DEVELOPMENT OF RFID SYSTEM FOR SMART CLASSROOM IN THE UNIVERSITY OF SOUTHEASTERN PHILIPPINES - COLLEGE OF ENGINEERING

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ABSTRACT

DEVELOPMENT OF RFID SYSTEM FOR SMART CLASSROOM IN THE UNIVERSITY OF SOUTHEASTERN PHILIPPINES - COLLEGE OF ENGINEERING

A Thesis

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Bachelor of Science in Electronics Engineering

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APPROVAL SHEET

In partial fulfillment of the requirements for the degree, Bachelor of Science in Electronics Engineering, this thesis entitled**, "Design and Development of RFID System for Smart Classroom in the University of Southeastern Philippines - College of Engineering"**, prepared and submitted by **John Keneth C. Casinillo, Danah Mae G. Narsolis, Richard Michael M. Ucab,** is hereby recommended for approval and acceptance.

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Chapter 1. INTRODUCTION

In this chapter, the proponents of this study outline the necessary information on why should this study be conducted. This chapter directly informs all of its readers the merits of the case, including history, related studies, shreds of evidence, ideas, thesis, and its antithesis.

1.1 Background of the Study

Sali (2017) discussed that in 2010, only fifteen million people around the world have access to the internet, and recently, it will skyrocket to around twenty million in the year 2020. By harnessing the power of technology as it improves, smart classrooms become popular in universities and institutions. In Canada, these types of classrooms are now utilized through interactive whiteboards (SMART Board Technologies). These types of IoT integrations can help develop the learning skills that the students have. Also, these can help them create opportunities to rapport his/her idea with the learning community (Ullman, 2017).

Smart classroom technology can help the university, the faculty and its primary stakeholders, the students, a lot. The technique, as stated above, can improve university in conserving electrical resources. Faculty will have their class schedules more managed, and students will have their time studying in libraries. In addition to the latter sentence, the students will not idle in classrooms waiting for their next classes. By conserving the electrical energy of the university, this study reiterates that it will only be a byproduct of one of the main advantages of why should this study be conducted.

Furthermore, the current dilemma of the College of Engineering of the abovementioned university is that it is inevitable that college professors will have to attend certain events immediately concerning academic affairs. Therefore, they will have their classes extended to finish in time. Students are also fond of idling inside the school rooms and making use of the school's electric supply. Therefore, to solve this problem, scheduled professors can only access the classrooms. The professors with no schedule at that time will not be able to access and utilize the room.

Moreover, concerning the electrical conservation, the University of Southeastern Philippines made its effort to conserve and electric power consumption by issuing a Board of Regents (BOR) Resolution No. 63, s. 2016 with the title: "Implementing Rules and Regulations of the Security and Austerity Measures or SAM," stating that students are discouraged from using electrical power resources of the university without due permission to the proper authorities. Title III Austerity Measures Rule 13- General Concerns Section 21 also emphasizes the following to conserve energy: Air conditioning units will be set to 22 degrees Celsius with a given time limit, all the lights in the offices should be turned off unless an employee is still rendering his/her service beyond the office hours, controlling the influx of active electrical devices in the university; these devices must inform first the Electrical Power Concerns (EPC) chairperson and General Services Unit (GSU), and the Vice President should duly approve it on behalf of the Administration.

Smart classrooms, in general, should be able to control the access of the classroom by allowing professors to have their classes on time, and students will have more time studying for their next class. The proponents of this study extremely recommends the time management so that professors will have their classes per the approved syllabi by the College/School they belong to.

1.2. Statement of the Problem

The proponents of this study identified and determined the following problems as follows:

1. Will the RFID Smart Classroom System control the ingress and egress of instructors and students inside a classroom?

2. What should be the approach to control the access of classroom utilities such as lights and power outlets inside the classroom? and;
3. What method should be done to effectively generate faculty attendance in the College of Engineering?

1.3. Objectives of the Study

The proponents of this study aim to develop a working prototype of an RFID Smart Classroom System and conduct a functionality test as its general objective. Moreover, specific objectives are also identified that will serve as the cornerstone and basis of success and these are the following:

1. To control the ingress and egress of instructors and students inside a classroom.
2. To control the access of classroom utilities such as lights and power outlets inside the room using the RFID system.
3. To automatically generate the attendance of the faculties in the College of Engineering.

1.4. Significance of the Study

The study aims to control the classroom access and as well as conserving the electrical energy of the school. The University of Southeastern Philippines, through its communication channels, discouraged the students from utilizing the electrical energy resource of the institution. The access of the classrooms can only be allowed if the professor registered through the RFID is scheduled to conduct lectures at that time. The project also promoted time management to prevent other professors from using the classroom beyond the allotted schedule. Professors are also encouraged to be present at all times so that they will not anymore conduct makeup classes and as well as attending to class late. Electricity consumption can be significantly reduced because students will not anymore idle at the classrooms while the professor is not around at that specific time. This project will promote a scenario that no students will be able to idle at classrooms. Therefore, they will also be encouraged to stay in the libraries to study during vacant times. Educational purposes and as well as university operations should only consume the energy resources of the institution. This project could significantly impact the environment, financial management of the university and attendance of the professors.

The primary beneficiaries of this study would be the university/institution, the professors, and its major stakeholders, the college dean, the students, and the future researchers.

The university should be able to conserve the electrical resources by providing power only to its operations. Lower electrical costs will yield a better appropriation to more essential projects. This is also beneficial to the university by protecting their properties inside the classroom from unauthorized persons.

The college dean should be able to monitor the performance of the instructors by knowing the time they entered their classes through the attendance monitoring offered by the project.

The instructors should be able to manage their time and schedules without conflicts and strictly follow the syllabus with regards to their discussion schedules (e.g., when should the topic be discussed). The study will also encourage students to use their free time for studying rather than staying inside the classroom during vacant hours, thus, managing their time efficiently.

For future researchers, they should be able to design and develop new techniques in terms of security. The study should not be limited in using only RFID, Biometrics, PIN, and Password as a method of authentication. Newer methods of authentication should be utilized to realize this study fully.

1.5. Scope and Limitations

The study will only be conducted in the College of Engineering building of the University of Southeastern Philippines (USEP). The project shall have a maximum of seven months (from June to December of 2019). The standard classroom setting will be the main coverage of this project. The exclusionary or limitation provisions of this project are as follows:

1. The study does not consider an event or circumstance such as theft.
2. Damaged bulbs and other lighting elements, as well as electric fans and power outlets, are also excluded from this study.
3. The actual implementation of the device to the College of Engineering of the University of Southeastern Philippines is at this moment also excluded. In accordance with the existing protocols and policies of the university, a working prototype should be proposed to the administration before its actual implementation.
4. Force majeure. The researchers of the study did not consider the effects of acts of God (such as war, crime, earthquake, tsunami, typhoons and the like).

1.6 Definition of Terms

Technical terms and definitions will be defined to exhibit these with clarification. The terms used in this study with deep technical definition are the following:

Smart Classroom is defined as a classroom integrated with technological advancements such as computers, specialized software, networking, and audio/visual technologies.

Local Area Network (LAN) is an interconnection of computers within a building or group of adjacent buildings.

Smart Device is generally defined as an electronic device connected to a Local Area Network (LAN) through different wireless protocols such as Bluetooth, Zigbee, NFC, WiFi, and several similar protocols that can also act with autonomy and free of human interactions.

Radio Frequency Identification (RFID) refers to a technology that stores digital data in RFID tags or smart labels. A reader captures RFID tags via radio waves technology.

The microcontroller is a mini-computer that has a single integrated circuit in which the Device performs one task and execute one specific application. The Device contains memory, programmable input/output peripherals.

Internet of Things (IoT) is an interconnection of everyday devices by integrating each of it capable of communicating through the internet. Everyday devices should be able to send and receive data.

NodeMCU is an open-source device that can perform Internet of Things (IoT) platforms. It is a special-type microcontroller version.

Data Server is the central database of all incoming and outgoing information. Verification processes take place here.

Chapter 2. REVIEW OF LITERATURE AND THEORETICAL FRAMEWORK

This chapter presents the studies and theories related to the research which will be helpful to support the existing problems and issues and to give this study a firm stand of its empirical roots. This includes the related literature and studies.

2.1 Related Literature and Studies

In this section, the proponents shall present a general overview of several studies that manifest similarities, including its purpose, methods, and findings. These studies also exhibit a fractional part of this present study with detailed explanatory sections. The interrelationships of these studies immediately justify the need for this project proposal to be designed and implemented.

2.1.1 Related Legal Bases

On July 31, 2017, Senators Loren B. Legarda, Maria Lourdes Nancy S. Binay, Antonio "Sonny" F. Trillanes and Sherwin T. Gatchalian filed Senate Bill No. 1531 or also known as "The Energy

Efficiency and Conservation Act of 2017". Chapter 1, Section 2 of the act above stressed to institutionalize the efficient and conservative use of energy through the formulation, development, and implementation of plans and programs to ensure sufficient and stable energy supply in the country.

The (Board of Regents) BOR Resolution No. 63, s. 2016 states that all students of the University of Southeastern Philippines (USeP) are discouraged from charging cell phones or any electrical gadgets unless authorized by university faculty or personnel.

On June 17, 2011, the same university also released a Memorandum Circular No. 2011-01 signed by the University President Perfecto A. Alibin: In Part II Section 1 of the Austerity Measures states that the air conditioning units within the university should be turned on at 9:00 AM and turned off at 4:00 PM. In the same part, section 6 that all electrical appliances must pass first the Electrical Power Concerns (EPC) and the General Services Unit (GSU). Section 2 also explicitly defines that students are prohibited from charging their cellular phones in any electrical outlets inside the university.

