Traffic Analysis of a Security System Prototype

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***Abstract*—It is presented in this work a proposal of a security system using Arduino board, that aims a possible future implementation of cars system, houses, commerce, etc. Through an activated presence sensor, it allows that invasions to be detected, enabling the owner to check the detection via the internet. The system was developed using a microcontroller board Arduino Uno, a GPRS/GSM board, GSM chip and a presence sensor. The objective of this work besides validating this prototype is to test the signals of operators Vivo and Claro. Tests of receipt time are done according to the data traffic. In general, Vivo operator had receipt time faster than Claro operator.**

Keywords— GPRS; Monitoring; Presence sensor; Security system.

I. Introduction

According to Secretary of Public Security, the theft index of cars and residences is growing year by year. Currently, the carmakers inovated in almost all the details in the cars, since sustainability until the comfort, but they could not create a car against thief. In the residence case, the insurers have good prices of home insurance, but this does not prevent the entry of a thief [1].

In the last years, provide security to property and to family is not a luxury, it is a necessity. The residence and commerce security due to theft cases and invasions and thefts from cars, popularized the security circuits through monitoring.

In view of this situation, it is proposed the utilization of presence sensor to warn the home owner or car owner about a possible invasion, being able to identify and make any decision [2].

With the information that a person passed in front of the sensor, the owner will be advised via SMS. Besides, another solution of this problem is a creation of an app and a data base to store the information that the owner wants to know.

The aim of this work is to develop a security system prototype that can be used in cars, houses, companies and others. The presence sensor monitors the someone's presence in a given environment. In the residence case, when the sensor is activated, the property owner is notified via SMS that someone is getting in the house. In the car case, the car owner is informed by SMS that his car is been stolen.

The idea of this project, as mentioned before, is to use a microcontroller board, arduino, and a presence sensor. After the detection of someone presence, the person will be notified via SMS. Besides, tests with operators Vivo and Claro were done and the focus is to know how long it takes for the SMS to be received, because this information is very important to catch the invader in time.

The tests are done in the Embedded System Laboratory at School of Technology of Unicamp. We chose to do the test only with Vivo and Claro Operators because of the signal inside the Embedded System Laboratory, that is, Tim and Oi operator did not have good signal there.

II. Security System Prototype

The materials used in this work are: Arduino Uno board; presence sensor PIR; shield GPRS/GSM, Vivo and Claro SIM; buzzer (to try to do the invader desists) and led (to signal the operation).

A. Arduino Uno

Arduino Uno was chosen for this project due to its simplicity and because its characteristics are sufficient to conclude this work. Arduino Uno is a microcontroller board based on the ATmega 328P with 14 digital pins of input/output, 6 of them can be used as PWM outputs; USB connector; 6 analog inputs; an oscillator crystal of 16 MHz and a reset button [3].

B. Presence Sensor

The movement sensor used in this work is PIR DYP-ME003 that can detect objects movements within a radius of up to seven meters. After that an alarm pin (with buzzer) is activated when a detection of any movement occurs. The sensitivity and the length of waiting time can be adjusted for PIR stabilization by the yellow potentiometer that stays under the sensor. Besides, it is possible to set the device to be disabled, after a certain time (delay).

C. Shield GPRS/GSM

The GSM (Global System for Mobile) is a standard of mobile communication totally digital employed mainly for telephony, data communication and short message service (SMS) [5]. It has as a customer terminal the mobile station, consisting of a mobile device, with a cell phone or a Shield

card with a SIM (Subscriber Identity Module) that permits the client identification.

The GPRS (General Packet Radio Service) was designed from the GSM cellular telephone system for data transmission \cite{almeida}, benefiting the cellular telephone network to be interconnected to the internet [4]. The service allows mobile phones to be used to send and receive information over the IP network enabling permanent wireless access where users can receive information immediately from the moment they connect to the network [5].

This shield was chosen due to the diversity of services in GSM, such as voice services, SMS, data transfers, and others.

D. System Architecture

This work is a development of a security system prototype that can be used in houses, cars and commerce. Through the sensor PIR that detects someone's presence, the owner receives a SMS and can call the police.

With the installation of the prototype in specified environments, another components can be coupled, like in the case of car, it can be used a GPS and, in the case of house or commerce, a security camera can be used, that through an app it is possible to know the car location and to see camera image.

E. Implementation

The prototype developed in this work is presented in Figure 1. It's possible to notice the components Arduino, Shield GPRS, sensor PIR and buzzer.

