RFID SMART ELECTRONIC VOTING MACHINE(EVM)

by

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Dissertation submitted in partial fulfilment of

the requirements for the

Bachelor of Information Technology (Hons)

September 2021

Universiti Teknologi PETRONAS,

32610 Seri Iskandar,

Perak Darul Ridzuan.

CERTIFICATION OF APPROVAL

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A project dissertation submitted to the
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Approved by,

____

(Dr Emelia Akashah Bt Patah Akhir)

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PERAK DARUL RIDZUAN.

SEPTEMBER 2021

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

Triambakan Amirthalingam

Acknowledgement

First and foremost, I want to express my thankfulness to God for providing me with the chance to complete this project. I'd want to express my gratitude to Madam Emelia Akashah Bt Patah Akhir, my supervisor, for agreeing to mentor me throughout this project during my final year. I carefully selected a project that has a wide variety of real-world application. Regarding the project work, I've received a great deal of assistance. It would not have been possible without their proper supervision, suggestions, constant support, and active participation in the work process.

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Finally, and most importantly, the FYP (Final Year Project) was fruitful thanks to God's grace. FYP 2 phase has been well adapted to the study environment as a final year student, with a good grasp of study ethics and HSE practices that was conducted in an efficient manner. Hopefully, there will be many great beginnings in the future.

Abstract

The Electronic Voting Machine (EVM) is indeed a basic electronic device that replaces the ballot papers and boxes that were previously used in traditional voting systems to record votes. Democracy is founded on the fundamental right to vote, or simply voting in elections. Previously, in all elections, whether state or federal, a voter would stamp his or her preferred candidate's name and then fold the ballot paper according to a set procedure before placing this in the Ballot Box. This is a lengthy, time-consuming process that is prone to mistakes. This condition persisted until computerized voting machines fundamentally transformed the election scene. There is no longer any need for ballot paper, ballot boxes, or stamping; all of this has been consolidated into a single box known as the electronic voting machine's ballot unit. Biometric identifiers are more trustworthy for person recognition than traditional token or knowledge-based approaches since they cannot be readily misplaced, falsified, or traded. As a result, the electronic electoral process must be enhanced using modern technology such as the RFID system. This study covers a thorough examination of this voting gadget, as well as issues and comparisons between voting techniques. This report will contain further information as well as a poll to learn more about the project. The problem description and objectives are met as planned by the end of this report.

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Abbreviations and Nomenclatures

1. EVM Electronic Voting Machine
2. FYP Final Year Project
3. UTP Universiti Teknologi Petronas
4. DRE Direct Recording Electronic
5. RFID Radio Frequency Identification
6. ID Identity
7. SRC Student Representative Council
8. UX User Experience
9. LCD Liquid Crystal Display
10. LED Light Emitting Diode
11. IDE Integrated Development Environment

Chapter 1

Introduction

Overview

In the context of the study, this chapter will explain the definition of an electronic voting machine. It will also go through the current voting system solutions that have been implemented.

1.1 Background Studies

It is always difficult to introduce new Digital technologies in elections, and it necessitates thorough consideration and planning. Electronic voting (e-voting) is the most complex upgrade because it affects the heart of the election process: the casting and calculating of ballots. E-voting lowers immediate human influence and control in the process and offers a way to tackle certain long-standing election issues, but it also raises a slew of new worries. As a result, e-voting is likely to face more opposition and criticism than any other Technology adoption in elections.

Electronic voting machines have evolved into an effective voting instrument in recent years. It ensures perfect voting, and as a result, it has grown in popularity. It gives them the assurance that their vote will be protected. It prevents any form of fraud or illegitimate votes. In addition, such a system becomes more cost-effective as a result of the reduction in manpower costs. It is also convenient for the voter, as he just needs to push one key to select his choices. The total combination of mechanical, electromechanical, or electronic equipment (which include software, hardware, and required documentation to control, and associated equipment) used to define ballots, cast and count votes, report or display election results, and maintain and produce any audit trail information is referred to as voting machines. The early voting machines were mechanical, but electronic voting machines are becoming more popular.

When properly implemented, e-voting solutions can reduce the cost of elections or referendums in the long run by eliminating certain common avenues of fraud, speeding up the processing of results, increasing accessibility, and making voting more useful for residents some cases, when used over a series of electoral events, e-voting solutions can even reduce the cost of elections or referendums in the long run. Electronic voting is defined in a variety of ways, some of which are quite broad. This report focuses on systems that employ information and communication technology to record, cast, or count votes in during UTP elections and referendums.

Electronic voting machine records votes by means of a ballot display provided with mechanical components that can be activated by the voter which is in form of buttons and that records voting data in memory components. After the election it produces a tabulation of the voting data stored in a removable memory component. The voting machine is a mechanical device but more commonly designed by an electronic substance, so it is an electronic voting machine. Cyber security measures in electronic voting machines (EVMs) will make a significant contribution to the UTP election. The voting machine has RFID features that are developed for a variety of purposes, including long-term use, security, high efficiency and accuracy of votes, and so on. The DRE (Direct Recording Electronic) voting system is also included with this machine.

A voting machine is traditionally defined by the method it utilizes to cast votes, and it is further classified by the place where the votes are tabulated. The usability, security, efficiency, and accuracy of voting devices vary. Certain voting systems may be more or less accessible to all voters or may be inaccessible to voters with specific disabilities. They can also affect the ability of the public to oversee elections.

1.2 Problem Statement

As information technology develops, a better, faster, more convenient, and secure electronic voting system becomes a requirement. One of the key considerations is security, which includes authentication, confidentiality, integrity, and non-repetition. Obtaining safe e-voting is not an easy task.

1) To prevent the "invisible voter"

During the recent UTP election, there were a few cases where students used another student's Ulearn ID for the purpose of cheating. They cheat by utilizing the credentials of other students who have previously graduated from the university or who are no longer enrolled at UTP. They vote for the preferred candidate by using a different name and casting two votes (one from his/her own id and one from the "invisible" one). Not only that, but some students use the same id to vote many times. Because of the online voting mechanism, the election process is vulnerable to fraudulent votes. This instance causes challenges for UTP administration in determining who is the voter, and as a result, the vote becomes invalid, affecting the election's winner.

2) Election is time consuming

Students must vote before heading to class, as if they do not have any free time on that particular day. Students may be too preoccupied to vote because they are too preoccupied with attending class and lectures, as well as submitting homework and reports. Sometime the online voting platform will crash or unresponsive due to heavy traffic. This makes the election process even harder. In terms of e-voting, people only need to tap the MyKad and cast their vote at their respective village before going to class in the morning.

1.3 Objectives

There are various objectives for this project, including:

- To design and develop a highly secured Electronic Voting Machine using RFID features.
- To design, implement and test a smart voting system using Malaysian identity card, known as MyKad
- To create a dataset to recognize the Identity Card whether the individual is eligible to vote or not.
- To design and develop a safer, faster and more efficient for election process.

1.4 Scope of study

The target market for this project is university campuses. The following are some of the project's limitations:

- This system solely involves students, the SRC, and the UTP administration.
- The scope of the project is limited as the RFID voting system only focuses within the UTP campus as for now. This is due to available data and information on the previous election and previous experiences of the author during the elections in UTP.
- Elections are usually held once a year.

1.5 Significance of study

The findings of this project are to use an existing hardware called an Electronic Voting Machine and enhance it with RFID features so that students can vote for their favourite party using their Identity card (MyKad) and cross-reference it with the campus's existing database to see if they are eligible to vote during the voting period. The machine will only enable people to vote if they are qualified to vote, and it will also track all of the data using an app called Blynk, which will allow UTP management to see live votes from students.

With this technology at our disposal, we can improve our campus' voting system while also assisting UTP administration by making the voting process easier. Multiple particular systems for distinct purposes can be designed and installed around the campus with more adjustments to the system.

