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RFID Smart Tags for Controlling Belonging in Shelters

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ABSTRACT
It is very important to identify each belongings to its owner to prevent these things get lost. A traditional way is to label or paste barcodes to every objects. Currently, there are emerging technologies that allow us to label everything, person or place. This paper presents a solution based on RFID technology (Radio Frequency Identification) for identifying objects in a temporary shelter. To do this, a computer application is used to control the incoming and outgoing of the personal belongings of victims rescued from a natural disaster, this application is used in temporary shelters. Our solution allows communication between a reader and RFID tags, just as the application accesses a database to store the information needed to control personal belongings of affected people. The application attempts to reduce risks of loss of belongings and information, allowing the identification of each object when located within the radius of coverage of the reader, showing the information associated with the items (objects) and owner.
***Keywords*:**RFID tag, IoT, Mobile Applications.

I. INTRODUCTION

Connect all things to the Internet is a recent trend that has been called Internet of Things (IoT), the concept of IoT is a new topic in the field of wireless technology. In IoT everything is connected. IoT describes the ubiquitous presence of a variety of devices such as sensors, actuators, and smartphones or mobile phones through unique addressing schemes, allowing all these items to interact and cooperate with each other to achieve common objectives [1].

In [2] it is mentioned that Internet of Things as a paradigm result of the convergence of three different visions: Internet-oriented vision (middleware), oriented things vision (sensors) and oriented semantics vision (knowledge). In various previous works dealing with these terms [3] [4].

To achieve a complete vision of IoT and storage resources is essential to cloud computing. Cloud computing is the latest model to emerge that promises reliable services delivered through data centers next-generation technologies that are based on virtualized storage. Cloud acts as a data receiver of the ubiquitous computing sensors; as a computer to analyze and interpret data; and provide the user easily to understand display based on the Web [5].

Therefore, it is possible to use the concept of IoT to provide communication capabilities for a device that could promptly alert a population before a natural disaster.

Before using sensors built into the IoT ("Things" -oriented view) some works have been proposed for disaster [6] [7] [8] [9]. Specifically "things" vision-oriented functions as [10] [11] where RFID technology is used. However, we are particularly interested in applications that focus on flood disasters. For example, the ALERT system to advice for flood [12]. This system uses remote sensing to transmit environmental data to a computer system. Some sensors installed in the warning system are used to detect rain, water level, and meteorological data. These sensors provide information to the system into a centralized database. Another example is found in [13], here there is a detection system using a landslide WSN (Wireless Sensor Network). This mentioned system is more convenient since it provides an early warning and allows learning about the phenomena of natural disasters.

Currently, systems, emergency management, and disaster recovery include several parts such as a communication infrastructure and a system of information management [14].

II. BACKGROUND

As we mentioned above, we are interested in flooding scenarios. Tabasco state represents a high-risk scenario because the flooding by rains that have occurred in recent years, these torrential rains have caused extensive damage to infrastructure, materials, and human losses.

During a flood caused by overflowing rivers due to torrential rains, a high percentage of homes are damaged, and therefore the habitats and owners of these homes take refuge in temporary shelters for protection, treatment and to be provided with food, medicines and a place to stay.

These natural disasters are common events in the history of Tabasco, therefore, shelters for the people that leave their homes because of these phenomena are frequently. There are families who arrive at these shelters with few personal belongings that they could save from their homes, which should be managed and stored properly.

In such disasters, people are afraid of losing their belongings that still remain, since facilities in shelters do not have an efficient control of goods. While some few shelters the control is carried out on printed formats, most of the shelters in Tabasco do not have a control system that identifies the victims' personal belongings, hence, a solution that solves this problem is necessary.

Traditionally, things (objects) are inventoried in many ways, one of which has been just to fill printed formats, otherwise is the use of a marker to write a code on these objects to identify them. From these codes is created a list, in the best case, is registered into a table or worksheet file. One more modern technique is to paste a barcode sticker to each object in order to save the identity and belongings. Although the techniques mentioned above are very commonly used, they are not completely reliable and secure to identify and control belongings. Consequently, it is proposed to use RFID smart tag technology.

Technology Radio Frequency Identification RFID (Radio Frequency IDentification) is undoubtedly one of the technologies that have experienced faster growth and sustained in recent times.

The current existence of viable RFID-based applications is due to the development of three main technological areas: a) Radio Frequency Electronics, it is necessary for the development of antennas and radio frequency systems present in the RFID tags; b) Information technology, in computing and communications it is necessary to associate the reader with the smart tag through an information system; and c) materials technology, it is necessary for to reduce cost of the smart tags.

