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Wireless DoorBell System Using Biometrics for Car Parking

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ABSTRACT

The development of information technology has promoted modernization in recording, monitoring and maintaining data of each unit owner and their visitors who owns a car. A system with biometrics for security that conserves a lot of time and wireless doorbell that gives the signal to the car owner in which they are being called. The descriptive-developmental type of research was used to provide systematic information with the cross-sectional design of biometrics to save time management and efforts. The results of the study suggest that Wireless Doorbell with Biometrics serves as an android application to support the development and implementation accessed by the users of an operator and plan includes identification and a resident of the building.

***Keywords*:** Biometrics, carparking, doorbell, water fall model

1. INTRODUCTION

Wireless doorbells offer advantages such as it is affordable devices. In comparison to hard-wired entrance components, wireless ones are way less expensive [1, 2, 4]. Therefore, it is more practical if they buy this kind of entrance gong. So much so, it is versatile because they

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can transfer it anywhere, they want since it does not need any cabling. Thus, they will only need much smaller time in order to put in it. Aside from that, the tune surpasses any other entrance chime. This is indeed must-have device [3, 5].

Car parking systems have been around almost since the time cars were invented. In any area where there is a significant amount of traffic, there are car parking [6, 9]. Car Parking were developed in response to the need for storage space for vehicle. Car parking may be traditional or automated. Automatic multi-storey automated car park systems are less expensive per parking slot since they tend to require less building volume and less ground area than a conventional facility with the same capacity. In the long term, automated car parking is likely to be more cost effective than traditional parking garages [8, 10, 12].

Presently, the residents of Guadalupe Bliss Building 5 are having a hard time on calling the car owners whenever there are cars blocking them to get out, they must go to the owner of the car's house and as what the researchers observed some residents are having a difficulty in going upstairs just to call the car owners some caused by old age, has injuries, and some have problem with their knees or has gout [7, 9].

The researchers would create a system for Car Parking, Doorbell, people know that doorbell is a signaling device typically placed near a door to a building / house entrance. As the years past wireless doorbell was introduced, it contains a built-in radio transmitter which may or may not be powered by a battery [11, 13]. When the button is pushed, the transmitter sends a radio signal to the receiver unit, which is plugged into a wall outlet inside the building. When the radio signal is detected by the receiver, it activates a sound chip that plays a sound. To avoid interference by nearby wireless doorbells on the same radio frequency, the units can usually be set by the owner to different radio channels [14, 16, 19].

Before the doorbell, there was the door knocker. A visitor would lift an iron or brass knob on the door and strike a metal plate to signify his presence. Later, a small bell was installed inside the home; the visitor would pull the string to ring the bell. The electric doorbell is by far the most common doorbell style. It is a simple device that when the door button is pushed, electrical current flows to a transformer, which activates a noise signal[17,20]. The noise signal may be a buzzer, a bell or a chime. Manufacturers have developed many styles and sounds from which consumers may choose. Doorbells are wired devices and are usually fixed at one place. They are becoming obsolete because of these reasons and are gradually being replaced by advanced Wireless Doorbell Devices [18, 21].

In most wired systems, a button on the outside next to the door, located around the height of the doorknob, activates a signaling device usually a chime, bell, or buzzer inside the building [22, 24]. Pressing the doorbell button, a single-pole, single-throw, pushbutton switch momentarily closes the doorbell circuit. One terminal of this button is wired to a terminal on a transformer[23, 26]. The doorbell button contains a built-in radio transmitter which may or may not be powered by a battery. When the button is pushed, the transmitter sends a radio signal to the receiver unit, which is plugged into a wall outlet inside the building. When the radio signal is detected by the receiver, it activates a sound chip that plays the sound of gongs through a loudspeaker—either a two-note "ding-dong" sound or a longer chime sequence [25, 27]. To avoid interference by nearby wireless doorbells on the same radio frequency, the units can usually be set by the owner to different radio channels. With a wireless doorbell, the position of the switch and the bell is not fixed, it can be place anywhere [28, 30]. As with wireless doorbells, musical doorbells have also become more common. Musical and continuous power doorbells serve as an attempt to bridge the gap between newer digital circuitry and older

doorbell wiring schemes. A major difference between the standard setup of a wired doorbell and a musical doorbell is that the musical doorbell must maintain power after the doorbell button is released to continue playing the doorbell song. In this project, the researchers designed an Arduino based Wireless Doorbell. The project is implemented using RF Module for wireless communication and also an Arduino board to analyze the data [29, 31, 32]

Biometric systems are composed of complex hardware and software designed to measure a signature of the human body, compare the signature to a database, and render a decision for a given application based on the identification achieved from this matching process [33, 36]. Uses of biometric systems for positive personal identification are experiencing rapid growth in such areas as law enforcement, access control, banking, and a wide range of business and administrative systems [34, 41].

In an even broader application context, biometric systems are having a revolutionary impact on health care and the enhancement of the human computer interface, including in vivo identification of specific human conditions via implantable devices and the automated administration of life-saving medical therapies [35, 42]. The continued rapid advance of integrated sensor, signal/image processing, computer, and mass storage technology promises to extend these applications further into our daily lives with even the most inanimate objects able to identify, interact with, and assist their users [36-38].