Chapter 2

Literature Review and Theory

Overview

This chapter will discuss about Electronic Voting Machine and current problems that happens during the voting process. It will also discuss about people's opinion about Smart Voting Machines and modern solutions that have been invented to reduce amount of failures in the voting machine during the voting process.

2.1 Electronic Voting Machine with deep learning

The definition of Smart Electronic Voting System is explored in this chapter. Electronic voting (often referred to as e-voting) is a type of voting that makes use of electronic devices to help or take care of the casting and counting of votes.[1] A good e-voting system should be able to do most of these things while complying to a set of regulatory standards, and it should also be able to meet restrictive security, accuracy, integrity, speed, privacy, auditability, accessibility, cost-effectiveness, scalability, and ecological sustainability requirements.[2] Punched cards, optical scan voting devices, and customised voting kiosks are all examples of electronic voting technologies (including self-contained direct-recording electronic voting systems, or DRE). It could also include the transmission of ballots and votes over the phone, private computer networks, or the Internet.

In general, there are two forms of electronic voting. First is e-voting that is physically monitored by members of governmental or non-governmental electoral authority (e.g., electronic voting machines located at polling stations). Next is virtual e-voting via the Internet (also known as e-voting), in which a voter casts his / her vote electronically and from any location. Electronic voting technology aims to speed up ballot counting, minimise the expense of hiring employees to manually tally ballots, and greater access for disabled voters. Expenses are also predicted to reduce in the long run. [3] Outcomes can be recorded and publicised in a shorter amount of time. [4] Having able to vote regardless of where they are saves voters time and money. This could result in a higher overall voter participation. Electronic elections serve residents who live overseas, citizens who live in rural areas far from polling places, and the handicapped with mobility limitations the most.

2.2 What do people think about it?

Is the public prepared for such a voting system? According to a countrywide poll conducted in 2003, 72 percent of the Swiss public favoured electronic voting [5]. As earlier as 2001, while we hired the University to perform a survey, 68 percent of the public in Geneva supported it. The tests done during official votes have resulted in a stronger demand: around 90% of voters who used the technology during the ballots organised thus far want eVoting to be made universal. Over 80% of those polled want the approach to be employed in elections. For the time being, it has only been used in referendums. [5] Only around a quarter to a third of e-Voters believe the system has any downsides. They highlight the speed with which ballots are counted, a rise in voter turnout, and the possibility of lowering the cost of ballots as major benefits. The primary apparent disadvantages of e Voting are the potential for socioeconomic inequity and the lack of security compared to traditional types of ballots. These assumptions are incorrect in this case since e-Voting will not replace existing voting methods. [5]

Geneva, Switzerland, rolled the cyber-dice and took a chance. They put a new E-Democracy project to the test. The project's focus is digital voting. 16,000 university graduates registered to vote remotely for this experiment. Only constitutional amendments were on the ballot, including a referendum about abortion legislation [5]. Some of the benefits of "e-voting" are obvious. The system is simple to maintain and operate after it has been set up. Referendums and more regular voting on local concerns could be performed easily. Counting votes is a lot easier. It would be simpler to have more frequent referendums and administer proportional representation vote counts [6]. "Vote early and vote often" had been a popular campaign slogan in Northern Ireland, and it is evident that votes could not be bought in tiny ward and council elections, when a few votes can change the outcome. Protecting the details of the cumulative vote until the polls shut is likely to be a critical security challenge. Political parties, particularly in marginal constituencies, would love to know the state of play on election day. [6]

The downsides stem mostly from the prospect that this mode of voting could eventually replace traditional voting systems because it is less expensive and easier to manage. This may disenfranchise elderly segments of the population, but for whom political gain? It could be a precursor to compulsory voting, similar to what Australia has. Politicians of all stripes are becoming increasingly concerned about a rising lack of interest in local and national politics, as evidenced by voter turnout. Compulsory voting could be made easier to implement through "e-voting." [6]

2.2.1 Accuracy

Calculating and comparing voter mistake rates is one technique to assess a voting system's accuracy. The lower the amount of voter errors, the more accurate the voting system is. The number of voters who cast a ballot but did not have their vote tallied for a certain election (usually President or Governor) is referred to as the voter mistake rate. The overall number of ballots cast for President or Governor is deducted from the total number of voters who voted [7].

2.2.2 Accessibility

Most voters with disability can utilise the multitouch voting device at Maryland University. Blind and visually impaired voters can vote independently and discreetly for the very first time in the state, utilising a headset and keypad to listen to ballot selections and make selections using the keypad. High-contrast ballots and votes that have been magnified or expanded are also available. The screen can be modified to assist voters who want or have to sit while voting. A "sip and puff" technology will be added in the future to allow voters with disabilities which prohibit them from using their arms to vote independently and secretly [7].

2.2.3 Voter Intent

When using paper-based voting methods, election authorities must occasionally determine which contender or vote question response the voter intended to vote for. The scanning equipment may not accurately read the ballot if a person erases a selection and makes a new one, or if the voter marks the ballot incorrectly. In this instance, election officials must examine the voter's ballot to ascertain for which candidate or response to the ballot question the voter intended to vote [7].

2.3 Supporting Information (e.g., References, etc.,)

“Wouldn't all our issues be addressed if they just used Electronic Voting?” some wondered as the globe watched the political drama develop in Florida at the end of 2000. People all across the world began to examine their voting equipment and techniques with a critical eye, attempting to improve them [8]. At least among politicians, there is a significant desire to go to Remote Internet Voting in order to improve voter convenience, voter trust, and voter turnout. However, as will be discussed later in this paper, there are significant technological and societal features that cause Remote Internet Polling in the near future unfeasible. As a result, many technologists believe that remote poll-site electronic voting, in which a voter can vote at any polling location (not just his home county polling location), is the best move forward because it improves voter convenience while maintaining security. This paper provides an understanding of the current situation of the knowledge in electronic voting, including research on Internet voting (as well as arguments for and against its implementation) and electronic poll-site voting.

Rivest addresses various concerns in “Electronic Voting” [9], such as the “secure platform problem” and the impossibility of providing a receipt to the voter. He also expresses his personal views on a variety of topics, including the striking differences between e-commerce and e-voting, the dangers of adversaries conducting automated, large-scale attacks while voting from home, the significance of compliance, support for disabled voters, security issues with absentee ballots, and so on. The NSF Internet Voting Report [10] examines the technological and social science viability of several forms of Internet voting and establishes a research agenda to undertake if Internet voting is to be successful in the future. The following three categories are used to classify Internet voting systems:

- Poll-site Internet voting promises increased convenience and efficiency because voters can cast ballots from any polling location, and the tallying process will be quick and accurate. More crucially, because election administrators would have control over both the voting platform as well as the physical environment, security issues associated with such systems could be managed.

- Booth polling: Voting machines would be placed in convenient areas such as supermarkets, libraries, or schools, away from typical polling booths. Election officials would still have control over the voting platforms, and the physical environment may be modified as needed and inspected (e.g., by voting machines, volunteer, or even cameras) to handle security and privacy concerns while avoiding coercion or other types of involvement.

- Remote Internet voting: Aims to increase voter convenience and accessibility by allowing them to cast ballots from nearly any Internet-connected location. While this notion is appealing and has a lot of advantages, it also has a lot of security problems and other difficulties in terms of civic culture. Technologies available now and in the near future are insufficient to address these dangers.

“e-Voting Security Study” [11] provides a thorough examination of e-voting technologies. It includes a review of current academic and business efforts in the area, as well as personal opinions and testimony from important academics in the field. It identifies dangers, potential attack sources, and attack methods in such electoral processes. It also specifies the electronic voting system's security objectives and needs. “An untraceable, universally verifiable voting scheme” [12] proposes a remote voting strategy in which a voter's ballot is blindly signed, making it impossible for anybody to track the ballot back to the voter. They provide the necessary privacy, universal verifiability, convenience, and untraceability characteristics, albeit at the cost of receipt-freeness.

Chapter 3

Methodology

Overview

In this section, we'll discuss about the project's methodology and the tools were employed to construct the proposed solution.

