Identification of Employees through Radio Frequency Control using Arduino and RFID

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Abstract— RFID technology allows objects to be identified automatically, through radio frequency, transmitting their data to receivers located remotely, the automated identification technology that has a high adaptability for multiple and different applications, being for small monitoring to advanced remote monitoring, and can be applied in several professional areas, from the health area, educational areas that extends to the engineering area. In today's society, RFID technology is increasingly present in our daily lives, although its presence is imperceptible and unknown to most of its users. In the present dissertation the mentioned technology, characteristics, applications are presented, with the final objective of creating a device to identify employees and with data from their specific episodes. In this sense, a previous study of the technology and its main areas of application was carried out, having been fundamental the study of the already existing applications of RFID applied in the area of civil construction and in other sectors focused on the part of security work.

Keywords— RFID. Identification. Technology. Security Work.

I. INTRODUCTION

The need for information dissemination was responsible for advancing the development of communication in the course of human evolution. People have always had the urge to express themselves through communication, and initially, there was no technology for transmitting information remotely and in real time, they were through letters, carrier pigeons, ships and others.

Nowadays, with the technology on the rise to innovate in a competitive market, companies are looking for new technologies that facilitate the organizational process, people identification, work safety and communication with greater speed in the execution of processes.

Large companies find it difficult to monitor the flow of products in and out of their inventories, and employees in the company to make this control more effective, rotary and partial inventories are made, as well as manual points or digital points for daily control of employees. But even the inventories are not one hundred percent effective, nor are the automatic points entirely correct (INFOVAREJO, 2019).

Thus, the use of technology is a strong ally, which in recent times has been widely explored for facilitating the professional's life, making the control of objects in a company more coherent (WOLDAYNSKY, 2010).

In the retail market, new technologies are being considered to replace the current standard of the bar code, for bringing specific information about each object individually, having an effective and real-time control (SOUZA, 2010).

Soon, the PPE (Personal Protective Equipment) is of paramount importance because it prevents accidents at work and thus also helps the Human Resources - HR sector (SAUDEEVIDA, 2017).

In order to aim for improvements in stock control and monitoring of safety equipment, companies are already using innovative means to manage the storage of products and the daily movement of people who work on site. One of the technologies that are currently used is RFID (Radio Frequency Identification) technology.

Thus, we implanted RFID cards on employee badges and with the help of a prototyping platform (Arduino) we monitored them. The equipment proposed here has as its main objective to control the flow of employees by means of radio frequency identification (RFID), using the Arduino software and hardware application. Thus, the prototype will show the PPE's that each employee will

have in their possession, helping the Health and Safety sector in relation to PPE's, in addition to the HR sector in controlling employees.

The data collected through the RFID reader are analyzed using a spreadsheet, making it easier to monitor the electronic point at the entry and exit of the employee, mitigating their forgetfulness in "hitting the point", also helping in the control of PPE's that each employee will have in their possession. Thus we analyze the operation of RFID technology in real time, through the employees who arrive at the correct time at the workplace and make their due departures at the corresponding time.

II. METHODOLOGY

The research is applied, qualitative, descriptive and experimental, using indirect approach procedures through field tests.

This study was carried out at Instituto Presidente Antônio Carlos, located in the municipality of Porto Nacional - TO (ITPAC - Porto), located at a latitude of 10 ° 41'42 " south and a longitude of 48 ° 23'01 ' 'Oeste, Zona 22, about 60 km from the state capital, Palmas, as shown in Fig. 1 and Fig 2.
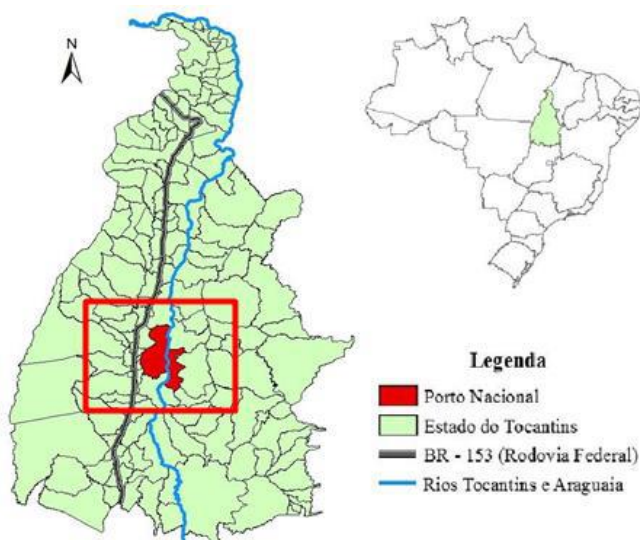