2.1.2. Related Literature

2.1.2.1 RFID System

Radio Frequency Identification (RFID) is a technology that makes use of radio frequency waves. This technology is convenient in the identification and tracking of objects (Shen,2010). An RFID system consists of an RFID tag, reader and a database server. The RFID reader operates by sending radio waves regularly when an RFID tag is within the range of the reader; a signal is fed back to the reader, hence detecting the object. Through this, objects are now uniquely identifiable (Parkash, Kundu, & Kaur, 2012). The use of RFID systems has been the benchmark towards technological innovation in large-scale identification scenarios (Delgado, et.al, 2017). RFID systems are widely used in industrial applications such as physical access control, item-tagging and payment systems (Weis, 2007).

The RFID system is a fast, and secure system that does not require contact to communicate (Iyer, 2005). Its ability to operate using low-cost components is a major advantage of this system. RFID tags are generally classified into two types; active and passive tags. Active RFID tags are battery powered while the latter does not require a power source (Kaur, Sandhu, Mohan, & Sandhu, 2011).

Table 1. Classification of Passive RFID Tags

Frequency Range	Frequencies	Passive Read Distance
Low Frequency (LF)	120-140 KHz	10-20 cm
High Frequency (HF)	13.56 MHz	10-20 cm
Ultra-High Frequency (UHF)	868-928MHz	3 meters
Microwave	2.45 & 5.8 GHz	3 meters
Ultra-wide Band (UWB)	3.1-10.6 GHz	10 meters

Table 1 shows the classification of passive RFID tags based on frequency range (Weis,2007). Low Frequency (LF) tag and HF tag have the smallest passive read distance of 10-20 cm. However, HF tags offer lesser proximity that LF tags when it comes to liquids and metals (Gonzalez, 2013). Generally, LF RFID tags are more expensive than HF RFID tags. Other RFID above tags with operating frequencies higher than the HF tags offer a wider reading range but are also prone to interference (Weis, 2007). Since the proposed study will not deal with liquid objects or items and is mainly concerned with low-cost, efficient components, HF tag is an ideal component for the study.

A special category under the HF RFID devices is the Near FIeld Communications (NFC). According to Rahul, Anusha & G, Gokul & H, Unni & Rao, Sethuraman(2015) NFC is one of the latest technology in wireless communication that enables a 4 cm range communication when used. Its major benefit is its short range transmission that offers tighter security in its dealings.

2.1.2.2 Development Board

One of the most significant factors that affect the whole study, specifically in terms of cost and system efficiency is the right choice of a microcontroller. A microcontroller is an integrated circuit that administers certain operations in an embedded system. Several microcontrollers available on the market differ in their processor core, number of timers and on the amount of memory (Gridling & Weiss,2007).

Zait(2018) states that NodeMCU, a development board which works on the ESP8266 Wi-Fi System-on-a-chip is best used in IoT applications due to its compactness and built-in WiFi support. Moreover, Aziz(2018) wrote in his research journal titled “Webserver Based Smart Monitoring System Using ESP8266 Node MCU Module” that the use of ESP8266 Module is more efficient than the

Arduino microcontroller because the device itself is capable of being a WiFi station and at the same time Access Points (AP). According to Tae-Gue Oh, Chung-Hyuk Yim, & Gyu-Sik Kim (2017), the Wi-Fi technology built on the ESP 8266 module can cover a range of 20 m indoor and even greater for outdoor use. Moreover, it is also considered as inexpensive when it comes to design and application cost compared to GSM module that works on SMS messages.

A comparative Study of Arduino, Raspberry Pi and ESP8266 as IoT Development Board was conducted by Patnaikuni (2017). Patnaikuni concluded that Raspberry Pi-3, a high-end development board, has a higher performance rate in terms of storage and computing speed compared to Arduino and ESP8266 but in expense to a higher price. On the other hand, ESP8266 strongly stands out in device level sensor networking on account of its small form factor and built-in wireless connectivity. However, Raspberry Pi appears to be an excellent choice for an IoT system based on specs and performance.

Gupta, Gupta, and Chhabra (2015) presented a design that utilized the ethernet-based GALILEO 2nd generation as a development board. The development board was intended to control the electrical devices and equipment wirelessly. The infrastructure that is already in the classroom is also utilized to maximize its efficiency and lower the general cost of the materials in this study. The study is the main objective is to conserve the electrical resources of universities and offices. The methodology is as follows: motion detector sensors are placed in the classrooms to check the real time status of the rooms (if it is occupied or not). A predefined class schedule is being imported to the GALILEO development board so that the system will have a basis which classes should be allowed to utilize the classrooms. The study was able to execute the desired functions, and its proponents were also able to make the energy-efficiency done by developing an intelligent system. The proponents also were able to conserve the electrical energy of the school.

Bento (2018) also performed a comparative and experimental survey between NodeMCU 12e and Arduino Uno as a development board for IoT applications. He recommended the use of Node MCU if the project is composed of few input and output devices. Node MCU is integrated with Wi-Fi Shield ESP8266 which makes it different from Arduino. Arduino requires a Wi-Fi shield to be suitable for wireless applications. When speaking about cost, the Node MCU and Arduino do not greatly differ. However, it should be taken into consideration the requirement for wireless connectivity, where Node MCU 12e has a more significant advantage. Node MCU is smaller in size compared to the latter.

2.1.2.3 Data Server and other Parameters

The data server system plays a vital role in the proposed study. The proponents have background knowledge on PostgreSQL which was tackled in their second year in college. PostgreSQL is a software program that was developed at the University of California, the USA that is widely used for Database Management System. (Xiaojie, 2011) It is an object-relational open-source system and provides distinct features for data security, storage and helps in managing the data.

The use of Real-time-clock (RTC) modules is relevant to the present study since it will be dealing with real-time time-in and time-out of professors. According to Roshan et al. (2017) RTC integrated with real-time timer, calendar, and alarm functions have become capable in precise schedule or time-controlled applications. This device also recommended in the power management application because of its competent in scheduling specific wake up and wireless sensor node. The RTC device is typically found in a variety of consumer, metering, medical, wearable, automotive communication, outdoor, safety, and automation applications, and these are a vital component of the upcoming IoE revolution.

2.1.3. Related studies

2.1.3.1. Access Control Systems

Divya & Mathew(2017) surveyed various access control mechanisms for door locks. The study also presented the pros and cons of the analyzed and surveyed systems. One of the first examples of access control systems shown in the study is the password-based locking system. It works on a simple mechanism that the entered password must match the stored password in the memory of the device. In some cases, a buzzer is connected to the system which will be switched on when an incorrect password is keyed-in thrice. The system uses a microcontroller and relay for the control operations. Other systems such as One Time Password (OTP) is also presented in the study. However, the OTP system is an SMS-based service which makes it vulnerable to service errors.

Other control mechanisms were also presented in the survey such as Cryptography-based Lock System, Wireless Based Lock System and IoT based lock system. Cryptography-based Lock System has a very complex system. The Wireless Based Lock System makes use of a Near Field Communication (NFC) protocol that utilizes a portable device, usually, a smartphone for communication. IoT based lock system enables communication with home appliances and physical devices like personal computers and smartphones. This technique is mostly used in Home Automation System that allows the remote users to have full control of the appliances inside their home.

2.1.3.3 Smart Classroom

In the last few years, designing distinctive room access systems for security and energy-efficiency has been an active study in the field of electronics engineering. The conventional way of unlocking door knobs through keys was manual and time-consuming. For instance, an automated system for room access control was proposed in the laboratory rooms and classrooms in Colegio de San Juan de Letran Engineering building using the biometric technology with keypad access control as a backup (Geralde et al., 2017). The attendance system of the college caused labor cost because of the necessity of an in-charge personnel to check the professors' attendance. Overstaying of students and extended classes is also a significant problem in the college. The researchers use ten unique fingerprints registered to the system and gathered 82 valid prints scanned out of 100, at which point they conclude that the fingerprint access system is accurate. The researchers also found that the prototype is working successfully by conducting a series of a trial to validate their proposed system workflow.

The biometric system needs a larger database capacity. Low-cost biometric fingerprint system consumes more time in identifying the fingerprint scanned, and its performance may vary on wet, dry or dirty fingers (Krishnasamy, Belongie & Kriegman,2011).

Another study has been published by Sali, Pardeshi, Malshette, et al. (2017) in the 2017 International Journal of Innovations in Engineering and Technology (IJIET). They concluded in their study that there are problems in terms of tracking records and attendance. Most of the colleges and universities follow the same standard procedure, such as using pen and paper to record their students' information. Companies and corporate offices already have a solution such as a card swipe method, yet the system cannot be directly attributed to the case of students in the universities and colleges probably due to lack of financial appropriations by the administration. The workplace that students soon realize should be applied immediately during their study period. The study suggests the use of relay modules, voltage supplies, and NodeMCU.

Additionally, they also used software such as mobile applications so that the professors of the students will have the authority to validate the information reflected in the system device. By integrating the above mentioned devices, the students will have an RFID card; then the system will verify the information and reflect it to the mobile devices. The information will be stored in an SQL Database system. The study provides the necessary devices to create the basic needs of a classroom automation system. The methodology, in general, is divided into two parts. The first part will cover the "Electrical Automation System," and the second part will be the "Attendance Automation." The Electrical Automation System will be using the relay modules, voltage supplies, NodeMCU, and for the software part of the mobile application. The professors will input their credentials to the software, and verification will initiate after entering the necessary information. The NodeMCU will directly communicate wirelessly to the mobile application to turn OFF/ON the lights and other necessary utilities inside the classroom. Relays are in general when there is no input signal from the microcontroller will turn off the system. Therefore, an introduction of voltage to it will directly yield power to the whole room. Lastly, the Attendance Automation will be using a Radio-Frequency Identification (RFID) card to NodeMCU. The NodeMCU will validate the information and after will recognize the card and as well as the student carrying it. The study conducted by the proponents strongly suggests that there should be a stronger validation system such as image detection techniques to generate more accurate information and free of fraud.

Other technological advances should also be integrated into the scheme to improve it at large. The experimental design worked and should be improved along with technological advancements.