Research is done to gain a clear picture and understanding of a situation based on one's interest by gathering information from numerous sources, reviewing it, and interpreting it. There are other methods for conducting research, but the two most common are quantitative and qualitative. This method will help to determine whether the value it proposes to the target user is genuinely necessary, and it can also be used to improve the project in the future. Quantitative methodologies have been chosen for this project. As the expression "number speaks louder than words," this would provide a statistical perspective on the proposed project.

3.1 System Development Methodology

To achieve the project's purpose and goal, extensive preparation over a period of time is required, and it is critical to select a methodology that is suited for project development. Methodology serves as a vehicle for dealing with the stages of project development from start to finish. It's crucial to pick the proper one because the project's modifications and cycle will be determined by it. During the development of a system, there are a number of approaches that can be used. Each one has its own set of strengths and weaknesses and can be used for a variety of purposes. As a result, for this project, agile methodology was chosen. Despite the fact that there have been a variety of different approaches, the following are the grounds for choosing this one:

- Agile accepts feedback and criticism and adapts to changing requirements.
- Agile allows you more flexibility and takes less time to execute new improvements.
- Product or system delivery in a timely manner.
- To avoid adjustments at a later stage, continuous feedback is required.

The major goal of using agile methodology is to allow for iteration in order to make improvements to the product that will satisfy the customer. Furthermore, agile techniques break the entire system into manageable components known as modules, which play an important role in development. Because this methodology focuses on customer happiness, each iteration aids the project's overall performance and productivity. Agile is a method of system development that is progressive. This methodology emphasises the necessity of delivering a fully functional system quickly. In agile, duration is divided into stages, which are commonly referred to as "sprints." Each sprint has its own time period, which will be measured in weeks and will include a number of goals at the start of each sprint. Customers rate deliverables based on their perceived business quality. If the intended tasks cannot be performed, the job must be redesigned, and the specifics will be used in the next sprint's planning.

Additionally, in Agile methodology, user input is critical, particularly during project review. Waterfall approach, on the other hand, is overly imprecise, with no provision for feedback and criticism, as well as no distribution of the result until the project is completed. The following is a feature-by-feature comparison between waterfall vs agile methodologies:

Agile Methodology	**Waterfall Methodology**
Flexible model	Structured and rigid model
Testing is done throughout project development	Testing is done after the completion of project
Informal	Hierarchical and formal
Expect changes during the development	Expect no changes during the development
Low project schedule risk	High project schedule risk
Runs in repeated iterations with multiple releases	Runs in a single cycle with single release
Decision made by the entire team	Decision made by project manager
Has high ability to respond fast to changes	Has low ability to respond fast to changes
Quickly recognize the problem	Takes time to recognize problem

Table 1- Agile Methodology vs Waterfall Methodology

Based on the table above, it is clear that agile methodology is the ideal technique for the project I am now engaged on. According to the current state of this project, the needs are constantly changing during each review course. Agile methodology is a good fit for dealing with the situation because it makes change implementation easier and faster. Opinions, comments, and suggestions to improve it will be expressed throughout the development process. It will be simple to adjust and modify the present system in the next days.

Finally, this process is unique and assists developers in coming up with new ideas to increase the project's performance. The major goal will be to meet the needs of the clients, and the project will be improved in accordance with its nature.

3.2 Stages of Agile Methodology

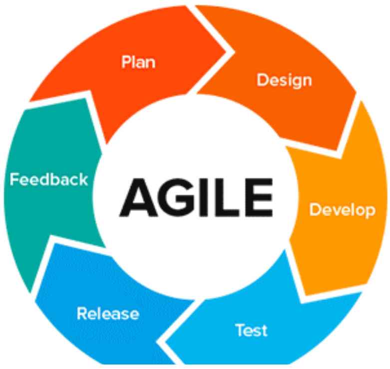


Figure 1-Stages of Agile Methodology

1. Planning

The required critical information/data is precisely evaluated and described in details file that will be referred to for future development purposes throughout this phase.

2. Design

This system is examined at this level in order to identify logic models and business reasoning that may be used to this application. The technical design needs, such as the tools to be used and the UX for the system, have been taken into account.

3. Development

The first three stages of the previously planned implementation have been written in source code and start developing the prototype.

4. Testing

During this stage, the developer and administrators test all application functionality in order to identify any bugs or faults that need to be improved and rectified.

5. Deployment/Release

The product has been released, and only authorized users have access to it.

6. Feedback/Review

Sessions to discuss and present the user requirements accomplished by the development team during the sprint.

3.3 System Design

When a system is designed, it is determined what the system's needs are. This includes deciding the architecture, modules, interfaces, and design. It's safe to assume that system design encompasses everything from discussing system needs to creating goods. Procedures, practises, and techniques are altered to create or change a system throughout system development.

3.3.1 System Architecture

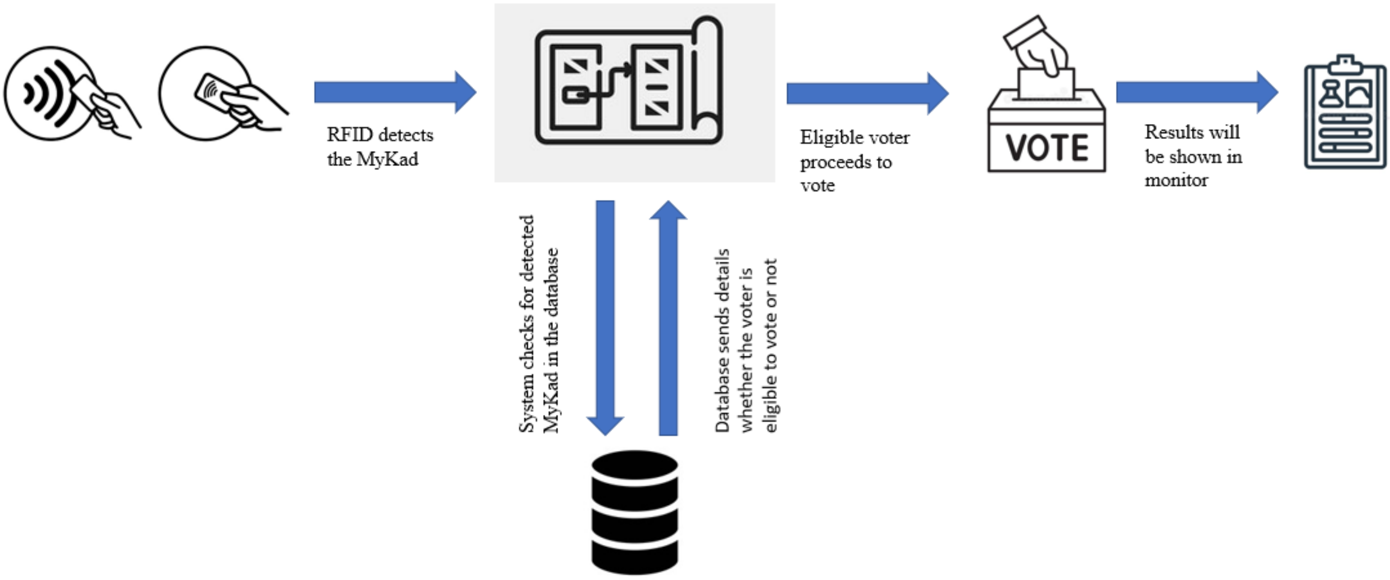


Figure 2-System Architecture

The RFID Smart electronic voting machine's system architecture is described in the diagram above. According to the diagram above, when a voter taps his or her MyKad on the RFID sensor installed on the machine, the sensor will immediately detect the MyKad's Hex number. The system will then cross-reference the Hex number acquired by the RFID Reader with the database that contains all of the students' Hex numbers. When the system recognises the voter's hex number, it moves on to the voting procedure, in which the voter selects their preferred party by waving their hand in front of the infrared sensor. If the system cannot find the hex number in the database, it will revert to the initial phase. The system will display the voting results in LCD Monitor on the machine itself for the voters to see the current results.

