BUSITEMA UNIVERSITY

FACULTY OF ENGINEERING

DEPARTMENT OF COMPUTER ENGINEERING

PROJECT REPORT

RFID Based Teachers' Attendance Logging System

By

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DECLARATION

I **WEKYAYE LASTONE** Reg. No **BU/UG/2012/1801** hereby declare that this project report is my original work except where explicit citation has been made and it has not been presented to any Institution of higher learning for any academic award.

Sign: ……...

Date: ……

APPROVAL

The undersigned certify that they have read and hereby recommend for acceptance of Busitema University project report entitled **"*RFID Based Teachers' Attendance Logging System*"**

Mr. Bwire Felix

Department of Computer Engineering

Sign: …….

Date: ……..

DEDICATION

To my family am proud of you.

To my brothers and sisters.

To my parents you stand above all of us may God bless you.

ACKNOWLEDGEMENT

This report could not appear before the eyes of you my ardent readers without the efforts of various personas.

First to the Department of Computer Engineering for the technological knowledge imparted to me since I joined the university.

To my supervisor Mr.Bwire Felix for the guidance given during the process of implementing this project.

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To my fellow students who have endured with me this long trek to achieve this rather prestigious award ,Sanon Julian, Edison, Zipola,Henry, Lillian, Isaac, Daniel,the list is endless, thanks so much.

ABSTRACT

In a school setting identification of teachers with regard to attendance of lessons takes a major concern of every stake holder in the education sector. With the current trend in Ugandan schools where teacher(s) presence in a school is realized by signing an arrival/departure book and lesson attendance books, this is not enough to guarantee attendance to the lesson because this is rather too manual and synchronizing the two books becomes difficult. Even with lesson attendance books which only provide for time in and time out don't cater for the various time lost due to the long or rather short breaks out of class that accumulates to valuable lost contact time to learners. The system developed provides a working solution since it is based on RFID technology where the teacher is automatically supervised by the Administrator. With this system the classroom module with the help of an RFID reader an RF card that is carried by the teacher is automatically scanned every time the card passes the reader and this information is relayed by the transceiver using RF technology to the system connected to the database on a computer in the Administrator's office. The data kept by the system provides a basis for evaluating the performance of a teacher in specific period of time.

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LIST OF ABBREVIATIONS

AC	Alternating current
ADC	Analog to digital converter
AVR	Advanced Virtual RISC
COM Port	Communication Port
DAC	Digital to Analog Converter
DC	Direct current
DDR	Data Direction Register
DOS	Director of Studies
H/M	Head Master/Mistress
I/O	Input/output
IC	Integrated circuit
RF	Radio Frequency
RFID	Radio frequency identification
RISC	Reduced Instruction Set Computer.
USB	Universal Serial Bus
USART	Universal Synchronous Asynchronous Receiver Transmitter

CHAPTER ONE:

INTRODUCTION

1.0 Introduction

This chapter consists of the background of the study, problem statement, objectives of the study, justification, significance, scope and the limitations.

1.1 Background

Enrolment for primary education in Uganda has grown significantly in recent years and the gender gap between girls and boys has reduced, so that almost equal numbers of girls and boys now attend primary school. But despite these successes, challenges still remain with the education system in Uganda, the quality of education provided being the biggest of these challenges.[1]

Very often, children are going to school, but they are not learning, and one of the biggest factors contributing to this is the high rate of teacher absenteeism. According to data from education authorities, 20 to 30% of teachers can be absent at any one time in each district, with one school reporting a teacher absence rate of 62%. This, in turn, leads to irregular pupil attendance – there are no consequences if they are absent as they are simply following the lead of their teachers. 27% of children in Uganda are not in school at any given time.[1]

Every organization whether it be an educational institution or business organization, it has to maintain a proper record of attendance of students or employees for effective functioning of organization. Designing a better attendance management system for students so that records are maintained with ease and accuracy was an important key behind motivating this paper. This would improve accuracy of attendance records because it will save valuable time of the students as well as teachers. A proper record of attendance of students should be maintained by the teachers or lecturers in every schools, colleges and universities[2].

Attendance of students in class is important and can be considered as the starting point towards attaining a good education. Recording and monitoring the attendance of students is an area of administration which requires significant amount of time to get necessary data. Up until now, class attendance records have been maintained manually by having students sign next to their names on printed class lists during class[2].

This project is prototype of a system that monitors the attendance of secondary and primary school teachers to lessons. This is managed by the school's supervisor of teachers who may be the Director of Studies (DOS), the Head Master/Mistress (H/M) or any other individual given such authority by the school administration. The supervisor have a computer that runs an application (software) which he/she uses to view information about teachers, the classes they are supposed to teach, the times they are supposed to be in any given class and how such teachers are doing their work. The software provides, on a real-time basis, record the time at which any teacher is entering any given class and the time at which he/she is leaving. The supervisor therefore is be able to monitor the attendance of teachers to their prescribed lessons. And such data logs may be used for further evaluation using other software tools that are optimized for data analysis.

Every teacher is registered with the system and given a portable electronic card that can be used to detect him when he/she enters any classroom. Every class therefore needs to have static system than can detect such cards possessed by the teachers and communicates wirelessly with the computer application in the supervisor's office.

The communication between the teacher and the in-classroom system are all wireless with the use of Radio Frequency Identification (RFID) technology and thus, no teacher needs to manually inform the system of his/her entrance into or departure out of the classroom. The Communication from the classroom system to the computer system is wireless though this employs the use of Radio Frequency (RF) Transmitters in every classroom and an RF receiver in the office.

The receiver is connect to the computer via a common communication port (COM Port) like a Universal Serial Bus (USB) Port such that the system can easily communicate with any kind of computer.

Whenever a teacher is *just* detected in the class the classroom system logs into the computer system by sending a message including the unique identifier of the teacher. A similar message is sent when the teacher just walks out of the classroom but information is added to indicate whether the teacher has moved in or out. The computer application automatically records the time at which the message has been received. Considering the fact that the system is real-time, this time stamp has only a small negligible difference from the time at which the teacher just walks in/out of the classroom.

1.2 Problem statement

Especially in secondary and primary schools, teachers are expected to follow teaching schedules and teach for as long as it is prescribed to them each. Whereas they come to their work station (the schools), it is not a guarantee that they attend to their lessons, thus end up *dodging* some lessons. This takes either of two aspects. Besides completely failing to attend a lesson, a teacher may teach for less than the required time either by coming late and/or leaving early, or by frequently taking breaks out of the classroom. As a result, the supervisor is usually overwhelmed with checking every class and such supervision has large efficiency loopholes. There is therefore, need for a convenient system that automatically monitors the way the teacher attends lessons.

1.3 Objectives

1.3.1 General objective

To design and implement an RFID Based Teachers' Attendance Logging System that automatically reports the attendance of teachers to lessons to a computer based database system on a real-time basis

1.3.2 Specific objective

i. To analyze the current teachers' monitoring system and project literature
ii. To design a computer-based database system for teachers monitoring.
iii. To design an RFID based teacher detection system for the classrooms and a communication system to the computer based system.
iv. To combine the subsystems and implement the whole proposed system.
v. To test and validate the system.

1.4 Justification

Considering the fact that the system avoids the need for the supervisor to walk around classes, the project makes the supervision of teachers more convenient than it is in the current manual system.

The supervisor also gets his/her time that he/she would spend walking around saved and thus can do other important work while in a stable station in his/her office and also allows for supervision of other teachers at the time when he/she is also teaching.

Manual supervision was also found to be interrupting and disrupting to both the teacher conducting a lesson and the students as they see the supervisor walk around the classroom, and sometimes piping through the windows.

The system also avails a transparence aspect based on the fact that records are taken by the system and not easily editable and thus a 'caught dodging teacher' cannot easily deny the allegation.

The system also has extra features that make it significant and these include

- It can easily be modified for use in large schools or even higher authorities like Boards of Directors (BODs) and the District Education Officer (DEO)
- Rather than just real-time logging/reporting of the attendance, the system also store records and this makes it a foundation for evaluation of teachers.

1.5 Scope

1.5.1 Content scope

The system is designed to work for a single school and not a group of schools. In this case, the system requires just one computer that should reside within the school premises. It is assumed that the supervisor's office is located in the middle of all classes with a maximum

separation of 120 meters although a central electronic device may be installed in the middle of the classrooms and this links to the supervisor's office through a cable.

Considering the fact that the system requires a computer, it may not apply to schools in remote rural areas with no steady power supply. The classroom systems is be powered by any source as may be determined by the school, though a 12V backup battery may be used to make sure that the system is always powered. The project however does not concentrate on power supply, bearing in mind that systems have already been developed to manage power.

Whereas schools are known to have very many classrooms, this project considers a variable number of classrooms in the computer software system. However, electronic systems for detection of teachers was developed for only one classroom. This was done in order to reduce the project cost since similar systems are required for every classroom.

1.5.2 Geographical scope

The system was designed to be deployed in Schools in Uganda and provided the schools have power.

1.5.3 Time scope

The system was developedin7 months.

1.6 Limitations

The system limited to monitoring Teachers'attendance.

CHAPTER TWO:

LITERATURE REVIEW

2.0 Introduction

Discussed in this chapter are projects that are similar to the proposed system. It also explains the various technologies used in the proposed system.

2.1 Radio Frequency (RF)

In the radio frequency spectrum, the usable frequency range for radio waves extends from about 20 kHz (just above sound waves) to above 30,000MHz. A wavelength at 20 kHz is 15 kilometers long. At 30,000 MHz, the wavelength is only 1 centimeter. The HF band is defined as the frequency range of 3 to 30MHz. In practice, most HF radios use the spectrum from 1.6 to 30MHz. Most long haul communications in this band take place between 4 and 18MHz.Higher frequencies (18 to 30 MHz) may also be available from time to time, depending on ionospheric conditions and the time of day. In the early days of radio, HF frequencies were called short wave because their wavelengths (10 to 100 meters) were shorter than those of commercial broadcast stations. The term is still applied to long distance radio communications.[3]

2.2 RFID Technology

At its most simple a radio frequency identification (RFID) system consists of two components, namely a tag (also called a transponder) and a reader (also called an interrogator).The tag is designed to be small and cheap(perhaps the size of a credit card),the reader is more expensive and larger (typically around the size of laptop computer). RFID relies on radio frequency communication. The RFID reader emits energy, in the form of a radio wave at a particular frequency, which is used to power and to communicate with the RFID tags. As the radio waves propagate through the environment, their energy gradually dissipates – so a tag that is beyond a certain distance from the RFID reader will not be

able to pick up enough signal to operate reliably. In other words, the maximum operating distance between the RFID reader and a tag (also known as the range) is limited. The exact range depends on a great many factors, including the radio frequency being used for communication, the power emitted by the RFID reader, sources of radio interference and objects in the environment that are likely to reflect or absorb radio waves. A typical range for a passive RFID system will be anywhere between a few centimeters and a few meters. If a battery is incorporated into the tag, the range is increased dramatically, too many tens of meters or more.[4]

This the wireless use of electromagnetic fields to transfer data, for the purposes of automatically identifying and tracking tags attached to object. The tags contain electronically stored information. An RFID reader transmits an encoded radio signal to interrogate the tag, the RFID tag receives the message and then responds with its identification and other information. This may be only a unique tag serial number, or may be product-related information such as a stock number, lot or batch number, production date, or other specific information. Since tags have individual serial numbers, the RFID system design can discriminate among several tags that might be within the range of the RFID reader and read them simultaneously.