The possibilities offered by remote reading of the information contained on a tag, without physical contact, along with the ability to perform multiple readings simultaneously, open the door to a very large set of applications in a variety of fields, from inventory control, location of people and property, security or access control [15].

Barcodes, smart tags, and other technologies withstand extreme temperatures, humidity, acids, solvents, paint, grease, among other damaging agents and also provide a unique code, cannot be repeated, they are ergonomic, its use is more flexible because they prevent straying.

III. ARCHITECTURAL DESIGN

To implement the solution we used the methodology based on RUP model because it tracks the best features of the software processes so that implement many of the best principles of agile development, so we can evaluate all phases that compose it.

Development software and language, reader/writer RFID and RFID tags

To develop and operate the prototype, we used a PC based on Windows 7 (64-bit) and corresponding drivers needed to operate the reader/writer RFID (D2XX and VCP), which were installed to generate a COM port to connect the RFID reader/writer and the PC. The programming language used to develop the prototype was C#, the IDE was Microsoft Visual Studio. The database management system was MySQL.

We used a multi ISO RFID reader (OK 5553) to read/write on tags (see Fig. 1). This reader contains a module for integration with RS-232 connectivity, compatible with ISO standards 14443, ISO 14443B, ISO 15693, ISO 18000-3, EPC RFID devices, Mifare, NFC and ICODE. This RFID reader can read Multi ISO tags, that can communicate with Philips MIFARE family and labels with standard ISO 15693, ISO 14443, ISO14443, ISO 18000-3, EPC and UID tags.

Fig 1. Multi ISO Reader (OK 5553) RFID for reading and writing on cards and tags.

The application allows writing and reading on two types of RFID tags: Tag Mifare (ISO 14443) and RFID (ISO 15693 card (see Fig 2).

Fig 2. Mifare (ISO 14443) and RFID (ISO 15693) tags for recording personal data of owners (guest).

IV. DEVELOPING

In an object control application, the priority is to achieve a risk reduction so that personal items are safe and no wanderings of those objects. Write over an object code or registration for inventory it is not safe, because after writing it, we have to score the same code in a notebook or an electronic format, running the risk that may be confused with a letter or number, which it would affect the identification of the owner and similarly the registration or code is written with down, which runs the risk of wearing out and is erased or illegible, plus it would still be an antiquated and tedious process.

The proposal of this work is to develop an application that interacts with a reader / writer RFID and can display data read from a tag attached to the object. This data can be stored in a database that records information on the contents of the object, amount, location, owner, etc. Identity information obtained with the reader / writer corresponds to that found in the database and displayed to the user with everything that contains the record.

It is considered that the system is able to provide risk reduction control to be able to show at any time the user information stored in the database system.

The main objective of the solution is to design a computer system based on RFID technology that takes control of the guest's personal belongings hosted in a temporary shelter. In addition to building software to read data from a RFID tag located on an object and personal identification of the owner, it is necessary to have a database that stores the information read from RFID tags and it is constantly up to date. And validate that the information stored in the database is complete and correct.

With RFID technology, personnel responsible for inspection of objects in shelters, they manage to know precisely and in real time how many and what type of objects are in the warehouses of shelters and even the data owner listed, improving thus integrated warehouse management of shelters. Similarly, if the RFID application is combined with other technologies such as tracking systems, video cameras and other surveillance related elements, it becomes a more useful tool to prevent theft in stores shelters.

While designing the application is submitted inventory control object, it should be noted that all activities commonly inventory control handles are not used.

Analysis and design

Turning to more specific aspects of design, project development model used is prototyping, since the intention was to create a first model that serves to build similar. The prototype was the result of the analysis and design of a proposal to control objects in a typical shelter.

The prototype was built in a short time using the appropriate programs and without using many resources. We used object-oriented programming (OOP) in C# language. C# uses OOP and works with .NET environment.

Regarding to the database design, in Figure 3 is shown the structure of the RFID database, relations with their respective prototype and fields of the RFID database. The database design fulfills the standards of the relational model required for optimum performance. The application uses four tables: propietario (owner), usuarios (users), almacen (stock), and articulos (items).