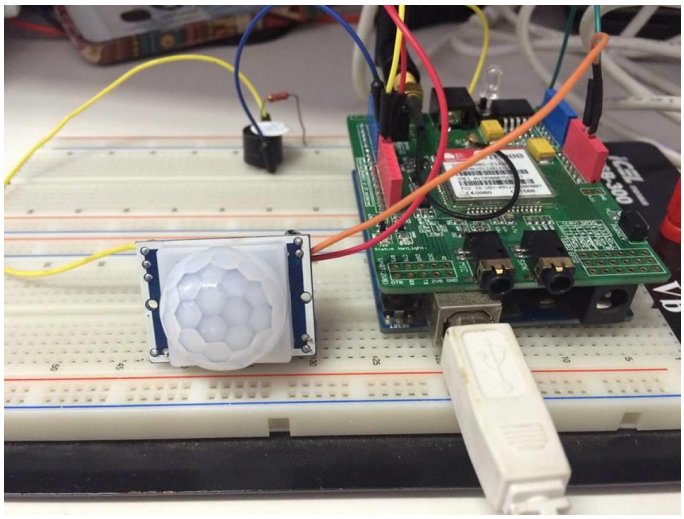

Fig. 1. Protoype of the security system.

After the presence sensor identifies someone, the buzzer beeps and a SMS is sent to the owner.

III. Results

According to [6] the days days of the week the mobile phones are most used are Monday and Friday. Another important point is the time of the day that is more used. According to [7] 10 am and 5 pm are more used and in the morning the peak time is between 9 and 11 am, in the afternoon period is between 2 and 4 pm, and in the night is between 8 and 10 pm.

So, we decided to do three days of tests, the first one on Wednesday between 9:45 am until 5 pm, the second one on Friday in the same time of Wednesday but until 6 pm. The last one was on Tuesday night (6 until 10 pm). The tests are done with Vivo and Claro Operators.

Table 1 presents the first day test results. The tests are done according to the peak time, it is, near 10 am, 12 am and 4 pm. These tests are done in September 28th (it was on Wednesday) at 9:50 am until 5 pm, focusing in the peaks time.

TABLE I
Tests with Vivo and Claro Operators on Wednesday

Hour	Receipt time of Vivo (s)	Receipt time of Claro (s)
9:50 am	9.53	9.46
10 am	12.67	11.67
10:15 am	10.80	10.68
10:30 am	8.79	10.80
11:50 am	8.10	10.17
12 am	10.88	11.90
12:15 am	8.35	8.90
12:30 am	10.20	11.91
3:50 pm	7.20	13.40
4 pm	6.42	5.13
4:15 pm	7.70	8.73
4:30 pm	7.53	8.52
5 pm	7.71	8.96

Figure 1 presents a graphical of the table 1 results. The blue line is Vivo operator results and red line is Claro operator results.

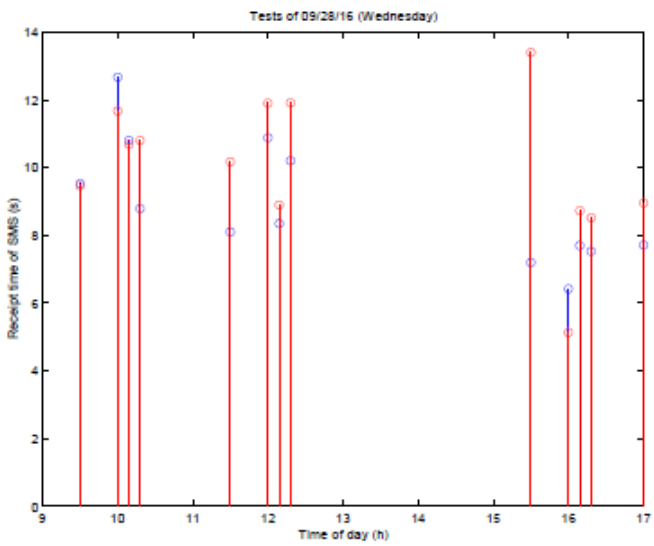

Fig. 2. First day test.

Only in four of the thirteen data collected Vivo operator spent more time than Claro. At 10 am and 4 pm the intensity of

mobile phone traffic is bigger. An interesting point to notice is that Vivo spent more time than Claro just near these two hours.

Table 2 presents the second day test results. The tests are done as in Table 1, but until 6 pm, because Friday has more traffic than Wednesday. These tests were done on October 07th (it was on Friday).

Figure 2 presents a graphical of the table 2 results. The blue line is Vivo operator results and red line is Claro operator results.