A study conducted by Shekhar, Zerihun, Haile, et., al (2017) deduced that educational institutions all over the world wasted their time recording information, entering the classroom in a queue. The paper presented that on average, one thousand and twenty-five hours are wasted each year for just following simple instructions. Traditionally, students manually write their name and affix their signature just to be recognized that they attended their classes on time. Educational institutions cannot directly implement classroom automation due to lack of financial capacity. Energy-saving techniques should also be considered in this study because many students forget to turn off the lights and that negligence could cause a significant increase in the energy bill. The study recommends the automation of classrooms such as the attendance systems, parent-school communication via Short Message Service (SMS), and electrical automation to conserve energy resources of the institution. The proponents also stated that their web interface for administrators, lecturers, parents, and students should be improved. The user interface should be clear, exact, and attractive in its state. RFID and Wireless Sensor Networks (WSNs) codes should run in parallel sequence.

Currently, the RFID and WSN prototype runs in sequential order; therefore, dependence on each other is still necessary.

For the methodology, classroom automation is divided into two parts; the first part covers the RFID attendance system, and the second one is the WSN Energy Saving System. The RFID system has two parts also, the prototype and web design. Prototype design will get the RFID information, validate and store it accordingly. After being confirmed as part of the class that the student wished to enter, a welcome message shall appear to confirm his/her attendance. The webpage is intended to display and control all records of the automated classroom monitoring. The administrator can create a user account, a course with a time table and attendance table in the system. The WSN Energy Saving System will control the turning OFF/ON of the electrical appliances. The system should always scan for human motion. Should no motion be detected for a certain amount of time, immediately the NodeMCU will send a signal to the relay node so that the utilities inside of the room will be automatically turned off to conserve electrical resources.

Banacia, Bernadez, Enriquez, Negru & Palencia(2015) conducted a study in the University of San Carlos, Cebu City, Philippines. They stated that opening a class and laboratory rooms in the University of San Carlos were manual and time-consuming. It requires a key in unlocking the doorknob and manual switching of lights and ac units in the room. The attendance system of the college caused labor cost because of assigned personnel charged in checking the attendance of professors. Overstaying of students and extended classes is also a significant problem in the college. Due to this, the researchers establish a system that would automate the access of rooms and the control of utilities such as lights and air-conditioning units in the University of San Carlos. The system is responsible also in checking the attendance of the professors in the college. The design system aims to lessen the time wasted on waiting for the personnel-in-charge in opening the room and the overstaying of the students in a particular class. A prototype of time-controlled access using RFID system automatically turns on and off utilities such as lights and air-conditioners, and it was successfully developed making use of the University of San Carlos RFID. The researchers also found that the prototype is working successfully by conducting a series of a trial to validate their proposed system workflow. It was recommended to upgrade the system to use a wireless communication protocol. It is also practical interest to test the system to an actual room setting using loads such as light bulb and air-conditioners.

In 2015, Kamelia, Effendi, and Pratama conducted a study titled Integrated Smart House Security System Using Sensor and RFID (Door and Lighting Automation). The proponents found solution to the integration of Security and lighting systems using sensors and RFID in order to improve efficiency and security accuracy in the conventional homes. Their system is subdivided into two main parts: Door Automation system and Lighting Automation System. For the door automation system, three security sensors are installed: (1) RFID system, (2)4x4 keypad and (3) limit switch sensor. The door can be accessed when a registered RFID tag is swiped to the RFID reader (2 cm range) or when the correct keypad password is entered. Otherwise, a limit switch will trigger an alarm for 60 seconds. Once the door is unlocked, the microcontroller sends signals to the relay to activate the sensors for Light Automation System. The Light Automation System is consists of (1) Light Dependent Resistance and (2) Passive Infra-Red (PIR) sensor. Should the value measured by the LDR to the ADC is greater than 380 and the PIR sensor detects human motion, a lamp is activated. However, it is strongly suggested for the system to upgrade from wired communication to wireless communication. The use of NODE MCU as its system microcontroller would best fit for the function since it has a built-in Wi-Fi component at a lower cost.

According to ShanEn, Fan, ZhangPing, WeiHua, and Peng (2015), "lit waste" is one of the major concerns in school's energy consumption. Complex human detection methods such as Digital Image Processing (DIP) and Pyroelectric Method for managing light waste has complex implementation scheme, low accuracy, limited accuracy range and high-cost. The proponents, however, provided a solution through their study titled Energy-saving System for Classroom Based on Campus Card. They designed a simple-use and low-cost intelligent classroom energy-saving system based on RF technology. The system is composed of an Information Center, Base Station and Sub-Control Nodes. The campus Information Center acts as the main database for the management of RFID cards registered within the campus. The Information System then communicates to the Building Base Stations that also updates the Sub-Control Nodes found in each classroom. A registered card should be inserted in the CY-14443A card reader module in order to activate the power switch in the classroom that is connected to the STC12C5A microcontroller. Once the card is removed, a warning alarm voice prompt is produced through the WT588D voice module. Should the user fail to reinsert the card after a few minutes, the classroom power switch will shut down. Moreover, the control nodes can determine the period of usage according to the settings of clock module in the main control center.

Unlike the research study reviewed, the present study is designed for ECE rooms only and not on a campus-based setting. Hence, the Information Center and Base Station will be integrated into a single server near the proposed classrooms. Moreover, the present study will not need for the RF card to be constantly inserted in the RF reader. A single tap of the registered RFID card will unlock the door and power system, given that a registered class schedule is in the database system.

Tanpure, Sonawane, Sonawane, & Maral, (2013) proposed a monitoring system for students using a passive RFID system. This system is commonly used in schools today to control the people who enter and leave the school premises. In the study, RFID readers are placed in fixed locations, and students are given passive RFID tags for unique identifier codes. Passive RFID tags do not need a power source to transmit and receive radio waves since they work through the load modulation technique. They mentioned that the use of RFID system is faster than barcode and smart card system and cheaper than the biometric system. Since a unique identification tag is given per student, differentiation of every tag holder is hassle-free. Also, a Graphical User Interface (GUI) is also provided for the easier and more comprehensible monitoring system. The study used RS 232 as its communication protocol because it is an inexpensive interface. However, RS 232 has its drawback in terms of speed of data transmission and its limited maximum cable length.

A practical, economic and simple approach is taken in a home automation system using GSM, IR, Bluetooth and Android devices

(Shinde et al., 2017). One of the components used in the study is the 8-channel DC relay module that enables the switching and control of appliances through the command from the microcontroller and also isolates the low voltage side of the microcontroller from the high-voltage circuit in home appliances. Since the proponents proposed a light, ventilation, power outlet and door control access system, a 4-channel DC relay module will be utilized for the study.

2.2. Conceptual Framework

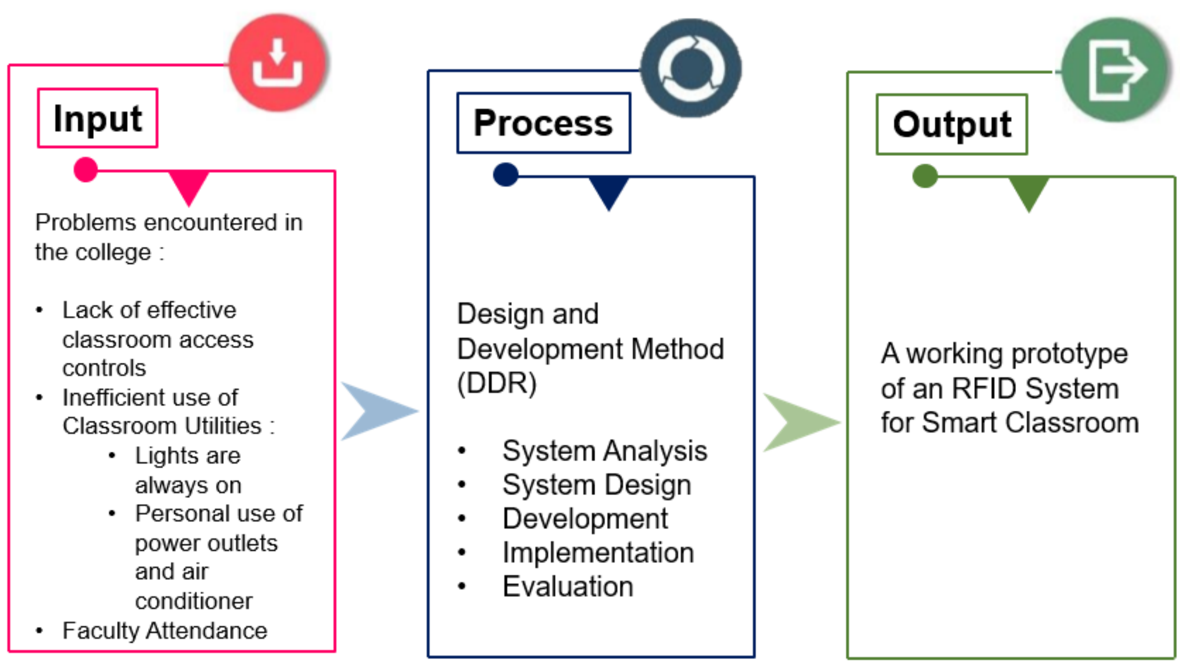

Figure 1. The Conceptual Framework of the Study

The project is guided by a conceptual framework graphically illustrated in Figure 1. The inputs tackled the specific problems encountered in the college that will be addressed by the study. At present, the college lacks an effective classroom access control system, thus, allowing unauthorized personnel to access the rooms and utilize it during vacant periods. In addition, conflict in a class schedule is also experienced because the professors tend to overstay in the classrooms and extend their classes. The checking of the faculty attendance in their designated classes is also manual and time-consuming. Lastly, students make use of utilities inside the room during vacant periods such as turning on the lights, the air conditioner, as well as charging their gadgets the lack of strong enforcement on the implementation of the Safety and Austerity Measures of the university.