The cycle comes to an end there. When the RFID reader identifies the new MyKad, the system will re-run the entire process. The system will maintain track of all of the votes cast by the students, and it will be able to remove all of the information by manually resetting the machine.

3.3.2 Activity Diagram

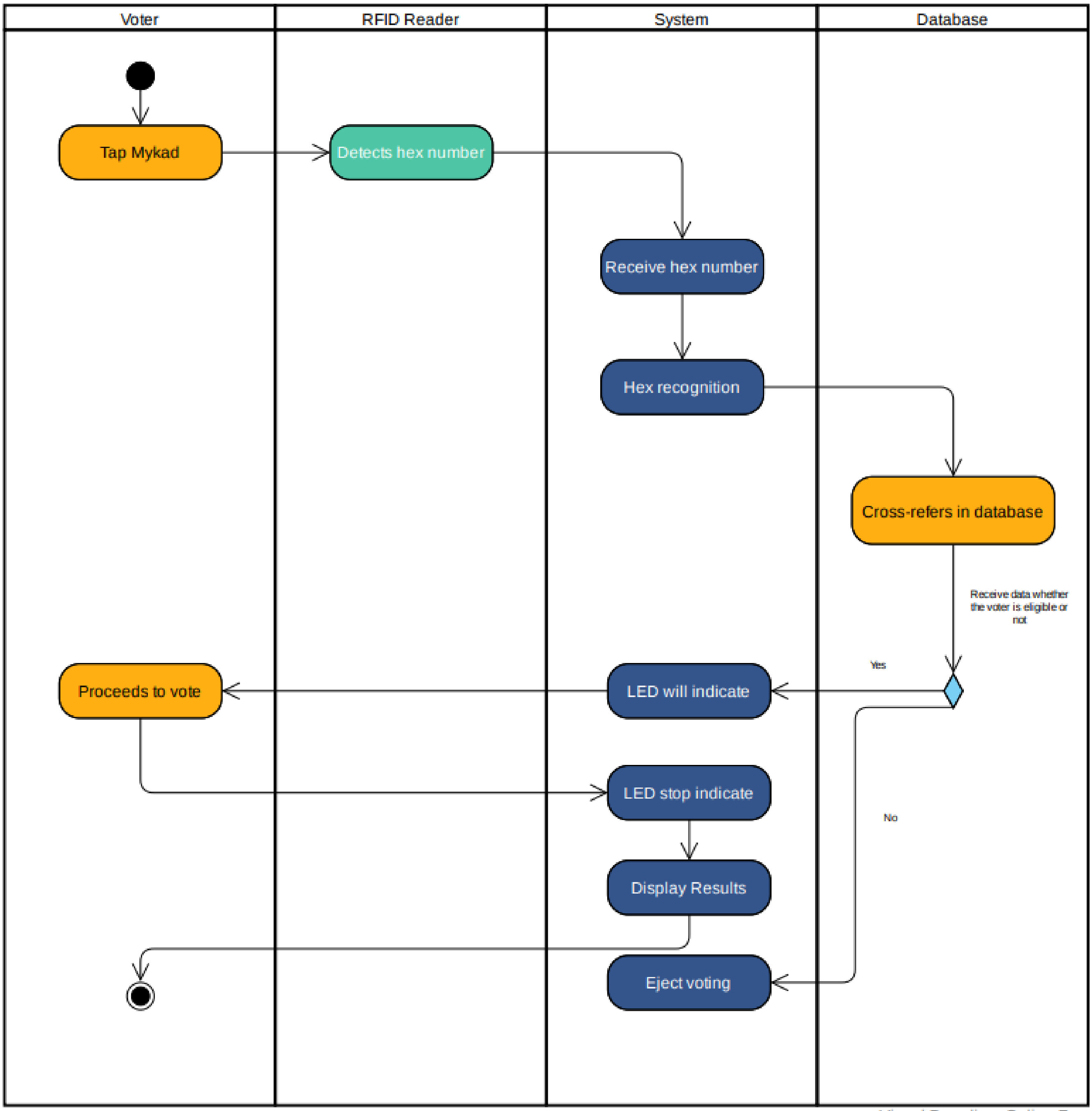


Figure 3-Activity Diagram

This activity diagram depicts the entire system's activity, which begins when a voter taps his or her MyKad on the RFID reader that has already been mounted on the machine. Later, the RFID reader will begin to detect the voter's MyKad's particular hex number. Each RFID readable card will have its own distinct hex number, which will greatly aid this effort by avoiding data redundancy. The machine's system will then refer to a database that holds all of the students' MyKad hex numbers, and if the voter's hex number isn't recognised by the system, the voter will be denied voting rights. A LED light will illuminate in front of the machine if the system recognises the hex number. The voter will then vote for their preferred party by waving their hand over the infrared sensor. The LED will turn off once the system has received the voter's vote. The current votes will be displayed on the machine's LED screen later. When the RFID scanner finds another MyKad from a different voter, the process will repeat. This process will run continuously until the system is shut down.

3.4 Quantitative Research

3.4.1 Primary Research

This is an improved version of an existing electronic voting machine (EVM). The core of the project, as well as components of choice, were developed in order to address the issues that UTP students are now experiencing throughout the voting period. As a result, the Smart EVM study was insane during this time. Articles and journals were gathered, as well as significant information for research. This is a project that relies on hardware. Various literatures were also examined and analysed in this procedure to learn more about its packages and components required for development. Aside from that, the review aided in the perception that the project is particularly needed and contributing to today's trimming culture.

To start the study, a survey of the major stakeholders, the students, was undertaken to learn more about the development of the proposed system. This survey includes questions that are specifically targeted and relevant to the technology. The survey results are provided in the next section, along with a brief explanation of why the question was asked in the first place. The survey was disseminated across several social media platforms and received 34 responses. The question was constructed in a straightforward manner, with no unfamiliar or difficult terms. This is done to ensure that the respondents properly comprehend the purpose of the survey.

The poll had seven questions with a variety of options for respondents to pick from. It includes 'yes or no' questions as well as '1 to 5' rating questions. There were no short questions included since a conventional easy questionnaire would be too complicated.

3.4.2 Secondary Research

Aside from researching knowledge and retrieving information on the subject of research, primary research should also be conducted on the machine that has been constructed. In order to meet the criteria, the appropriate components must be picked. The Arduino IDE was the ideal choice for this project to develop in because it is more focused on hardware development.

Before we begin developing, the Arduino IDE will ask that to download a few packages that will allow you to write the functions you'll need to complete the task at hand. These packages are critical and must be correctly installed in the machine's system. To do so, thorough research must be conducted in order to find those source codes and install them in the machine throughout development. The functionality should be implemented and will be able to complete the task at hand. Because students' personal information is integrated with their MyKad information, security is also a significant consideration. The database must be encrypted and only the UTP management in place should have access to it.

The machine's design, components, and buttons must all be visible and easy to operate. With the use of articles, journals, and some internet reading resources, research is conducted on correct components that can be used in the machine. To ensure that the system's margin is well utilised, it must be well planned. Aside from that, the machine's synchronisation and flow are important to avoid any glitches, problems, or difficulty in understanding the machine by the user.

3.5 Tools

3.5.1 Hardware Tools

3.5.1.1 Microcontroller

Figure 4-Microcontroller

Microcontrollers are integrated in products to control their actions and functions. As a result, they're also known as embedded controllers. They are dedicated to a particular task and run a single programming. They're low-power gadgets with dedicated inputs and modest LED or LCD displays. For this project I have used NodeMCU ESP8266 WIFI Module.

