vine, totally ripe, with a softened physical structure caused by mechanical damages usually caused by improper handling, which may cause stains and abrasions and be an entryway of insects and microorganisms (MELO et al. 2010; SOUSA et al. 2016).

According to Huber et al. (2012), the use of natural antioxidants may add the beneficial effects of bioactives to the foods in which they are added, thus protecting the consumer from toxicity of synthetic antioxidants.

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This study aims to evaluate the physical-chemical characterization and bioactive compounds of *Spondias* fruits.

II. MATERIALS AND METHODS

The experiment was conducted at the Food Engineering Laboratory (LEA), belonging to the Academic Unit of Food Engineering of the Federal University of Campina Grande. The fruits were purchased in the local market of Campina Grande, PB, in a ripe maturation stage.

The fruits were selected in laboratory, washed under running water, sanitized in sodium hypochlorite solution at 50 ppm for 15 minutes, and then rinsed under running water to remove excess of solution. At selection, besides the ripening stage, the integrity of the fruits was verified. Pulp extraction was performed using a food multiprocessor, and stored in a freezer at -18ºC.

2.1. Chemical composition and physical-chemical properties

The physical-chemical properties of *Spondias* fruits were evaluated by the standard methods of the Adolfo Lutz Institute: water content was determined using the gravimetric method in a greenhouse at 105 ± 3ºC for 24 h until constant weight; water activity (Wa) was determined using Aqualab 3TE (Decagon) with the sample at room temperature (25°C).

Color was determined by instrumental measurement using the MiniScan HunterLab XE Plus spectrophotometer and the CieLab color system, obtaining the readings of L* (luminosity), a* (transition from green to -a* to red +a*) and b* (transition from blue -b* to yellow +b*).

Ashes (%) were determined by incinerating the sample in muffle at 550°C until the ash became white or slightly gray. Soluble solids (SS) content, expressed as °Brix, was determined by reading the refractive index on an ABBE bench refractometer (model Q767B). Reducing sugar was determined by reducing the copper present in Fehling's solution.

Titratable acidity (TA, % of citric acid) was determined using 1 g of pulp to which 50 ml of distilled water and three drops of 1% alcoholic phenolphthalein indicator were added; then, the sample was titrated with a solution of 0.1 N NaOH previously standardized. The pH was evaluated directly in the pulp using a digital potentiometer

The determination of anthocyanins and flavonoids was based on the method of Francis (1982). The determination of alkaloids followed the methodology described by Sreevidya & Mehrotra (2003) and ascorbic acid according to Benassi and Antunes (1988).

The data of chemical and physical-chemical characteristics of *Spondias* fruits were evaluated by Tukey test at 5% probability.

III. RESULTS AND DISCUSSION

3.1. Physical-chemical characterization of fruits

The mean values for physical-chemical characteristics of *Spondias* sp. fruits are shown in Table 1.

There was a significant difference in all analyzed parameters when the Tukey test was applied, except for water activity. Sousa et al. (2016) observed similar results for the fresh pulp of umbu-cajá at two stages of ripening. The observed water activity is characteristic of fruits with large amounts of water.

Table.1. Mean values of physical-chemical characteristics of the fruits of Spondias sp.

Characteristics evaluated	Fruits evaluated				
	Cajá	Umbu-cajá	Cajarana	Seriguela	Umbu
Water content (%)	87.56b	90.43a	90.54a	80.13c	89.75b
Water activity	0.98a	0.99a	0.98a	0.98a	0.99a
pH	1.99a	1.50c	2.10a	2.13a	2.3b
ºBrix	10.5b	8.5c	8.5c	17.00a	9.2b
Reducing sugar (%)	4.00a	2.46c	3.46b	3.75b	4.5a
Ash (%)	0.79a	0.28c	0.62b	0.63b	0.32c
Luminosity	55.45a	47.35b	46.86b	55.77a	42.54c
Intensity of Red	15.78a	4.05d	10.19b	8.79c	3.05e
Intensity of Yellow	72.25b	48.12c	77.54a	64.00b	28.87d

The analysis of the results obtained for water content showed a unique variation among the varieties analyzed, ranging from 80.13% to 90.54%, indicating that these fruits are highly perishable and favorable to the development of microorganisms. Sousa et al. (2016), evaluating the physical-chemical quality of the fresh pulp of umbu-cajá fruits at two ripening stages, reported a value of water content ranging from 86 to 91.1%.