Biometrics allows a person to be identified and authenticated based on a set of recognizable and verifiable data, which are unique and specific to them [39, 40]. The aim is to capture an item of biometric data from this person. It can be a photo of their face, a record of their voice, or an image of their fingerprint. This data is then compared to the biometric data of several other persons kept in a database. It is the process of comparing data for the person's characteristics to that person's biometric template to determine resemblance. The reference data stored is then compared to the person's biometric data to be authenticated. Here it is the person's identity which is being verified. The researchers used the fingerprint scanner to make the system be more secured.

A fingerprint scanner system has two basic jobs, it needs to get an image of your finger, and it needs to determine whether the pattern of ridges and valleys in this image matches the pattern of ridges and valleys in pre-scanned image. Only specific characteristics, which are unique to every fingerprint, are filtered and saved as an encrypted biometric key or mathematical representation. No image of a fingerprint is ever saved, only a series of numbers (a binary code), which is used for verification. The algorithm cannot be reconverted to an image, so no one can duplicate your fingerprints.

In this case the researchers develop a Car Parking System that facilitate an easier and hassle-free way of calling the car owners for the residents. The study aimed to provide registration and complete processing of the resident’s information and help them to save time and reduce their amount effort [41, 42].

2. PROJECT DEVELOPMENT

The researchers made use of waterfall model to design a wireless doorbell system using biometrics application software because it gave the researchers an easy overview of the software based on the required specifications, and to present the general flow on the development of the software application.

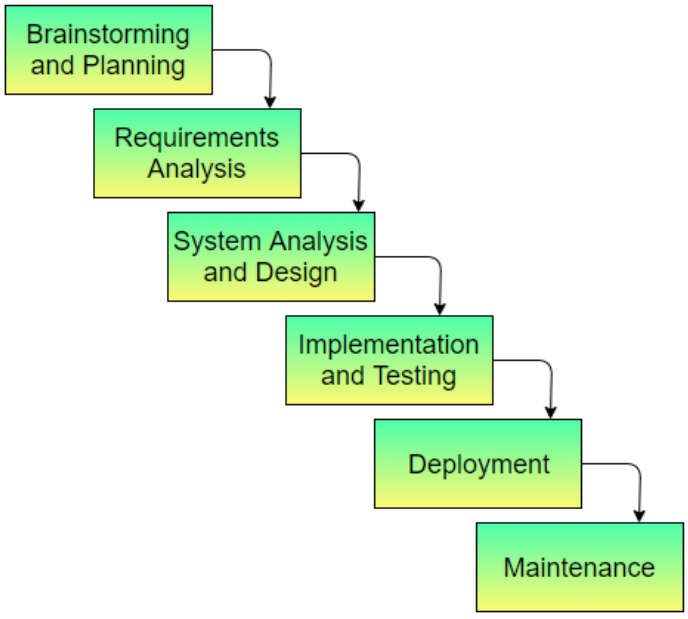

Figure 1. The Modified Waterfall Model

Waterfall approach was first SDLC Model to be used widely in Software Engineering to ensure success of the project. In "The Waterfall" approach, the whole process of software development is divided into separate phases. In this Waterfall model shown in Figure 1, the outcome of one phase acts as the input for the next phase sequentially.

2. 1. Brainstorming & Planning

This is the phase where the researchers had the spontaneous contribution of ideas and the process of generating each creative ideas and solutions through intensive and freewheeling discussion. Every researcher is encouraged to think aloud and suggest as many ideas as possible [43]. And the planning on how to gather data and requirements that are needed to achieve their desired goals.

2. 2. Requirement Analysis

This phase entails the gathering of requirements from the previous and current users of the system in the process of researching, reading journals and articles, and as well as the help of the related literature and studies that the researchers gathered online.

2. 3. System Analysis & Design

The requirement specifications are studied in this phase and the system design is conducted. The researchers studied and analyzed some of the previous and existing system for the better results of their proposed project. All the scope and limitations of the proposed system are analyzed and improved upon. Different design tools are being used for this project including Visual Basic and MySQL. The proponents designed the data structure based on the system requirements.

2. 4. Implementation & Testing

In this step, coding will start using Visual Basic for the graphical user interface. MySQL is used in designing a database and Arduino for the coding and synchronizing of the software and hardware to make sure that these two components are working together.

2. 5. Deployment

Once the functional and non-functional testing is done, the system is ready to deploy to the beneficiary. This stage involves training of the assigned officials that will be given the privilege of operating the system, populating the database with existing records, and converting such data. Assures that the system will continue to accomplish the task acquired. This includes checking for bugs and errors and ensuring that the entire system is working properly.

2. 6. Maintenance

Assures that the system will continue to accomplish the task acquired. This includes checking for bugs and errors and ensuring that the entire system is working properly.

3. RESULTS

As shown in Table 1, Using the t-test for functionality, it is found that there is no significant difference on the assessment of unit owners and visitors since the mean of 4.56 for the unit owners which is lesser compared to the mean of 4.60 for the visitors with their t-test value of -0.1707.