There are several versions of RFID that operate at different radio frequencies. The choice of frequency is dependent on the business requirements and read environment. Three primary frequency bands are being used for RFID:

Low Frequency (125/134KHz) – Most commonly used for Attendance & access control,

High –Frequency (13.56 MHz) – Used where medium data rate and read ranges up to about 1.5 meters are acceptable. This frequency also has the advantage of not being susceptible to interference from the presence of water or metals.

Ultra High-Frequency(850 MHz to 950 MHz) – offer the longest read ranges of up to approximately 3 meters and high reading speeds[5].

2.2 Types of RFID tags

Many types of RFID exist, but at the highest level, we can divide RFID devices into two classes.

2.2.1 Active

Active tags require a power source—they are either connected to a powered infrastructure or use energy stored in an integrated battery. In the latter case, a tag's lifetime is limited by the stored energy, balanced against the number of read operations the device must undergo.[6]

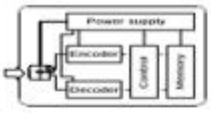
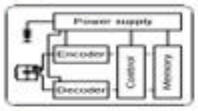
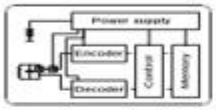
2.2.2 Passive

Passive RFID is of interest because the tags don't require batteries or maintenance. The tags also have an indefinite operational life and are small enough to fit into a practical adhesive label. A passive tag consists of three parts: an antenna, a semi- conductor chip attached to the antenna, and some form of encapsulation. The tag reader is responsible for powering and communicating with a tag. The tag antenna captures energy and transfers the tag's ID (the tag's chip coordinates this process).

The encapsulation maintains the tag's integrity and protects the antenna and chip from environmental conditions or reagents.[6]

According to Elisabeth ILIE-ZUDOR e'tal[7] gives the following table describing the different classifications of RFID tags.

Table 1: Classification of RFID tags

Classification of RFID tags	
Passive 	- also called 'pure passive', 'reflective' or 'beam powered' - obtains operating power from the reader - the reader sends electromagnetic waves that induce current in the tag's antenna, the tag reflects the RF signal transmitted and adds information by modulating the reflected signal
Semi-passive 	- uses a battery to maintain memory in the tag or power the electronics that enable the tag to modulate the reflected signal - communicates in the same method, as the other passive tags
Active 	- powered by an internal battery, used to run the microchip's circuitry and to broadcast a signal to the reader - generally ensures a longer read range than passive tags - more expensive than passive tags (especial because usually are read/write) - the batteries must be replaced periodically

By the tag's memory type	
Read-only	- the memory is factory programmed, can not be modified after its manufacture - its data is static - a very limited quantity of data can be stored, usually 96 bits of information - can be easily integrated with data collection systems - typically are cheaper than read-write tags
Read-write	- can be as well read as written into - its data can be dynamically altered - can store a larger amount of data, typically ranging from 32 kBytes to 128 kbBytes - being more expensive than read-only chips, is impractical for tracking inexpensive items
By the method of wireless signal used for communication between the tag and reader	
Induction 	- Close proximity electromagnetic, or inductive coupling—near field - Generally use. LF and HF frequency bands
Propagation 	- Propagating electromagnetic waves—far field - Operate in the UHF and microwaves frequency bands

2.3 RFID readers

RFID readers communicate with tags through an RF channel to obtain identifying information. Depending on the type of tag, this communication may be a simple *ping* or may be a more complex multi-round protocol. In environments with many tags, a reader may have to perform an *anti-collision* protocol to ensure that communication conflicts to not occur. Anti-collision protocols permit readers to rapidly communicate with many tags in serial order [8].

According to Elisabeth ILIE-ZUDOR e'tal[7] gives the following table describing the different classifications of RFID readers.

Table 2: Classification of readers

Classification of readers	
By design and technology used	
Read	- only reads data from the tag - usually a micro-controller-based unit with a wound output coil, peak detector hardware, comparators, and firmware designed to transmit energy to a tag and read information back from it by de-tecting the backscatter modulation - different types for different protocols, frequencies and standards exist
Read/write	- reads and writes data from/on the tag
By fixation of the device	
Stationary	The device is attached in a fixed way, for example at the entrance gate, respectively at the exit gate of products
Mobile	In this case the reader is a handy, movable device.

2.4 Other technologies

2.4.1 Bar code

This is the most comparable technology to RFID for many application areas. Both these technologies involve the addition of a 'tag' or 'label' to an item that contains information about that item which allows it to be identified by a computer system.
However RFID has the following advantages.

- Barcodes are fixed once they have been created, whereas the data contained within an RFID tag can typically be augmented or changed as appropriate.
- Barcodes have to be scanned deliberately by a person in a process that is difficult to automate. RFID tags, on the other hand, can be readily scanned automatically without human involvement.
- Barcodes require line-of-sight to read, while RFID tags can be read (in any orientation) as long as they are within the reader's range.[4]
- Barcodes have less security than RFID; as they can be more easily reproduced or forged.
- If a barcode is ripped or damaged there is no way to scan the product.[9]

2.4.2 Magnetic stripe and contact systems

Where information is stored on a magnetic stripe or in a chip .These are accessed by electrical contact.[4]

2.4.3 Vision systems

Computer vision systems that identify objects based on their visual appearance [4].

2.4.4 Comparison of RFID to other technology

Steve Hodges e'tal[4]gives the following comparisons.

Table 3: Comparison of RFID to other technologies

Characteristic	Tagging technology					
	Passive RFID	1-D barcode	2-D barcode	Magnetic stripe	Contact memory	Vision systems
Data capacity	High	Low	Medium	Low	High	Low
Data nature	Re-writeable	Read only	Read only	Re-writeable	Re-writeable	Read only
Human visibility/ readability	Hidden	Visible, may be readable	Visible	Stripe visible	Contacts visible	No specific tag!
Simultaneous identification	Yes	No	No	No	No	Possibly
Robustness	High	Medium	Low	Medium	Medium	
Operating distance	High	Medium	Medium	Low	Low	High
Line of sight needed?	No	Yes	Yes	No	In effect	Yes
Problematic objects (e.g. metal)	Yes	No	Not	Yes	Possibly	Yes (hard to see)
Tag cost	€0.1-1	<€0.01	<€0.01	<€0.1	€0.1-1	€0 (n/a)
Reader cost	High	Low	Medium	Low	Low	Very high

2.5 Existing projects

2.5.1 Student Management systems

Attendance management is the act of managing attendance or presence in a work setting to minimize loss due to employee downtime. Attendance control has traditionally been approached using time clocks and timesheets, but attendance management goes beyond this to provide a working environment which maximizes and motivates employee attendance[10][11].

According to Arulogun O e'tal[12] in previous years, there had been rise in the number of applications based on Radio Frequency Identification (RFID) systems and had been successfully applied to different areas as diverse as transportation, health-care, agriculture, and hospitality industry to name a few. RFID technology facilitates automatic wireless identification using electronic passive and active tags with suitable readers. In this paper, an attempt is made to solve recurrent lecture attendance monitoring problem in developing countries using RFID technology. The application of RFID to student attendance monitoring as developed and deployed in this study was capable of reducing time wasted during manual collection of attendance and an opportunity for the educational administrators to capture face-to-face classroom statistics for allocation of appropriate attendance scores and for further managerial decisions.

The emergence of electronic paradigm for learning compared to traditional method and availability of almost all information on the information superhighway (Internet), had caused students to be less motivated to go to the lecture rooms than ever before. Laziness on the part of students, nonchalance to school work, extra social activities that have no importance in aiding the objectives of the institution and a lot more, could prevent students from attending lectures. Sequel to these, lecturers and administrators in most developing countries had had to come up with ways to ensure a healthy participation from students, and make sure that the student-lecturer interactive relationship was kept intact. This in some cases had come in simple forms like roll calls, while in more interesting cases, could be formats like surprise quizzes, extra credit in class, etc. These strategies are however time

consuming, stressful and laborious because the valuable lecture time that could otherwise been used for lectures is dedicated to student attendance taking [13] and sometimes not accurate. In addition to all these challenges, the attendances are recorded manually by the tutor and therefore are prone to personal errors. There arose a need for a more efficient and effective method of solving this problem. A technology that could solve this problem and even do more was the RFID technology.

RFID is an automated identification and data collection technology, that ensures more accurate and timely data entry. RFID is not actually a new technology; it only quickly gained more attention recently because of its current low cost and advances in other computing fields that open up more application areas. RFID combines radio frequency and microchip technologies to create a smart system that can be used to identify, monitor, secure and do object inventory. At their simplest, RFID systems use tiny chips called ―tags that contain and transmit some piece of identifying information to an RFID reader, a device that in turn can interface with computers.[14]

The ability of RFID systems to deliver precise and accurate data about tagged items would improve efficiency and bring other benefits to business community and consumers alike in the not distant future.[15]

Smart checker

Smart Checker, exploits the use of personal digital assistance (PDA) to provide mobile and instant graphical display. It also furnishes reports and progress tracks for determining student class attendance baselines, and improves the quality of monitoring and data captured technique, data-driven decision making and school accountability. Smart Checker is a new application was developed for data entry and retrieving all the student information using PDA.[16]

Disadvantages

- PDAs are prone to physical, data and network insecurity.
- PDAs are expensive.

CHAPTER THREE:

METHODOLOGY

3.0 Introduction

This chapter explains the procedures and methods that were used in data collection, the purposes and relevancies of those methods and techniques that were used to meet the above mentioned objectives.

3.1 Requirements Elicitation

This exercise involved obtaining the functional and non- functional requirements of the system. Functional requirements determine what the system can do whereas non-functional requirements determine how the system satisfy user requirements. A number of research mechanisms were utilized in collecting the kind of data needed to accomplish the project. The following methods were applied.

i) **Document review**: This involved reading documents whose major source included text books, journals, magazines, articles, conference proceedings and newspapers and web sites.

ii) **Consultation:** This method was aimed at seeking and acquiring advice from experienced personnel and experts as well as people with knowledge about field in which the project was done from. These consultants included; lecturers, engineers in the field and who have handled related projects.

3.2 Requirements Analysis

This was aimed at analyzing the functional and non-functional requirements of the system from all the collected data for the purpose of designing an effective system. The data collected was analyzed qualitatively basing on the objectives of the study, cross checked for consistency basing on the concepts of the literature review and interpreted to provide

requirements for designing, proposed system. After collecting and interpreting all the relevant information, a documentation report with all the findings and challenges met shall be formed intended to help other people who might be interested in enhancing the performance of the system developed.

3.3 System Design

To achieve objective of designing the system as per the analyzed requirements, the interfaces have been designed PHP, Notepad++, C++.

3.3.1 Design tools and components needed

Key Software tools

i. **Proteus professional**. This was used to circuit diagram of the system in order to determine the specifications of each component needed before building the actual circuit.

ii. **Arduino software**. This was used to develop a C++ program that was loaded into the micro controller to run the system.

iii. **Microsoft office**. This was used for documentations about the system which includes proposal writing, presentation slides, and project report among others.

iv. **Terminal software**: This is run often to check whether there is communication to the com port.