Fig. 1: Location of the municipality of Porto Nacional.

Fig. 2: Location of the Itpac- Porto Nacional FL

Five (5) RFID cards were inserted at random in the badges of building maintenance employees at the Presidente Antônio Carlos Institution - ITPAC / PORTO.

As this is an indirect approach, employees are not identified, but differentiated by numbers, from employee 1 to employee 5. Two tools will be combined, RFID cards and Arduino, in order to monitor the arrival and departure of the employee and his PPE's.

The prototype was developed to help mainly in the management of the employees' point and thus also to manage the use of their PPE's, which are facing major difficulties in the management and management of the use of safety equipment. This small unidentified flaw can lead to product losses and waste due to inadequate control, which also affects the HR sector, creating difficulties for this sector with regard to the arrival and departure of employees with clarity.

In order to subtract losses and assist technicians, radio frequency management known as RFID will be adopted, an efficient technology that is innovating the world, as it provides speed and security in the exchange of information between the reader device and its cards, providing technician management or the person in charge of the sector.

The use of an information system to manage, control the exit and entry, which was done with the Arduino software can be found on the Arduino IDE website, in conjunction with an RFID technology system to perform data collection from people , making the whole process more efficient and agile.

The equipment consists of making the network cable, thus taking the information collected by the reader. The instant the tag enters the reader's range, that is, in its magnetic field it will be energized, thus transmitting information. The Arduino tool, appropriates the data

collected by the reader, the data that the employee is present and carrying the PPE's and transmits to the ethernet shild, which will inform itself with the network connected to it, looking for an address and ID, which is in the database.

Thus, this database will contain all the cards (RFID) registered by the researcher, and each card registered on the badge will pass to the Arduino monitor if the employee is present, showing free access. Monitoring the employee.

o Read the RFID tag with the prototype;

o Add the tag id number on the Arduino device;

o Incorporate the tag id number into the database;

If the prototype card reader identifies a tag that is not cataloged on the device or in the database, it will inform that that RFID card was not registered on the equipment, sending the message "access denied", thus making the professional responsible, take the measures to catalog the employee in his spreadsheet, through a computer.

The cards that will be used are of the passive type, that is, this model does not contain a battery, and so its energy is fomented by the reader in question, so when the radio waves from the reader find the tag, they create an electromagnetic field from which they take energy of the reader, sending information to its own memory which has a lower cost (SANTINI, 2008).

The switching of data between the card and the reader is done through an electromagnetic field capture, which will have a range of 6 meters, when the label (card) comes into contact with the field in question, it stimulates the label and sends an analog signal to the reader, converting the signal to digital, so that you can read the data on the card.

Each RFID card has its own numbering where none is equal to another, thus corresponding to the type of equipment that is in place, its quantity and its monitoring.

The prototype will be installed in the area with the highest flow of employees entering and leaving, that is, close to the ITPAC guardhouse. The RFID reader, which is of low frequency, was installed close to the connection port, so that it can energize the RFID cards and read them, at a maximum distance of 6 meters.

For the operation of the same to be used a source, so as to have the power of the Arduino, together with the cabling and the pin which will be coupled on top of the Arduino for communication via network cable.