Table 1. Significant Difference in the Assessments of Wireless Doorbell with Biometrics for Car Parking

Feature	Unit Owner	Visitors	T-Test	Verbal Interpretation
Functionality	4.56	4.60	-0.1707	No Significant Difference (p = 0.8728)
Usability	4.46	4.20	1.3131	No Significant Difference (p = 0.2594)
Reliability	4.45	4.00	3.3024	There is a Significant Difference (p = 0.0299)
Security	4.56	4.13	1.0660	No Significant Difference (p = 0.3465)
Maintainability	4.72	4.60	0.8147	No Significant Difference (p = 0.4610)

Moreover, in terms of usability**,** it is found that there is no significant difference on the assessment of unit owners and visitors since the mean of 4.46 for the unit owners which is greater compared to the mean of 4.20 for the visitors with their t-test value of 1.3131.while reliability, it is found that there is a significant difference on the assessment of unit owners and visitors since the mean of 4.45 for the unit owners which is greater compared to the mean of 4.00 for the visitors with their t-test value of 3.3024. In security, it is found that there is no significant difference on the assessment of unit owners and visitors since the mean of 4.56 for the unit owners which is greater compared to the mean of 4.13 for the visitors with their t-test value of 1.0660 while maintaining, it is found that there is no significant difference on the assessment of unit owners and visitors since the mean of 4.72 for the unit owners which is greater compared to the mean of 4.60 for the visitors with their t-test value of 0.8147

The Significant Difference on the Assessment of Unit Owners and Visitors in Wireless Doorbell with Biometrics for Car Parking in terms of functionality, usability, reliability, security and maintainability.

In Functionality using the t-test, it is found that there is no significant difference on the assessment of unit owners and visitors since the mean of 4.56 for the unit owners which is lesser compared to the mean of 4.60 for the visitors with their t-test value of -0.1707. In Usability, it is found that there is no significant difference on the assessment of unit owners and visitors since the mean of 4.46 for the unit owners which is greater compared to the mean of 4.20 for the visitors with their t-test value of 1.3131.

In terms of Reliability. it is found that there is a significant difference on the assessment of unit owners and visitors since the mean of 4.45 for the unit owners which is greater compared to the mean of 4.00 for the visitors with their t-test value of 3.3024 while security, it is found that there is no significant difference on the assessment of unit owners and visitors since the mean of 4.56 for the unit owners who is greater compared to the mean of 4.13 for the visitors with their t-test value of 1.0660. Moreover, Maintainability found that there is no significant difference on the assessment of unit owners and visitors since the mean of 4.72 for the unit owners who is greater compared to the mean of 4.60 for the visitors with their t-test value of 0.8147.

Assessment of Unit Owners and Visitors in Wireless Doorbell with Biometrics for Car Parking in terms of functionality, usability, reliability, security and maintainability. In Functionality using the t-test, it is found that there is no significant difference on the assessment of unit owners and visitors since the mean of 4.56 for the unit owners which is lesser compared to the mean of 4.60 for the visitors with their t-test value of -0.1707. In Usability, it is found that there is no significant difference on the assessment of unit owners and visitors since the mean of 4.46 for the unit owners which is greater compared to the mean of 4.20 for the visitors with their t-test value of 1.3131.

Reliability found that there is a significant difference on the assessment of unit owners and visitors since the mean of 4.45 for the unit owners which is greater compared to the mean of 4.00 for the visitors with their t-test value of 3.3024 while Security found that there is no significant difference on the assessment of unit owners and visitors since the mean of 4.56 for the unit owners which is greater compared to the mean of 4.13 for the visitors with their t-test value of 1.0660.

Moreover, Maintainability found that there is no significant difference on the assessment of unit owners and visitors since the mean of 4.72 for the unit owners which is greater compared to the mean of 4.60 for the visitors with their t-test value of 0.8147.

Significant Difference on the Assessment of Unit Owners and Visitors in Wireless Doorbell with Biometrics for Car Parking in terms of functionality, usability, reliability, security and maintainability.

The data imply that the assessment of the respondents was not significantly different as for the functionality, usability, security and maintainability but for the reliability the data implies that there is a significant difference. The Wireless Doorbell with Biometrics for Car Parking has the functionalities it is expected to have. All the stated functions of the proposed system met the satisfaction of users.

4. TECHNICAL BACKGROUND OF WIRELESS DOORBELL

The influence of technology nowadays is boundless, people are witnessing a shift in the role of technology is playing in our society and may continue to play for generations to come. This system promotes the innovation of technology wherein as time passes by, new projects and innovators are being created.

The innovation of technology is being proved time after time to be the greatest benefactor in the construction of the new world. Biometric security is one of the innovation of technology, an automated method recognizing a person based on a physical unique trait or like with the use of fingerprint scanner wherein it identifies and authenticates the fingerprint of an individual in order to grant or deny access to a computer system, which is very significant in the proposed project entitled, Wireless Doorbell with Biometrics for Car Parking.