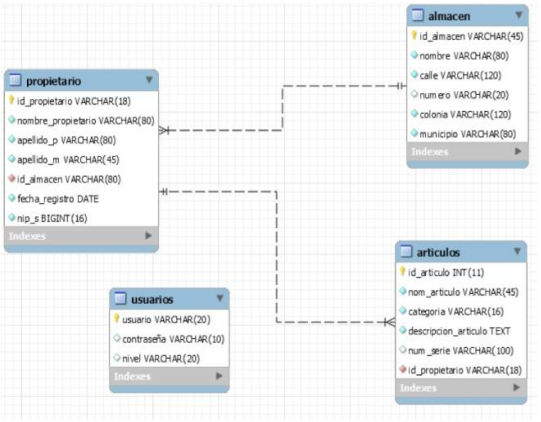

Fig 3. Tables: propietario, almacen, usuarios, articulos (owner, stock, users, items).

V. EXPERIMENTAL RESULTS

In order to check reading and writing operations on a tag, we made tests with the reader/writer (Multi ISO RFID). All tests (ID detection, data reading, and data writing operations) have been completed and all data have been checked to validate the appropriate processing.

Initially, data of refugees are stored in the database. CURP (ID) is the identifier or primary key for each user, this value is the unique field that is stored on the bracelet, other data users are stored in the database that resides on the hard disk.

Implementation

To carry out the tests of the application, we printed commons items (radios, TV, watches, home appliances, among others) to simulate belongings of the victims in shelters. Those images were printed on acetate sheets and RFID sticker was pasted on each acetate sheet in order to simulate the labeling associated to the belongings, an example can be seen in Figure 4.

Subsequently, many items marked were recorded with a RFID tag and stored in the database with its unique identification, description and the relevant association to an owner, so an article can only belong to one owner, however, an owner may have associated multiple items.

Fig 4. Smart tags to identify or label belongings (objects).

Figures 5 and 6 are shown four ID cards labeled with photographs and personal data of the victims (owners of the items). Here are presented such identifications that serve as examples of cards that users show as owners items that they bring and will be registered when entering into the shelter; these cards must be the "ID" from the same person, in this case may be the CURP. In addition to containing physical identification within the RFID chip, on the back side of the label owner also brings labeled a barcode and QR code that points to a link to expand the information about the person.

Fig 5. ID cards owners of objects or assets (front). Each card has an RFID card.

Fig 6. Owner's ID cards (rear).

The final product is shown below and describes the initial interface of the developed system.

Fig 7. Interface to the application.

In Fig. 7 the first interface that appears to start the prototype shown. This screen is to authenticate, must fill the fields username and password to start the application.

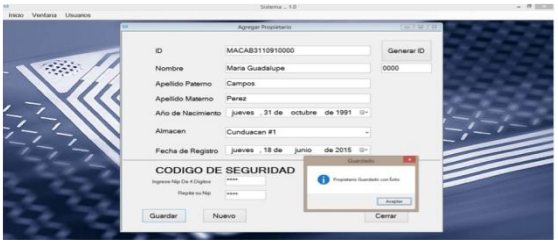

Fig 8. Interface in the application for registration of owners.

In Fig 8 is shown an example in order to store personal data of an owner of items in the database. We tap the card on the tag reader, to fill the data stored into the database and select the button "to generate id" followed by "save" option, so the ID card owner and their data are stored.

We write all RFID cards to each owner of belongings and each RFID tag to the items that the guests brought when arriving at the shelter. Once the system has registered owners and articles, it is possible to generate different queries and reports.

VI. CONCLUSIONS

When finishing the project, it was possible to achieve the initial needs and inventory control problems were resolved to benefit people. Guests are aware that safeguard their belongings will be guarded more reliable than those protection resources commonly used.

This proposal allows a reliable control of shelter guests to store personal items under guard,

thus we know exactly the number of people registered at the hostel. The benefit is that by having information, decisions can be made in favor of the place and the victims to offer better services.

The database is also reliable, is constantly updated and items are safe. The software applies a security level for the belongings of the guests; i.e., the information cannot be altered or deleted by anyone; the only way to alter or delete is to have the owner present, the ID card and PIN are the key security of their belongings. This creates a high level of security for all information that is handled by the database, so, the project is the best option for safeguarding objects and managing to reach the goal of this work.

In addition to recording and control guests' belongings, it is also possible to generate different types of reports.

The results obtained in this proposal are quite useful, either for guests or shelter managers, these are the main benefits: efficiency, safety, control, speed, and reliability.

Our application has some points that would help improve the use of the prototype, first, using mobile RFID readers (Smartphone) for reading tags and managing information through a mobile application, so it can be connected with other applications either distributed or remotely. And second, using high frequency and speed for simultaneous reading tags.

In this work each object in the shelter is properly registered and identified, thus fulfilling one of the purposes of IoT, every "thing" can be treated as an object connected to the Internet.

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