Arduino is an open-source platform for electronic prototyping (interactive process of creating software models that is part of the analysis of the life cycle of systems development in general) that is, open source, based on flexibility, being your hardware and software easy to handle. The product is intended for designers, hobbyists and anyone who wants to create something in an interactive environment (ARDUINO, 2012).

In this way, the safety equipment that is properly labeled and registered, showing the employee's name, safety equipment, and thus data collection is made, where the Arduino assigns the number read and does a search for the data on the server ARDUINO IDE.

The pinning was done as follows: SDA pin connected to Arduino port 10 - SCK pin connected to Arduino port 13 - MOSI pin connected to Arduino port 11 - MISO pin connected to Arduino port 12 - NC pin - Not connected - GND pin connected to Arduino GND pin - RST pin connected to Arduino port 9 - Pin 3.3 - connected to Arduino 3.3 V pin

If the employee leaves the company, in other words, when the card is disconnected, it will be collected and thus destroyed, as the card cannot be reused, the card data is unique, doing the same with the PPE.

From the assembly of our prototype, as shown in Fig 4, we used a 16×2 LCD Display, model HD44780. We replaced only pins 12 of Arduino Uno with pin 6, and 11 with 7, since they are already being used by the RFID reader. The potentiometer is used to control the LCD contrast, and a 10 K resistor was used in the circuit. To program the prototype, the Arduino IDE program was used, using the C ++ language, which is shown in Fig 5, (FILIPEFLOP, 2014).
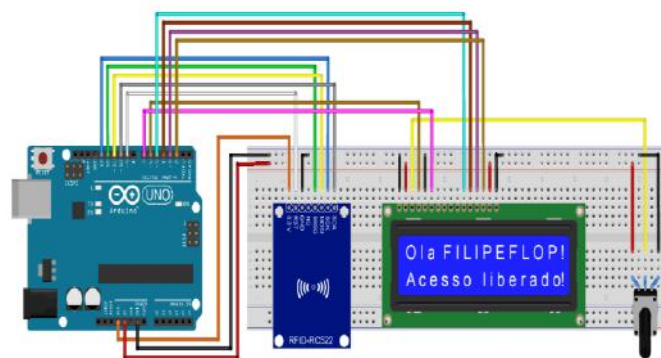

Fig. 4: Mounting Rfid Reader with Arduino.

```
rfid

1  #include <SPI.h>
2  #include <MFRC522.h>
3  #include <LiquidCrystal.h>
4
5  #define SS_PIN 10
6  #define RST_PIN 9
7
8  MFRC522 mfrc522(SS_PIN, RST_PIN);
9
10 LiquidCrystal lcd(6, 7, 5, 4, 3, 2);
11
12 char st[20];
13
14 void setup()
15 {
16
17 Serial.begin(9600);
18 SPI.begin();
19 mfrc522.PCD_Init();
20
21 Serial.println("Aproxime o seu cartao do leitor...");
22
23 Serial.println();
24
25 //Define o número de colunas e linhas do LCD:
26
27 lcd.begin(16, 2);
28
29 mensageminicial();
30
31 }
32
33 void loop()
34
35 {
37 // Look for new cards
38
39 if ( ! mfrc522.PICC_IsNewCardPresent())
40
41 {
42 return;
43 }
44
45 // Select one of the cards
46
47 if ( ! mfrc522.PICC_ReadCardSerial())
48
49 {
50
51 return;
52
53 }
54
55 //Mostra UID na serial
56
57 Serial.print("UID da tag :");
58
59 String conteudo= "";
60
61 byte letra;
62
63 for (byte i = 0; i < mfrc522.uid.size; i++)
64
65 {
66 Serial.print(mfrc522.uid.uidByte[i] < 0x10 ? " 0" : " ");
67
68 Serial.print(mfrc522.uid.uidByte[i], HEX);
69
70 conteudo.concat(String(mfrc522.uid.uidByte[i] < 0x10 ? " 0" : " "));
71
72 conteudo.concat(String(mfrc522.uid.uidByte[i], HEX));
73 }
74
75 Serial.println();
76
77 Serial.print("Mensagem : ");
78
79 conteudo.toUpperCase();
80
81 if (conteudo.substring(1) == "A0 FF 19 2A") //UID 1 - Chaveiro
82
83 {
84 Serial.println("Ola Gafanhoto !");
85
86 Serial.println();
87
88 lcd.clear();
89
90 lcd.setCursor(0,0);
91
92 lcd.print("Ola cartao !");
93
94 lcd.setCursor(0,1);
95
96 lcd.print("Acesso liberado!");
97
98 delay(3000);
99
100 mensageminicial();
101
102 }
103
104 if (conteudo.substring(1) == "E9 74 76 C2") //UID 2 - Cartao
105
106 {
107 Serial.println("Ola chaveiro !");
108
109 Serial.println();
110
111 lcd.clear();
112
113 lcd.setCursor(0,0);
114
115 lcd.print("Ola Chaveiro !");
116
117 lcd.setCursor(0,1);
118
119 lcd.print("Acesso Negado !");
120
121 delay(3000);
122
123 mensageminicial();
124 }
125
126 }
127 void mensageminicial()
128
129 {
130
131 lcd.clear();
132 lcd.setCursor(0,0);
133 lcd.print(" Aproxime o seu");
134 lcd.setCursor(0,1);
135 lcd.print("cartao do leitor");
136 }
```