In order to achieve the desired output of the study, the proponents used the Design and Development (DDR) process. Lastly, the proponents expected to achieve the working prototype of an RFID System for Smart Classroom in the College of Engineering, University of Southeastern Philippines as an output.

This project helps the institution to monitor the attendance of the instructor and control the activity inside a classroom. The teachers will only have to use the classroom if he or she is scheduled for that time. This study also aims to lessen the power consumption of the university.

Chapter 3. MATERIALS AND METHODS

This chapter includes descriptions of the method used, research materials, design overview, and procedure of the study.

3.1 Research Method

The research method that will be applied to this research would be design based research method. The proponents will create a prototype that could help the user for visualizations and serves as guidelines for how to implement the design.

3.2 Research Materials

Table 2. List of Components

Component Name	Quantity
NODEMCU V3 DEVELOPMENT BOARD (4MB LUA WIFI IOT DEVELOPMENT BOARD) ESP8266 ESP-12E	Two (2)
RC522 RFID Kit MFRC522 13.56 Mhz With S50 Tag/card	Two (2)
12V Electromagnetic Lock	One (1)
2-CHANNEL RELAY MODULE 5V LOW LEVEL	Three (3)

WiFi Router	One (1)
MultiVolts Power Supply	One (1)
AC Power Socket	Two (2)
Fluorescent Bulb and Socket	One (1)
25A/40A Solid State Relay	One (1)

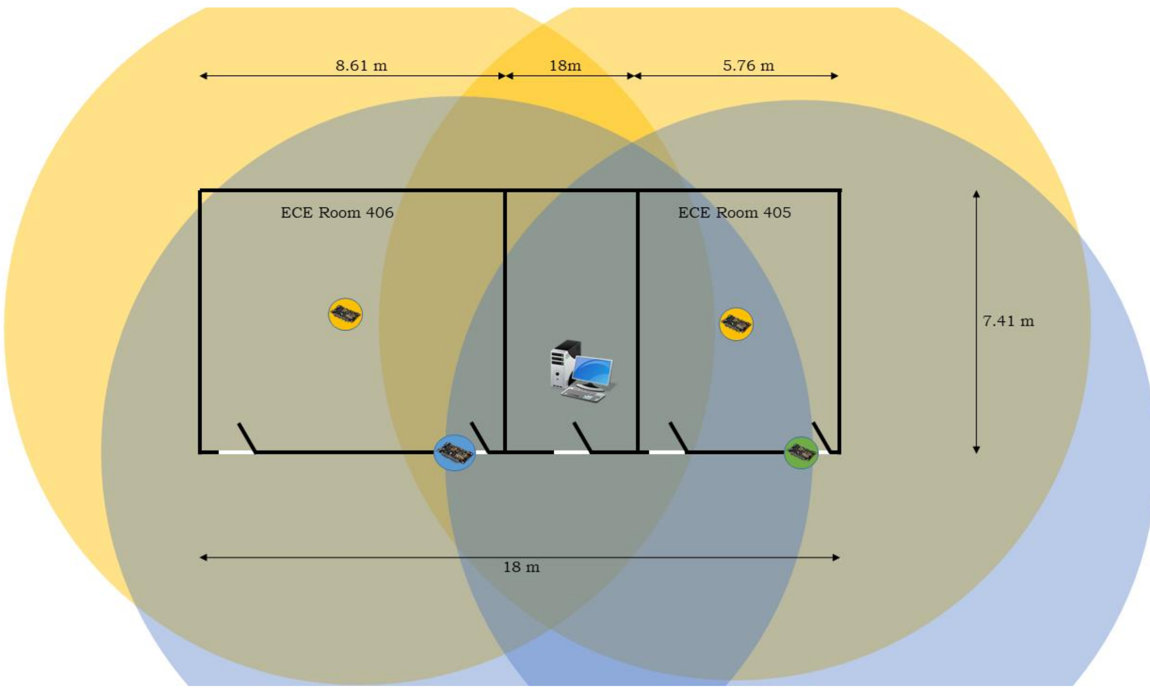

Figure 2. Top View of the Area of Implementation

Figure 2 illustrates a top view of the area of implementation. The picture showed the Wi-Fi range of the microprocessor used. The dimension of the overall area is 18 meters by 7.41 meters. The data server is located in the ECE laboratory equipment room.

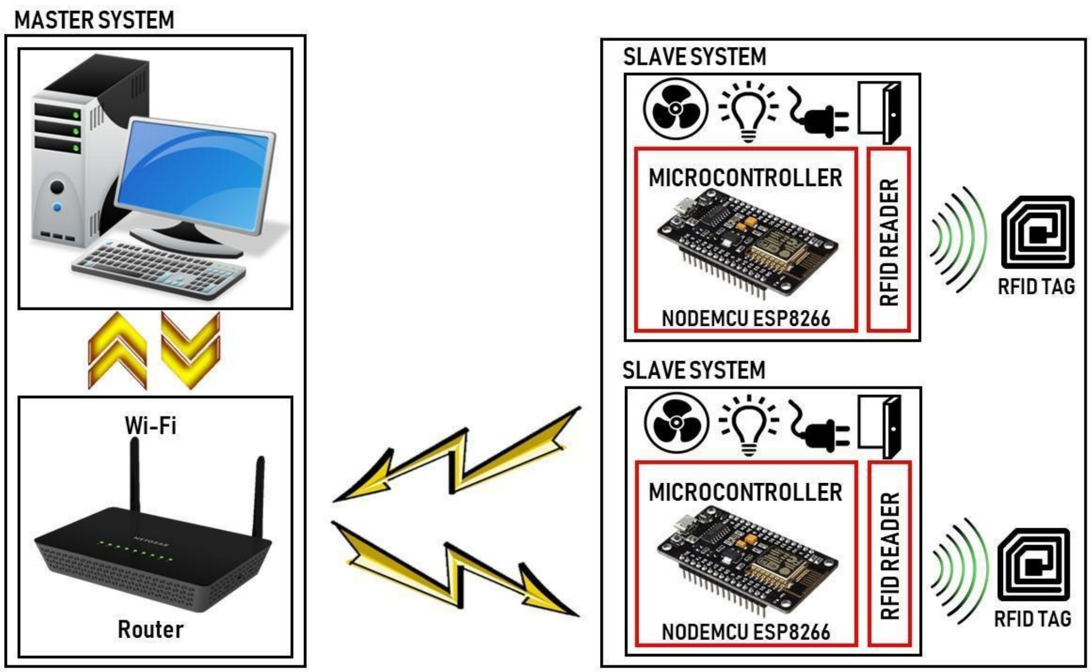

Figure 3. The Master and Slave System

In building the system for the RFID Based Smart Classroom, the researchers will use a couple of major elements. These elements are the slave and master system.

3.2.1. Slave System

The slave system is responsible for controlling the light, air-conditioner electrical outlet, and door in a classroom by the use of a solid-state relay. This system is capable of communicating with the master system for validation and confirmation of users in the classroom. The user can access the smart classroom by taping the RFID tag to the reader. These processes will be possible by utilizing the NodeMCU ESP8266 as a microprocessor for the whole system.

3.2.2. Master System

The master system is responsible for processing the data sent by the slave system and permit the slave to control the utilities. The local database is saved in the master system through the central computer. This system is responsible for validating and confirming the data sent by the slave system. Also, the master system can forcibly turn off the operation of its slave systems and monitor/record the attendance of the teachers. The information will be transmitted through the use of a Wi-Fi Router.

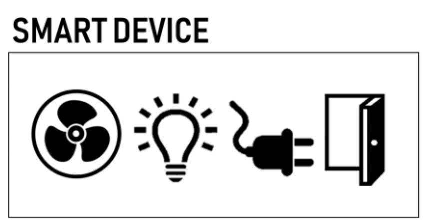

Figure 4. Controlled Utilities

Should the RFID system accepts and validates the credentials inserted, it will instantaneously control the utilities stated below:

- Door Lock
- Power Outlets
- Lights
- Air-conditioner

3.3 Design Overview

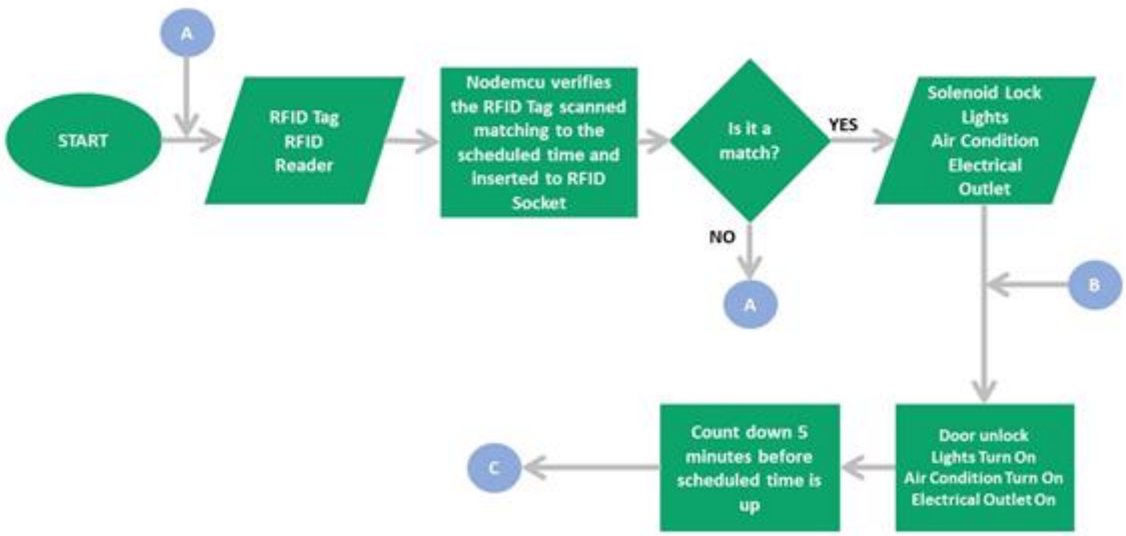

Figure 5. Operational Workflow A

Figure 5 Illustrated that the RFID reader should scan the RFID tag and verifies through the microprocessor. If the scanned RFID tag is valid and tag is inserted in the socket, the door will unlock, lights, air-conditioning, and electrical outlets will be operational. However, if the scanned RFID tag is not correct, the user can’t access the classroom. Moreover, when the system is functional, it will count down five (5) minutes before the time is up.

