

Development of An Intelligent Door Lock System

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Abstract: *The study made use of the recent technologies in order to come up with a simplified system. RFID (Radio Frequency Identification) was utilized and is considered as one of the consistent and speedy techniques to perceive the material dissent. Looking back the institutionalized distinguishing pieces of proof are more perfect when stood out from RFID are viably open and are more beneficial to use. Research has revealed some exceptional enhancements which make its programming significantly shorter and less requesting is an immediate consequence of supplanting microcontroller with Arduino. This study used a developmental type of research that has 30 participants. The results of the study revealed that in all of the ISO 25010 characteristics the participants strongly agreed to the developed system. Weighted mean, Standard Deviation and Likert scale with verbal interpretation were used to analyzed and evaluate the system. It is then concluded that the device was found to be helpful and beneficial to the University of Antique, Tario - Lim Memorial Campus, Tibiao, Antique.*

Keywords: Development, Intelligent Door, Intelligent Lock System, Developmental Research

1. Introduction

“Education is the key to unlock the golden door of freedom according to George Washington Carver.

University of Antique Tario - Lim Memorial Campus, formerly Tario - Lim Memorial Antique School of Fisheries (TLMASOF) was founded by the late former mayor of Tibiao Mayor Diodata Bandoja in 1948 located in Poblacion, Tibiao, Antique. This is a school site with eight - hectares land and was further expanded with additional six hectares donated by another late former Municipal Mayor Federico R. Ruiz Sr, with this, UA - TLMC was consider as the largest University in the province of Antique.

When you have a room, offices or a building that store and retrieve one the most confidential and classified data, it is important to protect the data from unauthorized use, disclosure, modification or destruction. Ensuring that users have the proper authority to see the data, load new data, or update existing data is an important aspect of application development.

Robbery now a day is a serious and a high rating of crime according to the Philippine National Police. The cashier's office in the administration building provide the most confidential files in the school where they hold one biggest database in the campus and it has a lot of money in the cashier office. Developing an intelligent Door for the office will give benefits not only for students and staff but also the school because it will assist them to achieve their vision.

The government has a mandate in protecting the personal information and communication systems as stated in Republic Act no.10173 stated in section 2 of the article.

Money, important documents and other properties in the cashier office is quite crucial because lack of safety devices among staff. Beside the traditional method door that used a key can be easily open by unauthorized person or burglar if they have the right key. This will allow them to steal the entire valuable thing in the cashier's office. The major reason of developing this project is to bring security to the offices

Therefore, the researchers came up to the study and create an intelligent door with RFID scanner to make the building secured and no files will ever be harmed.

Objectives of the Study

This study was intended for the computerization of the intelligent Door with RFID Scanner by the Administration Building University of Antique Tario - Lim Memorial Campus in order to:

- develop an Intelligent Door with RFID Scanner;
- secure the money, documents and other important or valuable properties.
- provide comfort and lessen the effort in locking and unlocking the door.
- develop state of the art door.

Specifically, this study was evaluated in terms of:

- 1) Accuracy
- 2) Timeliness
- 3) Security
- 4) Consistency
- 5) Efficiency
- 6) Ease of use
- 7) Interface design
- 8) Application tool

ISO/IEC 27002 provides best practice recommendations on information security controls for use by those responsible for initiating, implementing or maintaining information security management systems (ISMS). Information security is defined within the standard in the context of the C - I - A triad:

2. Conceptual Framework

This diagram was used to document a system by identifying the inputs to each major process, the general nature of these processes and the output produced. The Input process output is used as a framework as shown in the table 1.

3. Methodology

This chapter further discussed the methodology used in the study. This involves the research design, the development of the study, the samples and the instrument.

Volume 13 Issue 11, November 2024

Fully Refereed | Open Access | Double Blind Peer Reviewed Journal

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It shows how the developer develops the system from analysis to development until the installation of the system. The head of the cashier’s office would have the master tag that has been set into the system and the system would go into the normal mode. If they scan an unknown tag the access would be denied, but if they scan the master tag it will enter the program mode from where they can add and authorize the unknown tag, and if they scan it again the door will completely unlock and open.

Table 1: The Input Process Output of the system.

