DESIGN AND CONSTRUCTION OF AN ELECTRONIC VOTING DEVICE USING RFID

BY

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IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE DEGREE OF BACHELOR OF ENGINEERING (B.ENG) IN ELECTRICAL AND ELECTRONICS ENGINEERING

FEBRUARY, 2019.

DEDICATION

I dedicate this report to God, the Almighty; the All-knowing, the All sufficient, the Giver of wisdom, knowledge and understanding.

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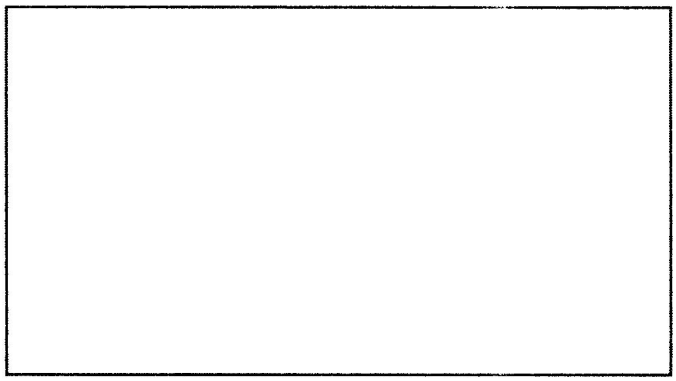

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CERTIFICATION

This is to certify that this project titled ELECTRONIC VOTING DEVICE USING RFID, by AJAYI TUNDE OLUWAGBEMISOLA meets the minimum requirements governing the award of Bachelor Degree in Electrical and Electronics Engineering of Federal university Oye-Ekiti, Nigeria.

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ABSTRACT

Voting is an important aspect of life whereby new leaders are chosen to rule and assume power of a nation, state, student union government, an organization. In later years, voting has always been accompanied with pandemonium, inconclusive balloting, rigging, ballot snatching, delay of voting materials, and also excessive funds on voting. In quest to solve all these hurdles, this project "ELECTRONIC VOTING DEVICE USING RFID" has been proposed in order to ease our voting culture. The aim of this project is to design and construct an electronic voting device that can be used for voting purpose.

This project "electronic voting device using RFID" is built around a micro-controller, programmed to read in data from an RFID tag through the RFID reader. The RFID reader sends in data (ID number of the RFID tag) to the micro-controller which checks whether or not the data from the RFID reader matches with the data that is programmed into the micro-controller. The developed system has an SQL database, which serve as a storage memory for storing every login details of each electorate or voter. There is a link between the microcontroller and the SQL database via a USART USB cable. The developed system reads and responds to both registered and unregistered tags, but grants access to only registered tags. The developed system can't read more than one card at a time and it does saves tag information inside the database. The developed system contains two displays which are computer interactive display and the liquid crystal display. The computer interactive display is allotted to the electoral personnel only while the liquid crystal displays is available only to the voter to see what is going on during the voting process. A system application "EVD application" was developed to help the electoral officer to visualize cogent information about the voter and also to activate voter for voting process. The EVD application contains a login page that each user must login into before he or she can access the application. The EVD application perform these functions; adding of new voter into the database, modifying of existing voter within the database. This application also helps to delete lost RFID card information from the database of the system in order to avoid its unrecognized usage by another voter. This EVD application also helps to verify each voter for accreditation, and it also displays the polling result to the electoral officer. The LCD helps to show voting status to the electorate during voting process.

Security checks is also available in the system developed in order to checks if the rightful owner of the card has actually come to cast his or vote wisely.

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CHAPTER ONE

INTRODUTION

1.1 INTRODUCTION TO PROJECT

RFID based electronic voting devices is the overall combination of electronic equipment, electro-mechanical, or mechanical (including firmware, software and documentation required to support equipment and program control) equipment, that is used to define ballots; to report or display election results; to cast and count votes; and to maintain and produce any audit trace the information (Praful Ranjan, 2015). Election is the backbone of a democratic society; therefore, it is necessary to employ efficient methods of conducting elections. Governments around the world are increasingly considering the replacement of traditional paper-based voting schemes with electronic voting systems in which Nigeria is not excluded. Paper base voting system has so many problems associated with it, which include the voters having multiple votes, rigging, impersonation, insufficient voting papers for voters, difficulties in counting of papers in the collating centers, lateness of result. This project describes the design, construction and operation of an electronic voting device using RFID system microcontroller. This project allows voters to cast his or her vote by swiping a tag over a tag reader, the tag reader reads the 12 - byte information stored inside the tag in accordance with the information stored inside the database of the microcontroller and also check the authenticity of the card. If the card is an authentic and registered card, the LCD displays "ACCESS GRANTED" and if otherwise the LCD displays "ACCESS DENIED". The information of the voter is displayed on the computer LCD to the personnel or presiding officer in-charge of the polling unit for verification allowing the personnel to confirm the originality of the voter. After this, a list of parties is shown on the 16 X 2 LCD screen, the voter can then vote for any party of their choice by pressing the button assigned to the party of their choice on the keypad of electronic voting device (cubicle). The maximum number of time which the voter is allowed to use his card for voting is only once. Subsequent attempt to use the card after the card has been used once, the electronic voting device (EVD) denies the user from voting by displaying "CARD USED" on the LCD.

1.2 BACKGROUND

The new age of technology has redefined voting system. Most people make use of their cards for various operation such as cash withdrawal, identification, transaction, and voting.

The invention of technology like RFID, Bluetooth, infra-red, Wi-Fi (wireless fidelity) among others has made the world a global village and interactive society. The role of electromagnetic field and waves has greatly influence and increase the rate information is being sent and received through a secured channel. Through self-inductance and mutual inductance, several electromagnetic equipment can be coupled together for the essence of communication. In this project, we make use of this great knowledge of electromagnetic field and waves to couple the tag(card) and tag reader (card reader) for the purpose of voting. The tag(card) is being coupled to tag reader through the process of swiping the card over the tag reader by a process of inductive coupling, whereby the tag is powered and also transmit data to the tag reader (Ajayi Fisayo, 2017).

1.3 PROBLEM STATEMENT

Technology has advanced so much in the one or two decades, that it has made life more efficient and comfortable (Tolu Adekoya, 2016). Conventionally, paper based voting system has a lot of challenges which it fails to overcome such as multiple voting, rigging of votes, collation of results, sorting out ballots, hijacking of ballot box, late declaration of voting results, excessive cost of implementation, void votes, late arrival of election materials, cumbersomeness of ballot box and so on. This project has taken into account the afore-mention problems encountered by conventional paper based voting system by introducing a microcontroller based electronic voting device which will reduce if not totally eliminate this challenges incurred from paper based voting system. This project makes use of two LCD displays to monitor and execute voting process, and it also use RFID technology to secure a transparent voting process.

1.4 MOTIVATION TO THE PROJECT

People in the whole world have been crying for free and fair elections in their various countries as a result of challenges and problems encountered with conventional paper based voting system. The advancement in technology has been a source of motivation to this project. Technology advancement such as RFID (Radio frequency identification), near field communications(NFC) and Bluetooth which operate at a range of 2.4GHz frequency is a source of inspiration to this project and the knowledge of RFID technology coupled with other technologies which are brain child of the new technologies invented in recent years are used to solve the challenges faced by paper based voting system.

1.5 SIGNIFICANCE OF THE STUDY

This project when successfully installed for voting regression, it will totally eliminate the issuance and use of paper thereby saving cost and giving convenience to voter. More cost will be saved on the purchase of stationeries used with receipts. The issue of rigging will be totally eliminated. This project can eradicate the fear imbibe into people before and during elections as the privacy of the voters during voting is highly protected with the use of this project. This project is so significant, because it helps to curb the issue of bribery during election as political party delegate is unaware of the party a voter chooses to vote for.

1.6 AIM OF THE PROJECT

The aim of this project is to design and construct an electronic voting device that can be used for voting purpose.

1.7 OBJECTIVES OF THE PROJECT

The project aims and objectives are highlighted to:

- Design a device that helps the voting system of our school, community, town, and nation to be free from rigging, collation of ballot results, sorting of casted votes.
- Design a device that will show the voting process to the voter and the presiding officer in charge of voting activities.
- Design a device that can be used as legal evidence in election court cases.
- Design a device that will limit or eliminate impersonation during voting process.
- Design a device that will display the information of the voter to clarify the true identity of the voter, limiting impersonation.
- Design a device that will improve and facilitate the rapid outcome of voting result.
- Design a device that will increase the number of people that will vote with less effort and without fear.

1.8 SCOPE OF THE PROJECT

This scope of this project cut across so many field of studies such as electrical, political science, nanotechnology and also human governance. The project embarked upon can serve as a replacement to our national, state, local government and academic paper based voting system. This project can be used in the senate meetings to select leaders of our choice, also in our student union governments to choose the student union president of the school. This project can be used in our day-to-day electoral process to make decisions that are valid. This project can also be used in a business biding deal to know the highest bidder to a particular item.

1.9 INTENDED USERS AND USES

This project is aimed toward all the average users who wish to have a free and fair electoral process, and also to cast their vote and select a tranquil leader of their choice. This guarantees safety to the voters, the presiding officers and also to the casted votes.

CHAPTER TWO

LITERATURE REVIEW

2.1 HISTORY OF RADIO-FREQUENCY IDENTIFICATION

RFID is a wireless radio-frequency technology that allows objects, persons, and space to be remotely identified using a low-cost electromagnetic tags(cards) or inductive cards. In its simplest form, an RFID tag attached to an object can store data that can be used to identify the existence of the object or maintain other information regarding the object. The RFID technology has been in place for more than 40 years. Primarily, it has been used in a very narrow range of industrial and military applications, and it remain unnoticed by the mass market. In the last several years, RFID technology has matured in many ways such as a longer signal range, faster data transfer rate, and shorter tag reading intervals. The reduced cost of RF tags has fostered mass deployment and the use of this technology in our society. The retail chain company Wal-Mart was arguably the strongest driving force behind the application of RFID technology (Pei Zheng *et.al*, 2010).

Radio frequency communication has been in existence for more than 100 years. Radio frequency has been wide used for voice, data, video, motion graphics communication over the decades. Despite the widespread of these technology, people still believe that RFID is just emerging (***Ron Price, wireless networking complete, 2007***).

Military aviation was first to deploy the technology of radio frequency in larger scale during the World War II when developing RADAR in the 1930s. During these period, backscattering radios were particularly utilized to identify friendly aircrafts by modulating backscattered radar signal. The breakthrough in the development of RADAR led to the publication of numerous journals in the field (***Juho Partanen, February 2015***).

According to the studies carried out by R.F Harrington in the year 1960, electromagnetic waves have a lot of relationship with RFID. These relationships led to the explosion of RFID technology in the year 1970, when investors began to deploy more researchers and field engineers to the manufacturing of radio frequency identification communications (***Richardson's. R, theory of loaded scatterers, 1964***).

2.2 LITERATURE SURVEY

(***Ajayi Fisayo, design and construction of electronic voting machine, 2017***) talks about electronic voting system using radio frequency identification (RFID). Fisayo proposed that, voting process can be achieved using a couple of electronics device for its implementation. He also analyzes that great security can be achieved adopting his method. In his work, he

was able to solve problem faced with multiple votes, unregistered voter. Fisayo's work was subjected to so many flaws which are listed below:

- failure to identify a particular voter
- failure to display the information of the voter
- failure to provide the polling booth of the voter
- failure to provide adequate security in a situation whereby the card of the voter is being stolen or lost due to some instances
- failure to provide private security to the votes being casted.

This project tends to solve the afore-mention problems by using a computer interactive display to show the voter's identity, voter's polling booth. This project also uses a security word to check if truly the voter is valid.

This project "ELECTRONIC VOTING DEVICE USING RFID" justifies itself from Fisayo's work, because it embeds a system application for its smooth running. This system application helps the electoral officer to visualize the voter's information.

(***Narendra Singh Pal et.al, biometric electronic voting machine using microcontroller, 2009***) talks about voting electronically with the use of fingerprint security system. Narenda Singh Pal introduces fingerprint module to work as added value or security checks to the existing electronic voting system. When Narenda Singh introduces fingerprint to voting system, voting became more and more pronounced and secured. Narenda's singh project has little challenges which are listed below:

- Failure in fingerprint module (as temperature may rise at any time or fall leading to failure of the module)
- Failure to display the correct information of the voter
- Use of low memory size microcontroller
- Insecurity of privacy and data
- Cost of implementing is very high.

This project looks into Narenda's shortcoming by providing a computer interactive display to show the information of the voter, large memory size microcontroller to store the information during voting process and after voting, use of both mini and main LCD as substitute for fingerprint.