With the use of fingerprint scanner, the registered unit owner and its visitor who owns a car can access the system conveniently within seconds and saves a lot of time. The researcher also used wireless doorbell in order to buzz and call the attention of the car owner. This project is created for Guadalupe Bliss Building 5 in order to change the traditional way of calling the attention of the car owner in a modern way.

4. 1. Requirement Specification

The Wireless Doorbell with Biometrics for Car Parking is a PC application software that provides an easier and simple way of calling the attention of the car owner. The admin is the one that controls, edit and can only see all the list and information of the registered unit owner that has a car together with its visitor.

The study aimed to provide registration and complete processing of the resident's name, birthdate, phone and mobile number, civil status, floor and room number, car's plate number, type, brand and color.

4. 2. System Flow Chart

The input modelling are enroll fingerprint, add unit owner (name, floor, unit number, vehicles) and add visitor (name, under what unit number, vehicles). the process modelling are certification of fingerprint, add new user, update user's information, delete a user, print user login tracking history, print admin action log tracking and search for plate number, name, unit number. Lastly, the output modelling are registered unit owners, registered visitors and doorbell interface.

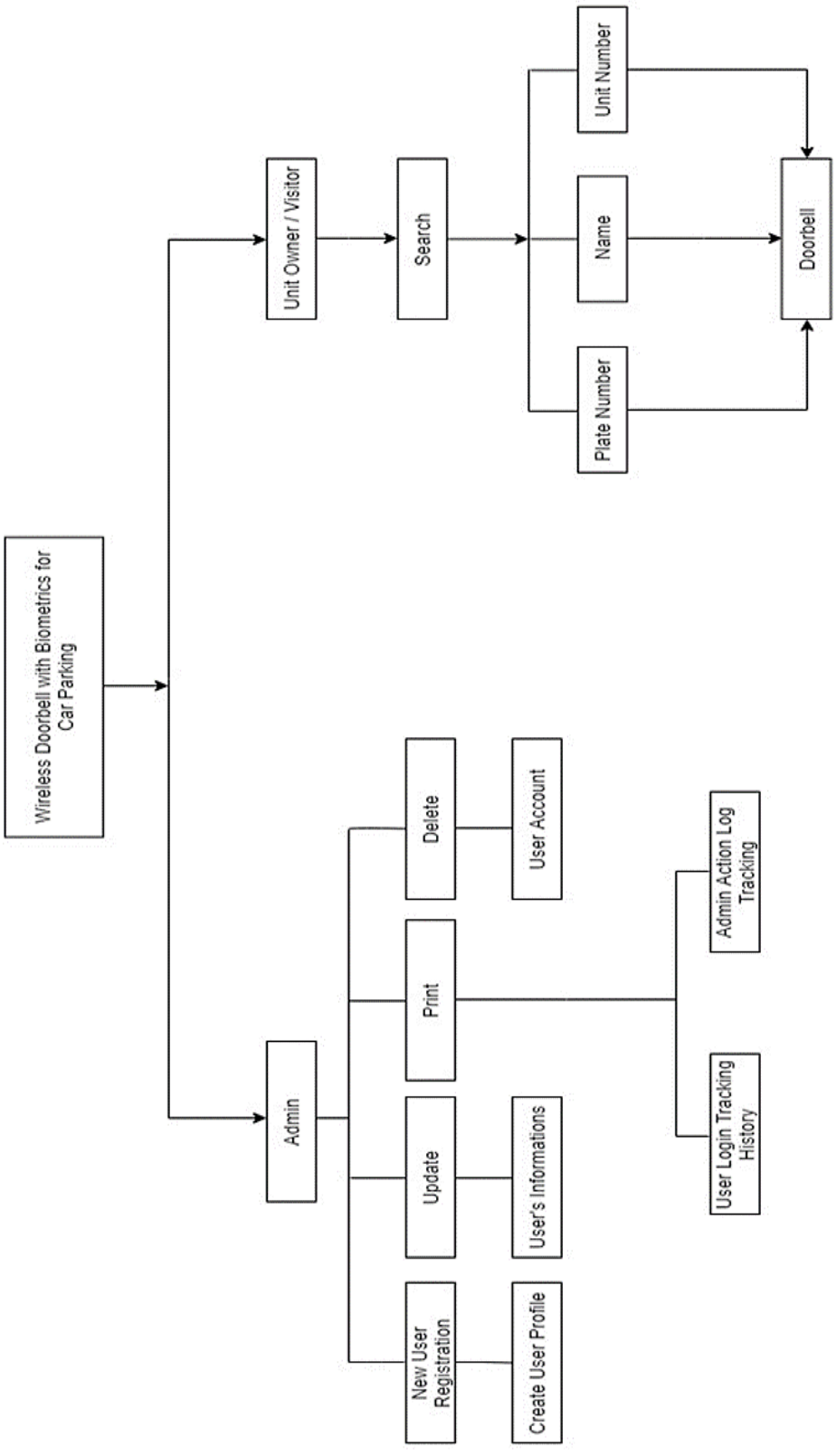

Figure 2. Functional Decomposition Diagram

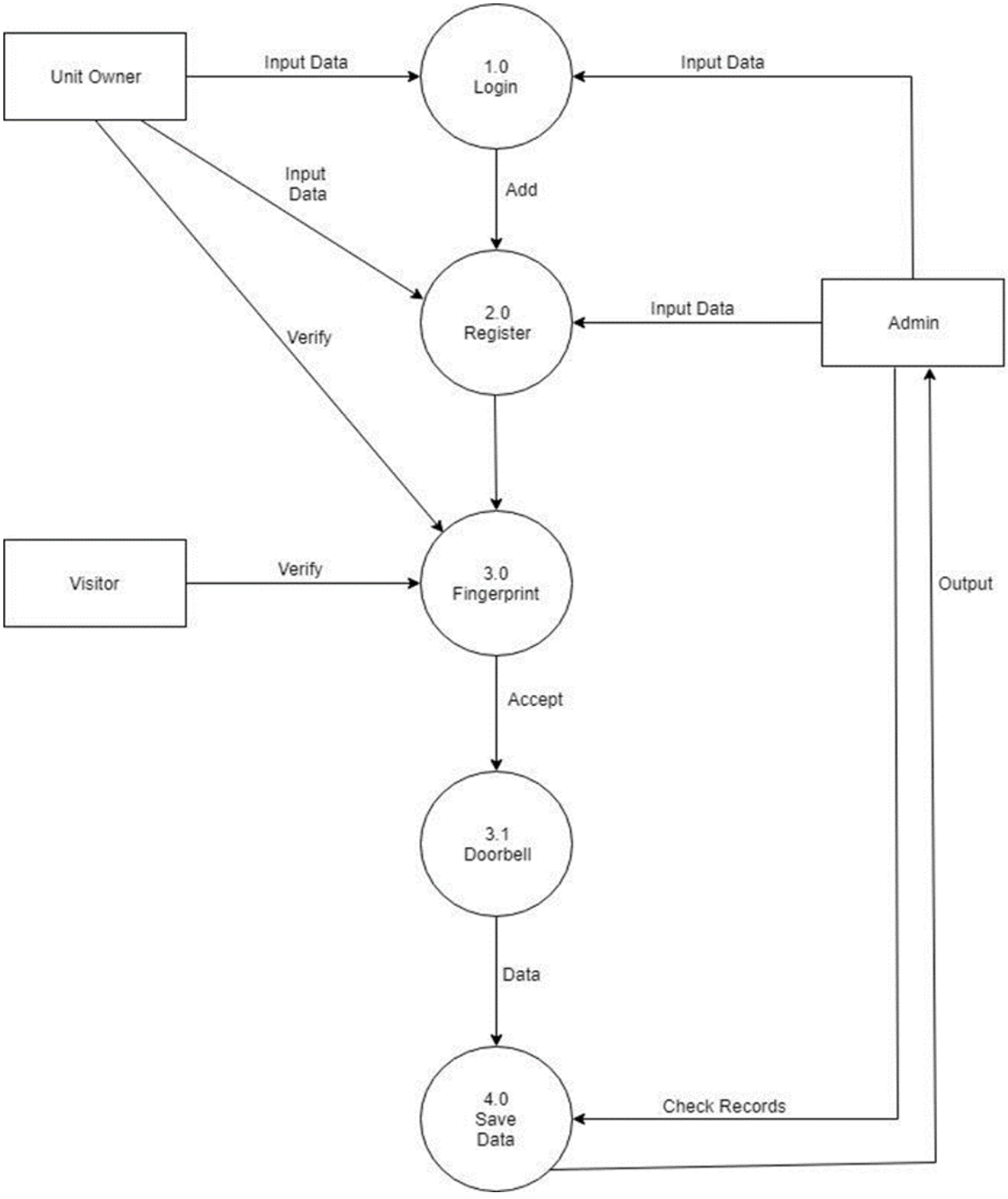

Figure 3. Data Flow Diagram

4. 3. User Manual

To disperse the information on the unit owners, the project requires all the occupants to register and give their necessary data in which the admin can only see. The admin's interface can view all the recorded data, can add, edit and delete information. There are 8 icons, 'User'

can add another administrator in which a registered admin can only operate, ‘Tenant’ can add a new unit owner that owns a car, ‘Search’ can look for name, plate number or room number, ‘Log History’ can view the time in and time out of the admin, ‘Admin Actions Done” can view the history of what the admin has done, ‘Map’ can view the floors and room numbers of all the tenants with their information, ‘Buzzer’ is the user interface where the tenants can access with the use of biometric fingerprint scanner together with their registered plate number and so they can buzz the resident in which a radio signal will be sent to the receiver the make a sound.