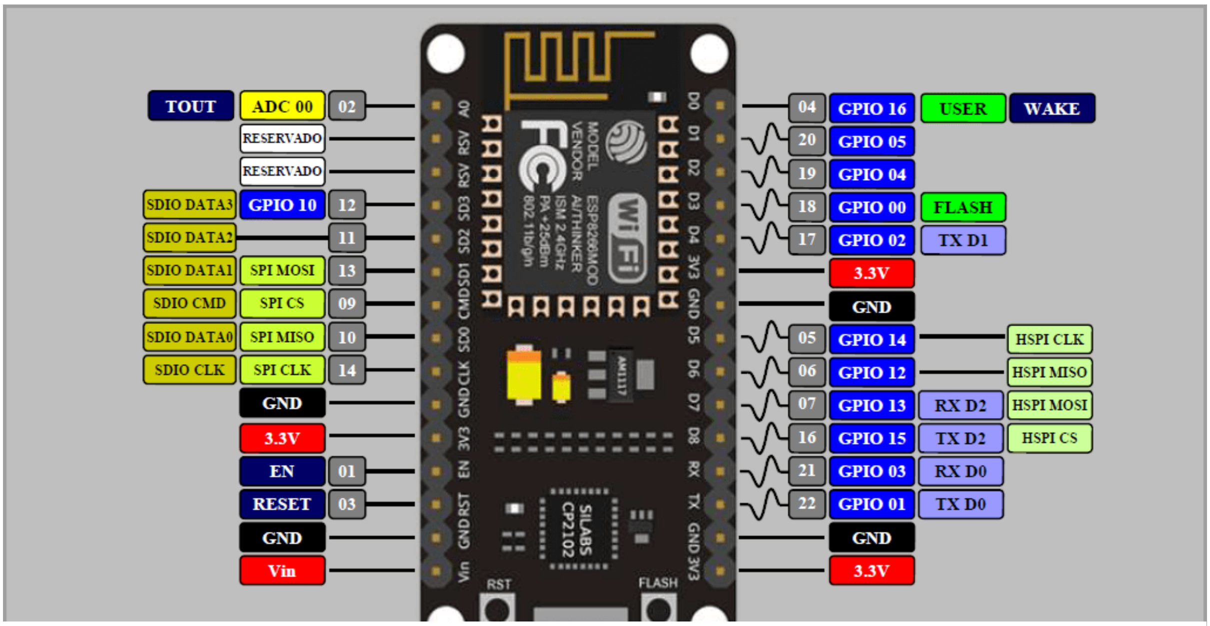


Figure 5-NodeMCU ESP8266

IoT goods may be prototyped or built using the NodeMCU open-source firmware and development kit, as seen in the figure above. Espressif Systems' ESP8266 Wi-Fi SoC and the ESP-12 module are both used to run this software. The firmware uses Lua, a scripting language, as its programming language. Espressif's Non-OS SDK for ESP8266 was used to construct it, and it was inspired by the eLua project. It stands for "computer on a single chip," and this is what the acronym MCU stands for. There are several different types of microcontrollers, each of which has a CPU (processing core), memory, and a variety of programmable input/output devices. Implantable medical devices, remote controls for office equipment and power tools are just a few examples of how they've been used. Anyone may modify, tweak, or produce NodeMCU's hardware design because the platform is open source. The Arduino IDE may easily be used to programme the NodeMCU Development Board.

3.5.1.2 RFID Reader

Figure 6-RFID Reader

It is a gadget that takes data from RFID tags, which are used to track certain items. Radio waves transport data from the tag to the reader. The Mifare RC522 RFID Kit was used in this project. For less than 10 Malaysian Ringgit (RM10), you may get an NXP MFRC522 IC-based RC522 RFID module. The RC522 RFID Reader module uses a 13.56MHz electromagnetic field to connect with RFID tags (ISO 14443A standard tags). At a maximum data rate of 10Mbps, a 4-pin Serial Peripheral Interface (SPI) allows the reader to communicate with a micro controller. I2C and UART protocols are also supported for communication. In spite of the fact that the module's working voltage spans from 2.5 to 3.3 volts, it is possible to connect it directly to an Arduino or any other 5-volt logic microcontroller without the need for a logic level converter.

3.5.1.3 Push-Button Switches

Figure 7-Push-Button Switch

Basic buttons, often known as push-buttons, are switch mechanisms that are used to operate machinery or procedures. Plastic or metal buttons are the most frequent materials for buttons. An easy-to-press or-push surface is one that is either flat or curved. To reset the vote count, I've added this button to this project.

3.5.1.4 LCD Screen

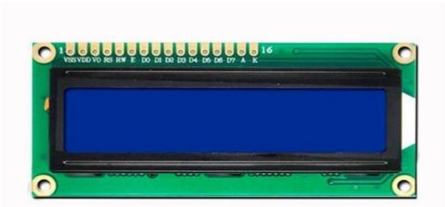


Figure 8-LCD Screen

Liquid Crystal Display (LCD) stands for Liquid Crystal and is an Alphanumeric Display, which means it can display Alphabets, Numerals, and Symbols. In contrast to seven-segment displays, LCDs are user-friendly Show devices that may be used to display a wide range of messages, such as numbers and letters. LCD's only limitation is that seven segment displays are more durable and may be viewed from a longer distance than LCD. Using a 16x2 Alphanumeric Show, I can display two lines of text each with a maximum of 16 characters per line. This LCD monitor will be used as a vote count display in this project.

3.5.1.5 LED

Figure 9-LED

A semiconductor light source is a light-emitting diode (LED). In various gadgets, LEDs are utilized as indicator lamps, and they are increasingly being employed for other lighting.

3.5.1.6 Infrared Sensor

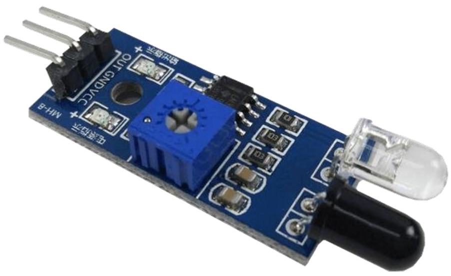


Figure 10-Infrared Sensor

Infrared obstacle/object detection sensor is extremely user-friendly. The sensitivity may be adjusted using an on-board potentiometer. A microcontroller such as the Arduino/Genuino UNO may be easily connected to the output because it is a digital signal. Using infrared reflection, this sensor is non-contact and provides easy, user-friendly, and rapid obstacle detection. Detection varies depending on the surface since it is reliant on light reflection. Front of the module has a couple of Infrared emitters and receivers. When there is a blockage, it reflects infrared back to the emitter, which is received by a comparator circuit on board. This has been setup as a vote counter for this project.

3.5.2 Software Tools

3.5.2.1 Arduino IDE

Figure 11-Arduino IDE

The Arduino Integrated Development Environment (IDE) is a cross-platform application written in C and C++ functions for Windows, macOS, and Linux. It's used to write and upload programmes to Arduino-compatible boards, as well as other vendor development boards with the support of third-party cores. As a result, Arduino IDE is utilised in this project to upload the code to the microcontroller's ROM.

3.5.2.2 Blynk App

Figure 12-Blynk App

Blynk is a platform that allows you to control Arduino, Raspberry Pi, and other devices via the Internet using IOS and Android apps. It's a digital dashboard where we may drag and drop widgets to create a graphic interface for our project.

3.6 Key Milestone

The purpose of a milestone is to track the progress of a project. This method ensures that the project is completed on time and within budget. A list of activities that must be done in order to reach the goal. A milestone is a one-time occurrence that is the most important event in a project. This project, too, had some significant occurrences that kept me on track. The following are some of the major achievements I've made thus far, both in FYP1 and FYP2. As it was the first term of the final year project, all of the FYP1 milestones were met. The majority of the FYP2 milestones have been met, with only a handful remaining at the time of writing.