The system application deployed in this project "ELECTRONIC VOTING DEVICE USING RFID" makes it different from Narenda's work. This project also deploys a large memory size microcontroller for storing voter's record.

(***R . Odaiah et.al, Raspberry Pi and voice activation electronic voting, 2012***) talks about voting using Raspberry Pi operating system and also voice activation. Odaiah introduces

Raspberry Pi operating system to the existing way of implementing electronic voting as alternative way or method of coding its microcontroller, and also voice activated voting system that compare discrepancy in voter's voice from the already stored voice. Odaiah's work suffer challenges which are highlighted below:

- Inadequate provision of user or voter detailed information
- No guarantee of voter's privacy
- Use of non-interactive operating system
- Imitation of voter's voice is a major problem

This project improves on Odaiah's work by using a computer interactive display to verify the information of the voters at any point in time. This project also uses a combination of computer interactive display and a 16x2 LCD to secure the privacy of the voter at the point of voting, and also use of security word at the point of accreditation and voting to verify voters' detailed information.

High level of security checks been deployed in this project "ELECTRONIC VOTING DEVICE USING RFID" separate it from Odaiah's work which does not employ such development.

(***D. Latha et.al, RFID based electronic voting machine with embedded protection, 2016***) explains the use of GSM module interfaced with RFID system as means of accomplishing voting procedure. Latha introduce GSM module to his work in order to distinguish it from existing method of securing e-voting sytem. In his work, he stored each voter's mobile id to its database for voting sake. Latha's works faced some challenges which are listed below:

- Failure to proffer lasting solution to network issues faced with GSM communication
- Inadequate security as a result of hijacked or stolen mobile phone from voter before coming to vote.

This project improves on Latha's work by using detailed and comprehensive interactive display for both electorates and the presiding officer, security word as substitute instead of GSM module which is very costly to acquire.

This project "ELECTRONIC VOTING DEVICE USING RFID" employs security checks and a system application which are not to be found in Latha's work. These two features make this project advance and different from Latha's existing model.

2.3 MARKET SURVEY

Research has shown that RFID module is readily available in the market for commercial and industrial use. The availability of RFID module has offered many applications in the real world such as RFID item or goods identifier. RFID is widely used in virtually all our day-to-day activities such as mini shopping, entrance into an office building, voting system, tracing of goods. RFID tags are made from semi-conductor materials which is readily available. RFID tags are made from complementary metal oxide silicon materials(CMOS) and which is easy to fabricate in the manufacturing industry. Due to its availability and ease of fabrication, someone or a researcher can easily get a module of RFID tag and its reader at a low cost.

Comparing and contrasting all the views and the methodologies of these authors, it can be drawn or concluded that RFID based electronic voting machine can be implemented in a so many ways, but the almost purpose is to achieve their respective aims and objectives. This study agreed to and also relate with the existing reviews, thoughts, and experimental facts as its backbone to implements its own aims and objectives.

CHAPTER THREE

DESIGN METHOLOGY

3.1 OVERVIEW OF THE ELECTRONIC VOTING DEVICE

The electronic voting device is built around a microcontroller which acts as the brain of the system, and it is so programmed to fetch data from RFID tags or cards through the RFID reader. The RFID reader sends stored data from the RFID tags to the microcontroller, to check if the data matches with the predefined data stored for that particular card inside the microcontroller.

The electronic voting device is an embedded system that is made up of hardware system and software system.

The hardware system consists of an assembly of various electronic components such as Vero-board, resistor, jumper wires, buzzer, USB (universal serial bus) cable, 16x2 LCD, RDM630 interface, capacitors, PIC16F883. The hardware component has a bidirectional link with the software system.

The electronic voting device has database management system and also a server that helps the smooth running of the software system. The electronic voting device database management system keeps the record of every entry of each tag or card into the database, it also stores personal information of voter such as the voter identification number, the name of the voter. The database management system is link with the microcontroller which control every action within the system. The personal information stored by the database is shared with the microcontroller for further processing or future use. The database system is served by its structured query language server (SQL) for its smooth running.

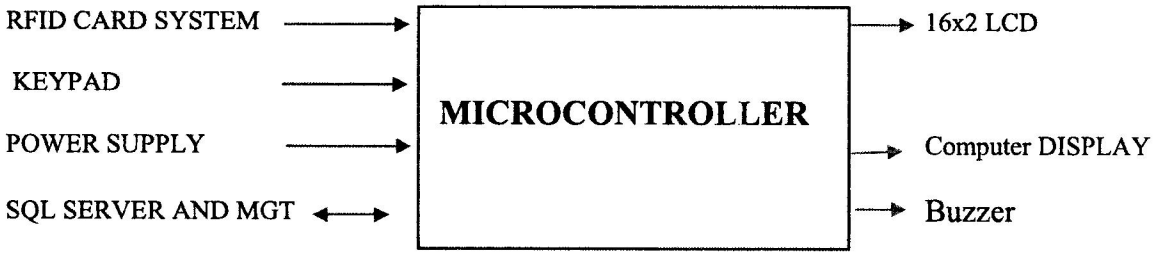
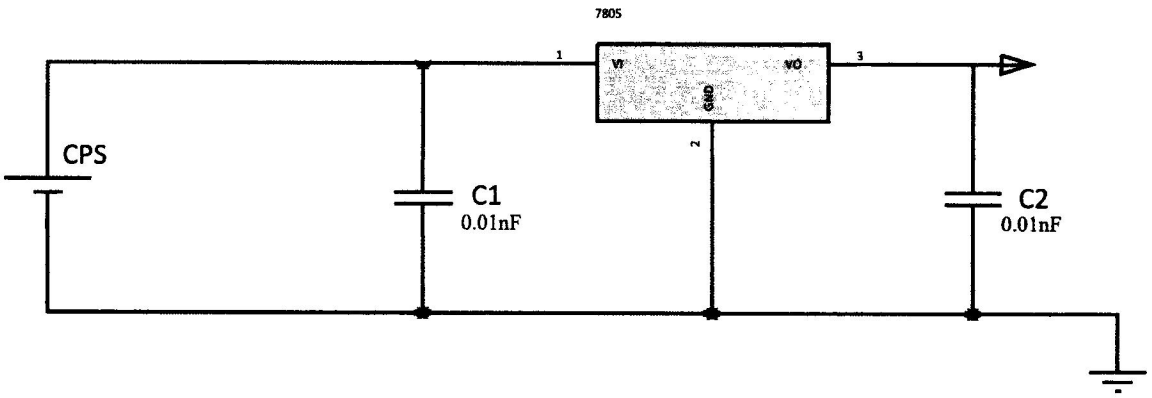
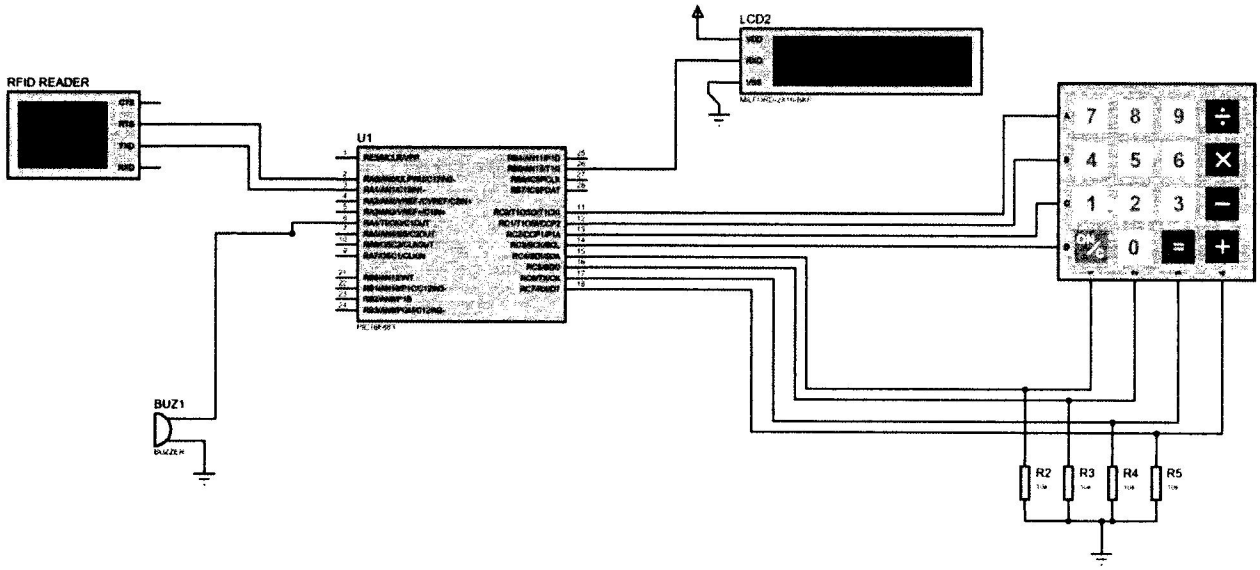


Fig 3.1 block diagram of electronic voting device

3.2 COMPLETE SYSTEM DESIGN

Proteus simulation software was used to simulate the complete working circuit (see Figure 3.2 below). The energy from the USB of computer powers (CPS) the whole circuit when its connected to the computer. Two parallel capacitor are connected to the transistor to filter the noise coming to circuit. The resistor connected to the keypad ensures that correct voltage is drop on this path. The 16x2 LCD is connected to pin 26 of the microcontroller, also the buzzer is connected to the pin 6 on the microcontroller respectively. The RFID module is connected to pin 2 and 3 of the microcontroller.





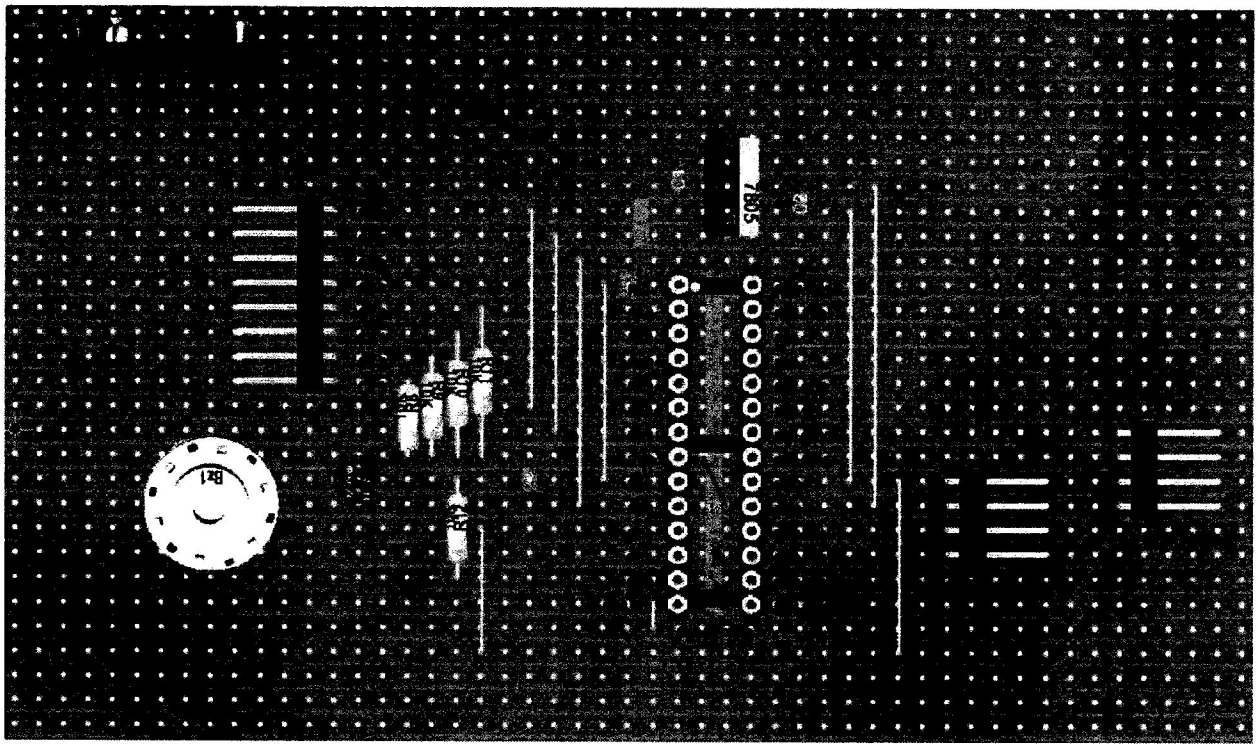


Fig 3.2 circuit diagram of electronic voting device

3.3 PROTOTYPE DEVELOPMENT

This system will be built by connecting the following configured components that are needed for the desired output of the system (see Figure 3.3 below). Here are the step by step procedures for the prototype development:

Step by Step Prototype Design Procedure:

- Connect the peripherals needed to the microcontroller using Ribbon cable and Header socket (LCD Display, RFID card reader module).
- Load the compiled code into the program memory of the microcontroller using MikroProg compiler.
- Connect the system with a source
- After all connections are made, power up the device by pressing the power button.
- Swipe your card on the RFID card reader module to see the actions performed by the constructed system.