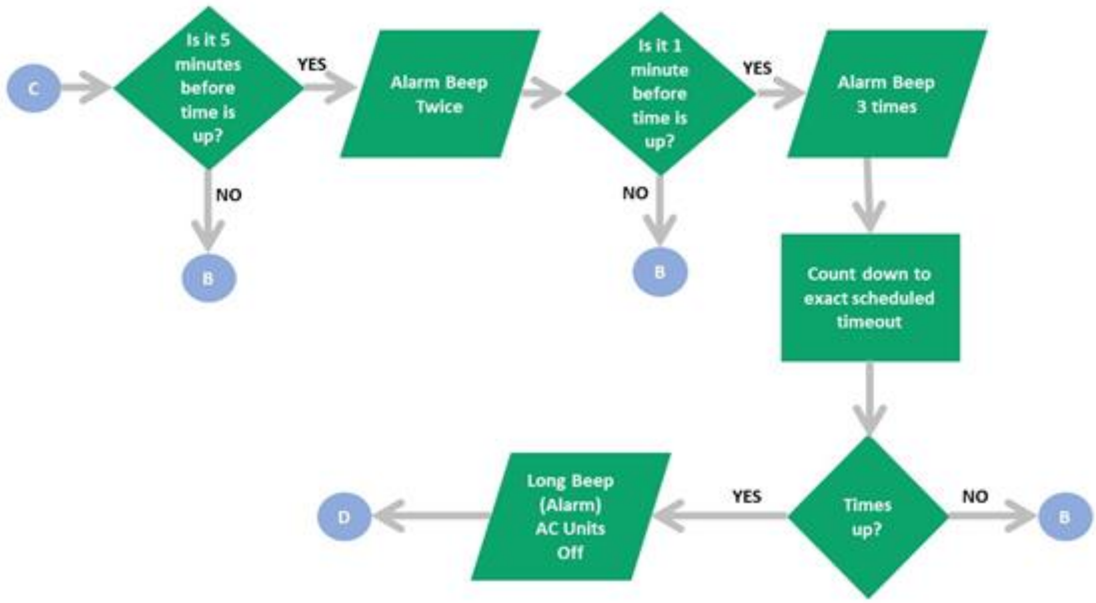

Figure 6. Operational Workflow B

Figure 6 illustrates that when the five (5) minutes and one (1) minute count down before time is up, the alarm will beep twice and thrice respectively. Another warning will occur when the system is on exact scheduled timeout. However, the system will still be operational even though several alarms arise during the process.

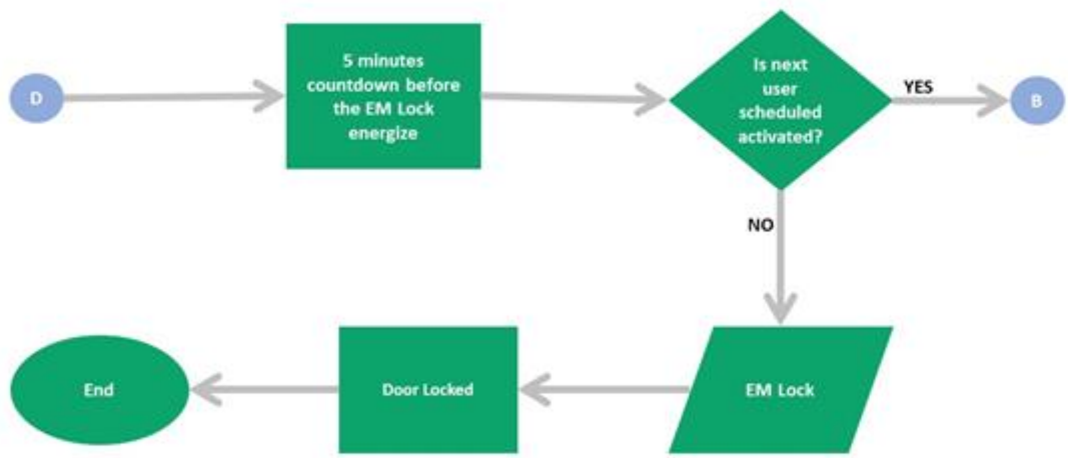

Figure 7. Operational Workflow C

Figure 5,6 & 7 shows the operational workflow of the system. The system should start at the scanning of RFID tag via the slave system, and transmit the information to the master system. The received information from the slave system will be processed to the master system. The criteria for the validation and confirmation of scanned RFID tags are as follows:

- The person is a certified teacher of the USeP College of Engineering
- The RFID tag of the teacher is registered to the database
- The teacher is scheduled to conduct his lecture in the specified room during the time the RFID tag is scanned

- The teacher is scheduled for makeup classes upon the scanning of the RFID tag

To complete the validation of the RFID tag, the tag should be inserted to the RFID socket. If the RFID tag scanned is not valid, the system is programmed to wait for another tag to scan. Otherwise, when the system validates and confirms the RFID tag, it will permit the slave to energize the controlled utilities. The operation of controlled utilities, if the RFID tag is valid, are as follows:

- The door is unlocked
- The LED fluorescent bulb is ON
- The power outlet is ready to use
- The air-condition is operational

The system will automatically turn OFF the air conditioner, power outlet, LED fluorescent bulb, and lock the door ten minutes after the official time is out. Moreover, a button will be placed to control the door if it is closed. Otherwise, if the registered time for the class lecture is not yet finished, the controlled utilities will still be operational. Below are the features of the web application:

- The system application can generate the attendance and logs of the teachers
- The system application can register the RFID tags for teachers

- The system application can monitor the operation of the smart classroom
- The system application can forcefully turn OFF the operation of the smart classroom
- The device is integrated with a 20x4 display to flash the name of the teacher, schedule, time, and status of the smart classroom.

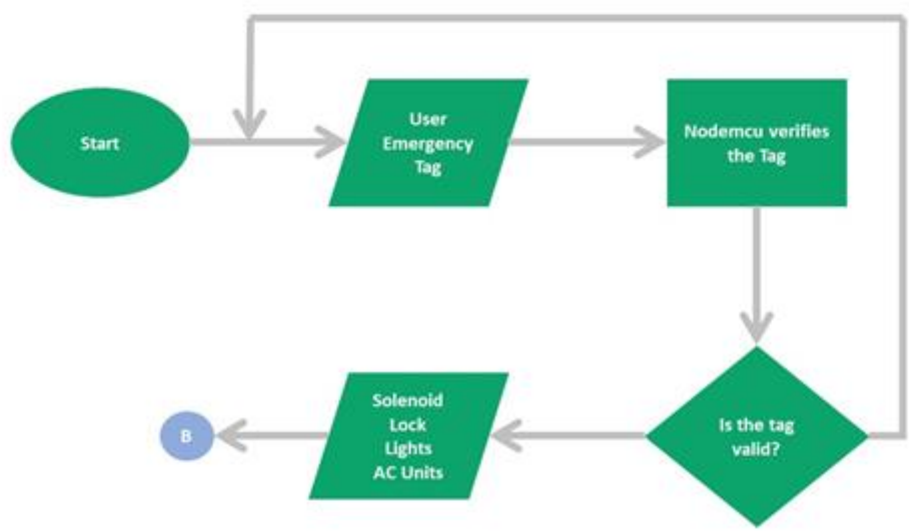

Figure 8. Emergency Access

Figure 8 illustrates the workflow for Emergency Access. The proponents include an extra RFID tag that will be able to override the scheduling system. Once the User Emergency Tag is tapped on the RFID reader, the microcontroller verifies the tag to the database server. The valid Emergency Tag will be able to access the rooms regardless of the present enrolled class schedule. Should the tag is proven to be valid, the user will be able to utilize the controlled utilities such as solenoid door lock, lights, power outlets and air conditioner. These tags are intended for emergency and security purposes only.a

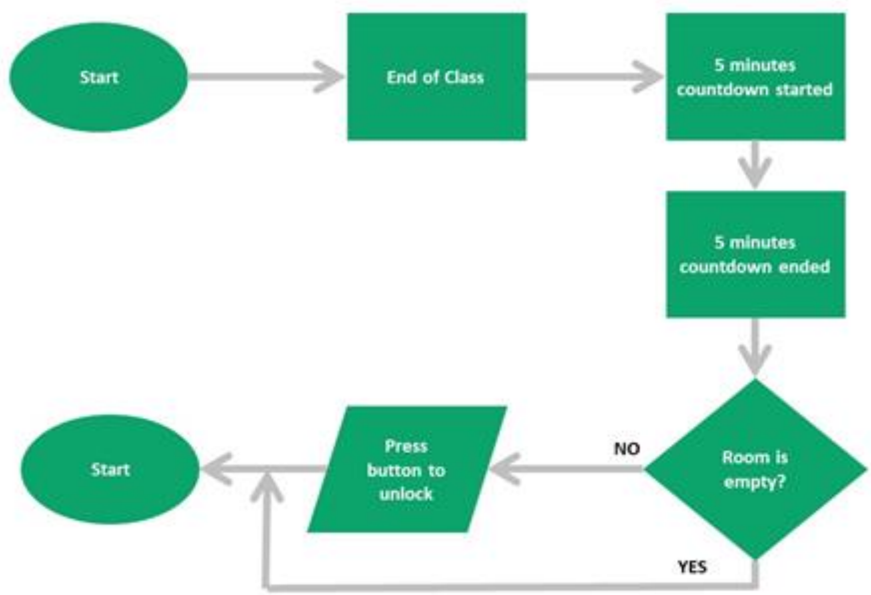

Figure 9. Exit (if 5 minutes extension lapses)

Figure 9 illustrates the workflow for the exit system. The proponents integrate a push button inside the room to be utilized by students or professors left in the room after five (5) minutes countdown ended, provided that the next user does not activate the smart classroom.