Input	Process	Output
RFIF Tag	The sensor will check if the tag is registered in the database.	The LCD will display “You are not registered” or “Welcome to the Cashier Office”
Insert another RFID tag of the user in the database.	The sensor will process if the tag is already register in the database The sensor will process and insert the RFID tag in the database	The LCD display will display “The RFID tag is already registered” The LCD display will display RFID tag registered”
Delete the RFID tag of the user in The Database	The sensor will process the RFID tag that you Want to delete and erase it to the database	The LCD display will display “The RFID tag Deleted
Pressing the Blue Button	The sensor will give signal to the Arduino when the blue button is being pressed.	The servo will rotate, and it will leave the door unlocked.
Pressing the Red Button	The sensor will give signal to the Arduino when the blue button is being pressed.	The servo will rotate and it will leave the door locked.

The system would have 4 main parts, the Arduino for the main parts of the system, the RFID module which uses SPI protocol for the communication with the Arduino, the servo motor for the lock mechanism and the character display. The Developmental Design

This study refers to the overall strategy to integrate the different components of the study in a coherent and logical way, thereby, ensuring you would effectively address the research problem; it constitutes the blueprint for the collection, measurement, and analysis of data.

The Samples

This study was evaluated by 30 evaluators which are the following:

- 15 students
- 6 staff
- 9 IT instructors

The Basic necessity of security can be attained by designing various door locks such as mechanical locks or electrical locks. This kind of door locks was designed with one or more keys, but for locking a large area various locks is needed. Generally, traditional locks are heavy and that are not strong as they can damage simply by using some tools. Mechanical locks are better over Electronic locks, to resolve the security problems that are connected with the mechanical locks. In recent days every device uses digital technology. For example, identification of digital device using token, door

lock system uses digital technology, automatic door lock opening and closing, automatic door lock systems, etc. This kind of systems is used for controlling the movement of a door without using a key.

There are two types of RFID tags used in this project. One is the master tag and the other one is for the user, and if this is held within 50mm of the RFID reader then lock has been open showing the LCD Display “Access Granted” and once you open the door it will show in the LCD Display “Door Open” and it is ready to lock after you close the door though push button.

Research Instrument

A survey using self - structured questionnaire, an interview, observation and research of related studies were the instruments used in the entire study. A self - structured questionnaire which reflects the necessary questions for gathering data related to the current status and the problems that the respondents encountered in terms of access control as well as monitoring of entries in the cashiers office was used to gather the necessary inputs during the survey. An interview was also conducted to other authorities in order to collect other significant feedback for further information and a broader knowledge on the topic for the development study.

This scale is used to determine the perceptions of the user’s base on the criteria provided for the evaluation.

Table 3: Rating Scale

Score	Quantitative Description
4.21 - 5.0	Very Good
3.41 - 4.20	Good
2.61 - 3.40	Acceptable
1.81 - 2.60	Poor
1.00 - 1.80	Very Poor

Developmental Stages

The developer followed the Evolutionary Prototype Model to develop the system.

Stage 1: Requirements Gathering and Analysis

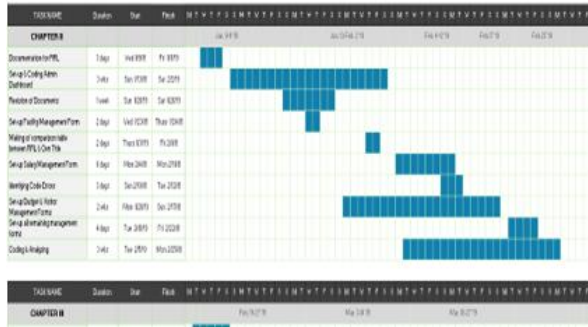
Our prototyping model starts with requirement analysis. In this phase, the requirements of our system are defined in detail. During the process, the users of the system were interviewed to know what their expectation from the system is.

Requirements of the system

Table 4: The requirements of the system

Hardware Requirements	Software Requirements
Arduino	Arduino IDE
RFID module	Fritzing
Led	
2x16 LCD	
Buzzer	
Servo motor	
CNY70 sensor	
Jumpwire	
Push button	
Breadboard	

Gantt Chart



Use Case Diagram

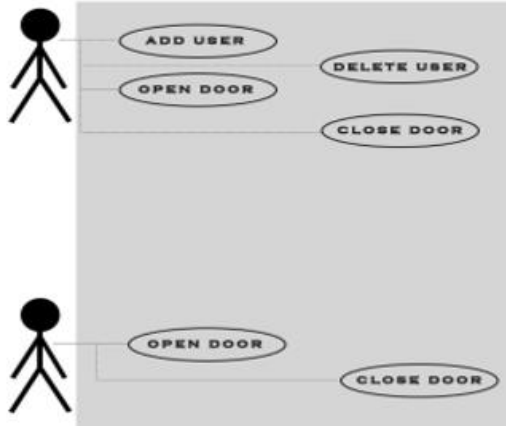


Figure 2: Use case diagram, this shows the relationship and interaction between the user and the system.