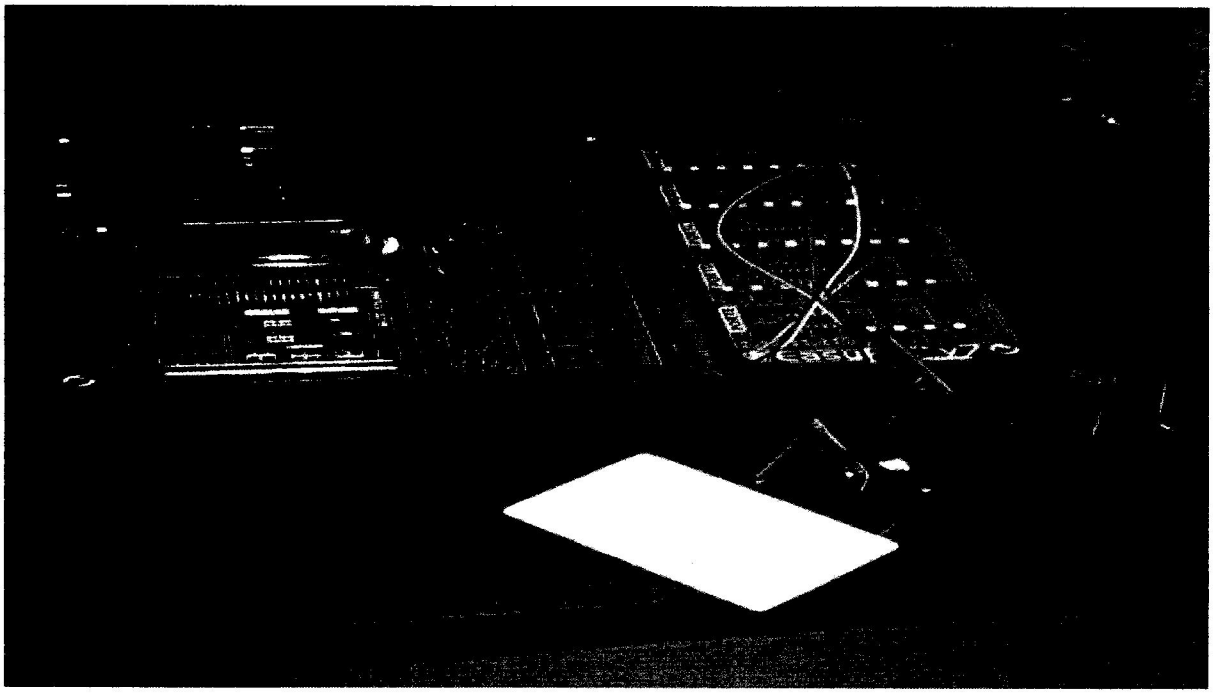


Fig 3.3 Prototype electronic voting device design using MikroProg.

3.4 SOFTWARE REQUIREMENT

The language used for coding or programming the microcontroller was FPGA (Field programmable gate array). The MikroProg was used to convert the source code into the machine readable language.

3.5 INPUT AND OUTPUT FLOW-CHART INTO THE MICRO-CONTROLLER

The input and output flow chart into the microcontroller is divided into its smallest units for better understanding and also for simplicity. The flow chart is given below:

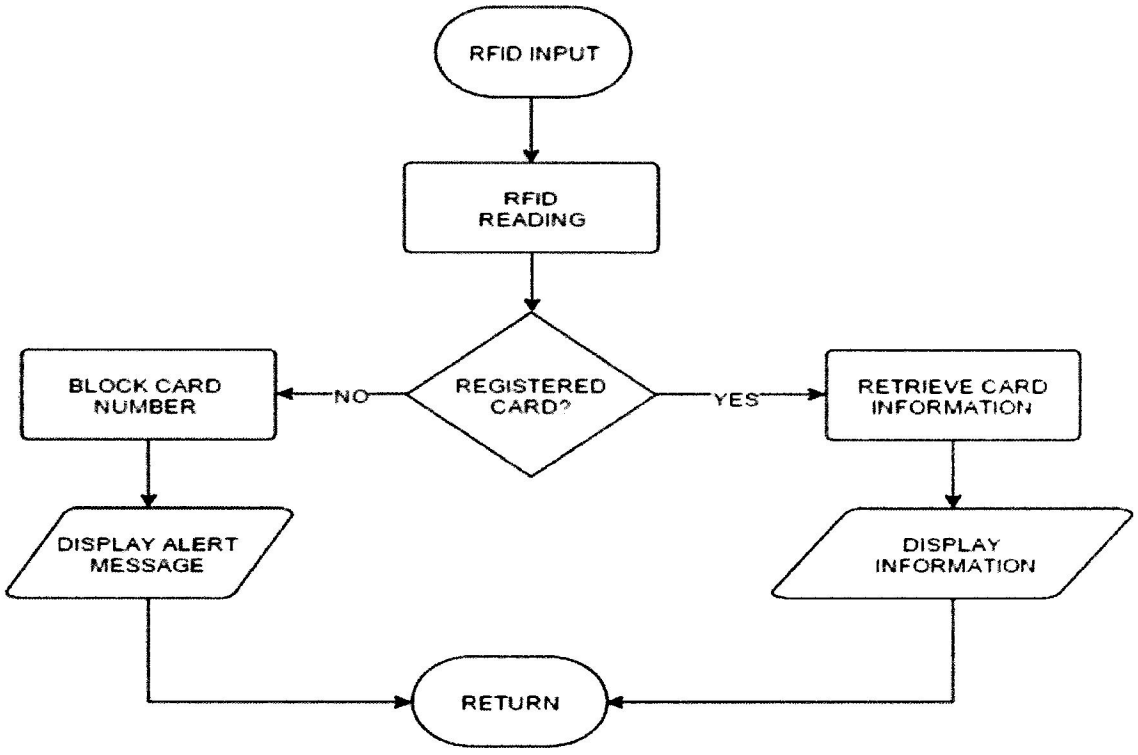


Fig 3.5 input-output flow chart to the microcontroller.

3.6 HARDWARE COMPONENTS

3.6.1 MICROCONTROLLER

3.6.1.1 MICROCONTROLLER SPECIFICATIONS

For effective development and usage of the entire electronic voting system, Microchip's PIC16F883 microcontroller was selected to be used for the development of this electronic voting device. The program controlling the entire electronic voting device is saved onto the memory of the microcontroller.

The Microchip's PIC16F883 microcontroller is an enhanced flash-based 8-bit microcontroller which can accommodate a wide frequency range with low power consumption. The instruction set for the PIC16F883 is fully compatible with the standard 8052. The microchip's PIC16F883 has 28 pin layout which can be configured depending on requirements.

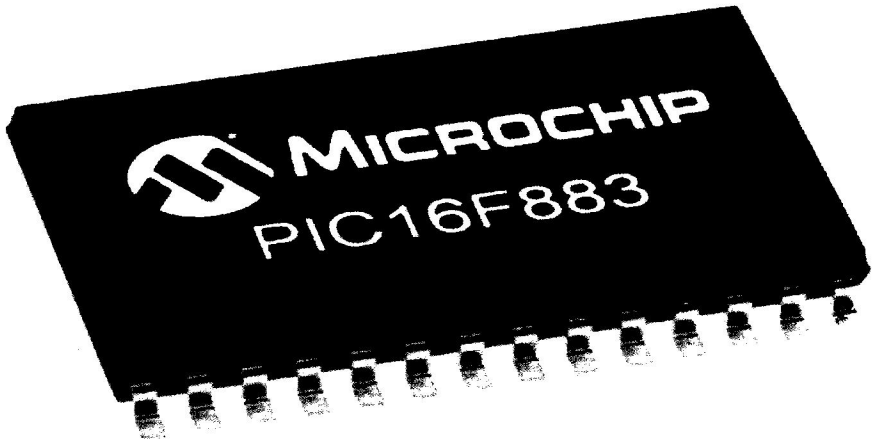


Fig 3.6.1.1 schematic diagram of microchip PIC16F883

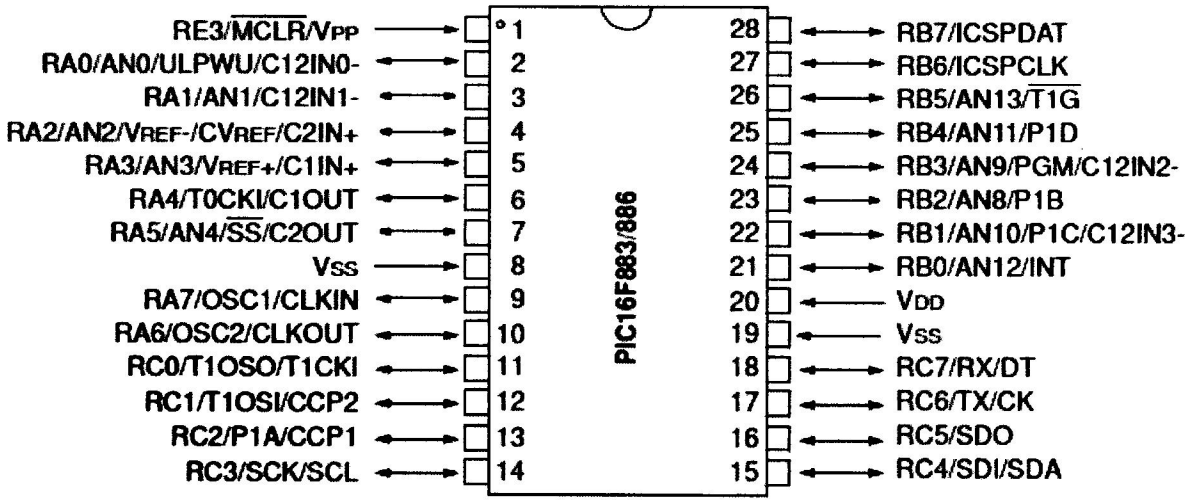


Fig 3.6.1.1.2 schematic diagram of PIC16F833

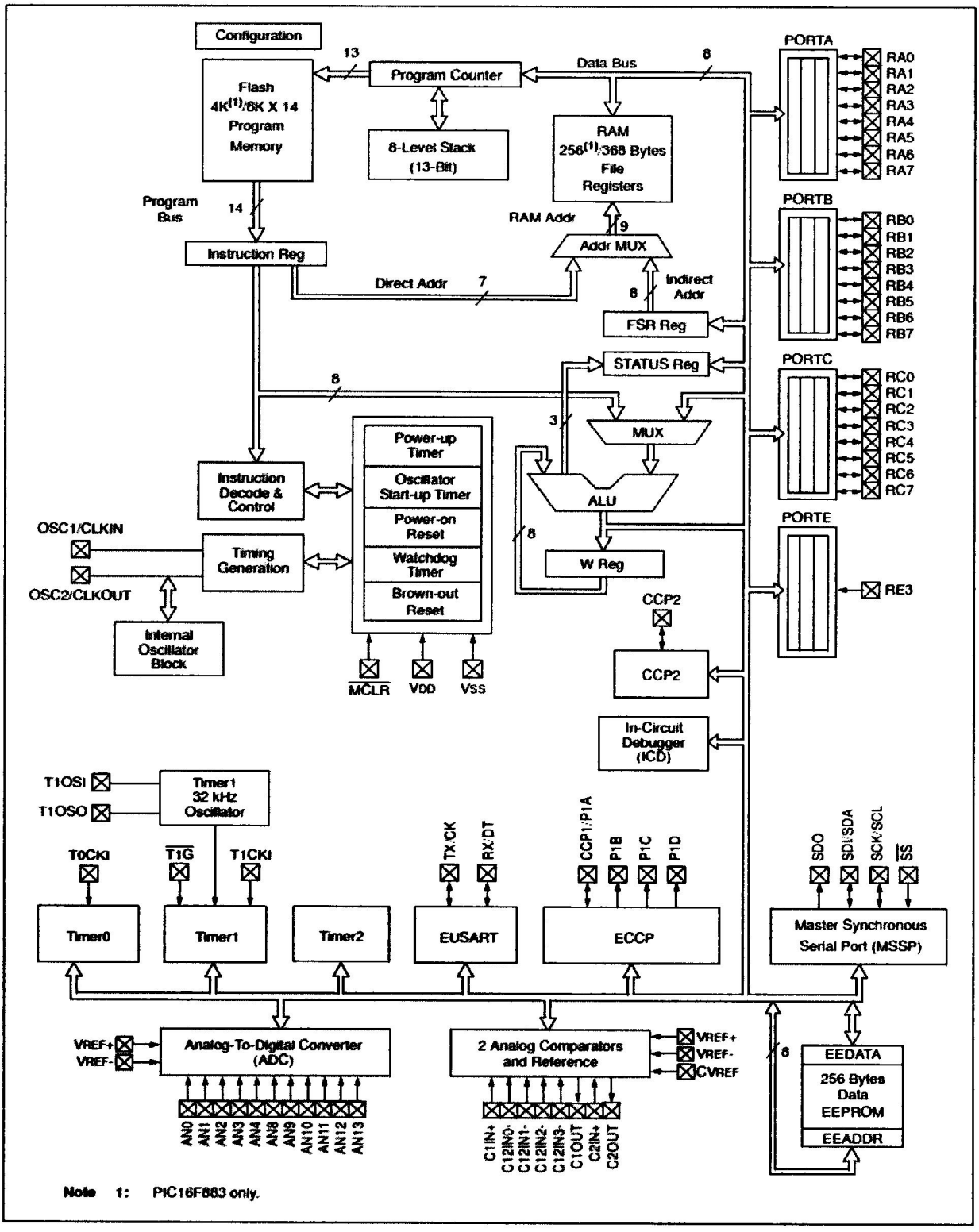


Fig 3.6.1.1.3 block diagram of PIC16F883

3.6.1.2 MICROCONTROLLER PROGRAMMING

The microcontroller PIC16F883 was programmed using MikroProg. The MikroProg has 40 pins ZIF sockets that are used for holding the pins of the microcontroller chip. MikroProg is a fast and reliable USB programmer and hardware debugger that transfers the source code from the computer into its hardware components using a USB cable. The source code of this project was written with FPGA (Field programmable gate array) and was later converted into machine language (hex file). AVR programmer software can also be used as an alternative for MikroProg software.