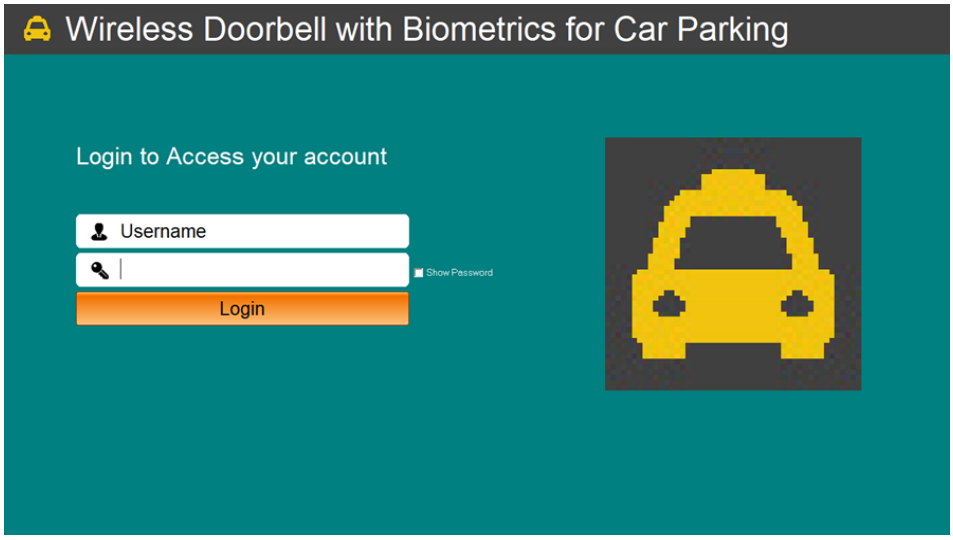

Figure 4. Admin

The admin is the one that can access, add, edit and view all the registered unit owners together with their necessary information.

Figure 5. Accounts and Icons

In Figure 5, the admin will log in his/her username and password in accounts while the icons is the is interface for admin use only

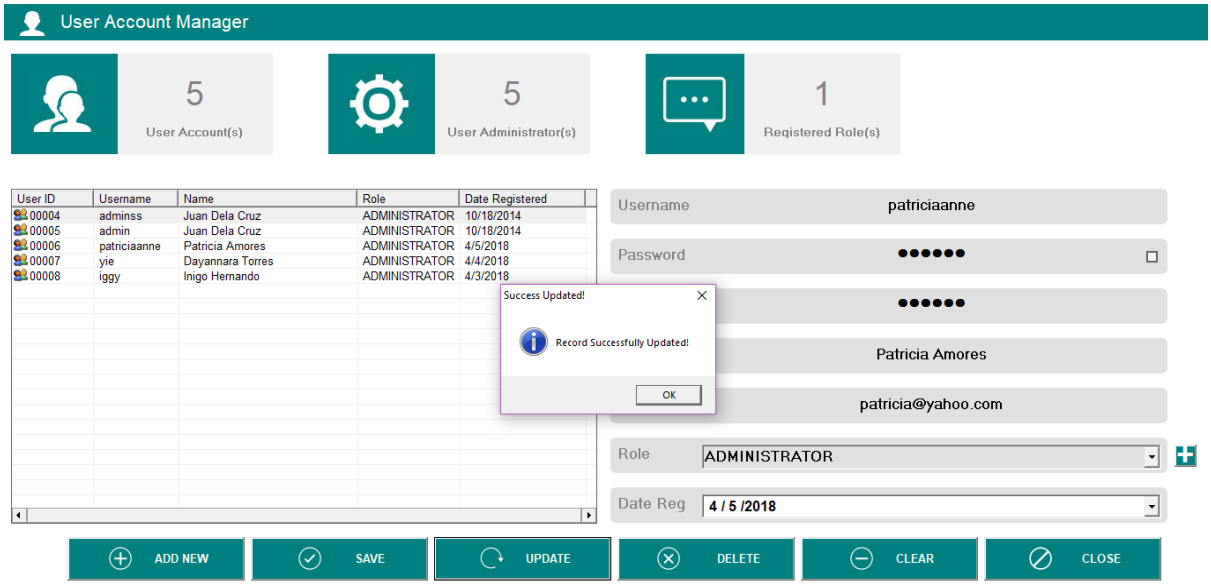

Figure 6. User Bottom

In Figure 6, if user button is clicked, this is where you can see the list of admin and can update and add new admin