System Flow Chart

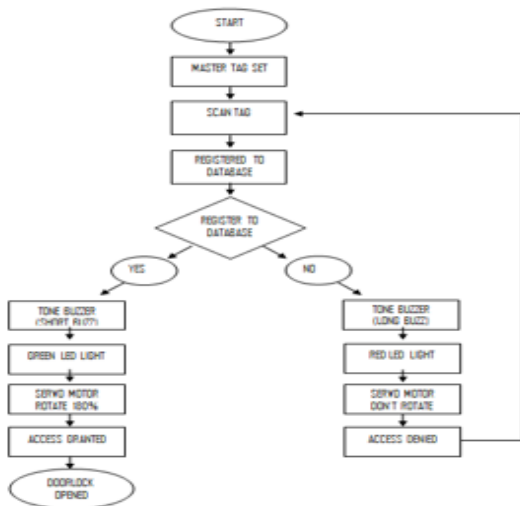


Figure 3: System flow chart shows the workflow or process of the system from scanning the RFID to unlocking the system

Stage 2: Quick Design

The second phase is a preliminary design or a quick design. In this stage, our simple design of the system is created. However, it is not a complete design. It gives a brief idea of the system to the user. The quick design helps developing the prototype.

The Preliminary Design of the System

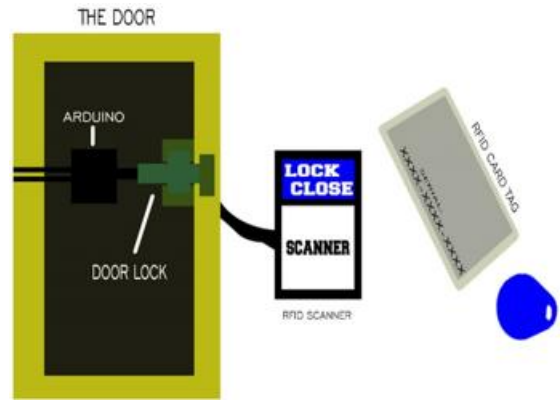


Figure 4: The preliminary system Design of Intelligent Door Lock

The Schematic Diagram of the Intelligent Door Lock

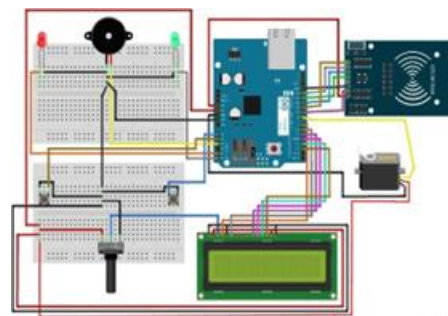


Figure 5: The schematic diagram of the intelligent door lock shows how the hardware was being arrange and configured.

Stage 3: Build a Prototype

In this phase, an actual prototype is designed based on the information gathered from quick design. It is a small working model of the required system.

The Prototype



Figure 6: The final design of the intelligent door lock

Stage 4: Initial User Evaluation

In this stage, the proposed system was presented to our client for an initial evaluation. It helps to find out the strength and weakness of the working model. Comment and suggestion are collected from the client and provided to the developer.

Stage 5: Refining Prototype

When our user is not satisfied with the current prototype, we need to refine the prototype according to the user’s feedback and suggestions.

During this phase in is not yet over until all the requirements specified by our user were met. Once our user is satisfied with the developed prototype, a final system is developed based on the approved final prototype.

Stage 6: Implement Product and Maintain

When our final system was developed based on the final prototype, it is thoroughly tested and to be deployed to production. The system undergoes routine maintenance for minimizing downtime and prevents large - scale failures.

4. Results and Discussion

This chapter discusses, present and analyses the data gathered through proper tabulation with textual form of discussion. It focuses on knowing the current process as well as the problem encountered in the cashier office in terms of access and security. Seven (7) IT faculty members, six (6) part - time teachers and two (2) 8were the respondents of the study. To fully understand the data gathered from the respondents during the survey, the results are presented through tables.