Key Hardware Sections

i. **Microcontroller Unit**: This section deals with all the data acquisition and controlling task to be performed. The data from TAG reader is fed to this unit. The controller converts the data into required form. Then as the set points are provided, the proper controlling action will be taken according to control logic with the help of microcontroller.

ii. **Power supply**: This was used to power the system from the PC by first regulating the supply voltage to the recommended in put voltage which will be used to power system components. The classroom module is powered by 9V battery

3.4 System implementation

The implementation of the system begun by designing of the appropriate circuit using on paper and/or in a simulation tool. The followed by designing the circuit of each module one by one on the prototyping board/ bread boards. The different sub-system components were then interconnected on a breadboard to give an overall system overview. And were later soldered on the Vero boards to order to obtain a complete prototype.

Coding of the microcontroller was done in embedded C++ language program and then uploaded onto the microcontroller using Arduino software.

3.5 System testing and validation

The objective of system testing is to verify that the integrated system as a whole is functionally complete and satisfies both functional and non-functional design requirements. In this case, testing was done in order to verify the behaviour, performance, and reliability of a system using the following steps;

Unit testing

This involved testing individual units of source code or development process to determine whether they are fit for use. This included testing all the different modules independently

Integration testing

The different parts will be brought together and tested for inter-process communication so as to identify which unit or module doesn’t work.

Front end testing

All the unit system modules were integrated to form a whole complete system which was then tested in accordance with the required goals of this project.

System Validation.

The validation process was to ensure that various processes consistently provide results which meet prior defined functional and non-functional requirements.

CHAPTER FOUR:

SYSTEM ANALYSIS AND DESIGN

4.0 Introduction

This chapter is comprised of system analysis and design. It has different sections that include the functional analysis, requirement analysis, system analysis and design, hardware and software analysis, logic design, physical design; schematic diagram and the features of a schematic diagram.

4.1 System Analysis

The system was analyzed to make sure that it is working. The system is able to detect a teacher (RF card), capture times, communicate (classroom and office module), add a teacher to the data base, and retrieve information about a particular teacher/class.

4.1.2 Functional Requirements

These requirements describe the behavior of the system as it relates to the system's functionality. Functional requirements capture the intended behavior of the system. This behavior may be expressed as services, tasks or functions the system is required to perform. The functional requirements of the developed system are;

- The RFID reader is able to detect the user (tag) as they move past the classroom module.
- The classroom module is capable of sending the captured information to the office module.
- The office module is able to post captured data to the database.
- The user can view/update his/her details on the database.
- The Head Teacher can add/delete a teacher in database.

In this case the user refers to either H/M DOS or teacher thus access is based on the privilege level of each.

4.1.2 Non-functional requirements

Non-functional requirements are the metrics that can be measured about the system for example performance. Non-functional requirements also describe aspects of the system that don't relate to its execution, but rather to its evolution over time.

- The user is able to perform most operations depending on the privilege levels.
- The system should be able to give feedback to the user.

4.1.3 Security requirements

The System allows users to login by use of password authentication as the security measure. This implies therefore that no access is granted if password and/or username are incorrect.

4.2 System Design

System design is the art of defining the architecture, components, modules, interfaces and data for a system to satisfy specified requirements. It is the transformation of the systems user stories into actual implementation designs.

The system architectural design gives a high level manifestation of the system in form of user interfaces both for the client and the server, the services each component provides how the user interacts with the system.

4.2.1 Entity Relation Diagram

This shows how the different tables are related to achieve the system functionality

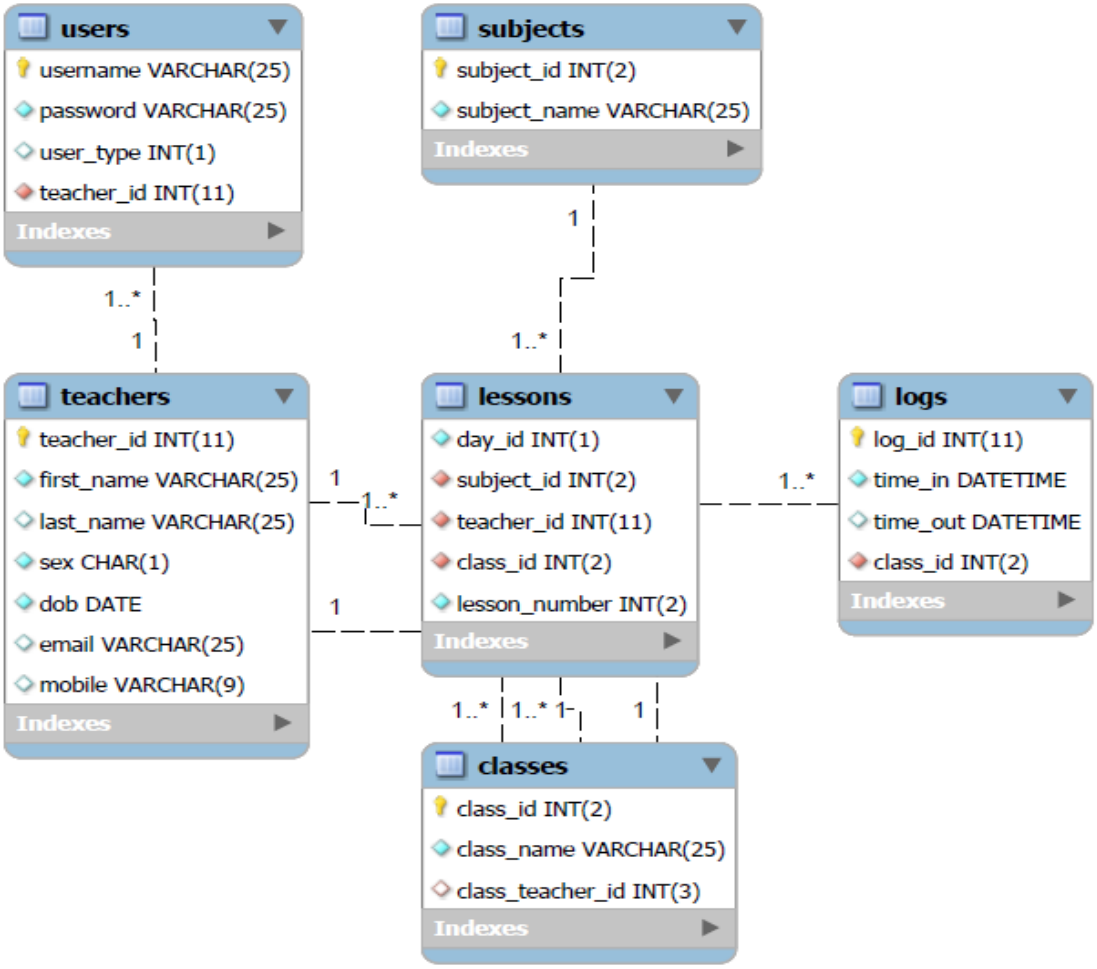


Figure 1: Entity relation diagram

4.2.2 Data flow diagrams

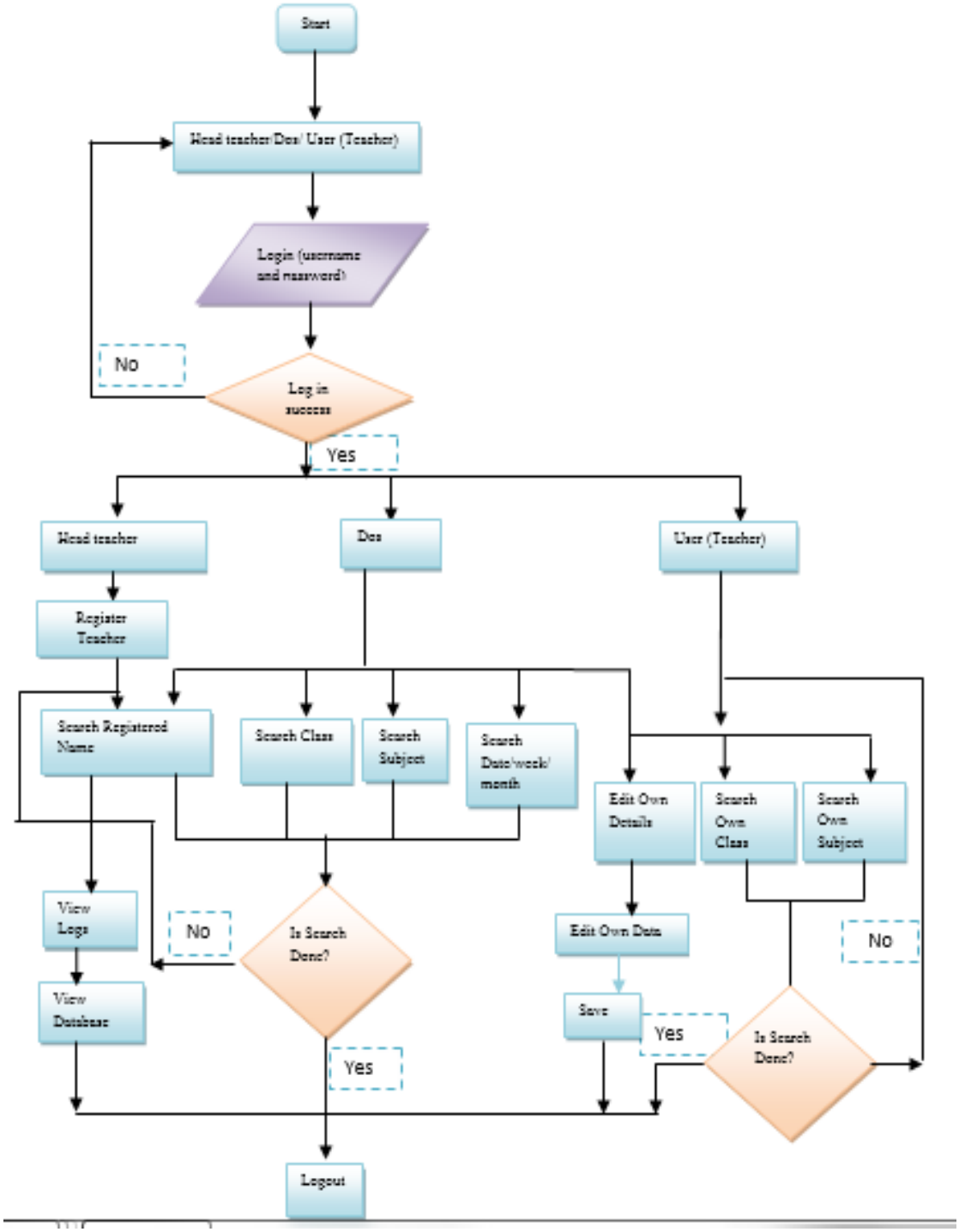


Figure 2: Flow chart

4.2.2 Use case diagram

The diagrammatic representation of the functional requirements of the system are mainly three actors that interact with the system as shown below; Administrator/HM, DOS,and Teacher(uses).The above three actors interact with the system as shown in the diagram below.