3.4 Procedure of the Study

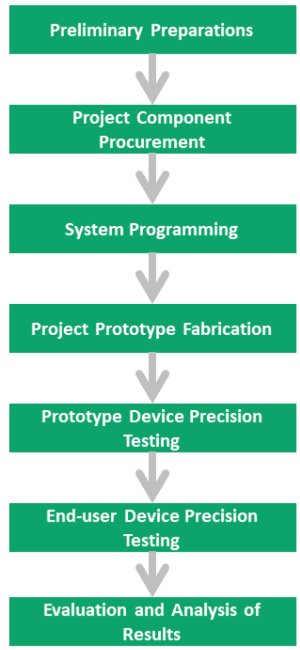

Figure 10. Flowchart of the Research Procedure

Figure 10 Preliminary Preparations, Project Component Procurement, Project Prototype Fabrication, System Programming, Prototype Device Precision Testing, End-user Device Precision Testing, and Evaluation and Analysis of Results are the step-by-step procedure applied to this study.

1. Preliminary Preparations

This section briefly explains the preliminaries on how should the conceptualization of the study executes. The study requires prior programming analysis and simulations, material canvassing, and material identification suitable for the necessary standards, as stated in this study.

2. Project Component Procurement

The section refers to the material acquisition required for the execution of the project.

3. System Programming

This section integrates the following materials including RFID reader and tags, NodeMCU ESP8266, and central database. The interactions of these several devices will result in correct scheduling schemes in the classrooms. Proper utilization of energy resources will exist should the programming schemes worked.

4. Project Prototype Fabrication

The final project output will be fabricated by initializing the final form of the project and after that it will be installed in the classroom areas identified by the proponents and the adviser.

5. Prototype Device Testing

This section deals with the actual output generated by the automated system. The device will be tested on the bases of table testing and actual testing. The table testing of the device is comprised of the components functionality test. During the table testing, individual components will be tested on the breadboard as well as the overall flow of the system. On the actual testing, a device prototype box is made and is implemented on the two classrooms of the College of Engineering building. The device prototype will be tested by the design overview found in this Chapter. The standards will be based on this study's final guidelines in harmony to the several studies presented in the review of related literature.

6. Evaluation of Results

This section refers that the study should be successful provided that the workflow and its relevant standards set in this study has been met. The operation of this project is considered auspicious and working correctly after the screening committee approves its performance.

Chapter 4. PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

This chapter presents the analysis based on the data gathered.

Table Testing: Functionality Test

The researchers performed ten (10) trials during the functionality testing. Each trial was set with a 10 minute-scheduled class to test if the whole system works using the passive RFID card.

Table 3. RFID System Functionality Test

RFID SYSTEM FUNCTIONALITY TEST							
Trial	EM Lock	Light	Power Outlet	AC Outlet	5-minute Alarm	1-minute Alarm	End of class Alarm
1	Off	On	On	On	On	On	On
2	Off	On	On	On	On	On	On
3	Off	On	On	On	On	On	On
4	Off	On	On	On	On	On	On
5	Off	On	On	On	On	On	On
6	Off	On	On	On	On	On	On
7	Off	On	On	On	On	On	On
8	Off	On	On	On	On	On	On
9	Off	On	On	On	On	On	On
10	Off	On	On	On	On	On	On

Table 3 shows the data indicating that the whole system functioned properly using the RFID Card. 10 out of 10 trials showed that when an RFID card was tapped then inserted in the two RFID readers accordingly, the EM lock was de-energized indicating room access, the lights and outlets were also turned on and the alarms functioned properly.

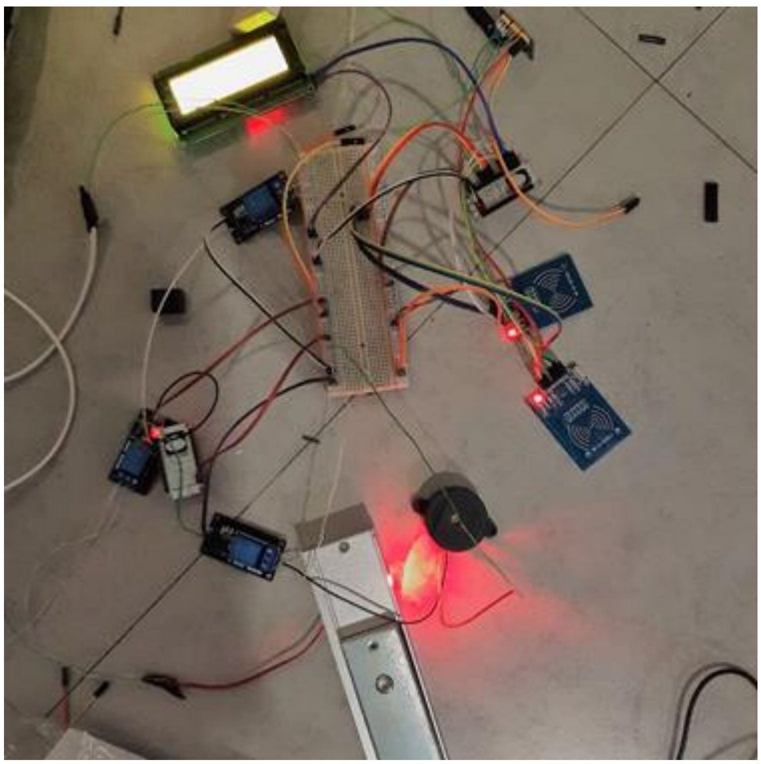

Figure 11. Testing of Components on Breadboard

Figure 11 shows the different components specified in Table 2 placed on the breadboard to test the system functionality. The Nodemcu microcontrollers were uploaded with the corresponding programs using the Arduino IDE.

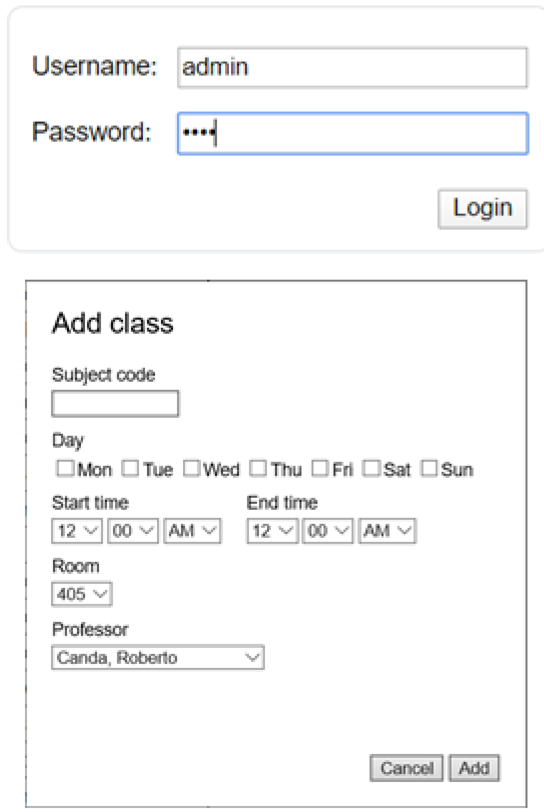

Figure 12. Class Registration Page

Figure 12 shows a Graphic User Interface (GUI) for the Class Registration Page. HTML, JS, and PHP scripts were used in making the GUI in order for the administrator to add a class schedule easily and also check the log records of the cards in the system.


+ Options

id	firstname	lastname	picc_uid	reg_date
0			19dce26e	2019-11-19 16:41:05

Figure 13. Table of Accounts

	id	date	prof_id	fullname	room	subject	time_in	time_out
Edit Copy Delete	35	2019-12-07	3	Narsolis	406	TESTING1	03:40:14	03:50:11

Figure 14. Logs Table

The researchers created the "Smartclass" database using the MySql database management system. Inside the "smartclass" database are "accounts", "classes", and "log" table. The "accounts" table as shown in Fig. 11 was used to store necessary pieces of information (i.e., full name, picc uid, id number) for both the instructors and administrators. The "classes" table was used to store the schedule of classes in a particular classroom along with the subject codes and instructor's id, which are entered in the HTML GUI by the administrator. This data will serve as the basis for accessing the classrooms, thus, controlling the ingress and egress of the instructors and the students inside the classroom. The "log" schedule is intended to show the time-in and time-out of professors as they insert and take out their RFID cards to and from the system to be able to generate the instructor's attendance.

Actual Testing: System Integration

The researchers were able to conduct the research and produce an output which was initially installed in the classrooms of the College of Engineering. The proponents enrolled thirteen (13) RFID cards for the corresponding 13 professors who utilize the classrooms 405 and 406 (See Appendix A). The assigned schedules for each card is also enrolled in order to test the system's operation for multiple access on the six-day period from December 9-14,2019. A total of 56 scheduled classes were pre-encoded in the dataserver with 28 classes each room (See Appendix B). The system should allow access, switching of utilities, and triggering of the alarm when the scheduled RFID card is tapped and inserted.

Figure 15. RFID Smart Classroom Prototype Devises for Room 405

Figure 16. RFID Classroom Prototype Devices for Room 406

Figure 15 and 16 shows the the RFID Smart Classroom Prototype Devices and placed in two classrooms, 405 and 406, for the final testing. The first prototype-receptacle containing the RFID card 1, microcontroller, and LCD display and the second prototype-receptacle containing the RFID card 2 only was placed outside the classroom. Moreover, the third box containing the microcontroller, relays, and all the loads were placed inside the classroom. At the moment, the system was powered on, the Electromagnetic lock was activated and the LCD displayed the current subject scheduled for the assigned room.