Spondias pulps are mostly acidic. Regarding pH, the lowest value was reported for the fruit of the umbu-cajá. Silva et al. (2015), evaluating the quality of umbu-cajá fruits from different genotypes, found pH values ranging from 2.60 to 2.93. According to the Normative Instruction No. 01 of January 7, 2000, the minimum pH established for the commercial pulp of cajá is at least 2.2. The values found are close to those obtained by Carvalho et al. (2011), who reported values of 1.7 for cajá, and in disagreement with the values reported by Carvalho et al. (2008), who verified pH values ranging from 2.5 to 3.0 when analyzing the physical and chemical characteristics

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of the umbu-cajá of Bahia, considering its degree of ripening.

Regarding the total soluble solids content (ºBrix), the values were statistically the same, and there was no statistical difference between the fruits of cajá and umbu. The highest result for total soluble solids was found for seriguela, considering that it is a sweet fruit. Sugars make up the bulk of soluble solids and are mainly in the form of glucose, fructose and sucrose. The reducing sugars of the umbu-cajá differed statistically ($p \leq 0.05$) from the other evaluated fruits. The values found are in accordance with the results found by Jesus et al. (2016) for umbu *in natura*.

The average value found for ash ranged from 0.28 to 0.79%; cajá was statistically different. These results corroborate those found by Silva et al. (2017) upon analyzing the quality of the fresh pulp of umbu, presenting an average content of 0.37%.

The results obtained for colorimetric analysis (L*, a* and b*) (Table 1) showed that there was a predominance of yellow, and the pulp of cajá and cajarana fruits showed a more intense color, tending to orange. Similar results were observed by Zielinski et al. (2014) (L* = 55.97 ± 3.20) (a* = 13.81 ± 0.04) (b* = 49.18 ± 0.40).

In Table 2, the chemical data of the fruit pulp of five *Spondias* varieties are presented. The results show that no alkaloids were found in the *in natura* pulp of the fruits analyzed.

The results obtained for anthocyanins in the *in natura* pulp of the fruits analyzed are in accordance with Almeida et al. (2011) who, upon evaluating bioactive compounds and the antioxidant activity of exotic fruits in Northeast Brazil, reported contents of 1.35 mg/100 g for seriguela and 0.46 mg/100 g for umbu.

Table 2. Bioactive compounds in varieties of Spondias

Fruits evaluated	**Characteristics evaluated**			
	Alkaloids (mg/g)	Anthocyanins (mg/100 g)	Flavonoids (mg/100 g)	Ascorbic acid (mg/100 g)
Cajá	-	0.15c	2.86a	36.75a
Umbu-cajá	-	0.28b	2.27b	15.83c
Cajarana	-	0.14c	3.13a	24.39b
Seriguela	-	3.45a	2.55b	22.67b
Umbu	-	0.32b	2.45b	10.55d

The statistical analysis of the data concerning flavonoid values presented in Table 2 showed that the fruit of cajarana obtained the best result, followed by cajá. The other fruits did not differ statistically among themselves. Moreira et al. (2012) observed similar values by studying phytochemical compounds in umbu-cajá genotypes. They reported flavonoid values ranging from 1.95 to 2.37 g in catechin-equivalent/100 g of pulp**.**

In general, the varieties analyzed presented a significant difference in ascorbic acid content, providing a higher value for the fruits of cajá. The values found were higher than those found by Canuto et al. (2010) and Gregoris et al. (2013), who verified values of 0.3 mg/100 g of pulp of cajá, 4.7 mg/100 g of pulp of seriguela and 1.5 mg/100 g of pulp of umbu, respectively.

IV. CONCLUSION

The fruits of the five species of *Spondias* analyzed presented in general a high water content, predominance of yellow coloration and relevant values of bioactive compounds.

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