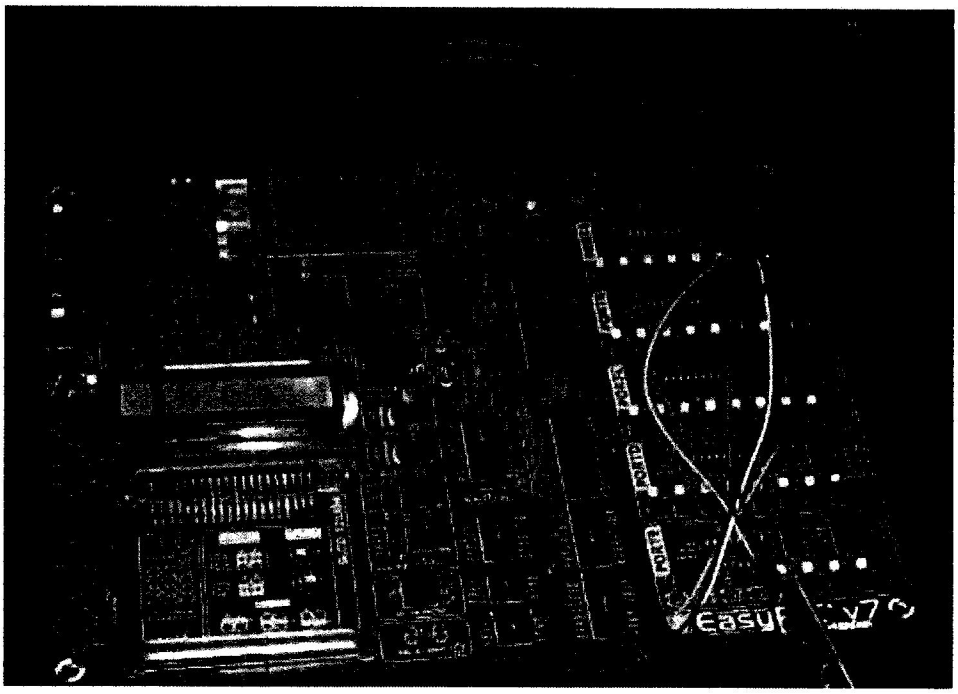


Fig 3.6.1.2.1 Diagram of MikroProg

3.6.2 RFID SYSTEM

RFID system is a reliable and maintenance-free option to electronic voting process. The RFID system contains the RFID tag and the RFID reader which permits voters of various categories to cast their votes by swiping cards over RFID reader.

3.6.2.1 RFID CARD READER

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

(Mazidi et al, 2006). The RDM 630 shown in Figure 3.6.2.1 below works at an operating frequency of 125 KHz and reading distance up to 4 inches is used for this project. The reader can be easily installed on voting cubicle any other platform for this purpose.

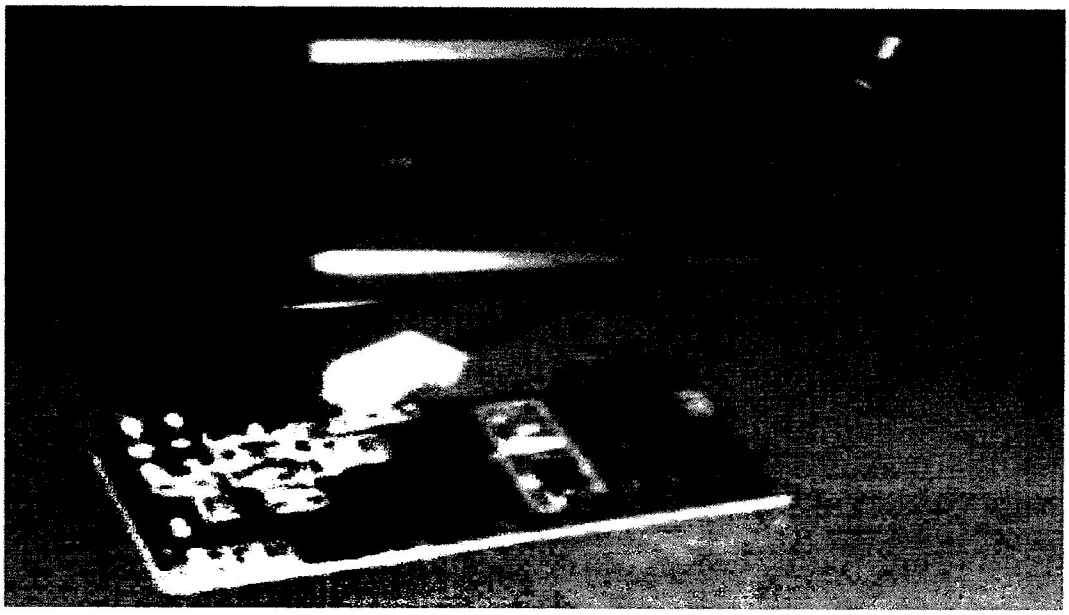


Fig 3.6.2.1 Diagram of RDM 630

3.6.2.2 RFID TAG

An RFID tag can either be passive, active or battery assisted. For this project (electronic voting device) a passive RFID tag operating at a frequency of 125 KHz was used. The tags (Figure 3.4 below) have been pre-programmed with unique ID numbers which is encoded inside them. The RFID tags transmit information to the reader in Amplitude Shift Keying format.

Fig 3.6.2.2 Schematic diagram of RFID tag

3.6.3 LIQUID CRYSTALL DISPLAY (LCD)

The LCD serves the purpose of displaying information to the user of electronic voting device. The LCD used in this project is divided into two:

Computer interactive display

16x2 LCD

3.6.3.1 COMPUTER INTERACTIVE DISPLAY (CID)

The computer interactive display shows information of the voter to the presiding officer in-charge of the electoral process. It also serves the purpose of displaying the user interface program (application software) on the screen.

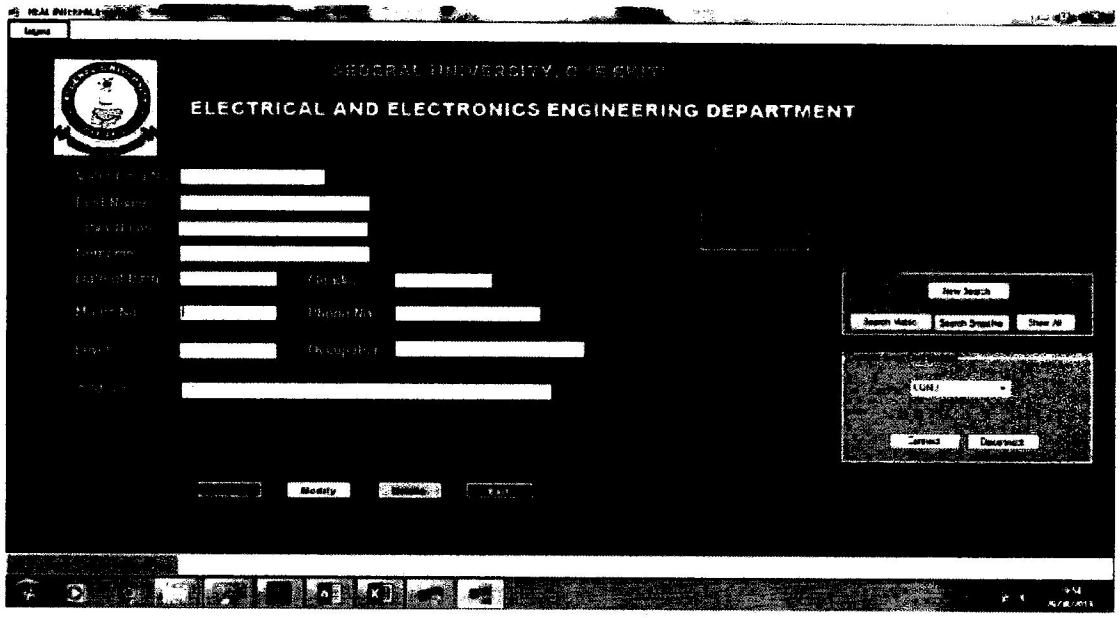


Fig 3.6.3.1 computer interactive display (CID)

3.6.3.2 16x2 LCD

The 16x2 LCD displays information about the voting procedure, action and other imperative process to the voter in an electronic voting process. The LCD displays information like the party of choice, status of result, and voter identity number.

Fig 3.6.3.2 diagram of 16x2 LCD

3.6.4 COMPUTER POWER SOURCE (CPS)

A power source is a device which delivers an exact voltage to another device as per what the device its supplying needs. A power source coming from the computer universal serial bus(USB) has been used to provide electric supply to this project (electronic voting device).

3.6.5 KEYPAD

For the design of this system, I have used a 1x3 matrix keypad (See Figure 3.9 below). The function of the keypad is to help the voter select the party of his choice on the voting cubicle. The matrix keypad consists of a set of push buttons or switches which are arranged in a matrix format of rows and columns. The matrix keypad is connected to the microcontroller which detects the key buttons pressed from the keypad.

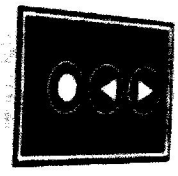


Fig 3.6.5 picture of 1x3 matrix keypad

3.6.6 BUZZER

The Buzzer is use for audible sound indicators when the card reader has finished reading/scanning a card placed in its field and also when the EVD is first put into use.

Fig 3.6.6 view of buzzer

3.6.7 CRYSTAL OSCILLATOR

An 8MHz crystal oscillator is used to providing the free running clock that is needed for microcontroller operation in this project.

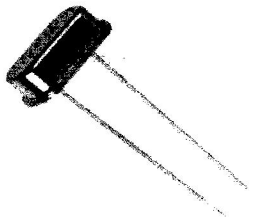


Fig 3.6.7 crystal oscillator

3.6.8 TRANSISTOR

A BJT (Bipolar Junction Transistor, BC547, NPN) is used as a switch to control the power source supplied to the buzzer and other passive element.

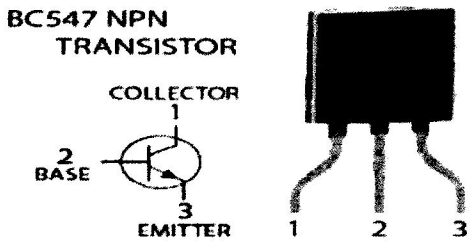


Fig 3.6.8 BC547 NPN transistor

3.6.9 RESISTOR

Various resistor with variety of resistance values were used in this project such as 100kilo-ohm, 50kilo-ohm. Resistor was used in this project to limit the flow of current to the passive element in series or parallel in the circuit.

Fig 3.6.9 Resistor

3.6.10 CAPACITOR

Capacitor were used in this project to the filter noise and other distortion from the microcontroller. Capacitor also helps to store charges in this project.

Fig 3.6.10 capacitor

3.6.11 JUMPER WIRES

Jumper wires were used to connect various modules in this project. It helps to ensure continuity of the circuit in a fashioned manner.