Table 4. Actual Test in Accessing Classroom Utilities in Rooms 405 and 406

Actual Test in Accessing Classroom Utilities in Rooms 405 and 406														
Day	EM Lock		Light		Power Outlet		AC Outlet		Alarms					
									5-minute		1-minute		End-of-Time	
	405	406	405	406	405	406	405	406	405	406	405	406	405	406
1	7	6	7	6	7	6	7	6	0	6	0	6	0	6
2	5	7	5	7	5	7	5	7	5	7	5	7	5	7
3	7	6	7	6	7	6	7	6	7	6	7	6	7	6
4	5	8	5	8	5	8	5	8	5	8	5	8	5	8
5	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6	3	0	3	0	3	0	3	0	3	0	3	0	3	0
Total	28	28	28	28	28	28	28	28	21	28	21	28	21	28

Table 4 shows the summary on the number of classes that accessed the classroom utilities once the scheduled RFID card was tapped and inserted during the six-day period actual testing. 28 out of 28 classes were able to access the EM Lock, Lights, Power Outlet and AC Outlet for both rooms. However, the alarm was able to function on 21 out of 28 classes only for room 405 as it failed to work on the first day of actual testing. Conversely, the alarms worked properly on all the classes of room 406. Overall, the system functioned properly during the actual testing period.

Moreover, the log-in and log-out time of the professors during the actual testing were generated and recorded in the database (See Appendix B).

CHAPTER 5. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Summary

The researchers identified before the actual execution of this study that unauthorized students are accessing classrooms to consume electrical resources of the university. Additionally, the faculty also manifested extended class hours after their specific schedule appropriation lapsed. The researchers, to solve the problem, developed a device that can control the electrical systems of the classrooms, and control class schedules implementations. Also, they developed report generators regarding the ingress and egress of the faculty inside the classes to monitor the attendance of the said person. The research method applied in this study was designed-based. The designed device allows electrical resources to be consummated only during the actual class schedules. Otherwise, the device should immediately terminate the electrical supplies. The students are discouraged idling inside the classrooms and encouraged to stay in the libraries and study during vacant periods. The research study was successful in developing a device that can control the electrical supplies of the classrooms, automating the door lock systems, and classroom accessing methods are now through Radio Frequency Identification (RFID) system. All components of the device, including electromagnetic locks, lights, power outlets, alarms, and air conditioners, were also successfully controlled and monitored. Furthermore, the device can also monitor the faculty attendance through logging every time in and time outs. Only the faculty has the authority to access the classroom with the condition actual schedule matched to the accessing instructor. The device can generate a system report to consolidate all transactions of the faculty to the device.

5.2 Conclusions

In this study, the researchers successfully developed a device that can control the electromagnetic locks, lights, power outlets, alarms, and air conditioners. The device can generate transaction reports made by the faculty to the device. The researchers also attained the objectives of the study and were also able to address all the problems identified.

5.3 Recommendations

The researchers identified the proposals for the future researchers the following: First, the study should be integrated with humidity and temperature sensors. It is essential to determine the current ambient temperature to allow the students to experience the best environmental conditions for learning. It will also enable the air conditioners to adjust according to the standards presented by the university administration. Second, surge protection devices should also be integrated to the overvoltage and undervoltage sensitive devices. Frequent electrical termination and reconnection can damage devices; therefore, to protect the device from sudden fluctuations, it is recommended to install these surge protectors. Third, earthquake detecting devices should also be integrated into the system. Early earthquake detection should trip off the electrical supplies in the classrooms to allow safe evacuations without the possibility of electrocution due to exposed wires.

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APPENDICES

Appendix A – Enrolled Accounts of Professors used in Actual Testing

Database: smartclass, Table: accounts, Purpose: Dumping data

id	firstname	lastname	picc_uid	reg_date
0			19dce26e	2019-11-19 16:41:05
1	Roberto	Canda	d09dd8a4	2019-12-06 01:25:08
2	Lynneth	Sorronda	8983c256	2019-12-06 01:25:08
3	Franch Maverick	Lorilla	b941d96e	2019-12-06 01:26:08
4	Francis Jay	Jumawan	b7724562	2019-12-06 17:41:14
5	Ernani	Villasencio	77ca4f62	2019-12-06 17:42:23
6	Fulton	Yap	679a4e62	2019-12-06 17:43:02
7	Phillip	Despares	a7ac5f63	2019-12-06 17:43:56
8	Paulo	Dipaling	a7cb4562	2019-12-06 17:44:49
9	Roldan	Bustamante	672a4e62	2019-12-06 17:45:39
10	Joey	Dela Cruz	f7363162	2019-12-06 17:48:14
11	Filmann	Simpao	d7464762	2019-12-06 17:49:11
13	Dennis	Rebuta	57134762	2019-12-06 17:50:24
14	Charito	Claro	75d4262	2019-12-06 17:51:02

Appendix B – Encoded Class Schedules of 13 Professors for Room 405 and 406

Room	Subject code	Day	Time	Professor
406	ECE 211	Mon	08:30 AM – 10:00 AM	Canda, Roberto
406	ECE EL1	Mon	11:30 AM – 01:00 PM	Sorronda, Lynneth

	406	ME 512A	Mon	04:00 PM – 05:30 PM	Rebuta, Dennis
	406	ECE EL3A	Mon	06:30 PM – 08:00 PM	Sorronda, Lynneth
	405	ES106	Mon	08:30 AM – 10:00 AM	Bustamante, Roldan
	405	ECE EL1	Mon	10:00 AM – 11:30 AM	Sorronda, Lynneth
	405	ECE 511A	Mon	11:30 AM – 01:00 PM	Claro, Charito
	405	ECE 513A	Mon	01:00 PM – 02:30 PM	Canda, Roberto
	405	ECE 512A	Mon	02:30 PM – 04:00 PM	Lorilla, Franch Maverick
	405	ECE 516A	Mon	04:00 PM – 05:30 PM	Sorronda, Lynneth
	405	ECE EL3A	Mon	05:30 PM – 06:30 PM	Sorronda, Lynneth
	406	ES 104L	Mon	01:00 PM – 02:30 PM	Sorronda, Lynneth
	406	ECE 412	Mon	02:30 PM – 04:00 PM	Jumawan, Francis Jay
	405	EE 417	Tue	08:30 AM – 10:00 AM	Claro, Charito
	405	ES 111	Tue	10:00 AM – 11:30 AM	Dipaling, Paulo
	405	ECE 514A	Tue	11:30 AM – 01:00 PM	Canda, Roberto
	405	ECE 413	Tue	01:00 PM – 02:30 PM	Sorronda, Lynneth
	405	ECE 411	Tue	04:00 PM – 05:30 PM	Simpao, Filmann
	406	EE 211L	Tue	08:30 AM – 10:00 AM	Despares, Phillip

	406	EE 211	Tue	10:00 AM – 11:30 AM	Yap, Fulton
	406	EE 417	Tue	11:30 AM – 01:00 PM	Claro, Charito
	406	EE 311L	Tue	01:00 PM – 02:30 PM	Villasencio, Ernani
	406	ECE 512A	Tue	02:30 PM – 04:00 PM	Lorilla, Franch Maverick
	406	ECE 511A	Tue	04:00 PM – 05:30 PM	Claro, Charito
	406	ECE 322	Tue	05:30 PM – 08:30 PM	Canda, Roberto
	405	ES 106	Wed	08:30 AM – 10:00 AM	Bustamante, Roldan
	405	ECE EL1	Wed	10:00 AM – 11:30 AM	Sorronda, Lynneth
	405	ECE 511A	Wed	11:30 AM – 01:00 PM	Claro, Charito
	405	ECE 513A	Wed	01:00 PM – 02:30 PM	Canda, Roberto
	405	ECE 512A	Wed	02:30 PM – 04:00 PM	Lorilla, Franch Maverick
	405	ECE 516A	Wed	04:00 PM – 05:30 PM	Sorronda, Lynneth
	405	ECE EL3A	Wed	05:30 PM – 06:30 PM	Sorronda, Lynneth
	406	ECE 211	Wed	08:30 AM – 10:00 AM	Canda, Roberto
	406	ECE EL1	Wed	11:30 AM – 01:00 PM	Sorronda, Lynneth
	406	ES 104L	Wed	01:00 PM – 02:30 PM	Sorronda, Lynneth
	406	ECE 412	Wed	02:30 PM – 04:00 PM	Jumawan, Francis Jay

	406	ME 512A	Wed	04:00 PM – 05:30 PM	Rebuta, Dennis
	406	ECE EL3A	Wed	06:30 PM – 08:00 PM	Sorronda, Lynneth
	405	EE 417	Thu	08:30 AM – 10:00 AM	Claro, Charito
	405	ES 111	Thu	10:00 AM – 11:30 AM	Dipaling, Paulo
	405	ECE 514A	Thu	11:30 AM – 01:00 PM	Canda, Roberto
	405	ECE 413	Thu	01:00 PM – 02:30 PM	Sorronda, Lynneth
	405	ECE 411	Thu	04:00 PM – 05:30 PM	Simpao, Filmann
	406	EE 211L	Thu	08:30 AM – 10:00 AM	Despares, Phillip
	406	EE 211	Thu	10:00 AM – 11:30 AM	Yap, Fulton
	406	EE 417	Thu	11:30 AM – 01:00 PM	Claro, Charito
	406	ECE 311L	Thu	01:00 PM – 02:30 PM	Villasencio, Ernani
	406	ECE 512A	Thu	02:30 PM – 04:00 PM	Lorilla, Franch Maverick
	406	ECE 511A	Thu	04:00 PM – 05:30 PM	Claro, Charito
	406	ECE 322	Thu	05:30 PM – 07:00 PM	Canda, Roberto
	406	ECE 322	Thu	07:00 PM – 08:30 PM	Canda, Roberto
	405	ECE 412	Fri	12:30 PM – 03:30 PM	Jumawan, Francis Jay
	406	ECE 211L	Fri	01:00 PM – 04:00 PM	Canda, Roberto

