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Public Security and the Internet of Things: at the Service of Community Policing

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Abstract*—The popularization of low-cost microcontrollers has increasingly allowed the development of Internet based solutions of things - IoT, financial viability allows to apply the Internet of things in solutions that the market already has commercial explanations, but with higher financial cost. This work proposal presents a low cost answers based on the microcontroller Arduino UNO, for the problem of residential thefts in the master plan of the city of Palmas - Tocantins, aligned the policies of public security based on the guidelines of Community Policing of the Military Police of Tocantins , facilitating the integration of the community and Military Police - (PMTO), providing information for area vehicles in the fight against residential thefts. Being the general objective to provide in real time for the fittings of the PMTO communications of opening of doors and windows unauthorized in residences, being the specific objectives to develop communicator using a microcontroller with communication by SMS; providing real-time reporting and economic viability of the device.*

***Keywords*—Internet of Things; military police; low cost; public security; community police.**

I. INTRODUCTION

The society lives a period of knowledge and technological progress in a frightening way, and this moment can be explained by the increase of institutional capacities in education through universities and the Internet, offered to society in a way never before seen by Brazilian population.

The world every day experiences technological innovations that present themselves very quickly in front of the demands of society. [1]. Thus, public safety becomes the subject of great discussions in the national scenario in view of the resources available, and the non-use of these technologies for the benefit of society.

Therefore, the breadth of these discussions, especially public safety, warns of the use of technological innovation for the benefit of society in order to provide the necessary support for social welfare. [2] It clarifies what knowledge is generated and administered by the human being, in function of all and satisfaction of their needs. In this way, we can ask ourselves if the quantity of thefts that occurs in the master plan of the city of Palmas, Tocantins can decrease with the implantation of technologies that can inform in real time the occurrence of the crime, thus, it gives an immediate response to society in the fight against crimes against equity. According to the Brazilian Penal Code, in art. 155. Stealing means subtracting, for yourself or someone else, something from others.

In this way, the provision of service has been presented as one of the most interesting challenges of the police, as a great opportunity for the improvement of the professionals, which is driven by the scientific and technological development and by the level of citizens' awareness. Today, police activity demands from its members discernment in the most varied and complex situations of action, due to the technological advance and the diffusion of knowledge, demanding competency for decision making and for conflicts [3].

However, in order to meet this demand, it would be necessary to develop and implement a system with an opening sensor that, through the Internet of Things (IoT), sends a real-time signal to the military police area vehicles, decreasing in this way, , the time in the monitoring of the occurrence. IoT is a used term that refers to a phenomenon that has been observed of the connection of simple objects found in the day to day to the Internet [4].

By combining the evolving capacity of the Internet of Things, society can collect, transmit, analyze, and distribute data, so that people's way of processing this information will enable humanity to gain the necessary knowledge and wisdom not only to survive but to evolve for centuries [5]. In 2017, the Military Police establishes the guideline 001/2017, which regulates the activities of the Military Police along with the Community Security

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Networks - RCS, within the scope of the Command of the policing of the Capital [6].

The purpose of which is to contribute with the units' commands to work in integrated networks demonstrating viable alternatives in terms of the institution's capacity building for citizen assistance. Assisting them in decision-making to bring the police closer to the community in order to guarantee the work already done, in a technical, uniform and standardized way. The historical process of the community networks according to guidelines No 001-2017 of November 2017 of the Tocantins Military Police. The origin occurred in 2014, when blocks from the capital decided to meet, in partnership with the PM, so that they could analyze, prioritize, decide and act in situations of crimes.

In order to be implemented and have the necessary feedback, the systems using Iot need to receive digital information be connected network and process this information in an automated way.

It was exampling the 110 neighborhoods south of the city of Palmas, the intention was to interact to identify, prioritize and seek solutions to problems related to crime and prevention.

The proposal gained more emphasis when the First Military Police Battalion included the Urban Policing Command in groups formed by WhatsApp applications, in this way, the crime rate in that region at that been reduced.

In the year of 2013, the Standard Operational Procedure (POP) was implemented, qualifying the police for Community Police actions, implemented Citizen Solidarity visits, Monitoring and monthly community meetings. From the use of this tool, the network began to include more military, administrative and operational service, in proactive visits. In the years and 2015 and 2016, Participatory Community Safety Meetings were held, bringing together all the presidents and community leaders, members of the RCS of residents.

In 2014, the Military Police used technology in order to involve the community in search of solutions against crimes against the patrimony. The objectives of community safety nets are to encourage the community to form RCSs, placing PMTO as a partner. The police will offer the community courses and capacitation's, meetings, lectures and events directed to public security. Disseminating preventive actions and response to criminal indices reducing in this way, the rates of thefts in the areas served. [6].

Therefore, one of the objectives of this project is to provide subsidies and technological mechanisms to reduce the theft rates in the area of the 1st Military Police Battalion of Tocantins. Thefts are one of the main sources of inequality due to the lack of public policies aimed at poorer neighborhoods and the lack of quality public services. [5].