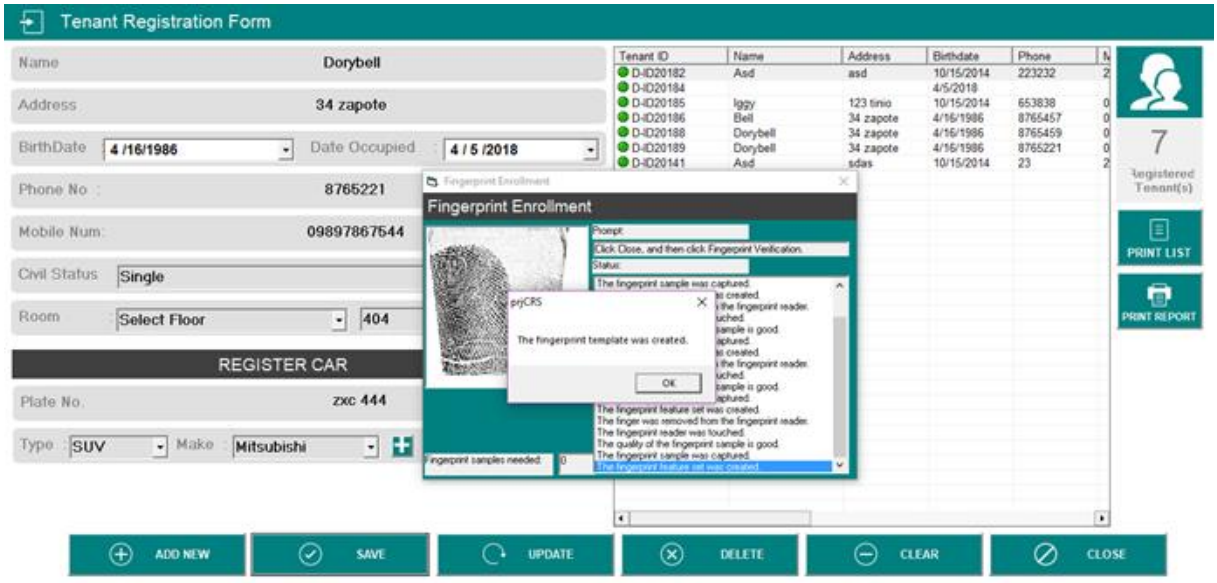

Figure 7. Tenant Bottom

If Tenant button is clicked as shown in Figure 7, the admin can register a tenant together with his/her information needed. On the right side, you can see the list of all Registered Tenants