	405	MEPECE 133	Sat	10:00 AM – 01:00 PM	Canda, Roberto
	405	MEPECE 131	Sat	01:00 PM – 04:00 PM	Simpao, Filmann
	405	MEPECE 135	Sat	04:00 PM – 07:00 PM	Dela Cruz, Joey

Appendix C – Generated Professor's Attendance during the 6-day Period for Rooms 405 and 406

id	date	prof_id	fullname	room	subject	time_in	time_out
36	09/12/2019	1	Canda, Roberto	406	ECE 211	8:31:05	10:00:00
47	09/12/2019	1	Canda, Roberto	405	ECE 513A	13:02:05	14:30:00
56	10/12/2019	1	Canda, Roberto	405	ECE514A	11:39:52	13:00:10
61	10/12/2019	1	Canda, Roberto	406	ECE 322	17:31:52	20:00:00
62	11/12/2019	1	Canda, Roberto	405	ECE 513A	13:02:05	14:30:00
63	11/12/2019	1	Canda, Roberto	406	ECE 211	8:31:05	10:00:00
64	12/12/2019	1	Canda, Roberto	405	ECE514A	11:31:52	13:00:10
65	12/12/2019	1	Canda, Roberto	406	ECE 322	17:31:52	19:00:00
66	12/12/2019	1	Canda, Roberto	406	ECE 322	19:00:00	20:20:55
67	13/12/2019	1	Canda, Roberto	406	ECE 211L	13:02:05	16:00:00
68	14/12/2019	1	Canda, Roberto	405	MEPECE 1	10:54:28	13:00:10

id	date	prof_id	fullname	room	subject	time_in	time_out
42	09/12/2019	2	Sorronda, Lynneth	405	ECE 516A	16:04:38	17:28:48
43	09/12/2019	2	Sorronda, Lynneth	406	ECE EL3A	18:32:04	19:00:05
49	09/12/2019	2	Sorronda, Lynneth	406	ECE EL1	11:32:16	13:00:00
59	09/12/2019	2	Sorronda, Lynneth	405	ECE EL1	10:04:16	11:30:00
69	09/12/2019	2	Sorronda, Lynneth	405	ECE EL3A	17:32:04	18:30:00
70	09/12/2019	2	Sorronda, Lynneth	406	ES104L	13:01:16	14:30:00
71	10/12/2019	2	Sorronda, Lynneth	405	ECE 413	13:07:01	13:59:51
72	11/12/2019	2	Sorronda, Lynneth	405	ECE EL1	10:18:16	11:30:00
73	11/12/2019	2	Sorronda, Lynneth	405	ECE 516A	16:03:38	17:25:48
74	11/12/2019	2	Sorronda, Lynneth	405	ECE EL3A	17:42:04	18:30:00
75	11/12/2019	2	Sorronda, Lynneth	406	ECE EL1	11:43:16	13:00:00
76	11/12/2019	2	Sorronda, Lynneth	406	ES 104L	13:11:16	14:30:00
77	11/12/2019	2	Sorronda, Lynneth	406	ECE EL3A	18:41:04	20:00:00

id	date	prof_id	fullname	room	subject	time_in	time_out
38	09/12/2019	3	Lorilla, Franch Maverick	405	ECE 512A	14:34:51	16:00:00
50	10/12/2019	3	Lorilla, Franch Maverick	406	ECE 512A	14:33:39	16:00:00
87	11/12/2019	3	Lorilla, Franch Maverick	405	ECE 512A	14:41:51	16:00:00
88	12/12/2019	3	Lorilla, Franch Maverick	406	ECE 512A	14:53:39	16:00:00

id	date	prof_id	fullname	room	subject	time_in	time_out
89	09/12/2019	4	Jumawan, Francis Jay	406	ECE412	14:38:27	16:00:00
90	11/12/2019	4	Jumawan, Francis Jay	406	ECE412	14:41:42	16:00:00
91	13/12/2019	4	Jumawan, Francis Jay	405	ECE 412	12:36:46	15:23:17

id	date	prof_id	fullname	room	subject	time_in	time_out
48	10/12/2019	5	Villasencio, Ernani	406	EE 311L	13:06:30	14:21:58
97	12/12/2019	5	Villasencio, Ernani	406	EE 311L	13:05:24	14:30:00

id	date	prof_id	fullname	room	subject	time_in	time_out
44	10/12/2019	6	Yap, Fulton	406	EE 211	11:03:07	11:30:00
96	12/12/2019	6	Yap, Fulton	406	EE 211	10:02:34	11:30:00

id	date	prof_id	fullname	room	subject	time_in	time_out
94	10/12/2019	7	Despares, Phillip	406	EE 211L	8:36:18	10:00:00
95	12/12/2019	7	Despares, Phillip	406	EE 211L	8:31:54	10:00:00

id	date	prof_id	fullname	room	subject	time_in	time_out
45	10/12/2019	8	Dipaling, Paulo	405	ES111	11:06:04	11:30:00
99	12/12/2019	8	Dipaling, Paulo	405	ES111	10:06:04	11:30:00

id	date	prof_id	fullname	room	subject	time_in
60	09/12/2019	9	Bustamante, Roldan	405	ES 106	8:34:51
80	11/12/2019	9	Bustamante, Roldan	405	ES 106	8:40:06

id	date	prof_id	fullname	room	subject	time_in	time_out
98	14/12/2019	10	Dela Cruz, Joey	405	MEPECE 1:	16:05:13	19:00:00

id	date	prof_id	fullname	room	subject	time_in	time_out
51	10/12/2019	11	Simpao, Filmann	405	ECE 411	16:03:28	17:21:09
92	12/12/2019	11	Simpao, Filmann	405	ECE 411	16:08:21	17:30:00
93	14/12/2019	11	Simpao, Filmann	405	MEPECE 1:	13:07:28	16:00:00

id	date	prof_id	fullname	room	subject	time_in	time_out
58	09/12/2019	13	Rebuta, Dennis	406	ME 512A	16:02:16	17:30:00
79	11/12/2019	13	Rebuta, Dennis	406	ME 512A	16:21:16	17:30:00

id	date	prof_id	fullname	room	subject	time_in	time_out
46	09/12/2019	14	Claro, Charito	405	ECE 511A	11:32:24	13:00:00
52	10/12/2019	14	Claro, Charito	406	EE 417	11:37:57	13:00:00
81	10/12/2019	14	Claro, Charito	406	ECE 511A	16:07:29	17:18:11
82	10/12/2019	14	Claro, Charito	405	EE 417	8:33:14	10:00:00
83	11/12/2019	14	Claro, Charito	405	ECE 511A	11:36:21	13:00:00
84	12/12/2019	14	Claro, Charito	405	EE 417	8:34:03	9:45:12
85	12/12/2019	14	Claro, Charito	406	EE 417	11:34:34	13:00:00
86	12/12/2019	14	Claro, Charito	406	ECE 511A	16:04:23	17:20:41

Appendix D – Documentation

Curriculum Vitae – work-in-progress

John Keneth C. Casinillo

Purok Waling-waling B., Baguio Proper, Baguio District, Davao City

E-mail: jkcasinillo@gmail.com

Contact number: 09664611498

PERSONAL INFORMATION

Age: 19 Nationality: Filipino Religion: Roman Catholic

Date of Birth: August 8, 1999 Place of Birth: Davao City Civil Status: Single

EDUCATIONAL BACKGROUND

Primary: Baguio Central Elementary School (2011)

Baguio Proper, Baguio District, Davao City

Secondary: Baguio National School of Arts and Trades (2015)

Baguio Proper, Baguio District, Davao City

Tertiary: University of Southeastern Philippines

Bo. Obrero, Davao City

Undergraduate

Degree: Bachelor of Science in Electronics Engineering

MEMBERSHIP AND AFFILIATION

- Association of Electronics Engineering Students – Secretary (A.Y. 2018 - 2019)
- Association of Electronics Engineering Students - President (A.Y. 2019 - 2020)
- Junior Institute of Electronics Engineering of the Philippines Southern Mindanao Sector - Governor (A.Y. 2019 - 2020)
- Obrero Campus Student Council - Chief of Staff (A.Y. 2019 - 2020)

Danah Mae G. Narsolis

Poblacion, Sindangan, Zamboanga del Norte

E-mail: danahmaenarsolis@gmail.com

Contact number: 09179645351

PERSONAL INFORMATION

Age: 20 Nationality: Filipino Religion: Alliance CAMACOP

Date of Birth: September 15,1998 Place of Birth: Davao City

Civil Status: Single

EDUCATIONAL BACKGROUND

Primary: Sindangan Pilot Demonstration School – Special Education (2011)

Poblacion, Sindangan, Zamboanga del Norte

Secondary: Sindangan National High School (2015)

Dapaon, Sindangan, Zamboanga del Norte

Tertiary: University of Southeastern Philippines

Bo. Obrero, Davao City

Undergraduate

Degree: Bachelor of Science in Electronics Engineering

MEMBERSHIP AND AFFILIATION

- Association of Electronics Engineering Students – Auditor

Richard Michael M. Ucab

Mineral Village, Bajada, Davao City

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Contact number: 0977 769 5780

PERSONAL INFORMATION

Age: 20 Nationality: Filipino Religion: Roman Catholic

Date of Birth: July 30,1998 Place of Birth: Davao City Civil Status: Single

EDUCATIONAL BACKGROUND

Primary: San Roque Central Elementary School (2011) Davao City

Secondary: University of the Immaculate Conception (UIC) (2015)

Tertiary: University of Southeastern Philippines Bo. Obrero, Davao City Undergraduate

Degree: Bachelor of Science in Electronics Engineering

MEMBERSHIP AND AFFILIATION

-none-