Fig 3.6.11 jumper wires

3.7 SOFTWARE DESIGN

Structured Query Language server and Management are the two major component that make up the software design of this project. The SQL server is an application software that is run in background mode to facilitate the smooth running of the SQL database management system of this project. The SQL server can be both internal or external as the case may be. In this project, I adopted the internally run SQL server. The internally run SQL server serves the SQL database management within or from a single computer. It is normally used for single purpose management.

The SQL database management helps to keep the login records of various voter into this electronic voting device. The SQL database management stores entry in form of rows and columns in the table of the database.

3.7.1 SOFTWARE CODE

The software codes for this project entails the structured query language code for the database, visual basic code for the EVD application, and the FPGA code for the micro-controller. All software codes that is responsible for the smooth running of this project work has been included in the appendices section of this project due to the length of codes and also for better understanding of the program codes.

CHAPTER FOUR

TESTING, ANALYSIS OF RESULTS AND DISCUSSIONS

4.1 DESIGN AND VALIDATION

It has now become possible to program micro-controllers; gone are the days when circuits are built around chips, now we can build chips around circuits.

PIC16F883, enhanced flash-based 8-bit micro-controller will be used for this project. In order for the micro-controller to be able to perform its function in this project, a series of program codes will be written for its functionality. This code will allow the PIC16F883 to do the required job. The code of program could be written in High Level Language (HLLs) or Assembler language (Low Level Language). HLLs compilers for PIC microcontroller include: MikroC, PicBasic, PICC18 etc. The assembly language for PIC microcontroller is MPLAB from MICROCHIP. HLLs will be adopted in the development of this project over assembly language based on below advantages and disadvantage of both languages.

ADVANTAGES OF HLLS

- The code written in HLL can be reusable
- Code portability
- The code is easy to write
- Less code to perform specific function
- They allow High programmer efficiency
- They have complex math capability
- Ease of code debugging
- It is quickly understood by human.

DISADVANTAGES OF HLLS

The programs written in HLLs are slow when compared with program written in Low level language

- The HLLs available for PIC microcontrollers are strictly not free
- The programmer does not have absolute control over the Chip

ADVANTAGES OF ASSEMBLY LANGUAGE

- Less memory is required for storage, hence the program run faster and are compact.
- It gives the programmer absolute control over the PIC microcontroller
- The MPLAB for writing assembly program code for PIC16f883 is free to download, and the code length is not restricted.

DISADVANTAGES OF ASSEMBLY LANGUAGE

- A strict understanding of assembly language and of PIC12F1840's featured required
- The code written in assembly language is not portable. It is not re-useable in another different assembly language or HLL
- Many code are written to perform a specific function.
- Cannot perform complex math function.

CONCLUSION

High level language has greater significance over low level language in terms of High programmer efficiency, complex math capability, ease of error debugging. Due to the aforementioned advantages of high level language over low level language, high level language has been chosen as the language that will be used in programming the micro-controller of this project. **The compiler that will be used for the project is MikroProg.**

4.2 SYSTEM IMPLEMENTATION

The construction of this project was done in four different stages: Firstly, the implementation of the components in the system design onto a solderless experiment board (breadboard). Next is the transfer of components from the solderless experiment board to the development board, and then soldering the components permanently on the development board. Thirdly, the development board was connected to the MikroProg programmer which helps to feed in the program code and also power the circuit. Finally, the entire project was coupled together into a casing. The Bill of Engineering Measurement and Evaluation (BEME) which highlights all the components used for the system implementation are listed in the Appendix section of this report.

4.2.1 COMPONENTS IMPLEMENTATION ON SOLDERLESS EXPERIMENT BOARD (BREADBOARD)

Firstly, the microcontroller (after it has been programmed using the MikroProg), the buzzer, the RFID reader, and the keypad were all setup on a breadboard and interconnected with each other. Interconnections were done using jumper wires and a Multimeter was used to test every component to verify whether or not they are in good conditions and also for continuity. The digital multimeter was also used to measure the voltage and current that gets to every component present in the connection.

4.2.2 COMPONENTS IMPLEMENTATION ON DEVELOPMENT BOARD

After a successful components layout and testing on the breadboard, the components were then transferred to the development board, and were permanently soldered to the development board as seen in Figure 4.2.2.1 below. The micro-controller was placed on an IC holder before soldering it to the development board. Connection ports (12V and GND) are used to connect the development board to the power source.

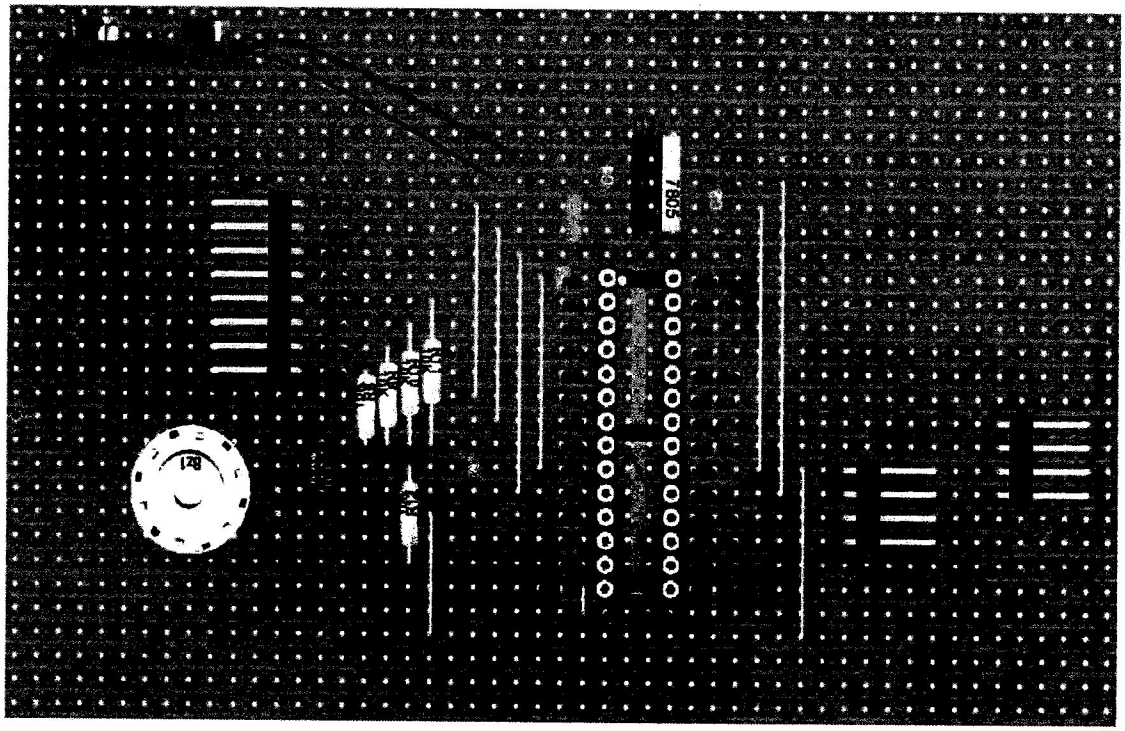


Fig 4.2.2.1 implementation of component on Veroboard

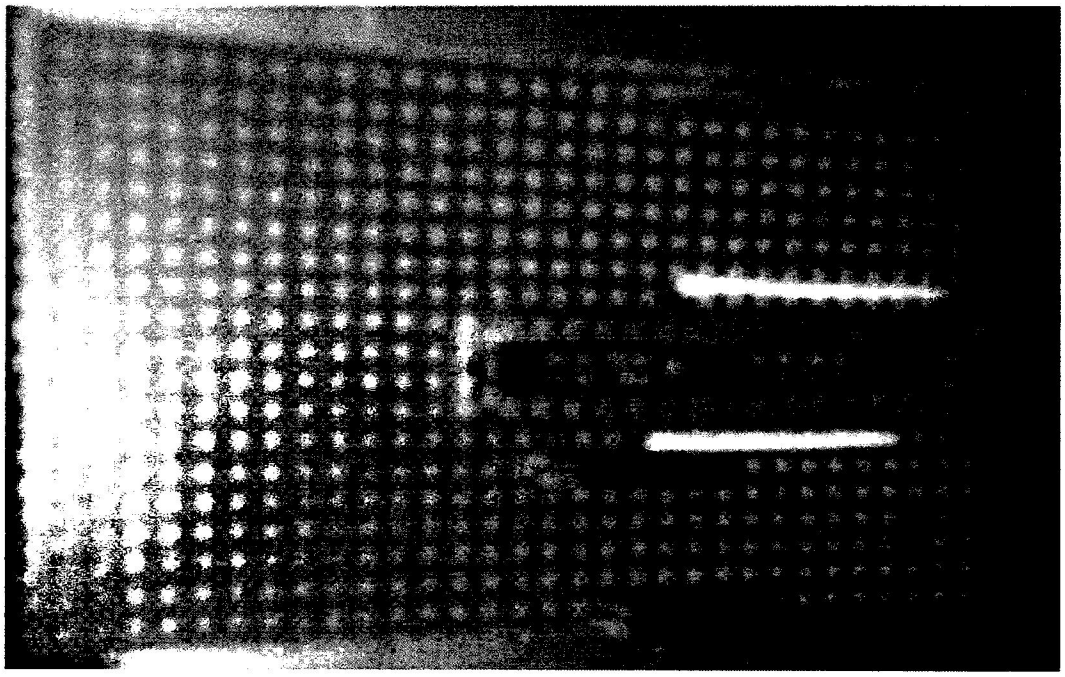


Fig 4.2.2.2 implementation of component on veroboard

4.2.3 INTERCONNECTION OF COMPONENTS

After a successful layout of components on the development board, there is need to interconnect every other component that makes up the entire circuit. The interconnection phase is shown below in Fig 4.2.3

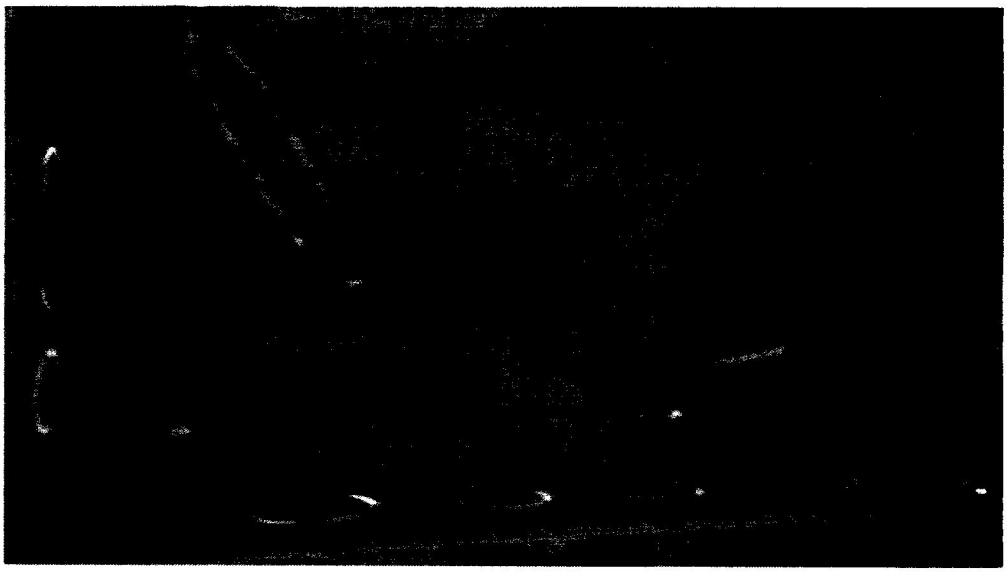


Fig 4.2.3.1 interconnection phase

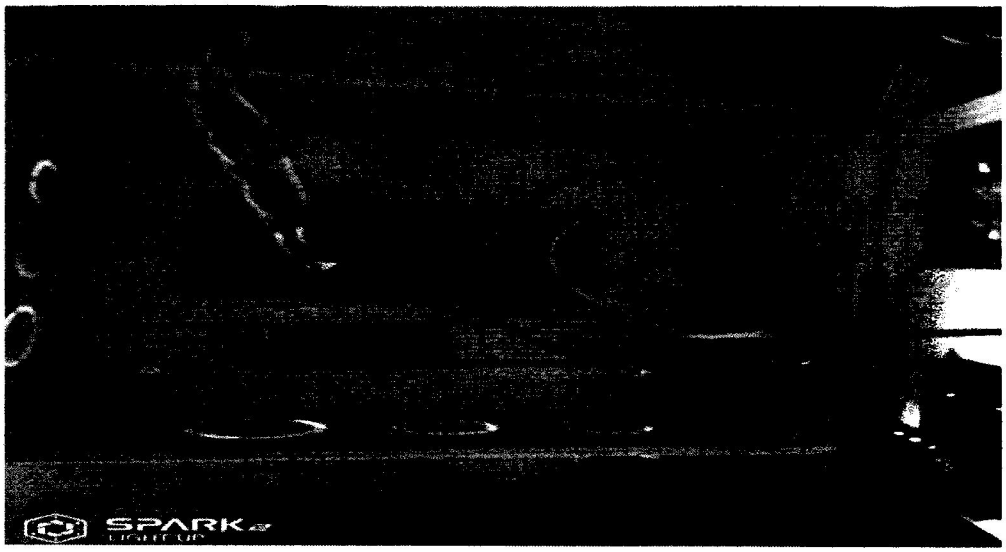


Fig 4.2.3.2 interconnection section

4.2.4 COUPLING OF PROTOTYPE COMPONENTS

After a successful components interconnection, the whole connection is tested to check whether or not it is in good working condition. If the connections perform the desired operation, then there is need to couple the components together into a casing. For this project, the casing used is a plastic box, and the components are well laid and screwed to the box. The RFID reader module was placed just beneath the box cover in order to have a good coverage area whenever a user tries to use the electronic voting device. The LCD module was well house inside the plastic box. Also, the buzzer and development board that houses the micro-controller was well glued to the box.