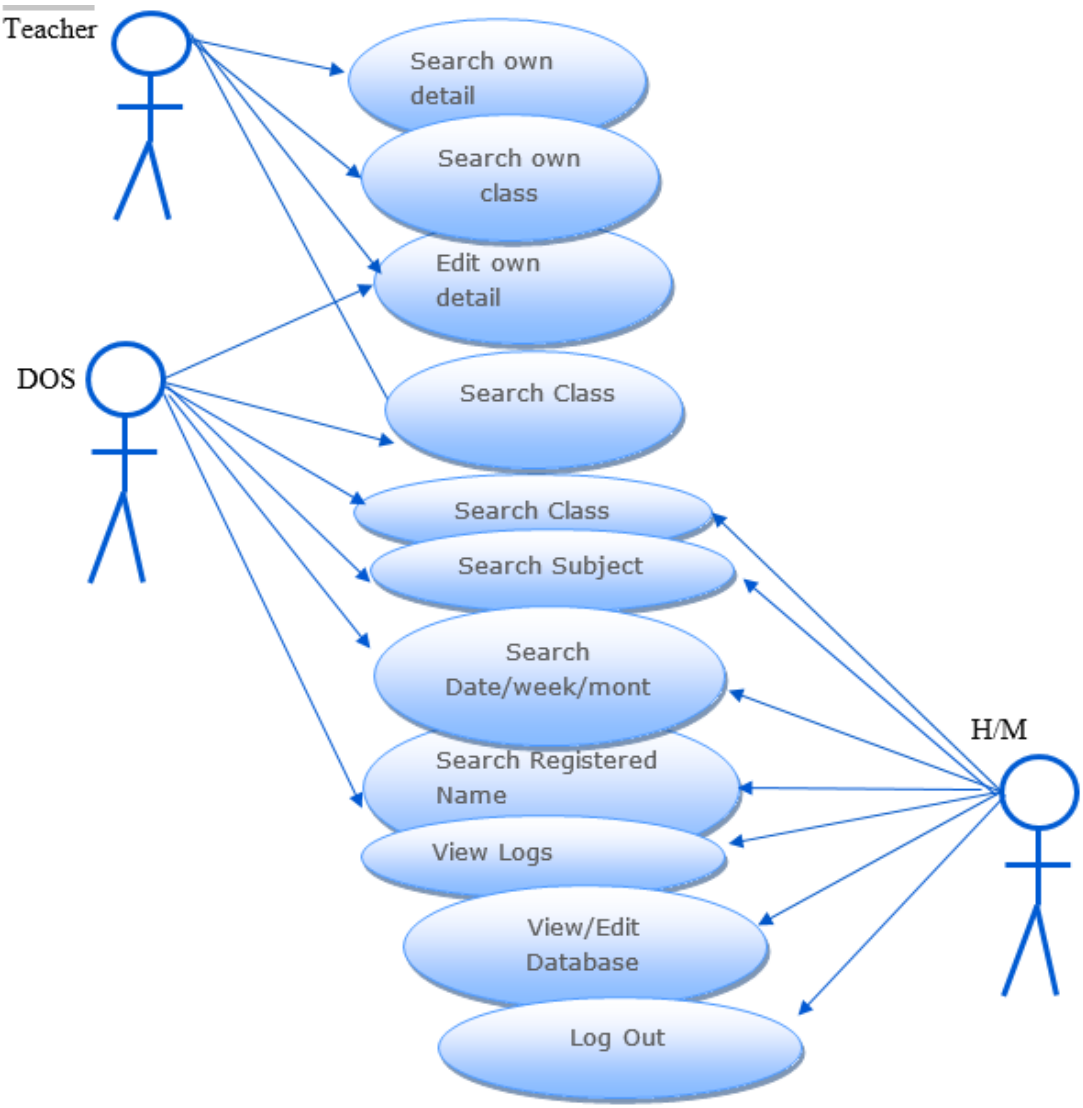


Figure 3: Use case diagram

4.2.3 Hardware design

This gives the physical components that are essential to the system and how they are interconnected.

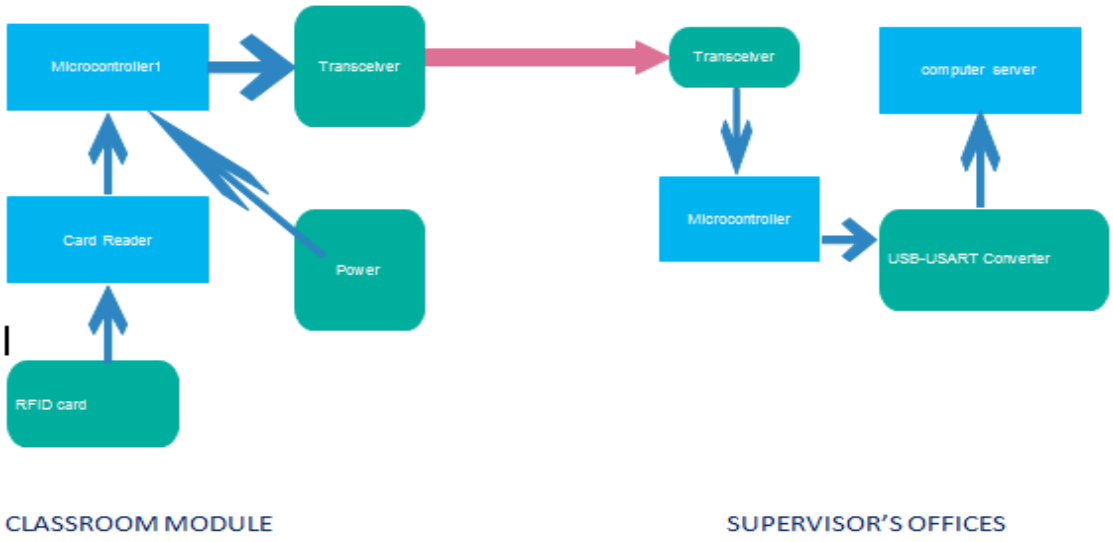


Figure 4: Block diagram

Microcontroller

The microcontroller used is AT mega 168 microcontroller produced by Atmel Inc and falls under the AVR family.

Microcontroller is a small computer on a single integrated circuit containing a processor core, memory, and programmable input/output peripherals. Program memory in the form of flash is also often included on chip, as well as a typically small amount of RAM. Microcontrollers are used in automatically controlled products and devices.

The circuit below shows minimum circuit connections using an atmega168 in a circuit. For the purpose of better timing performance, an external crystal is connected. For the purpose of resetting the microcontroller, a 10Ω resistor and a push is connected as show in the circuit. The circuit shows the Vcc and GND pins of atmega168 which are important.

RFID reader

RFID, or Radio Frequency Identification, is a technology for transferring data over short distances. Reader is powered (active device), while the tag is a passive device. The reader used is called MFRC522 which is 13.56MHz IC by MIFARE. On the Arduino many of the pins are cannot be swapped. The device uses the SPI bus, the pins of SPI cannot be interchanged pins 11, 12 13 remain and the RST and IRQ are user specified. The reader is powered by 3.3 volts. Higher values of voltage causes overheating of the RFID module may result which damages it. Its schematic is shown below;

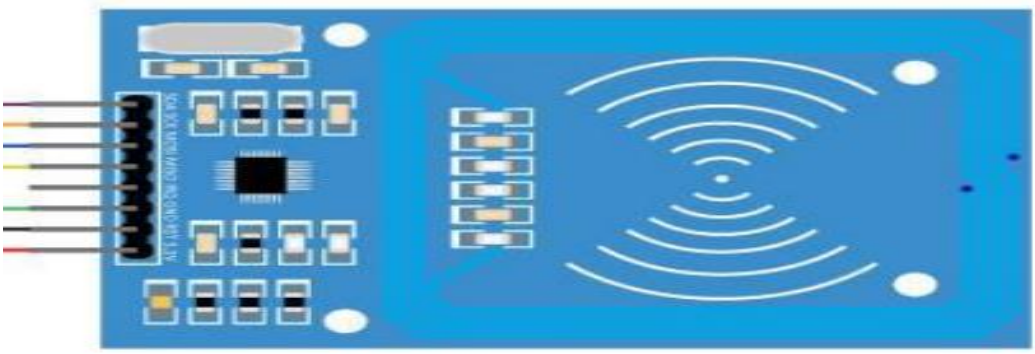


Figure 5: RFID card

The figure below illustrates the communication of the system modules

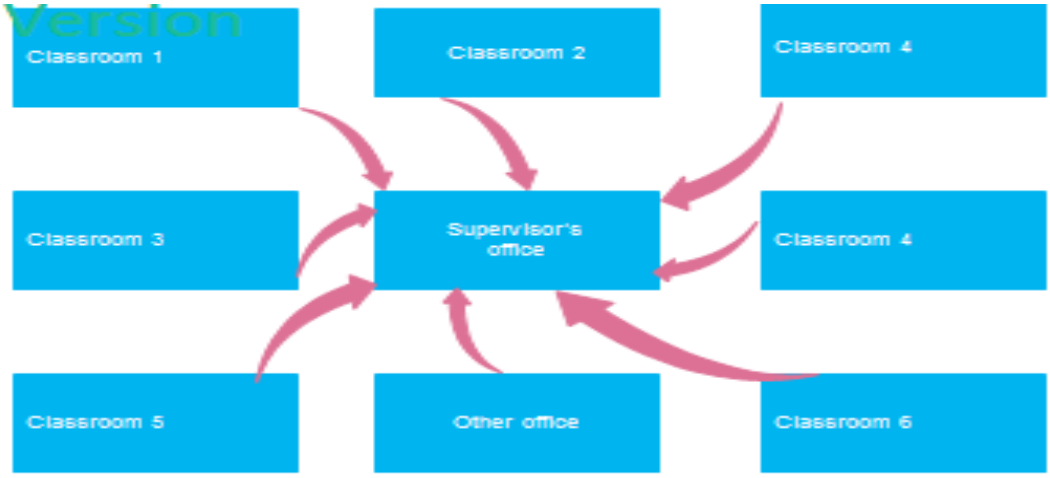


Figure 6: Communication between classrooms

RF transceiver

The RF transceiver used in the project is CC1101. This module uses the Chipcon CC1100 chip. It is operating at 433/868/915MHZ of ISM band. It consists of a frequency modulator, a receiver with demodulator, a power amplifier, a crystal oscillator and a regulator. Preamble and the CRC code are generated automatically, which can be easily configured through SPI interface.

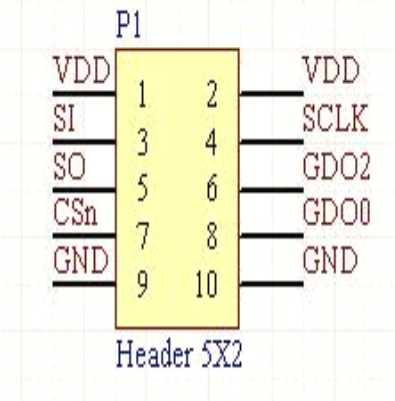


Figure 7: Transceiver

The device is interfaced with the microcontroller as explained below

- VCC is connected with power supply between 1.9V~3.6V.Recommended voltage is 3.3V
- VCC and other pins can be directly connected to 3vor 5v MCUIO ports, except for power
- 9 feet, 10 feet is connected to GND
- Standard DIP pin with spacing of 2.54mm, other DIP interface can be customized.
- For 51MCU, 10K pull-up resistor is necessary if connecting with P0. While connecting with other pins, it is not necessary.
- If MCU outputs 5V and more than 10mA, resistance is recommended to be connected as a divider. Or it may damage the module. If the output is 3.3V, no divider is needed.