Fig. 5: Arduino programming with Rfid reader.

III.   RESULTS AND DISCUSSIONS

Therefore, with the programming done and the prototype working, we implanted it so that it could capture the electromagnetic waves of the employees' badges and identify their presence and their respective PPE's, the employee who is not registered or with problems at the point will be denied access according to Fig 6, the employee who is normalized and no pending will have access released as shown in Fig 7.

Fig. 6: Prototype accusing denial.

Fig. 7: Prototype accusing release.

After the installation and the prototype as shown in Fig. 8 and the implantation of the cards on the badges, we

monitored the entry and exit of the badges, thus verifying the veracity of the equipment functioning.

Fig. 8: Arduino e cartão.

With the data collected we can make a more accurate survey, thus bringing more practicality and fewer errors regarding the employees' days worked.

So the data is collected by network cable and placed in an Excel spreadsheet showing the employees who are using the badge and use the PPE, the table shown in Fig 9, the spreadsheet was assembled in an easy way using as five columns and six lines with the first line being the employee subdivisions, the type of epi used and whether he is allowed or denied access, making a change in color, if denied red if released green.

Funcionario	EPI (BOTINA)	EPI (OCULOS)	LIBERADO	NEGADO
C1	OK	OK		
C2	OK	OK		
C3	OK	OK		
C4	OK	OK		
C5	OK	OK		

Fig. 9: Employee relationship using Badge and PPE.

According to Deys (2018) who implemented an Inventory Management System using Rfid Technology, using materials compatible with our work, we realized that it is a tool that brings benefits to the company helping in making future decisions.

IV.   CONCLUSION

In view of the problem found, the management and control of employees' points was adopted through radio frequency identification, using RFID technology, a management model that can be implemented, from small to large companies. A tool a little more expensive than the

method used today, but in the end it becomes very effective. Having as main objective the speed of the results.

With the data collected we can make a more accurate survey, thus bringing more practicality and fewer errors regarding the employees' days worked. Therefore, the implantation of the device makes the process of electronic entry and exit point greatly accelerated, as well as assists in the verification of the use of PPE by the employee, assisting the HR and workplace safety sector. The challenge of using robotics software was faced, which we managed to obtain good results, which was proposed, which is to identify employees through RFID.

The present work proposes future research, so I leave as a contribution the material and the prototyping model, develop a real-time monitoring prototype using a mobile application, thus bringing together RFID, Arduino and the app, in order to accelerate the model even more already proposed with numerous improvements.

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