In this way, we can say that the Internet of Things can help the military police and the community in the fight against crime. IoT can offer many opportunities for the development of quality services. It is necessary to observe its characteristics, in order to understand the full potential of this technology, in favor of quality services and the development of society with quality. [4]. In this sense, the relevance of the theme made us think about how to reduce the number of thefts in homes using Internet of things in the fight against crime, especially thefts in homes. In this way, we can highlight that the technology based on Iot, has the potential to improve the development of society, contributing to people's quality of life.

It can be highlighted that the technological and fundamental innovation in the fight against crime can be used by public security institutions providing efficient and effective services. [7]. Imagine, in a state of law, that we do not have the necessary means to fight crime. We can thus claim that we have the means, however, not apply in a way to provide sufficient sense of security against such crimes. In this context, the question arises of this article, the Internet of things can provide adequate mechanisms and real-time information for the Military Police in the fight against thefts to residence? The overall objective of this article is to create a device that can provide real-time military police with the opening of unauthorized doors and windows in homes.

Being the specific objectives to develop a system using the platform with a microcontroller; implement a device to provide information in real time; analyze the economic viability of the device; we can highlight that technology positively affects people, improving their quality of life. The Internet of Things can bring short-term benefits in the fight against crime in order to systematize technologies to assist the military police.

II. MATERIALS AND METHODS

The Arduino UNO microcontroller has the advantage of having a programmable USB chip on the board, which allows to access the chip in such a way that when connect the device to your PC, it will appear as any type of USB device you want, for example , such as a keyboard, mouse, or joystick. This allows you to use the Arduino as an interface to create your own USB devices. [8] It is an Atmel AVR microcontroller, with excellent performance with low consumption, with current average cost in Brazil of R $ 40.00.

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Fig. 1:Arduino Microcontroller ONE

The Intelbras Wireless XAS 4010 Smart Wireless Opening Sensor is used to monitor tampering with unauthorized openings of windows, doors and gates. It can be used in internal and external environment, its current average cost in Brazil and R $ 28,00

Fig. 2:Wireless Sensor Opening Intelbras XAS 4010 Smart (Doors and Windows)
Source: [10]

The SIM 800L chipboard is used as interface for GSM chips in sending SMS and making calls, its current average cost in Brazil is R $ 12,00. Communication with the microcontroller is ugly through serial communication on the T (x) R (x), transmission and receiver channels respectively.

Fig. 3:Shield GSM Sim800L

The SIM 800L chipboard uses power from 4.1V by 2A, the ESP8266 microcontroller uses 5V by 1A, due to this variation it is recommended to apply the voltage regulator LM2596 that transforms AC into DC powering both components without prejudice to any of them.

*Fig. 4:*Voltage regulator2596

For monitoring indoor environments, the use of the HC-SR501 motion sensor is recommended, with mechanical adjustment for delay and sensitivity in the adjustment according to the maximum coverage area of 7 meters.

Fig5:Motion Sensor HC-SR501

III. DEVELOPMENT

A. Stages for the development of the prototype
Step I - Assembly of the circuit
Step II - Programming
Step III - Prototype Test

1) Stage I: Assembly on the Protoboard of the Arduino UNO microcontroller was performed to facilitate the understanding of the scheme with the other components, following the described steps. Programming was done in the Arduino IDE using the C language, using the SoftwareSerial.h library, which allows serial

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communication between the microcontroller and the GSM module.

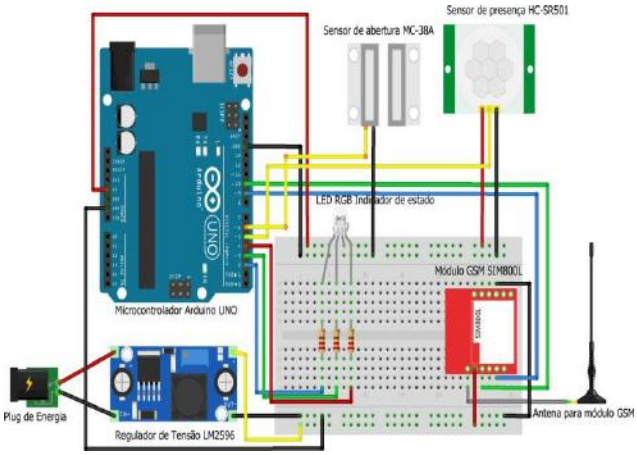


Fig 6:Component assembly Diagram

2) Stage II: In this stage we considered the peculiarities of programming in microcontrollers, especially in the Arduino language that is one of the language family C. The definition of which digital port of the microcontroller to use and essential part in the construction of the algorithm, also the interruptions made by the programmed actions, such as: opening sensor reading, moving sensor reading, sending SMS, waiting for new verification loop. The flowchart shows the operation of the verification of the state of each sensor, you can notice the simplicity of the actions, all thanks to the scheme mounted with each sensor.