TABLE II
TESTS WITH VIVO AND CLARO OPERATORS ON FRIDAY

Hour	Receipt time of Vivo (s)	Receipt time of Claro (s)
9:50 am	6.07	7.96
10 am	8.62	8.72
10:15 am	6.50	6.45
10:30 am	7.15	7.58
11:50 am	6.35	7.42
12 am	7.91	8.18
12:15 am	8.06	8.46
12:30 am	7.36	7.97
3:50 pm	7.51	7.02
4 pm	8.05	8.15
4:15 pm	7.77	7.88
4:30 pm	7.47	8.34
5 pm	8.41	8.71
5:30 pm	10.63	9.22
6 pm	10.29	10.12

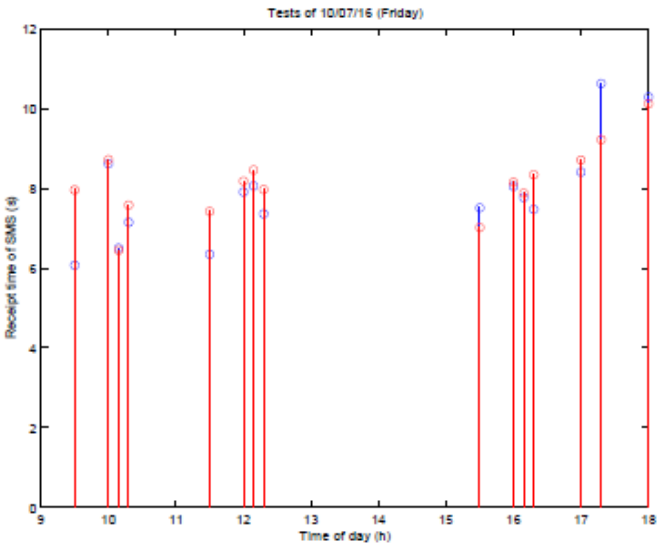

Fig. 3. Second day test.

As well as in the first day test, four data were bigger in the Vivo operator. But, in this case were collected fifteen data. These four data had occurred near 10 am, 4 pm and 6 pm.

Table 3 presents the third day test results. These tests were done at night on October 10th (Tuesday) at 6 pm until 10 pm. This day test were done to know if the traffic night is smaller than morning and afternoon.

TABLE III
TESTS WITH VIVO AND CLARO OPERATORS ON TUESDAY NIGHT

Hour	Receipt time of Vivo (s)	Receipt time of Claro (s)
6 pm	6.48	6.32
6:30 pm	6.94	6.44
7 pm	7.69	7.62
7:30 pm	7.88	7.46
8 pm	8.11	8.28
8:30 pm	8.01	8.32
9 pm	7.98	8.19
9:30 pm	6.53	6.99
10 pm	6.42	6.30

Figure 3 presents a graphical of the table 3 results. The blue line is Vivo operator results and red line is Claro operator results.

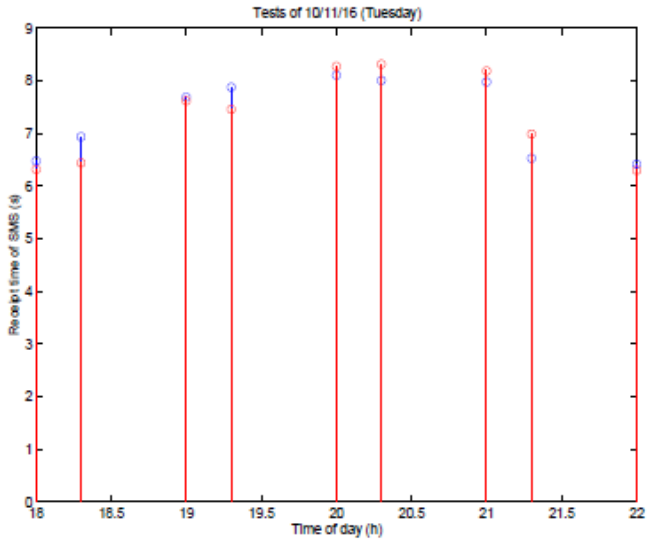

Fig. 4. Third day test.

Again, Vivo operator had four data with time bigger than Claro. But, in this case were collected only nine data. This last day test was done at night.

IV. CONCLUSION

In this work it was developed a security system prototype. In this prototype if anyone pass in front of the movement sensor, a buzzer beeps and the owner receives a message that the house is being invaded. This prototype was successfully validated because it works very well in all the tests.

Besides development of this prototype traffic analysis tests are done. The objective of this analysis is to know what operator sends and receives the alert message first. The tests are done in the Embedded System Laboratory of School of Technology of Unicamp and in this Lab only Vivo and Claro operators had good signal to validate the tests. The times chose for data collection were based on mobile phone traffic rules found in literature.

In these traffic analysis tests Vivo operator had better results. In the majority of data the receipt time of the message

was faster than Claro operator. But it is also important to notice that in the peaks time Claro had better results.

A. Future Work

As a continuity and improvement of this work, in the case of implementation in cars, is use also a GPS shield. The idea of GPS is monitoring the car localization and after that the are transmitted through satellite or mobile phone communication. So, when the owner receives the SMS about your car is being stolen, he can receive also the localization of his car.

In the commerce and residence case, the idea is to use a security camera for recording images simultaneously.

a.

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