Week	Progress
1-2	• Project Title Selection
3-4	• Preliminary research work • Submission of Progress Report 1
5-8	• Literature analysis
7-9	• Data collection and review • Submission of Progress Report 2
9-12	• Submission of Interim Report Draft
12	• Submission of Interim Report

Table 2-FYP 1 Progress

Week	Progress
6	• Submission of Progress Report 1
9	• Submission of Draft Dissertation
10	• Submission of Dissertation (Soft Bound)
12	• Submission of Progress Report 2 • Submission of Interim Report (Hard Bound)
15	• VIVA Presentation

Table 3-FYP 2 Progress

3.7 Gantt Chart

The Gantt chart is a visual representation of the project's progress. The project is broken down into sections on a Gantt chart, which is updated based on the progress at each stage. The primary goal of a Gantt chart is to achieve the goal within the allotted time frame and fulfil the deadline. This ensures that the project is completed within the specified time range and meets the project's requirements. As seen in the Gantt Chart below, the project is split into four distinct parts. Phases 1 and 2 were completed during FYP1, while Phases 3 and 4 are scheduled to be completed in FYP2.

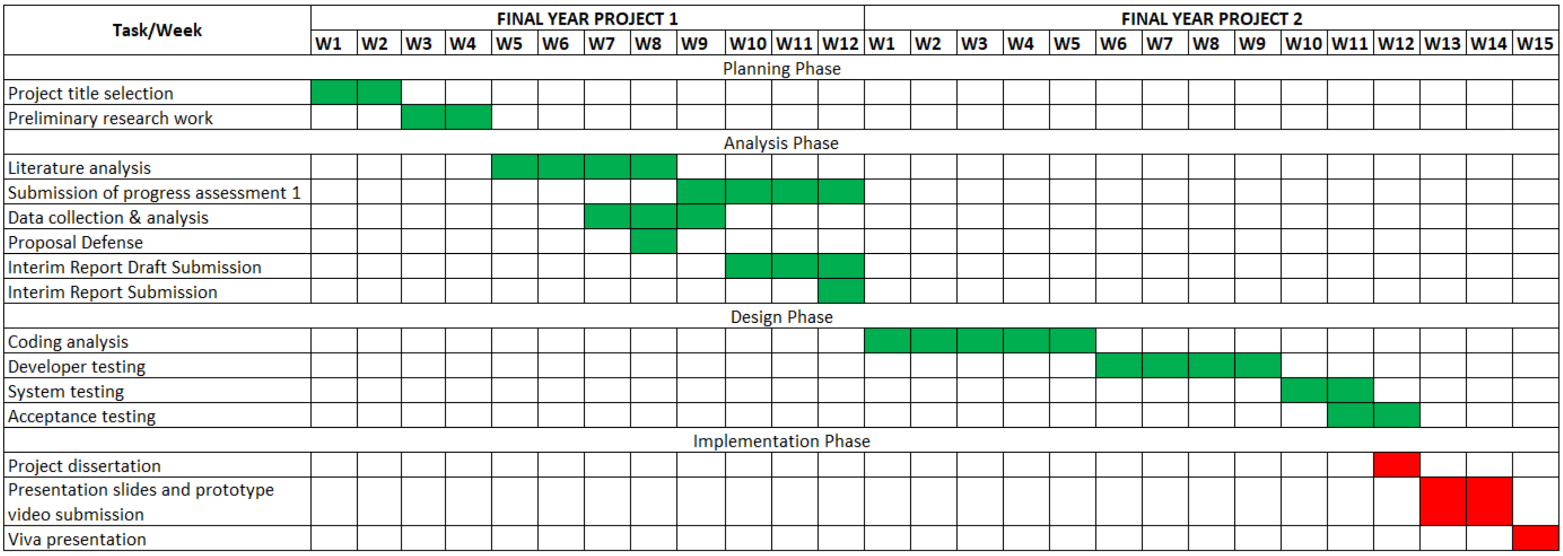
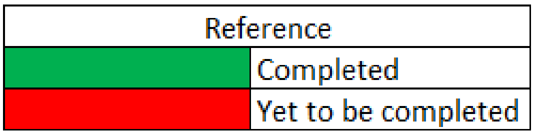


Figure 13-Gantt Chart



Chapter 4

Results and Discussion

4.1 Pilot Studying

4.1.1 Study Setting

This section focuses on how stakeholders perceive the system's ideas and concepts, as well as how they comprehend its requirements in depth. The survey results, as well as a brief description of each, are appended below. Apps that can be used to respond, such as WhatsApp and Facebook. The survey garnered roughly 34 replies, which indicates that it was well-received.

Because Google Forms is an open-source programme, it was used to create the survey. The survey began with a brief summary of what the survey should be, and it was constant throughout so that the respondent understood the survey's aim.

The outcomes of the questionnaire that I distributed at random to gather requirements for this proposed project are listed below. The responses are in the form of a chart, which is attached below for a better look at the statistics:

4.1.2 Survey Outcome

As previously stated, surveys were conducted as part of the requirements gathering process to determine the challenges that students are having in the current situation and whether the application created for them can meet their demands. UTP students were asked seven questions about this topic, and they responded with thirty different answers. The survey findings are listed below to aid with the research.

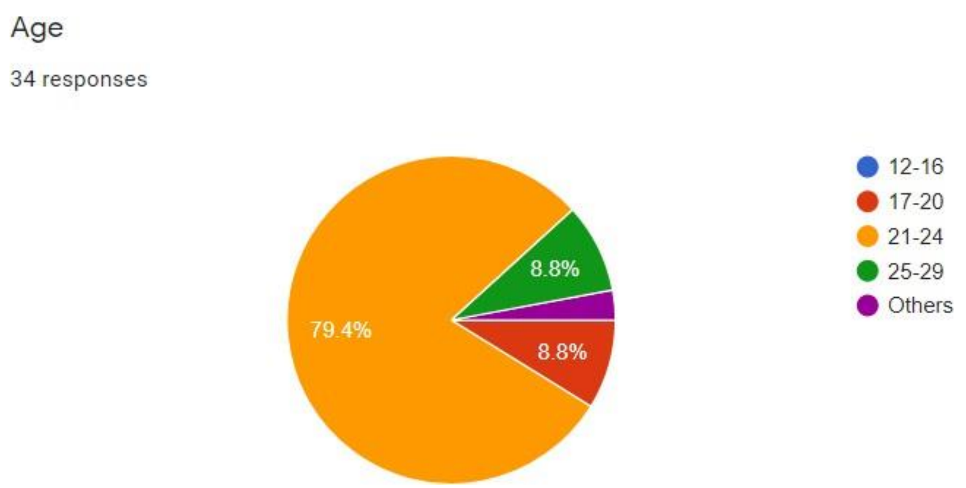


Figure 14-Question 1

Aside from asking for the respondent's name, figure above of the survey asks for the respondents' age range, as university students are the primary users of or affected by this system. According to the poll, the majority of respondents were between the ages of 21 and 24. With the age ranges of 17-20 and 25-29, 8.8 percent is the second highest. Others, which are UTP students who have previously graduated from UTP, will be the third group.

What do you think about current voting system in UTP?

34 responses

Bandwidth of the system is pretty crack sometimes	The system crash each time to vote. Students wont vote if this continues in UTP
Moderate	So far so good
Slow	Not so good
Great but can upgrade better	Hmm not bad
Not safe	Okey la
Tak teratur	Ok not bad
Unorganised well	The system is there, but in terms of functionality, it is too cluttered
Not a Utp student	No so simple
Good but not organised	

I dont know about it at all
I dont like to use powerapps
Not organised very easily can cast fake votes
Too much work to login powerapps or cast paper votes
Too much work to login powerapps or cast paper votes
Slow
Old fashioned
Seems like can easily be cheated with and not so trustable
Not very well implemented

Figure 15-Question 2

The next question in figure above indicates the student's opinion about current UTP voting system. Based on the answers given by the respondents, the current UTP voting system is not promising and a lot of them have given negative opinions.

Do you prefer if this smart electronic voting machine implemented in upcoming election in UTP?