4.3 Data bases

The database stores data inform of tables which include teachers table, users table, lessons table, logs table, classes table, and subjects table. The table below describes the constraints attached to each table.

Table 4: Data Base tables

Teachers table				
Column name	Data type	constraint	key	Description
Teacher_id	Int (11)	Not null	Primary key	
First_name	Varchar(25)	Not null		Stores first name of user
Last_name	Varchar(25)	Not null		Stores last name user
Sex	Varchar(1)	Not null		Stores sex user
Dob	Date	Auto		Stores date
Email	Varchar(25)	null		Stores email
Mobile	Varchar(25)	Not null		Stores telephone number
Users table				
User name	Varchar(25)	Not null	Primary key	
Password	Varchar(25)	Not null		Stores password of user
User_type	Int(1)	Not null		Stores status of user
Teacher_id	Int(11)	Not null	Foreign key	
Lessons table				
Day_id	Int(1)	Not null		Stores day
Subject_id	Int(2)	Not null		Stores subject
Teacher_id	Int(11)	Not null	Foreign key	Stores teachers id
Class_id	Int(2)	Not null	Foreign key	Stores class id

Lesson_number	Int(2)	Not null		Stores lesson number
Subject tables				
Subject_id	Int(2)	Not null	Primary key	Stores subject
Subject_name	Varchar(25)	Not null		Stores subject
Classes tables				
Class_id	Int(2)	Not null	Primary key	Stores class id
Class_name	Varchar(25)	Not null		Stores class name
Class_teacher_id	Int(3)	Not null		Stores class teacher id
Logs tables				
Log_id	Int(11)	Not null	Primary key	
Time_in	Datetime(30)	Not null		Stores time in
Time_out	Datetime(30)	Not null		Stores time out
Class_id	Int(2)	Not null		Stores class id

CHAPTER FIVE

DEVELOPMENT AND TESTING

5.0 Introduction

This chapter details how the system was implemented once the basic structure of the program was designed, the development environment, and how the research carried out before development helped in the development of the system. It also deals with any problems that were encountered during development and how they were resolved. Any problems that were not able to be resolved were discussed and what was done to work around them.

5.1 Development platforms

5.1.1 PHP

PHP Hypertext Preprocessor is an open source server side programming language extensively used for web scripts. It is a popular server-side scripting language designed specifically for integration with HTML, and is used (often in conjunction with MySQL) in content Management System and other web applications. I used PHP to write web services that connects the mobile application to the database server.

5.1.2 MySQL

MySQL is an open source relational database management system (RDBMS) that uses Structured Query Language (SQL); I used it for adding, accessing, and processing data in a database. MySQL is noted mainly for its speed, reliability, and flexibility.

5.1.3 MySQL Work Bench

This is an application that facilitates development of entity relationship diagram in MySQL.

5.1.4 Wamp server

Is a database management system that runs on Windows Operating System, supports Apache server, MySQL and PHP. This software was used to host the database locally as it will hold all the system info.

5.1.5 Notepad++

Notepad++ is a text editor and source code editor for windows. It supports and allows working with multiple open files in a single window. It also opens larger files compared to other text editors.

5.2 Code design

5.2.1 Sample code for creating data base

The code below creates a database called ***teachermonitor*** and allows the use of the created database.

The other code creates table ***teachers*** with columns ***'teacher_id', 'first_name', 'last_name', 'sex', 'dob', 'email'*** with their respective data types and constraints attached. ***teacher_id*** is a primary key that uniquely identifies the table.

Foreign key is key in some other table that references a primary key in another table.

```
SET SQL_MODE = "NO_AUTO_VALUE_ON_ZERO";
SET time_zone = "+00:00";


--
-- Database: `teachermonitor`
--
DROP DATABASE IF EXISTS teachermonitor;
CREATE DATABASE teachermonitor;
USE teachermonitor;
-- --------------------------------------------------------


--
-- Table structure for table `teachers`
--

CREATE TABLE IF NOT EXISTS `teachers` (
  `teacher_id` int(11) NOT NULL,
  `first_name` varchar(25) NOT NULL,
  `last_name` varchar(25) DEFAULT NULL,
  `sex` char(1) NOT NULL,
  `dob` date NOT NULL,
  `email` varchar(25) DEFAULT NULL,
  `mobile` varchar(9) DEFAULT NULL,
  PRIMARY KEY (`teacher_id`)
) ENGINE=InnoDB DEFAULT CHARSET=latin1;
-- ----------------------------end of `teachers`
```

```
--
-- Table structure for table `usera`
--

CREATE TABLE IF NOT EXISTS `usera` (
  `username` varchar(25) NOT NULL,
  `password` varchar(25) NOT NULL,
  `user_type` int(1) DEFAULT 0,
  `teacher_id` int(11) NOT NULL,
  PRIMARY KEY (`username`),
  FOREIGN KEY (`teacher_id`) REFERENCES `teachers` (`teacher_id`)
) ENGINE=InnoDB DEFAULT CHARSET=latin1;
-- user_type 2 ==> H/M
-- user_type 1 ==> DoS
-- user_type 0 ==> Normal User (Teacher)

-- -------------------------------end of `users`
--
```

Code for inserting dummy data into database.

```
-- insert teachers------------------------------------------------------------
INSERT INTO `teachers` (`teacher_id`, `first_name`, `last_name`, `sex`, `dob`, `email`, `mobile`) VALUES
(51, 'Lastone', 'Wekyaye', 'M', 19800521, 'wekyayelastone@gmail.com', '705700534'),
(233, 'Viola', 'Namuyomba', 'F', 19901203, 'vycky@gmail.com', '701128745'),
(173, 'Julian', 'Kyaluzi', 'M', 19941111, "julian@hotmail.com", '75555521'),
(129, 'Najiwah', 'Babirye', 'F', 19730625, NULL, '0772994131');

-- insert users---------------------------------------------------------------
INSERT INTO `users` (`username`, `password`, `user_type`, `teacher_id`) VALUES
('dynamic', '0705700534', 2, 51),
('viola', 'naamu', 1, 233),
('juliana', '2juliana', 0, 173),
('najiwa', 'najiwa2', 0, 129);
-- user_type 0 ==> Normal Teacher
-- user_type 1 ==> DOS
-- user_type 2 ==> Head master/Admin
-- insert classes-------------------------------------------------------------
```

```
-- insert users---------------------------------------------------------------
INSERT INTO `users` (`username`, `password`, `user_type`, `teacher_id`) VALUES
('dynamic', '0705700534', 2, 51),
('viola', 'naamu', 1, 233),
('juliana', '2juliana', 0, 173),
('najiwa', 'najiwa2', 0, 129);
-- user_type 0 ==> Normal Teacher
-- user_type 1 ==> DOS
-- user_type 2 ==> Head master/Admin
-- insert classes-------------------------------------------------------------
INSERT INTO `classes` (`class_name`, `class_teacher_id`) VALUES
('S1W', 51),
('S2E', 233),
('S3W', 51),
('S4E', 51),
('S1E', NULL);
-- insert subjects------------------------------------------------------------
INSERT INTO `subjects` (`subject_name`) VALUES ('Mathematics'), ('Physics'), ('Biology'), ('Chemistry'), ('History'), ('Fine Art
-- insert lessons-------------------------------------------------------------
INSERT INTO `lessons` (`day_id`, `subject_id`,`teacher_id`, `class_id`, `lesson_number`) VALUES
(1, 1, 51, 2, 1),
(1, 5, 233, 2, 2),
(1, 2, 51, 2, 3),
(1, 6, 173, 2, 4),
(2, 1, 51, 1, 1);

-- insert logs----------------------------------------------------------

INSERT INTO `logs` (`log_id`, `time_in`, `time_out`, `class_id`) VALUES
(1, CURRENT_TIME, CURRENT_TIME, 1);
```

5.2.2 Hardware code for class module

```
#include <SoftwareSerial.h>

#include <AddicoreRFID.h>
#include <SPI.h>

#define  uchar unsigned char
#define uint  unsigned int

//4 bytes tag serial number, the first 5 bytes for the checksum byte
uchar serNumA[5];

uchar fifobytes;
uchar fifoValue;
int last_recieved = 0;
const int class_id = 1;
AddicoreRFID myRFID; // create AddicoreRFID object to control the RFID module


/////////////////////////////////////////////////////////////////////
//set the pins
/////////////////////////////////////////////////////////////////////
const int chipSelectPin = 10;
const int RCVD = A5;
const int SENT = A4;

//Maximum length of the array
#define MAX_LEN 16
long startT = millis();

SoftwareSerial TRANCV (7, 8);
const int SET = 6;
void initRF()
{
  pinMode( RCVD, OUTPUT);
  pinMode( SENT, OUTPUT);
  digitalWrite(RCVD,LOW);
  digitalWrite(SENT,LOW);

  pinMode( SET, OUTPUT);
  digitalWrite(SET,HIGH);
  TRANCV.begin(9600);
  Serial.begin(9600);
```

```
  delay(1000);
  digitalWrite(SET,LOW);
  delay(1000);
  TRANCV.println("AT+A100");
  delay(100);
  digitalWrite(SET,HIGH);
}
void myRFID_Init()
{
  SPI.begin();
  pinMode(chipSelectPin, OUTPUT);              // Set digital pin 10 as OUTPUT to connect it to the RFID /ENABLE pin
  digitalWrite(chipSelectPin, LOW);
  myRFID.AddicoreRFID_Init();
}
String rfid_querry()
{
  String ret = "";
  uchar i; uchar tmp; uchar checksum1; uchar statas; uchar RC_size; uchar blockAddr;
  uchar str[MAX_LEN];
  String mynum = "";

  str[1] = 0x4400;
  //Find tags, return tag type
  statas = myRFID.AddicoreRFID_Request(PICC_REQIDL, str);
  //Anti-collision, return tag serial number 4 bytes
  statas = myRFID.AddicoreRFID_Anticoll(str);
  if (statas == MI_OK) {
    ret = ret + str[0];
  }


  myRFID.AddicoreRFID_Halt();      //Command tag into hibernation
  return ret;
}

void setup()
{
  myRFID_Init();
  initRF();
  delay(1000);
  //TRANCV.println("Class 1");
}

void loop()
{
  String val = rfid_querry();
  if ( (val != "") )
  {
    digitalWrite(RCVD,HIGH);
    int temp = val.toInt();

  digitalWrite(SENT,HIGH);
    TRANCV.print("WEKY:IN:"); TRANCV.print(class_id); TRANCV.print(":"); TRANCV.print(temp);
  Serial.print("WEKY:OUT:"); Serial.print(class_id); Serial.print(":"); Serial.print(temp);
```

```
  digitalWrite(SENT,LOW);
    while ( val.toInt() == temp )
    {
      delay(100);
      val = rfid_querry();
    }
  digitalWrite(SENT,HIGH);
    //TRANCV.print( (millis() - startT) / 1000); TRANCV.print(":"); TRANCV.print(class_id); TRANCV.print(":"); TRANCV.print(temp); TRANCV.println("OUT");
    TRANCV.print("WEKY:OUT:"); TRANCV.print(class_id); TRANCV.print(":"); TRANCV.print(temp);
  Serial.print("WEKY:OUT:"); Serial.print(class_id); Serial.print(":"); Serial.print(temp);

  digitalWrite(SENT,LOW);
  digitalWrite(RCVD,LOW);
  }
  if ( TRANCV.available() )
  {
    String tt = "";
  digitalWrite(RCVD,HIGH); delay(50);
    while( TRANCV.available() ){ tt = tt + (char)TRANCV.read(); } tt.trim();
    Serial.println(tt);
  digitalWrite(RCVD,LOW);
  }

}
```