4.3 SYSTEM EVALUATION

In order to ensure that all the necessary specifications and requirements are met, the performance of the system has been evaluated according to real life situations. Both the simulation program and the hardware have been tested in real scenarios by many users. The two major metrics that have been used are Hardware testing and functional requirements.

4.3.1 HARDWARE TESTING

It is of paramount importance to establish a highly efficient testing technique in other to minimize cost. The testing instrument used for examining logical signal, testing and troubleshooting application in the course of this project is the digital multimeter. Among the hardware that was tested during the course of this project includes the power source, the RFID module, LCD board.

4.3.1.1 TESTING THE POWER SOURCE

It is important that the power source must be tested since it provides power to the entire system. Any damage that results from the power source may damage the entire system. The result of testing the power source shows us that, the voltage of the power source must be 5V, as any voltage that is less than or greater than 5V will not make the system work or will damage the system respectively. Also, the AC current to be used to power the power source must be within the range of 110-240V; any voltage greater than 240V will damage the power source itself.

4.3.1.2 TESTING THE RADIO FREQUENCY IDENTIFICATION MODULE

It is of paramount important to test the compatibility of the radio frequency reader module with other component that makes up the circuit. The radio frequency identification module requires 5V DC power supply and a current of 500mA to work efficiently. The required wattage needed is given by this formula below:

$P = VICos\theta$

Where P is the useful power, V is the voltage drop across the module, and I is the current that flows through the module, $Cos\theta$ is the power factor.

Power factor is approximately unity for the sake of this report = 1

P = 5 * 0.5= 2.5 watts. Therefore, the required power by the module is 2.5 watts

4.3.2 FUNCTIONAL REQUIREMENTS

The system has been evaluated by different users (using two registered tags and one unregistered tags) to determine the functional requirement of the system based on its response to registered and unregistered tags, whether or not it saves tag information after reading the tag, whether or not it grants access to registered tags, whether or not it reads more than one tag information at a time, data management, and theft tolerance.

Table 4.3.2 Performance evaluation of the electronic voting device

Functional requirements	Yes	No
Read registered card	Yes	
Read unregistered card	Yes	
Grant access to registered card	Yes	
Grant access to unregistered card		No
Save card information	Yes	
Check for Ownership of card	Yes	
Read more than one card at a time		No
Verify multiple card for accreditation	Yes	
Theft tolerance		No

4.4 SOFTWARE DESIGNS INTERFACE AND RESULTS

The role of software implementation in this project is very germane and crucial. To implement this project, a software application has been developed to work with the hardware components. This application has been written with visual basic language for its effectiveness and ease of prior understanding, and furthermore, this software application displays information about the voter and also displays every activity that is been carried out in the voting process. This software application helps to add new voter into the database of the electronic voting device, it helps to modify existing voter information in case of any error occurrence, it accepts deletion of voter information from the database of the system

when the field is not needed, and it output the voting result to the presiding officer in charge of the voting process.

4.4.1 EVD LOGIN INTERFACE

This interface helps the presiding officer to access the EVD application. The page had two box. The first box is for username and the second is meant for password. A screenshot is displayed below.

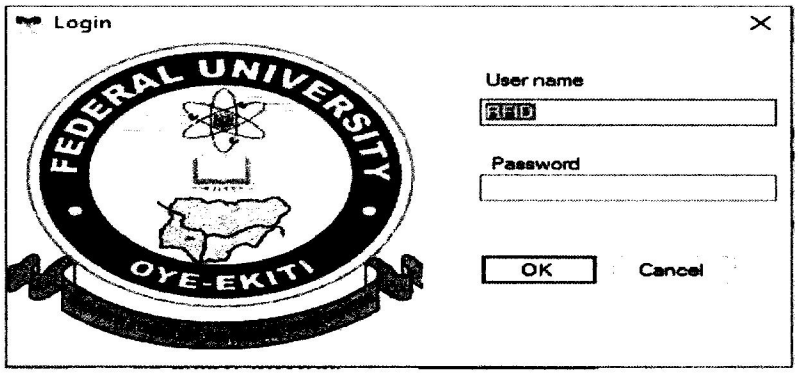


Fig 4.4.1 EVD Login Interface

4.4.2 EVD SEARCHING ENGINE INTERFACE

This page lets the user or the presiding officer to search for the record of the voter in the database. A prompt response is displayed to the user or the presiding officer if the voter's record is available for use or not. The picture of this interface is shown below.

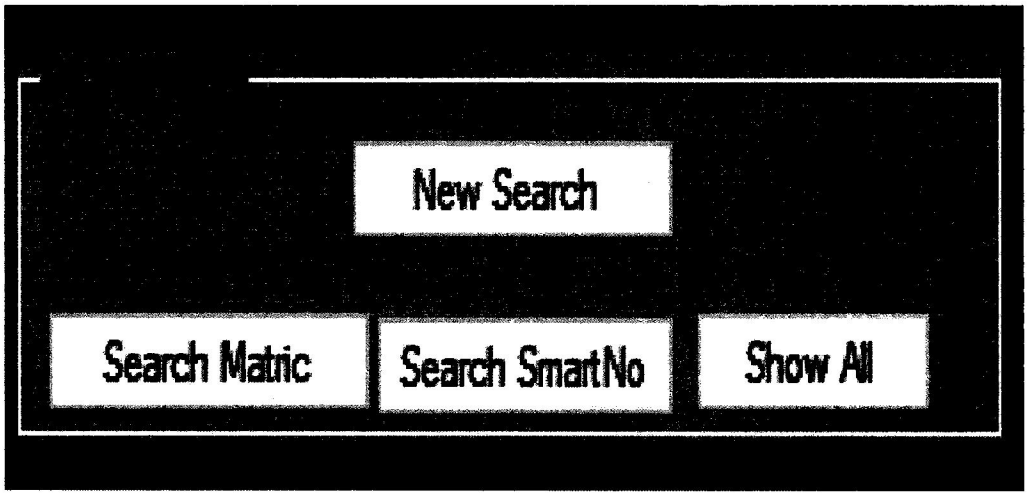


Fig 4.4.2 EVD Searching Engine Interface

4.4.3 EVD INTERFACE WHEN ADDING NEW VOTER

This software helps to add new voter to the database of the micro-controller with a link from the SQL database management system. Pictorial display of this page is shown below.

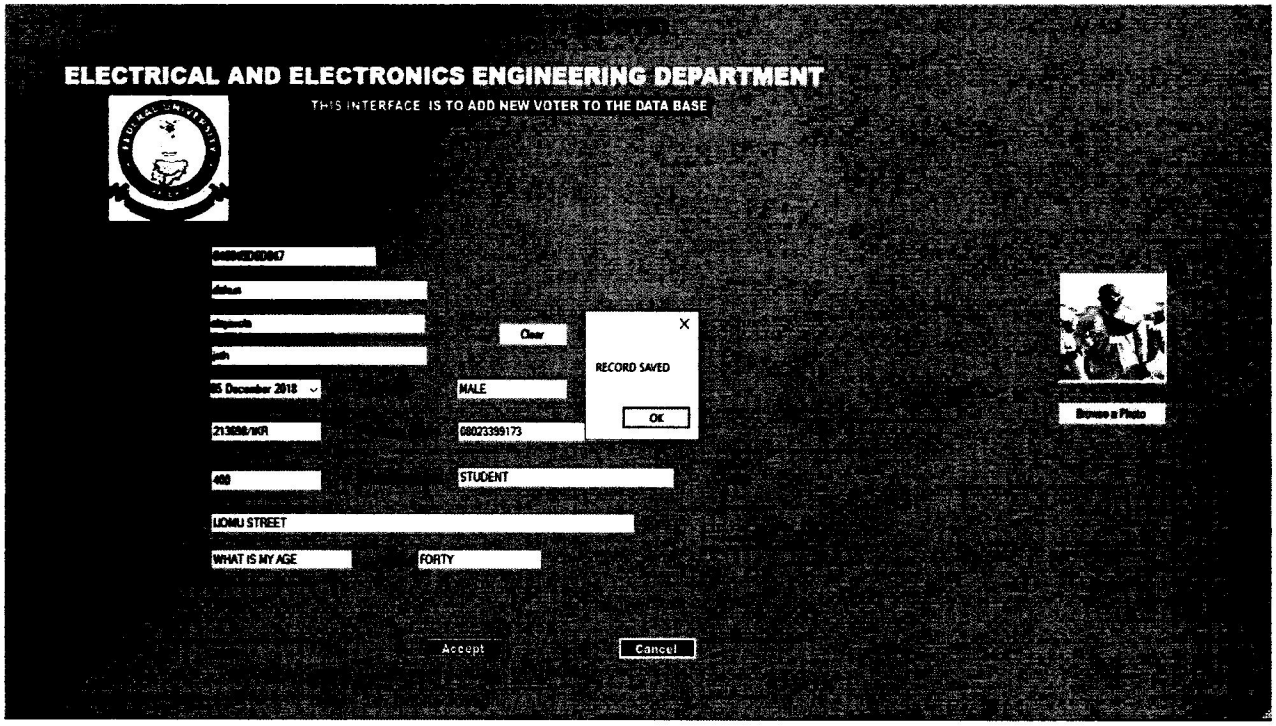


Fig 4.4.3 New Voter interface

4.4.4 EVD VERIFICATION INTERFACE

This interface helps the presiding officer to verify the voter if his/her stored information matches with his/her identity for voting accreditation process. This interface has the capability of verifying many registered voter's card simultaneously without any delay. The interface is shown below.

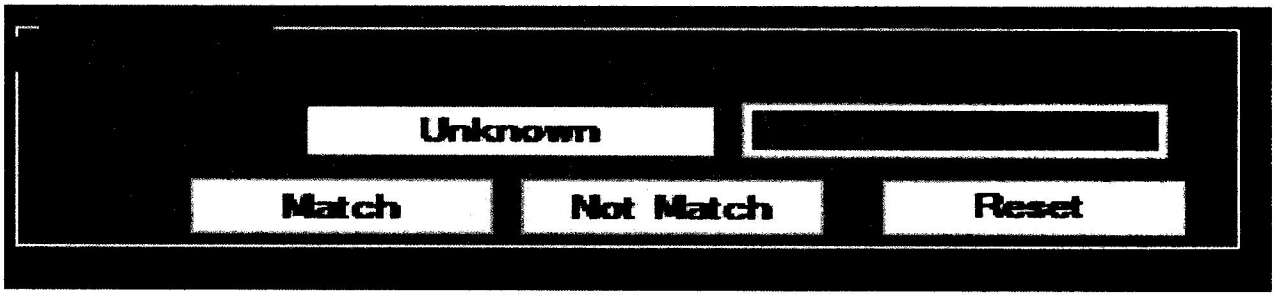


Fig 4.4.4 Verification interface

4.4.5 EVD VOTING INTERFACE

This interface displays results of the voting regression according to the names of party displayed on the RFID page. This interface helps the electoral presiding officer to know if a voter has actually casted his or her properly. It also displays if a voter is attempting to vote more once. The voting page is shown below.