34 responses

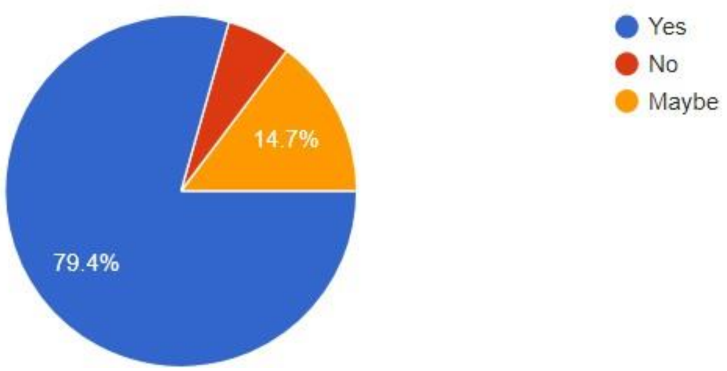


Figure 16-Question 3

According to the answers on the pie chart above, 79.4 percent of students wish to put this concept into action in the upcoming UTP election.

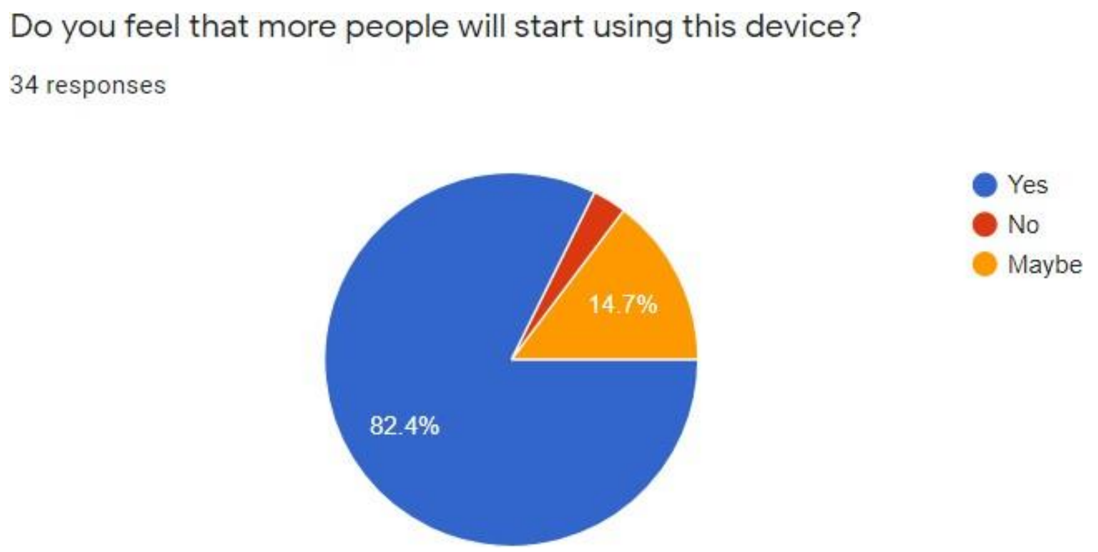


Figure 17-Question 4

We can see that 82.4 percent of the students desire to use the device based on the responses on the pie chart in figure above.

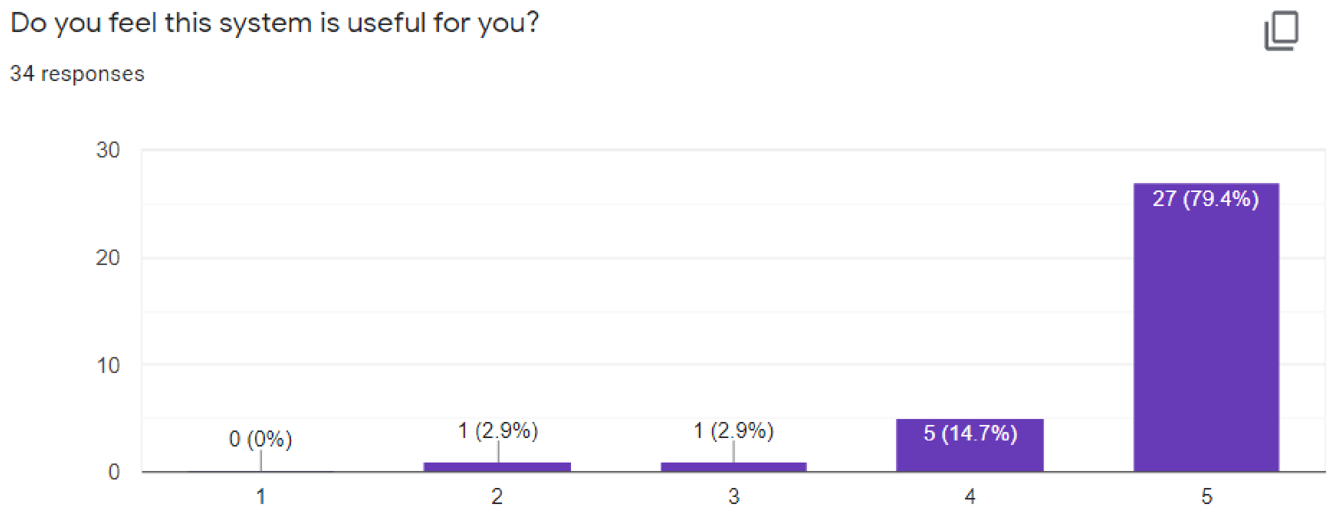


Figure 18-Question 5

Based on the question in figure above majority of the respondents which is 27 out of 34 of them said that it will be very useful.

4.2 General Flowchart

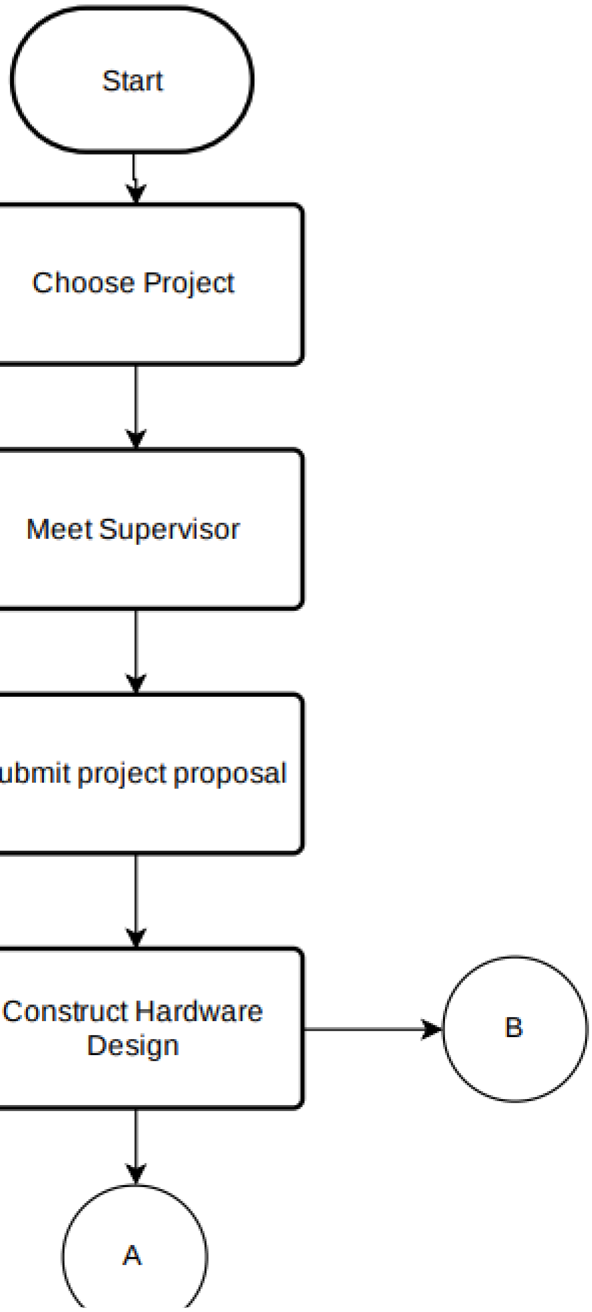


Figure 19-General Flowchart

The process of this project is depicted in the diagram above. First and foremost, I had a briefing from the coordinator on how to choose a project title, and then I met with the supervisor for project help. After the title has been decided, submit a project proposal to the supervisor for approval of the planned project. Then, schedule a meeting with my supervisor to receive additional information about the final year project and to get further ideas from him or her. Even after the meeting, the submitted proposal can be improved or revised in subsequent steps.