5.2.3 Hardware code for office module

```
#include <SoftwareSerial.h>

SoftwareSerial TRANCV (9, 10);
const int SET = 11;

//SoftwareSerial TRANCV (7, 8);
//const int SET = 6;

const int RCVD = A5;
const int SENT = A4;
void initRF()
{
   pinMode( RCVD, OUTPUT);
   pinMode( SENT, OUTPUT);
   digitalWrite(RCVD,LOW);
   digitalWrite(SENT,LOW);

   pinMode( SET, OUTPUT);
   digitalWrite(SET,HIGH);

  TRANCV.begin(9600);
   delay(1000);
   digitalWrite(SET,LOW);
   delay(1000);
   TRANCV.println("AT+A100");
   delay(100);
   digitalWrite(SET,HIGH);
}
void setup()
{
   Serial.begin(9600);
   initRF();
   delay(1000);
   Serial.println("PC Side");
}
```

```
void loop()
{
  if ( TRANCV.available() )
  {
    String tt = "";
  digitalWrite(RCVD,HIGH); delay(50);
    while( TRANCV.available() ){ tt = tt + (char)TRANCV.read(); } tt.trim();
    Serial.println(tt);
  digitalWrite(RCVD,LOW);
  }
  if ( Serial.available() )
  {
    String tt = ""; delay(50);
    digitalWrite(SENT,HIGH);
    while( Serial.available() ){ tt = tt + (char)Serial.read(); } tt.trim();
    TRANCV.println(tt);
    digitalWrite(SENT,LOW);
  }

  }
  delay(500);
  TRANCV.println("AT00");
}
```

5.2.4 Code that ensures communication to the port

This code ensures that data received by the office modules transceiver is posted to the data base and ensures access to the port thus it runs continuously. It is runs as ***localhost/teachers/SerialGet.php*** in the web browser.

```php
<?php

header( 'Content-type: text/html; charset=utf-8' );
include "thread.php";
function echoFlush($string)
    {
        echo $string . "\n";
        flush();
        ob_flush();
    }
function startswith($haystack, $needle)
{
return $needle ==="" || strrpos ($haystack, $neele, -strlen($haystack)) !== false;
}
function endswith($haystack, $needle)
{
    return $needle===""|| (($temp = strlen($haystack)-strlen($needle))>0 && strpos($haystack,$needle, $temp) !== false);
}
class STD extends Thread
{
    private $std;
    private $portName = 'com6:';
    private $baudRate = 19200;
    private $bits = 8;
    private $spotBit = 1;

    private $bbSerialPort;
    public function __construct()
    {
        if(!extension_loaded('dio'))
        {
            echoFlush( "PHP Direct IO does not appear to be installed for more info see: http://www.php.net/manual/en/book.dio.php" );
            exit;
        }
```

```php

        try
        {
            //the serial port resource
            echoFlush(  "Connecting to serial port: {$this->portName}" );

            if (strtoupper(substr(PHP_OS, 0, 3)) === 'WIN')
            {
                $this->bbSerialPort = dio_open($this->portName,O_RDWR);//O_RDWR );
                //we're on windows configure com port from command line
                exec("mode {$this->portName} baud={$this->baudRate} data={$this->bits} stop={$this->spotBit} parity=n xon=on");
            }
            if(!($this->bbSerialPort) )
            {
                echoFlush( "Could not open Serial port {$this->portName} ");
                exit;
            }
            $this->run();
        }
        catch (Exception $e)
        {
            echoFlush(  $e->getMessage() );
            dio_close($this->bbSerialPort);
            exit;
        }

    }

    public function run()
    {
        //$this->synchronised( function(){
                //// my read and print function
                                echoFlush(  "connected<p>" );
                while(true)
                {
```

```
70                  try
71                  {
72                      $data = dio_read($this->bbSerialPort, 256); //this is a blocking call
73                      if(  substr($data, 0, 9)=="WEKY:OUT:" )//if(strpos($data,"MENU:")!=false)
74                          {
75                              echo $data ;//substr(PHP_OS, 0, 3);//
76                              //WEKY:IN:class_id:temp
77                              //substr(PHP_OS, 0, 3);//
78                              $inP = explode(":", $data);
79                              $class_id = $inP[2];
80                              $teacher_id =  $inP[3];
81                              include 'config.php';
82                              $query5="SELECT MAX(log_id) FROM logs WHERE class_id= ".$class_id." AND teacher_id = ".$teacher_id;
83                              $result5=  mysql_query($query5);
84                              while( $last_id= mysql_fetch_array($result5))
85                              {
86                                  echo "UPDATE logs SET time_out = CURRENT_TIME WHERE log_id=".$last_id[0];
87                                  mysql_query("UPDATE logs SET time_out = CURRENT_TIME WHERE log_id=".$last_id[0]);
88                              }
89                          }
90                          else if(  substr($data,0, 8)=="WEKY:IN:" )//if(strpos($data,"MENU:")!=false)
91                          {
92                              echo $data ;//substr(PHP_OS, 0, 3);//
93                              //WEKY:IN:class_id:temp
94                              //substr(PHP_OS, 0, 3);//
95                              $inP = explode(":", $data);
96                              $class_id = $inP[2];
97                              $teacher_id =  $inP[3];
98                              include 'config.php';
99                              mysql_query("INSERT INTO logs (time_in, class_id, teacher_id) VALUES ( CURRENT_TIME,".$class_id.", ".$teacher_id.")"    );
100                             echo "INSERT INTO logs (time_in, class_id, teacher_id) VALUES ( CURRENT_TIME,".$class_id.", ".$teacher_id.")";
101                             echo "<br>";
102                         }
103                 }
104                 catch (Exception $e)
```

```
105                         {
106                             echoFlush(  $e->getMessage() );
107                             dio_close($this->bbSerialPort);
108                             break;
109                         }
110                     }
111             //});
112             exit;
113         }
114 }
115 //echo "ON.....";
116 $std = new STD();
117 //$std->run();
118 ?>
```

5.3 The circuit design for the system

Transmission circuit (Classroom Module)

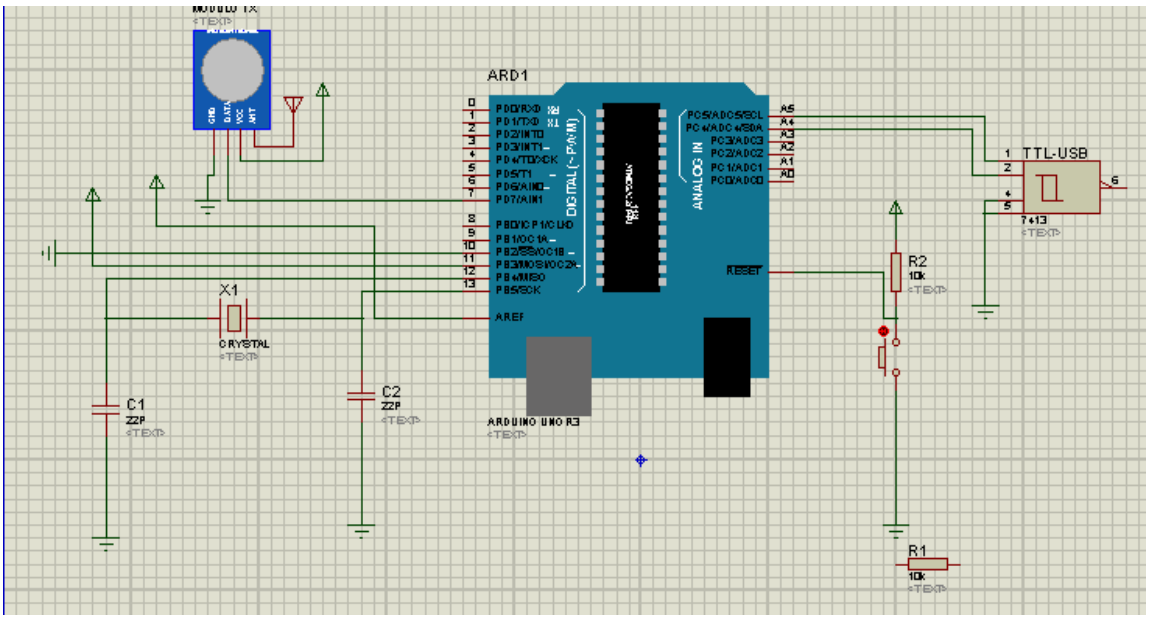


Figure 8: Design for transmission circuit

Receiver Circuit (office module)

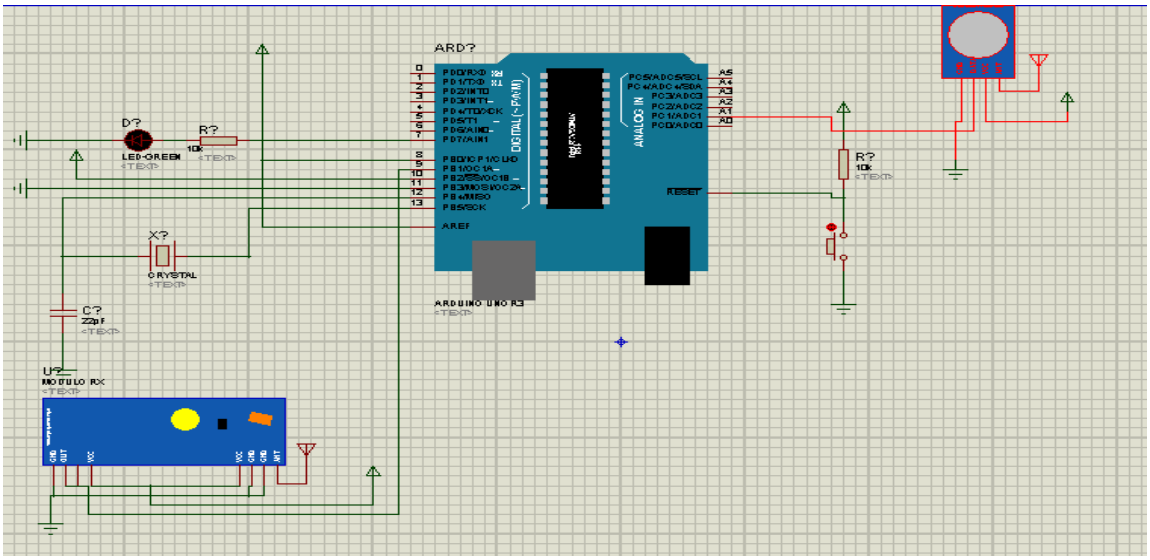


Figure 9: Design for receiver circuit

5.4 The system operation

The head teacher needs to have the following software installed on the computer, web browser and wamp server.