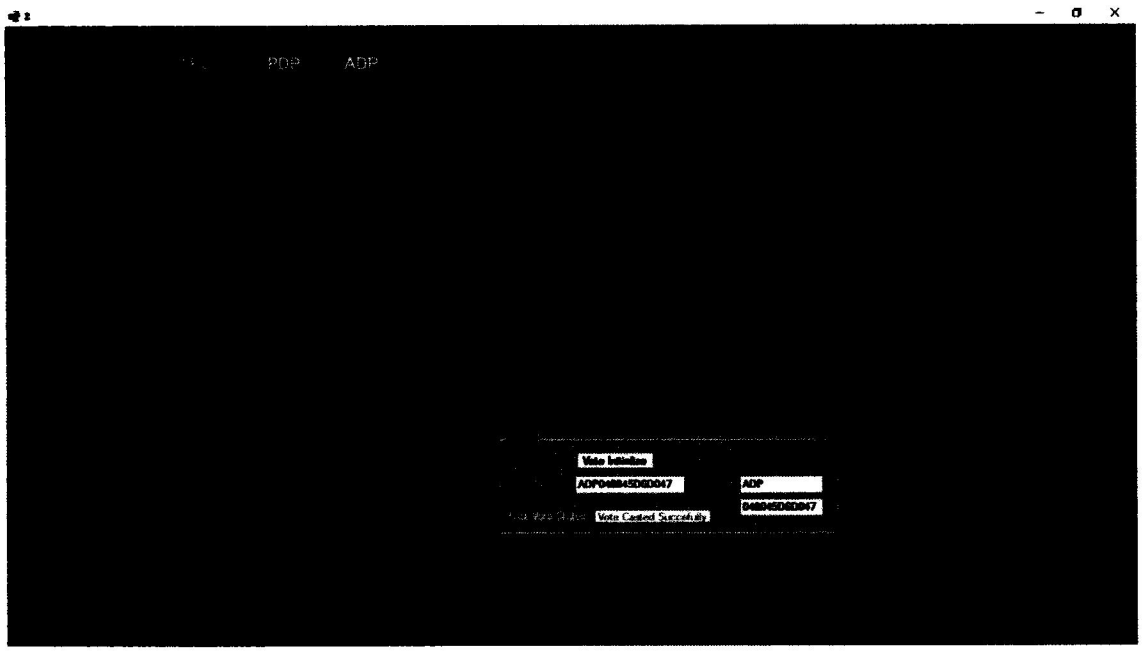


Fig 4.4.5.1 Voting page on the computer

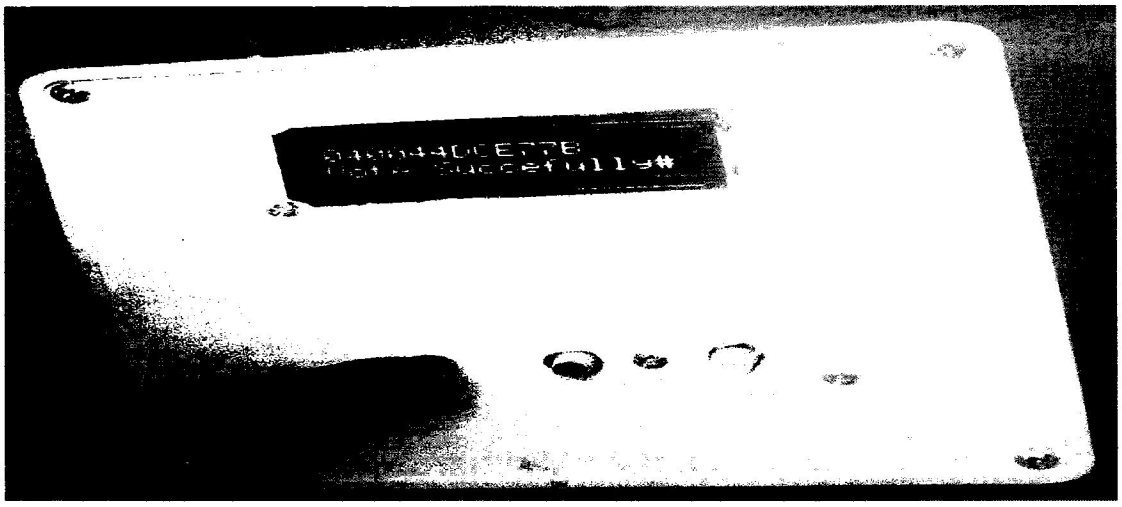


Fig 4.4.5.2 voting interface on voting box

Fig 4.4.5.3 verification interface on the voting box

Fig 4.4.5.4 voting page displaying attempt to vote twice

4.5 AUXILIARY SOFTWARE AND THEIR INTERFACE FOR THIS PROJECT

The supporting software for the smooth running and proper execution of this project includes:

- Microsoft SQL server management studio
- SQL server configuration manager
- USART Communication Port Manager

Microsoft SQL server management studio is the application software that helps in storing cogent information such as the voter's eligibility information, login details, expected outcome of polls and many more. A screenshot of this interface is given below.

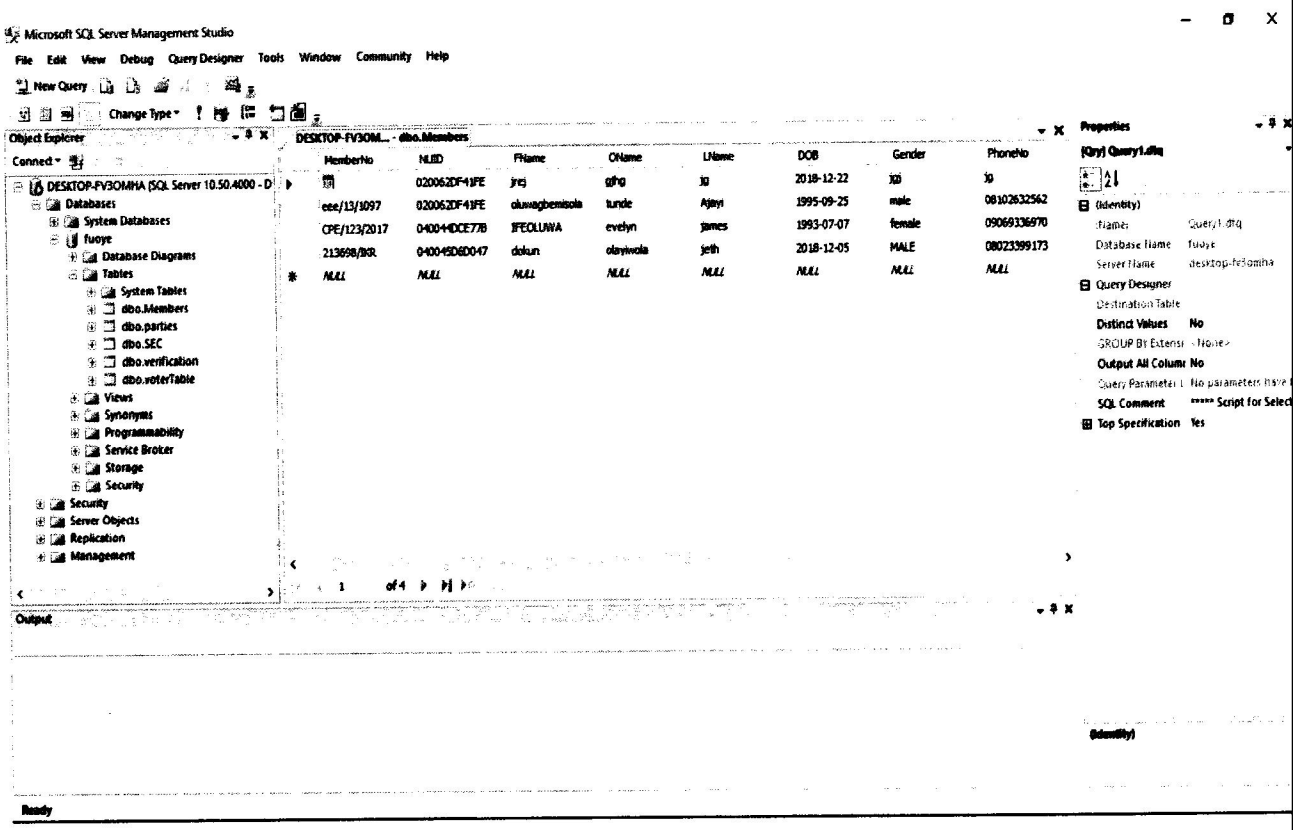


Fig 4.5.1 Microsoft SQL server management studio interface

SQL server configuration manager is the server that facilitate the proper running of the SQL server management studio. The configuration manager has to be running before initializing the server studio to work. A screenshot of this interface is provided with clarity below.

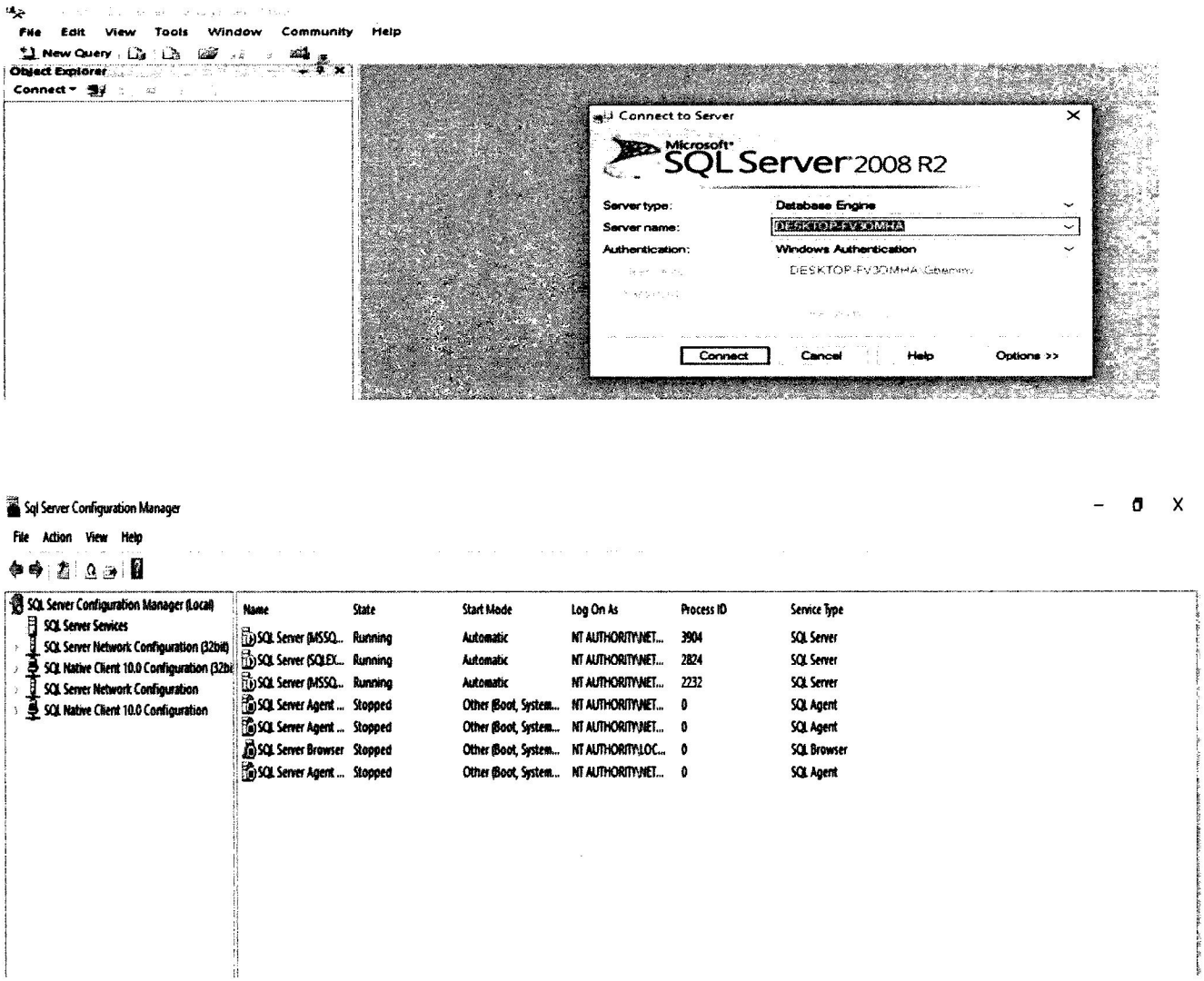


Fig 4.5.2 SQL server configuration manager interface

USART communication port manager helps the electronic voting device hardware i.e the voting box or cubicle, to be connected via USB cable with the EVD application.