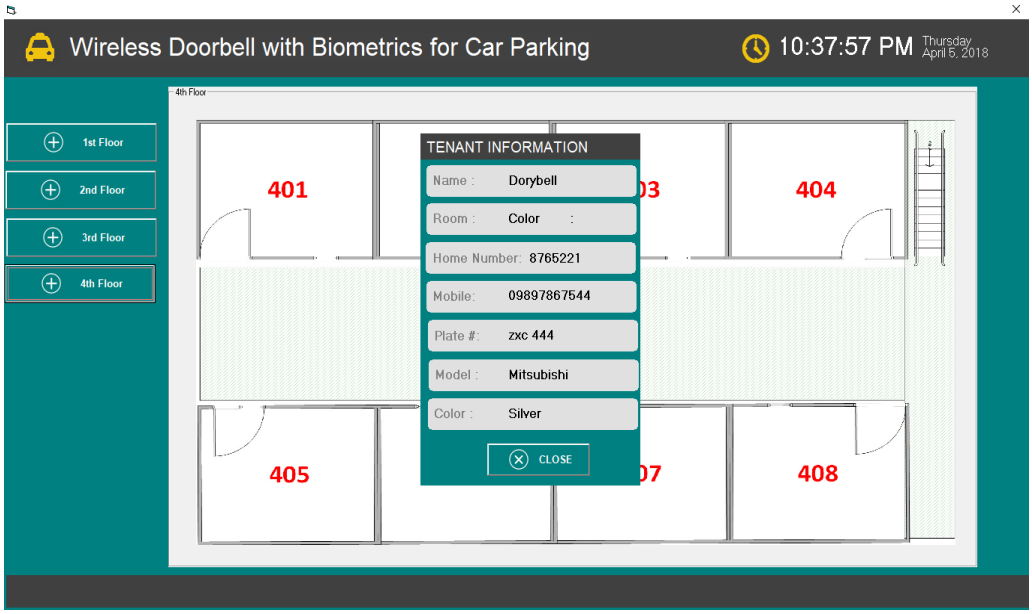

Figure 8. Map Bottom

In Figure 8, if Map is clicked, this can show information about the Tenant

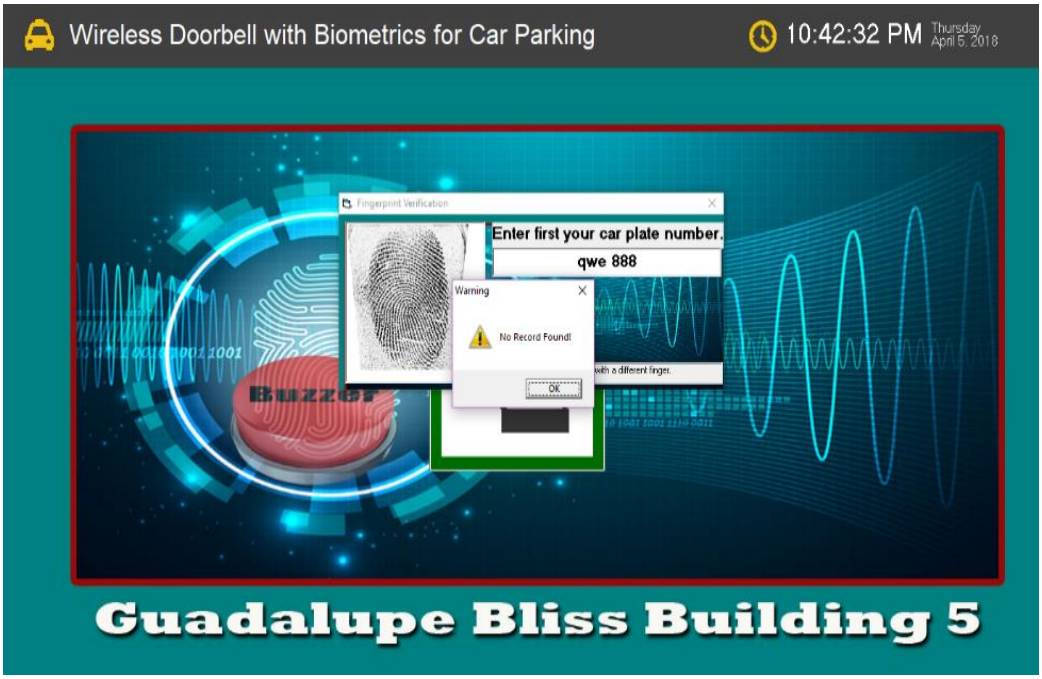

Figure 9. Buzzer Verification

The Buzzer Verification is the Unit Owners and Visitors interface by just entering their registered plate number together with their scanned fingerprint.

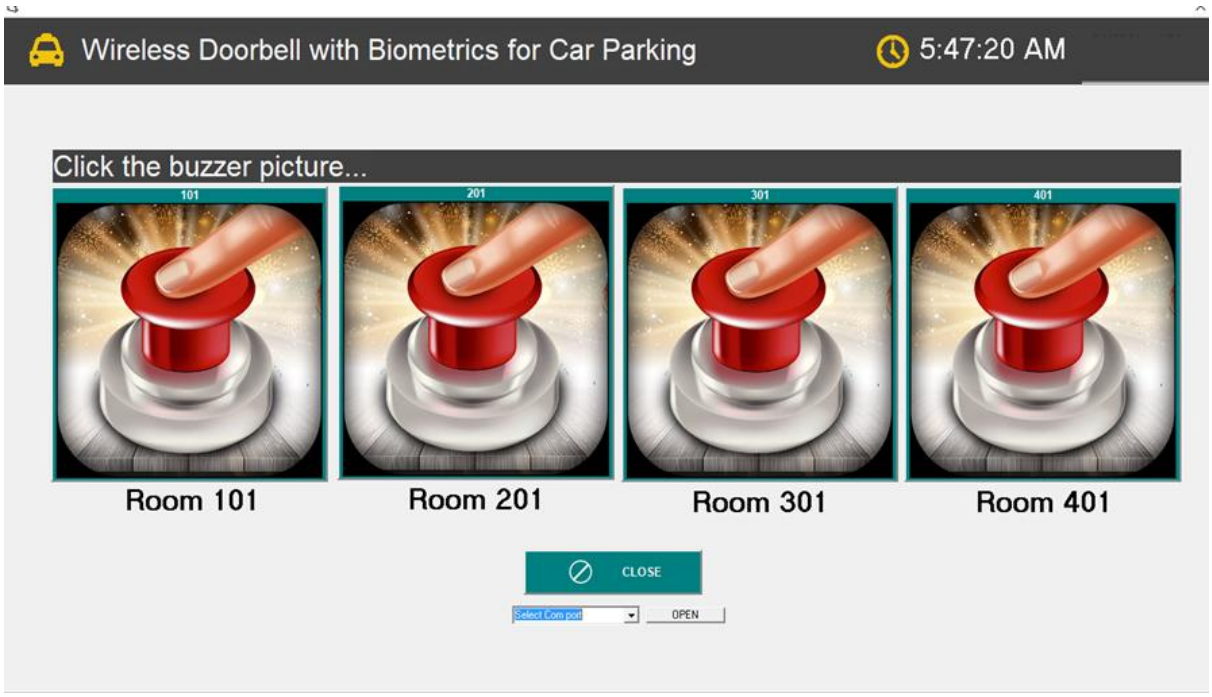

Figure 10. Buzzer Bottom

In Figure 10, when Buzzer is clicked, the tenant can access with his/her finger print to buzz and call the attention of the Tenant in which his/her car will be requested to move

5. CONCLUSIONS AND RECOMMENDATIONS

The Wireless Doorbell with Biometrics for Car Parking would be easier in calling the attention of car owners if someone is blocking their cars. The system is helpful to those who are having a hard time going up and down the building. The system initiates of providing the users the most reliable process. The simplicity and the friendliness are the advantages of this system.

The software is built with options such as the registration, a search bar for the vehicle they're looking for. In this modern world, innovation in Guadalupe Bliss Building 5 with the use of wireless doorbell and biometrics presented a simple but efficient, and convenient way of calling car owners and the requirements provided better perspective and very user-friendly and flexible for all the times. his makes the development to be efficient and the system prototype allows users to call the attention of the car owner.

The researcher recommended the following for further study: widening the limit of the system by considering other buildings; upgrade the system by putting a camera on the doorbell with motion detector, once it detects motion, it'll start recording and send an alert to user's phone either iOS or Android. This adds greater security and accuracy to its motion sensing capabilities.

The researcher also recommend that the Wireless Doorbell with Biometrics will be running as an android application to support the development and implementation to be

accessed by the users of an operator. The plan should include identification and a resident of the building. In that case, the system would be high tech as the level of technology upgrades the old system should also be updated.

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