Upon deployment of the entire system all system users will be registered by the headteacher and given tag with known frequency of operation hence uniquely identifying the user of the system.

On entering and moving out of the class the ‘two times’ are captured by the module and transmitted using RF technology to the module attached to the head teacher’s computer and stored into the database.

5.5 System testing

This was conducted on a complete, integrated system to evaluate the system's compliance with its specified requirements.

Unit Testing: The C++code for both classroom module and office module was tested before uploading onto each of the microcontrollers which was running without errors. The different source code for implementing; reading tag, microcontroller operations, transceiver communication, database update.

5.6 System verification and validation

During the implementation the required soft wares were installed and the folder containing the software for the project copied in the ***www*** folder of the wamp server and copying MySQL file into the same folder.

The wamp server software was launched and fire fox web browser was launched and access to the application was made by search path ***localhost/teachers/index.php.***

The search path provides a login interface and I was able to register one teacher and made him enter and leave class and all was successful.

The path ***localhost/teachers/SerialGet.php***.should be running to ensure communication to the port.

VALIDATION:

This was done to ascertain that the system was meeting its specification and delivering the functionality it was expected to do. The validation of system was based on accuracy, performance, and completeness.

Accuracy: The system was checked to find whether it was working well at different times and in all the tests carried out correct results were output. This proved that system is accurate.

Performance: The system was checked to find out the time it takes to respond to user, the system response was fast. This proves that the system's performance is good.

Completeness: The system was checked to find out whether all the functionalities specified during the design stage were satisfied. The system had all the functionalities and was therefore declared complete.

5.7 System Evaluation

The system is evaluated as follows in comparison to existing projects.

Table 5: System evaluation

Parameters considered	Existing system	The system
Data Recording	Manual	Automatic
Technology used	Internet	RFID
Cost	Expensive	Cheap

CHAPTER SIX

DISCUSSIONS AND RECOMMENDATIONS

6.0 Introduction

This chapter will evaluate whether or not the project specification was met, any weaknesses in the approach taken and possible directions this project could be taken in the future to achieve a more regarded goal.

6.1 Summary of project

The system's database is capture all required information about the user.

This system was able to detect entry and exit of a teacher automatically and data was sent to the data base.

The data bases can be accessed by the system users and depending on privileges.

6.2 Critical analysis

The project was able to achieve its objectives by use of RFID to automatically capture a teacher and information sent to the database using RF technology.

The database can be accessed by the various users of the system and different operations can be made per someone's status.

6.3 Recommendations

This project has been based on the experience of the author and feels that the project could quench the cry of the Ministry of Education Science, Technology and Sports of absenteeism of various officers and yet no back borne (evidence) to reprimand. The database gives the evidence.

The administrator should be trained to manage the system.

The reading range of the reader is rather short therefore an RFID reader with a very big range would be of better use.

The same idea can be implemented by other technologies such as Zig-Bee.

A more analysis (mathematical output) of log result into pie charts, bar graph.

In case the school large a central communication system that links to the office computer may be designed.

6.4 Conclusion

Proper monitoring of employees is a necessary evil for the progress of an organization.

In the system, the RFID technology is used to collect the data about attendance conveniently. The real-time data acquisition and disposal largely enhances the efficiency of the operation of the attendance collection, and significantly enhance the efficiency of other modules in the system. The versatility of RFID is utilized in implementing a functional and RFID based Teacher's attendance logging system that allows automatic recording of entry and exit of a teacher to/from the classroom. This system should change the way schools monitor attendance of teachers to their lessons and provide a new, accurate, and less cumbersome way of recording. This technology offers reliability, saves time. All processes of managing the teachers attendance record are performed, allowing administrators to view or modify the users' data using the computer . The captured can be processed and analyzed automatically with less risk of data loss, compared to a manual recording approach.

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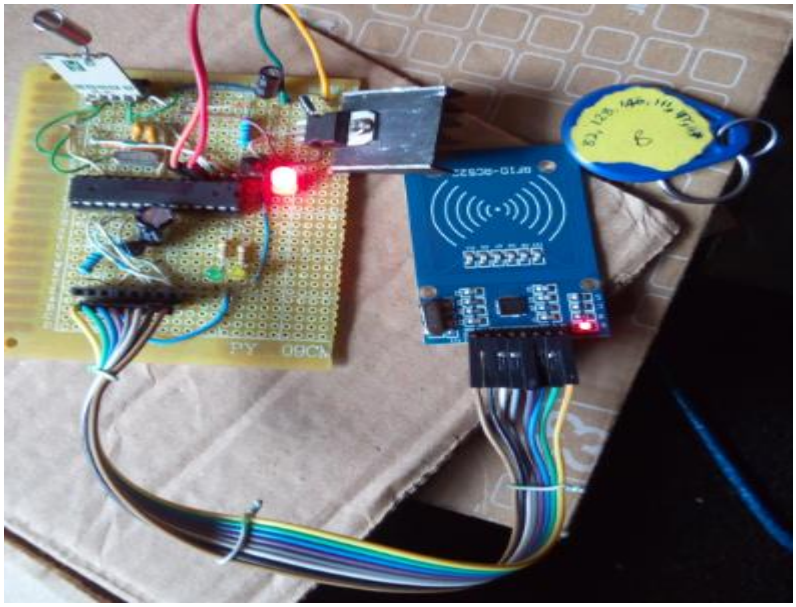
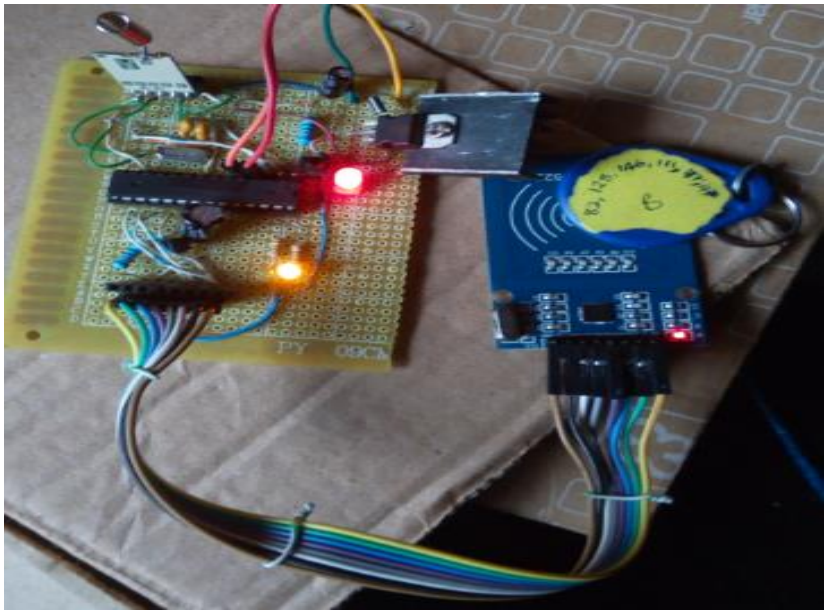
Appendices

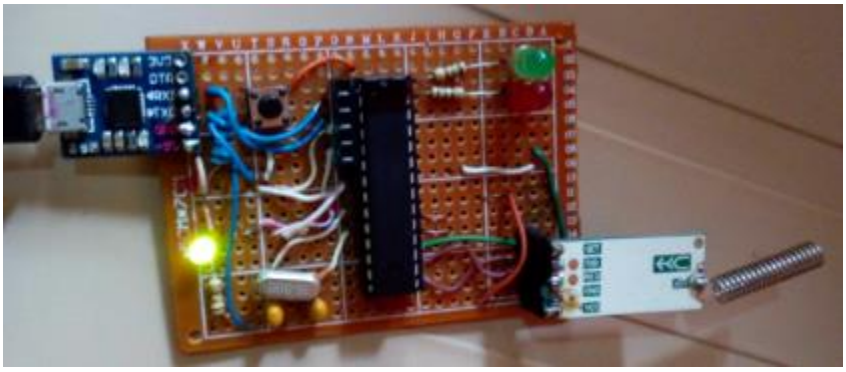
A.1 Snapshot of classroom module with tag not being read by the RFID reader



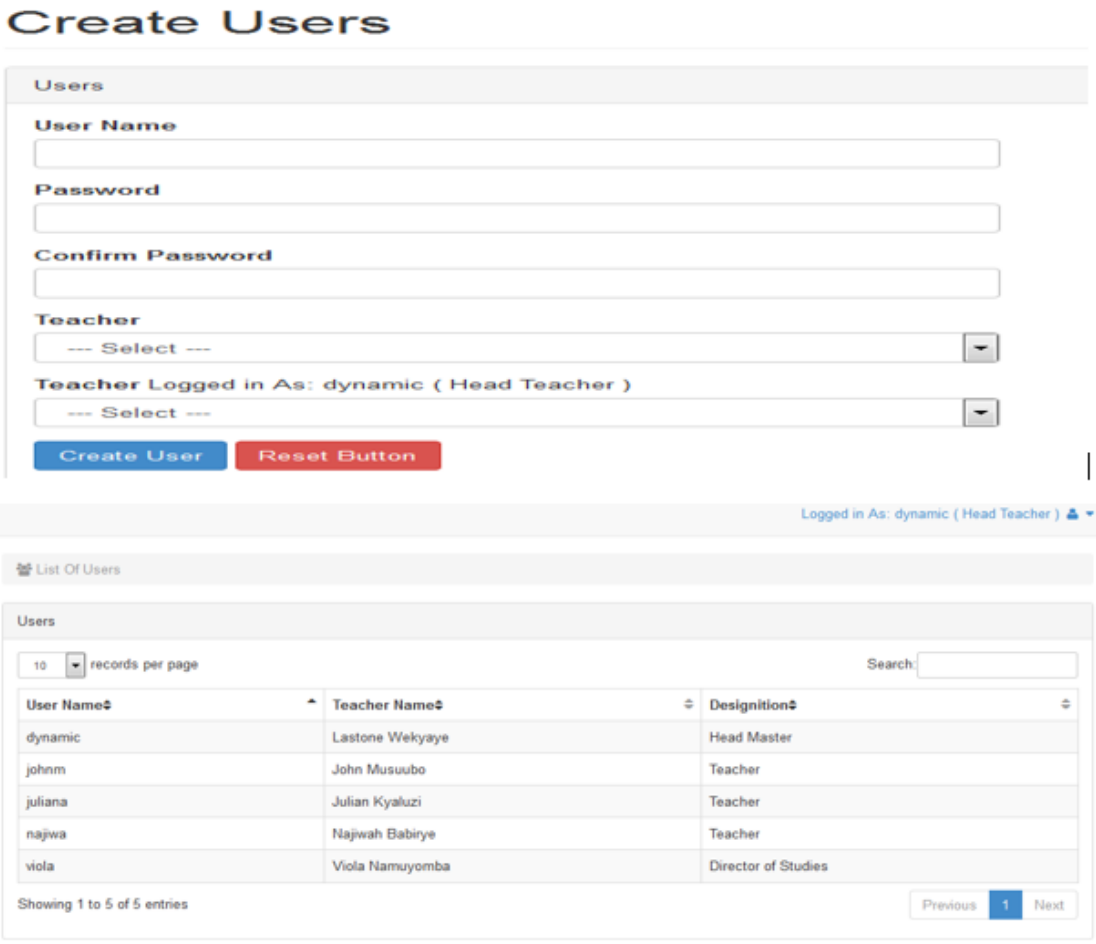
A.2 Snapshot of classroom module with tag being read by the RFID reader