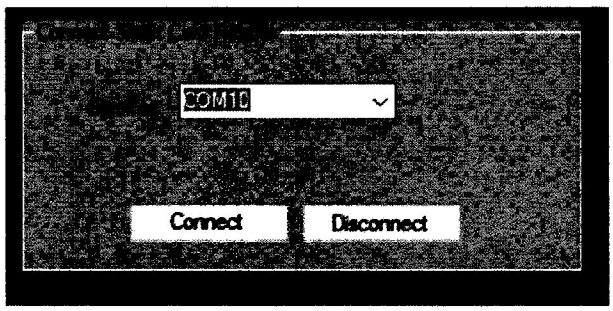


Fig 4.5.3 USART communication port manager page

4.6 PROJECT MANAGEMENT

Project management of this project entails the practice of initiation, planning, execution, controlling, testing, and also collaborative efforts of individuals towards the achievement of this project. This project was planned to start by January 2018, but due to change of supervisor and some other latent factors, it started lately by September 2018. This project was fully executed under the supervision of experience personnel and also through consultation with other relevant web pages. Testing and control of this project was carried out at various intervals in order to discover any intricacies that may occur.

4.6.1 PROJECT SCHEDULE

The breakdown of this project work started with conceptualization and imaginative thinking. The work schedule of this project is shown below.

Table 4.6.1 showing Project schedule

PERIOD	DESCRIPTION OF WORKDONE	COMMENTS
AUGUST 2018	Discussion of project topic with supervisor	Enlightenment on the project topic
SEPTEMBER 10 - SEPTEMBER 25, 2018	Initialization of project work	This aspect entails the simulation, review of related works, ordering of project components.
OCTOBER 5 - OCTOBER 7, 2018	Development phase of the project work	This aspect covers the assembly of various individual component on the boards and also the soldering of the passive elements.
OCTOBER 10-OCTOBER 11, 2018	Programming of micro-controller	This aspect covers the dumping of field programmable gate array code into the PIC16f883 with the use of MikroProg programmer.
OCTOBER 15- OCTOBER 18, 2018	Development of the EVD application	This section covers the writing of visual basic codes for the EVD application and also the

		debugging of errors within the program codes.
OCTOBER 20, 2018	Interaction of the EVD application with the hardware	Testing of the EVD application with the hardware component was covered under this section
OCTOBER 30, 2018	Packaging and casing of the project work	This section covers the entire packaging and casing of the project work.

4.7 RISK INVOLVED DURING THE PROCESS OF THIS PROJECT

The risk involve during the process of this project are highlighted below:

- Error debugging challenges
- Inhaling of soldering iron smoke
- Fear of electrical shock that may arise when holding electronic cables and other electronic devices.

4.8 PACKAGING

After proper testing was conducted, the packaging of the design into a model and casing was considered. The connecting wires were properly connected and well insulated, also the wires were well packed and bounded together.

4.9 TOOLS USED DURING THE IMPLEMENTATION OF THIS PROJECT

Boring tool: Used for creating holes into the casing of the electronic voting device.

Soldering iron: used for soldering components to the veroboard.

Screw driver: used for driving screws into the electronic voting device casing and also for tightening the cubicle firmly.

Lead: used to bind metallic junctions together in order ensure electrical continuity within the circuit.

Cutting pliers: used for cutting wires and the pins of on-board soldered components.

Searchlight: It was used to locate missing screws and other passive elements.

Multimeter: Used for voltage, current, resistance and continuity readings.

Glue: used for holding passive element like buzzer, RDM module firmly to the casing.

Spanner: used for tightening of bolts and nuts in the required areas of the project coupling.

Twisters: used for twisting wires together in order to form a strand which can be easily packed.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

In this project, a prototype of electronic voting device that is safe for use, accurate, user-friendly, independent, easy to manage, and efficient was designed and implemented using radio frequency identification technology. The system is implemented to help individuals, group of people, institution, community, organization perform their franchise in an orderly manner. A radio frequency identification module is placed inside a voting box or a cubicle, and it reads the information stored inside a RFID tag or card. This RFID card enables the voter to gain access to the electronic voting device when the voter swipes his or her card over the RFID reader. The information of the voter is displayed to the presiding electoral officer through the EVD application, which can be access on the personal computer or desktop computer. This EVD application enables the presiding officer to check the identity of the voter, register new voter to the database, modify existing voter information as a result of previous errors made, delete existing voter information from the database, and display voting result to the presiding officer and the general public that is available at the polling booth. Likewise, voting status is also displayed through the mini screen on the voting box. EVD application is also accompanied with other auxiliary software application that enables its proper and efficient running.

5.1 RECOMMENDATIONS

The areas listed below should be critically and meticulously look into by both government and supervisory bodies.

- Government through related bodies should help fund or finance student's project to improve the quality and possibly standardize the project for the market use and industrial use.
- Higher institution of learning should teach student in practical course that are relevant to their disciplines.
- Student should be familiarized with electronic component in order to stay updated in the world of electronics and power electronics.
- High level Programming language should be taught in schools right from the basic or elementary levels in order to transmit this knowledge into students in a fashionable manner.

5.2 CONTRIBUTION TO KNOWLEDGE

The system is user friendly and can easily be employed by those who have little knowledge about computers and electronics, thus, it can be implemented in either an academic institution or in organizations. This system also contributes a great impact on our voting tradition, because it helps the electoral body to devise a way to minimize the use of paper based voting process. This system also contributes the knowledge of radio frequency technology to the student, individuals, general public who are seeking knowledge, and also to those that doesn't have the prior knowledge about the working principle of near field communications and far field communications.

5.3 LIMITATIONS OF THE PROJECT

The limitations of this project work is highlighted below:

- The RFID card reader and RFID card used has a low range frequency of 125kHz, therefore it cannot read other cards with wider range of frequency.
- The electronic voting device has to be powered solely by a personal computer or a desktop computer for its use, therefore redundancy policy for power is limited when the computer is dead or the battery is flat.
- The electronic voting device cannot be used without its corresponding Electronic Voting Device (EVD) application. Therefore, there is need to install all the necessary applications software before the electronic voting device can be fully put into use, which actually take a lot of time and it also requires the knowledge of computer to install all the necessary applications software.
- The USB cable that is used for the project is not long, and it cannot serve a longer distance voting area. i.e the distance from voting box to the corresponding computer.

5.4 FUTURE IMPROVEMENTS

The future improvements on this project are very great when properly channelled.

- This project can have a link with the internet in order to publicize the voting outcome immediately the voting process is concluded so that the transparency of the voting process will be known within a shorter time.
- This project can be linked with a GSM module that will dispatch voting outcome or results to individual mobile phones in form of SMS message.
- This project can also be used as an examination permits in schools.
- This project can be modified to work as an automatic attendance register for students and other industrial use.

5.5 CRITICAL APPRAISAL

This project has been critically carried out in a careful and systematic way. Some major challenges that arise during the course of using this system has been solved and addressed using an updated approach. During the full implementation of this system, a major challenge of how to save and print voting result that is stored inside the database of the server studio for public evidence arise. Fortunately, this challenge has been addressed by copying voting results rows and columns into Microsoft word for printing. Also, during the full implementation of this project, another challenge came up when trying to delete an existing voter's record from the EVD application. This ordeal has been solved by debugging possible errors that lies within the program codes of the application software.

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APPENDICES

APPENDIX A: Bill of Engineering Measurement and Evaluation (BEME)

For the complete development of the electronic voting device using Radio Frequency Identification, the items used are highlighted in the Table A below:

S/N	DESCRIPTION OF ITEM	QTY	RATE(IN NAIRA)	AMOUNT (IN NAIRA)
1	RFID READER	1	6000	6000
2	RFID CARD	3	1000	3000
3	JUMPER WIRES	20	10	200
4	2X16 LCD	1	5000	5000
5	KEYPAD	3	150	450
6	MICRO-CONTROLLER	1	1000	1000
7	BUZZER	1	300	300
8	VEROBOARD	2	150	150
9	CASING	1	300	300
TOTAL				16400

APPENDIX B: Program codes

```
USE [master]

GO


/****** Object:  Database [fuoye]    Script Date: 10/13/2018 14:16:57 ******/

CREATE DATABASE [fuoye] ON  PRIMARY

( NAME = N'fuoye1', FILENAME = N'c:\Program Files\Microsoft SQL Server\MSSQL10_50.MSSQLSERVER\MSSQL\DATA\fuoye.mdf' , SIZE = 4096KB , MAXSIZE = UNLIMITED, FILEGROWTH = 1024KB )

 LOG ON

( NAME = N'fuoye_log', FILENAME = N'c:\Program Files\Microsoft SQL Server\MSSQL10_50.MSSQLSERVER\MSSQL\DATA\fuoye_log.ldf' , SIZE = 2048KB , MAXSIZE = 2048GB , FILEGROWTH = 10%)

GO


ALTER DATABASE [fuoye] SET COMPATIBILITY_LEVEL = 100

GO


IF (1 = FULLTEXTSERVICEPROPERTY('IsFullTextInstalled'))

begin

EXEC [fuoye].[dbo].[sp_fulltext_database] @action = 'enable'

end

GO


ALTER DATABASE [fuoye] SET ANSI_NULL_DEFAULT OFF

GO
```

```
ALTER DATABASE [fuoye] SET ANSI_NULLS OFF
GO

ALTER DATABASE [fuoye] SET ANSI_PADDING OFF
GO

ALTER DATABASE [fuoye] SET ANSI_WARNINGS OFF
GO

ALTER DATABASE [fuoye] SET ARITHABORT OFF
GO

ALTER DATABASE [fuoye] SET AUTO_CLOSE OFF
GO

ALTER DATABASE [fuoye] SET AUTO_CREATE_STATISTICS ON
GO

ALTER DATABASE [fuoye] SET AUTO_SHRINK OFF
GO

ALTER DATABASE [fuoye] SET AUTO_UPDATE_STATISTICS ON
GO
```

```
ALTER DATABASE [fuoye] SET CURSOR_CLOSE_ON_COMMIT OFF
GO

ALTER DATABASE [fuoye] SET CURSOR_DEFAULT  GLOBAL
GO

ALTER DATABASE [fuoye] SET CONCAT_NULL_YIELDS_NULL OFF
GO

ALTER DATABASE [fuoye] SET NUMERIC_ROUNDABORT OFF
GO

ALTER DATABASE [fuoye] SET QUOTED_IDENTIFIER OFF
GO

ALTER DATABASE [fuoye] SET RECURSIVE_TRIGGERS OFF
GO

ALTER DATABASE [fuoye] SET  DISABLE_BROKER
GO

ALTER DATABASE [fuoye] SET AUTO_UPDATE_STATISTICS_ASYNC OFF
GO

ALTER DATABASE [fuoye] SET DATE_CORRELATION_OPTIMIZATION OFF
```

```
GO

ALTER DATABASE [fuoye] SET TRUSTWORTHY OFF
GO

ALTER DATABASE [fuoye] SET ALLOW_SNAPSHOT_ISOLATION OFF
GO

ALTER DATABASE [fuoye] SET PARAMETERIZATION SIMPLE
GO

ALTER DATABASE [fuoye] SET READ_COMMITTED_SNAPSHOT OFF
GO

ALTER DATABASE [fuoye] SET HONOR_BROKER_PRIORITY OFF
GO

ALTER DATABASE [fuoye] SET  READ_WRITE
GO

ALTER DATABASE [fuoye] SET RECOVERY SIMPLE
GO

ALTER DATABASE [fuoye] SET  MULTI_USER
GO
```

```
ALTER DATABASE [fuoye] SET PAGE_VERIFY CHECKSUM
GO

ALTER DATABASE [fuoye] SET DB_CHAINING OFF
GO
```

VISUAL BASIC CODES

```
If platform = "APC" Then
                    If insert(platform, id) Then
                      ' btnAPC.PerformClick()
                      apcvote()
                      lblStatus.Text = ("Vote Casted Succefully")
                      writeData("*Vote Succefully#")
                    Else
                      lblStatus.Text = ("Vote not casted")
                      writeData("*Vote not casted#")
                    End If
                  ElseIf platform = "PDP" Then
                    If insert(platform, id) Then
                      ' btnPDP.PerformClick()
                      pdpvote()
                      lblStatus.Text = ("Vote Casted Succefully")
                      writeData("*Vote Succefully#")
                    Else
                      lblStatus.Text = ("Vote not casted")
```

```
            writeData("*Vote not casted#")
        End If

    ElseIf platform = "ADP" Then
        If insert(platform, id) Then
            adpvote() '
            ' btnAPC.PerformClick()
            lblStatus.Text = ("Vote Casted Succefully")
            writeData("*Vote Succefully#")

        Else
            lblStatus.Text = ("Vote not casted")
            writeData("*Vote not casted#")
        End If
    Else

        lblStatus.Text = ("Vote not casted, Party Not Selected")
        writeData("* Select a Party # ")
    End If
Public Class AVoters
    Private m_NUID As String
    Private m_Party As String


    Public Property NUID() As String
```

```
    Get
      Return m_NUID
    End Get
    Set(ByVal value As String)
      m_NUID = value
    End Set
  End Property
  Public Property Party() As String
    Get
      Return m_Party
    End Get
    Set(ByVal value As String)
      m_Party = value
    End Set
  End Property
End Class
```