Table 6: Problems Encountered in the Office in Terms of Access

Problems encountered in the cashier’s office in terms of Access	(4) Often		(3) Sometimes		(2) Seldom		(1) Never		Level of occurrences (Score)	Interpretation
	N	%	N	%	N	%	N	%		
Time Consuming	7	87.5	1	12.5	0	0	0	0	3.88	sometimes
Unavailability of keys	7	87.5	1	12.5	0	0	0	0	3.88	sometimes
Misplace Key	7	87.5	1	12.5	0	0	0	0	3.88	sometimes
Defective Door lock	8	100	0	0	0	0	0	0	4.00	Often

Problem Encountered in the Cashiers Office in Terms of Access.

Table 6 above shows the problems encountered in the cashier’s office in terms of access. It also presents the total number of response (n), the percentage (%), the level of occurrences through the scoring and the interpretation of the result from the level of occurrences.

According to the respondents, time - consuming occurs when the key is lost since it takes time, or it is time - consuming in re - keying it (the smart alternative to master keying n. d). Therefore, with the data presented above means that through a computerized registration by simply tapping the RFID reader to saved and registered the card in the proposed system for accessing the office makes the access control system fast and effective.

Based on the researcher’s interview, the reason why the keys were not available or the unavailability of keys is because the person who used it has not returned the keys to its designated place. The result implies that there is a need of providing an individual access cards to open the doors in the office for their convenience. The proposed system provides the users a unique access card each in opening the doors in the office. In terms of lost or misplaced keys, although based on the result of the interview that it was never been a problem in accessing the office, misplaced or losing the keys is

Current Process in the Office in terms of Access

This section presents the answer in the question in the statement of the problem of what the current process in the office in terms of access.

Table 5: Current process in the office in terms of access

Means of Access	N	Percentage
Manual Locking associated with keys	8	100
Electronic or keyless Door Lock	0	0
Others	0	0

Current Process in the Office in Terms of Access.

The table shows the current process in the office in terms of access is through manual locking associated with keys. In relation with the study, the current way of accessing the office by providing a keyless locking and unlocking of doors in the office, given with the fact using an electronic lock provides a more secure method to control a door the system.

Problems Encountered in the Cashiers office in terms of Access

This section presents the answer in second question of the statement of the problem which what is are the problem encountered in the cashier’s office in terms of access. The table 5 shows the data gathered from the respondents during the survey.

inevitable, it is a result of everyday memory or cognitive lapses, average person misplaces up to nine items a day, and one - third of respondents in a poll said they spend an average of 15 minutes each day searching for items.

Table 7: Overall results of the evaluation of the system

Characteristics	Mean	Interpretation
Appearance	4.7	Excellent
Functionality	4.8	Excellent
User Friendliness	4.7	Excellent
System Feature	4.9	Excellent
Over - all	4.8	Excellent

Table 10 shows the results of the study based on the appearance of the system, design and colors and overall appearance of the system was rated by the instructors, staff, office clerk and students as for the Overall Effectiveness of the System “Excellent” with the mean of 4.7.

5. Summary

This study was about Intelligent Door Lock. The purpose of this study is to find out whether the system is better to use in terms of functionality of the system, functionality of the system and overall effectiveness.

The respondents evaluated the system using the evaluation form. The rating scale was used to determine the evaluator’s

responses to the questionnaires and was interpreted using mean and standard deviation.

The results show that the respondents agreed to the system. Thus, the respondents perceive that the Intelligent Door Lock was much appropriate this time.

6. Findings

- 1) The appearance of the system was found to be excellent.
- 2) The functionality of the system was found to be excellent.
- 3) The system was found to be user friendly as it was found to be excellent.
- 4) The system feature of the system was excellent.
- 5) The system was found as excellent as to its overall effectiveness.

7. Conclusions

- 1) The appearance of the system was found to be excellent in terms of design and colors and overall appearance of the system.
- 2) The overall effectiveness of the system was found to be excellent in terms of manner of controlling the system, accuracy of the contents, reliability and security.
- 3) The system was found to be user - friendly with an interpretation of excellent because of the interactions between system and user.
- 4) The features of the system were found to excellent when it is comes to effectiveness in giving security in the office.
- 5) The overall effectiveness of the system was found to be excellent because the system is accurate, easy to use, complete, reliable and secure.

8. Recommendations

In view of the findings and conclusions of the study the developers recommend the following to give light to the present problems of the Cashier's office.

- 1) The University of Antique TLMC must have this kind of system for reliable, secured offices.
- 2) There must be an orientation on the use of the system so that the staff and office clerk would be properly guided in using the system.
- 3) Maintenance of the system must be performed so that the next year generation can benefit from it and add some features to be upgraded in today's advance technology or the IoT (Internet of Things.)

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