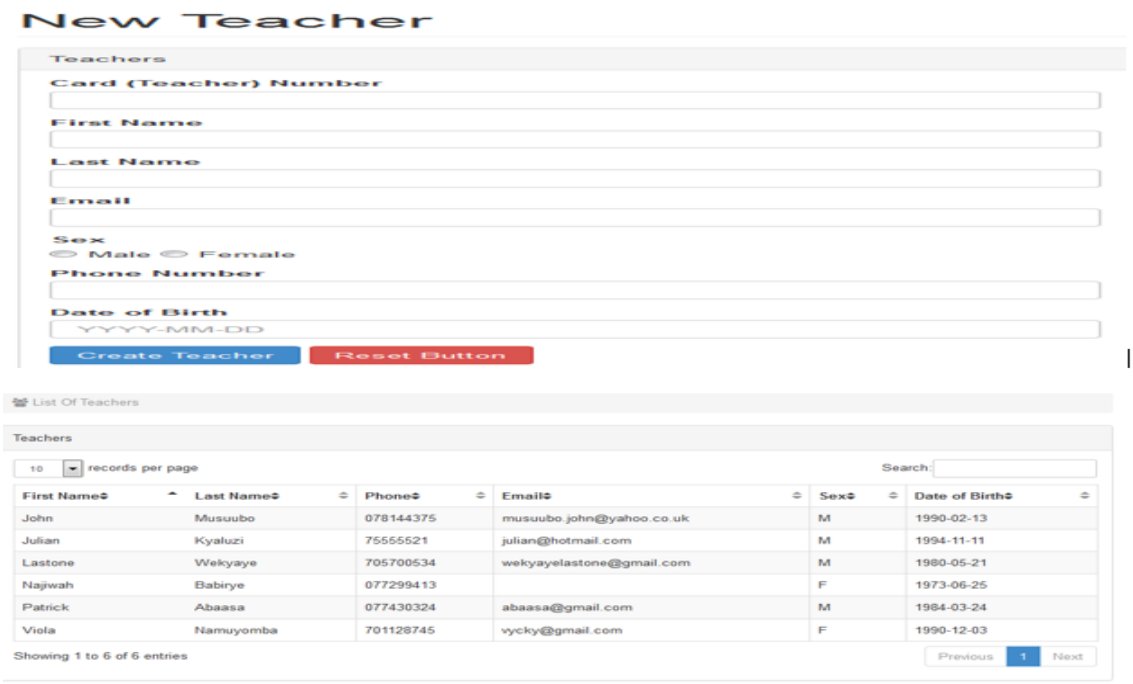
A.3 Snapshot of office module



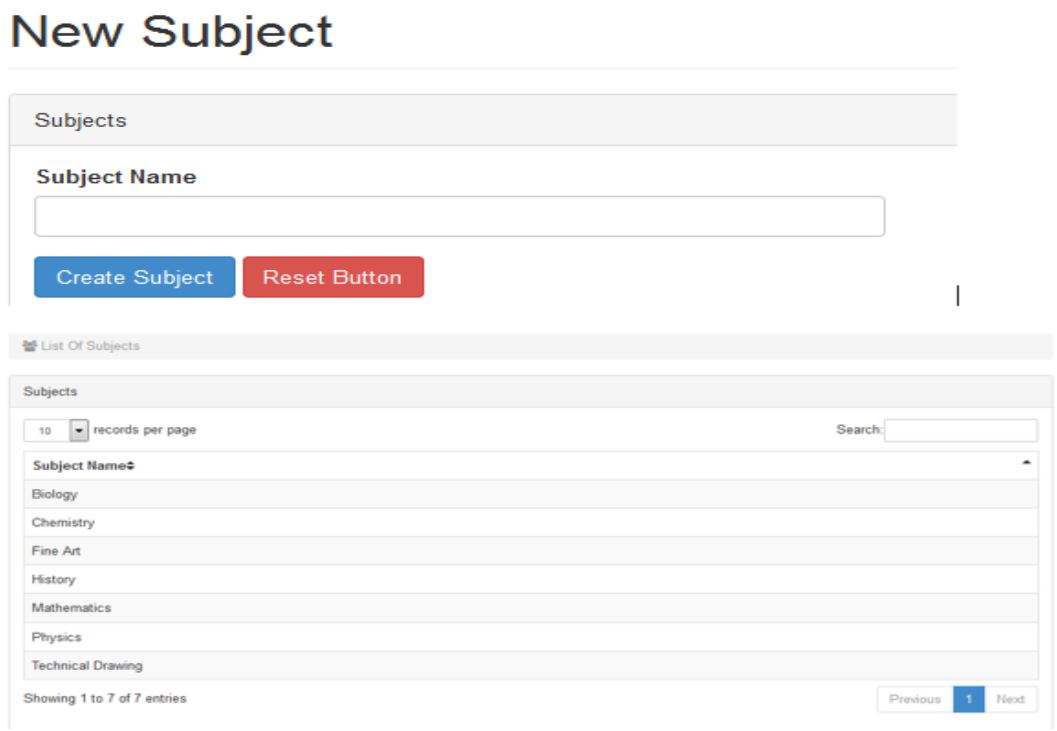
A.4 Create users and list of users interfaces



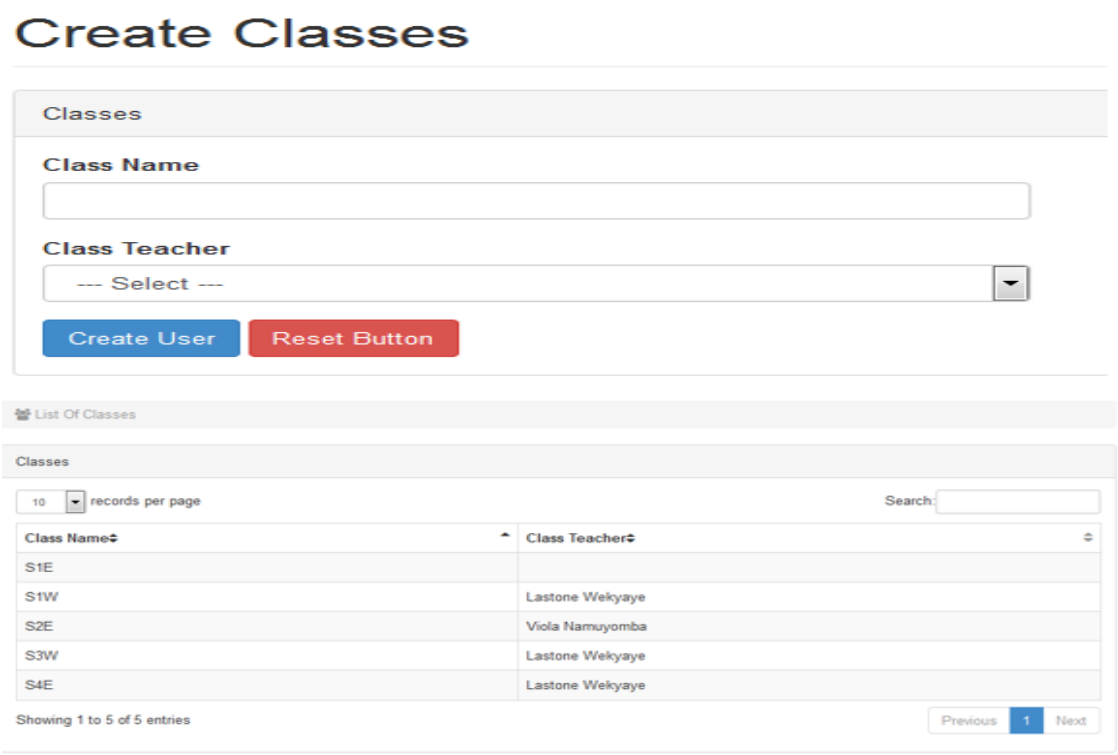
A.5 Create new teacher and list of teachers



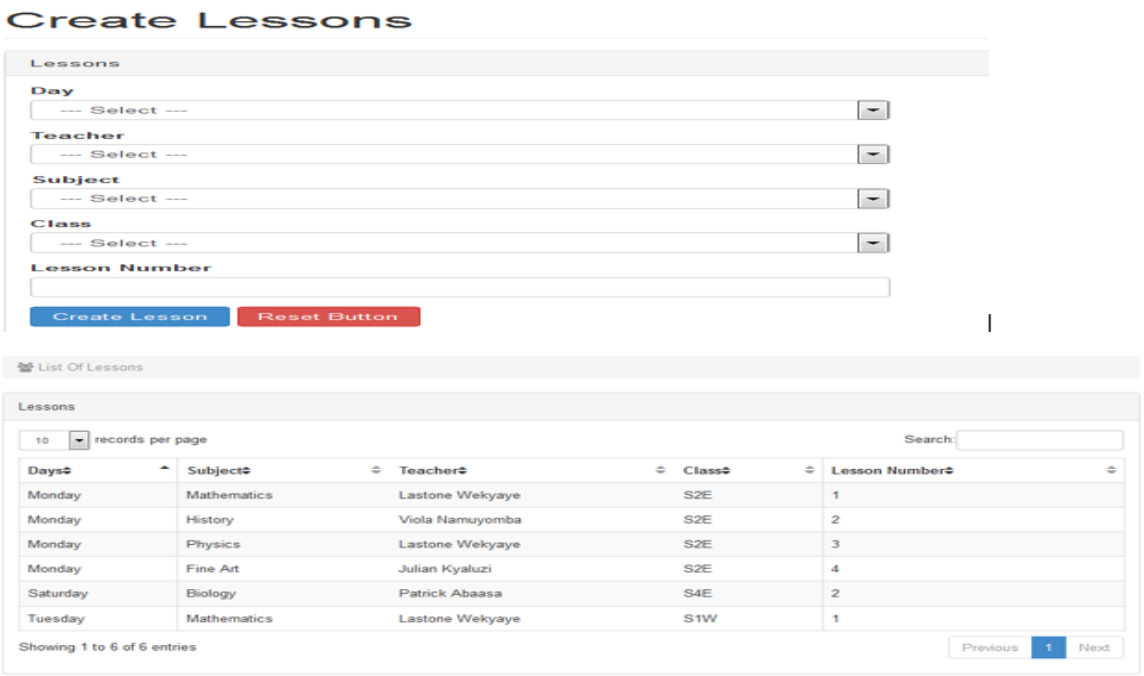
A.6 Create new subject and list of subject



A.7 Create classes and list of classes



A.8 Create lessons and list of lessons



A.9 List of logs