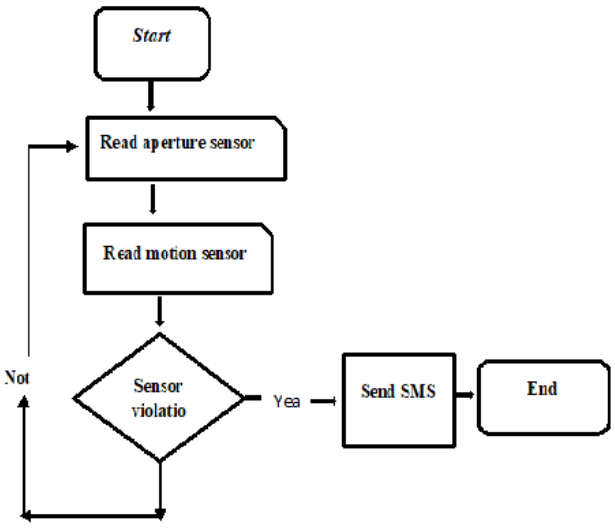


Fig 7: System flowchart

3) Step III: In this step, a door was opened and the system sent an SMS to two registered cell phones, representing the owner of the residence and the military police, taking about 15 seconds to send the message. Thus, the prototype meets, the needs of sending an SMS, in time for the police in the confrontation against crime.

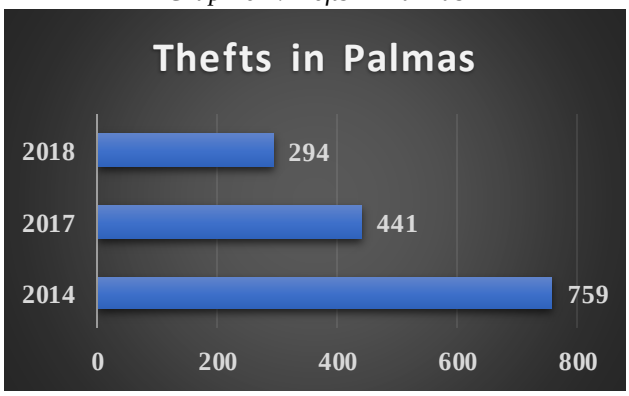
IV. RESULTS AND DISCUSSIONS

The provision of service has lately been presented as one of the most interesting challenges of the police, as a great opportunity for the emergence of technology capable of assisting in the fight against crime, which is being driven by scientific and technological development and by the level of citizens' awareness.

After the creation of Community Safety Networks that through community participation, with the help of technology and technology tools WhatsApp decreases considerablythe number of thefts in the master plan of Palmas. This policy seeks to integrate diverse partners through the use of social networking applications, such as WhatsApp, enhancing community participation in the detection, prioritization, and resolution of problems that afflict everyone.

Therefore, providing information in public security, linked in interest groups, excluding the problems outside the group, reducing the sense of insecurity, based mainly on fragments of news and rumors. Therefore, suggesting the community to participate in public security, meeting the precepts of the CF in which public safety and duty of the State, right and responsibility of all. [6]. Graph 1 illustrates the thefts occurred in the master plan of Palmas having, in three distinct periods clearly demonstrating that technology can help the citizen in partnership with the Military Police, which, through the use of social networks and applications, has been strengthening the fight against crime, way to reduce crime in this capital.

Graphic 1:Thefts in Palmas



Source: *Intelligence Agency of the 1st BPM of Palmas*

In the year 2014, there were 758 thefts, and in 2018 there were a total of 294 cases, equivalent to 38% of the cases occurred in 2014. Therefore, it should be noted that the technology can be used in a way that effectively contributes to the benefit of the citizen. IoT can help

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public authorities assist people in problem resolution in real time, thereby helping to map, discuss and address these difficulties.

V. CONSIDERATIONS

This article showed that with limited resources it is possible for military police with technology assistance to combat crime in a more effective way, improving people's sense of security with the use of IoT, whether technological resources relate to the real world, or Iot / Military Police / Community. Therefore, interconnecting them with a single purpose "quality public safety".

Thus, it is noteworthy that with this information can be useful in making decisions by the military police, with the aim of improving the welfare of the communities. Therefore, when using low-cost technological equipment, users can rely on a system that will immediately inform the entry of persons not authorized in his residence, and that the military police vehicle of the registered area, at the same time to move to the site in order to cease the crime. It is important to highlight that this information is in real time. In this way, the Internet of things fully meets the objectives proposed in this work, as severing that it is possible to develop and implement real-time opening information of unauthorized doors and windows in residencies, via communicator Using a microcontroller with SMS communication providing information to users and Military Police.

As can be seen in table I the total value of the prototype had a cost of $ 29,61. Price far below what is practiced in the market. That today is around $ 233.78.

Table I: Cost of Components

COMPONENT	VALUE
Arduíno UNO	$ 10,39
Motion Sensor HC-SR501	$ 3,90
Opening Sensor	$ 7,23
Shield GSM Sim800L	$ 5,80
Voltageregulator 2596	$ 2,86
TOTAL	**$ 29,61**

Nevertheless, the sharing of information and the partnership between PM and Citizen should be taken seriously in the current scenario of violence in urban centers in Brazil. Aiming, the use of these devices contributes to the solution of problems that people attend. Highlighting that other projects can be developed using the same components, but the goal was to develop a low-cost prototype.

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