4.3 Overall Project Flowchart

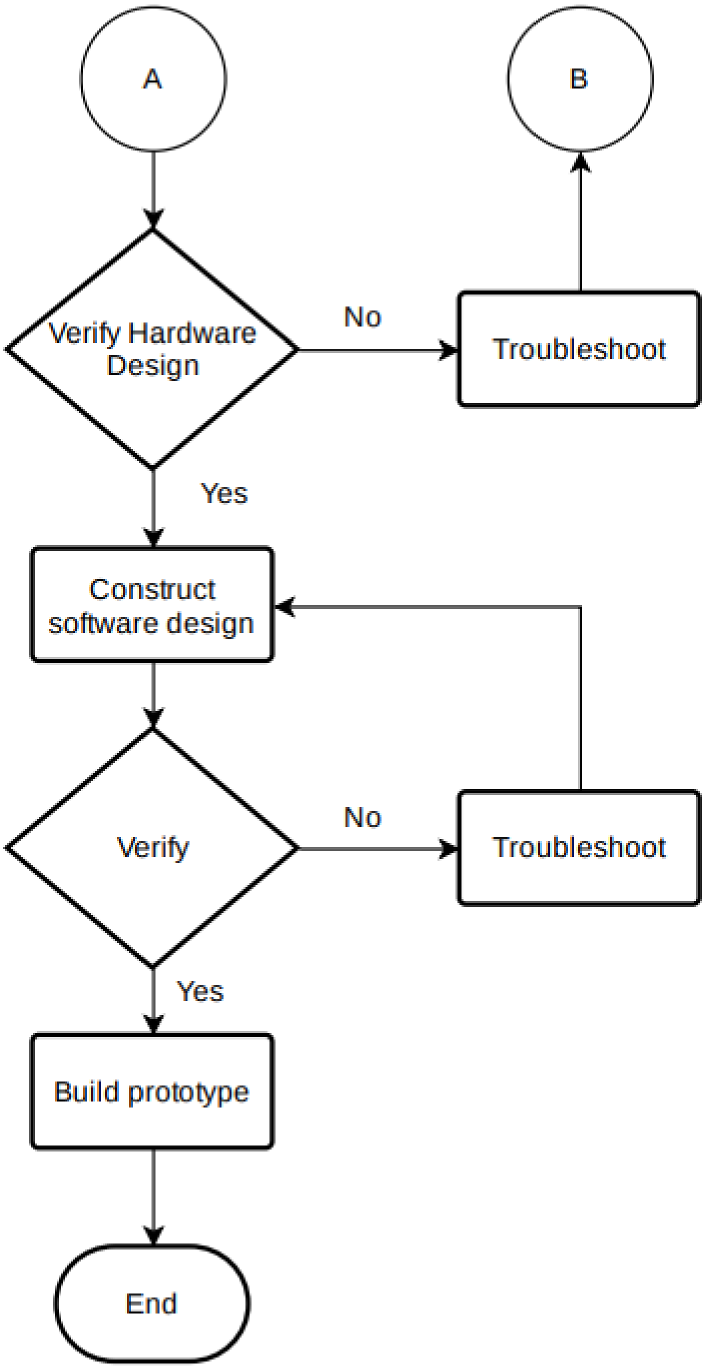


Figure 20-Overall Project Flowchart

Figure above depicts a general project flowchart. Before beginning the project, research which coding language to use or build in the proposed project to ensure that it is not messed up in the future. The research code was then developed using the Arduino IDE and compiled to confirm that there were no problems in the code. After that, Easy EDA was used to build the circuit and simulate it. The prototype has been built once the hardware and software designs have been finished.

4.4 Block Diagram

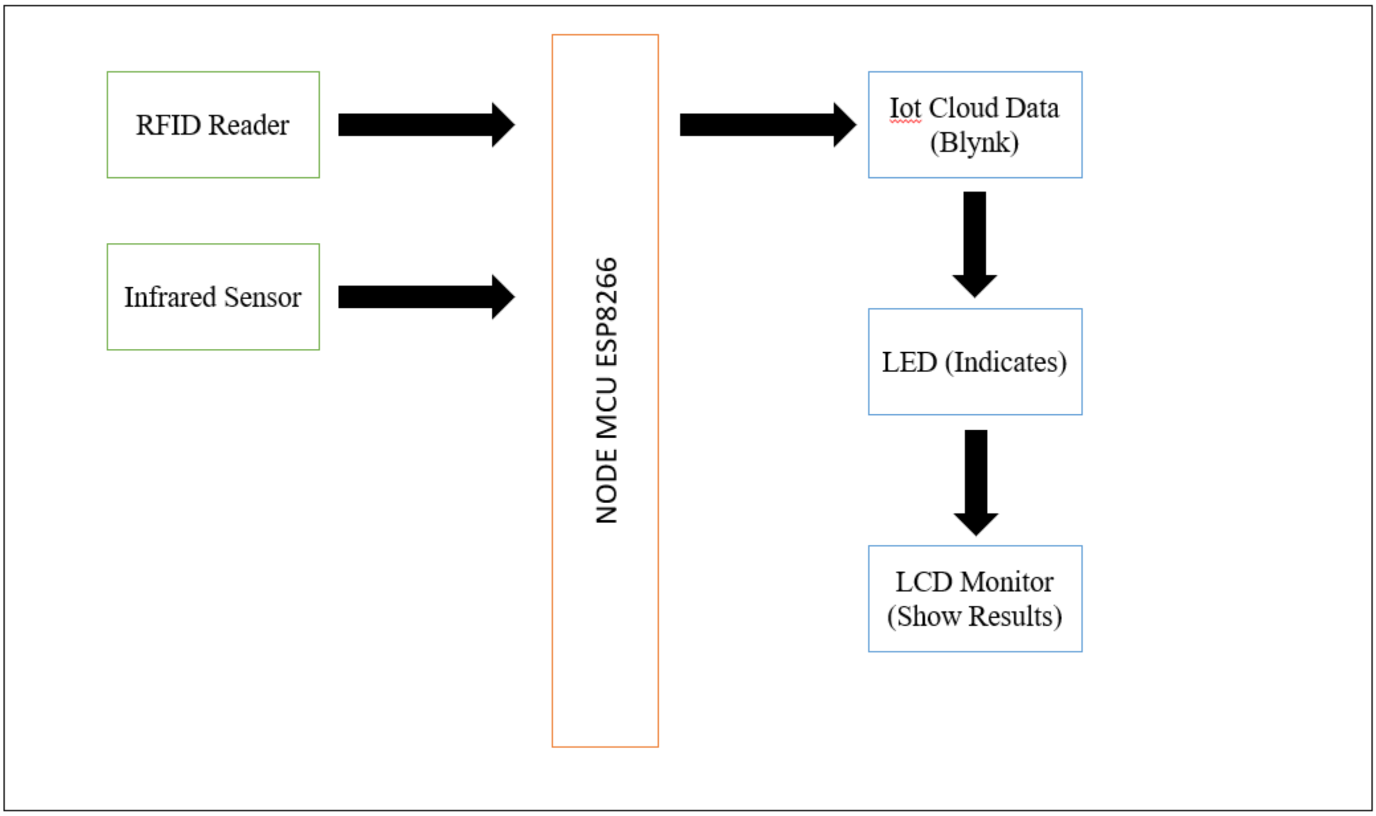


Figure 21-Block Diagram

To begin, the image above depicts a Block Diagram of an RFID Smart Electronic Voting Machine. After power is supplied to the microcontroller, NodeMCU will connect to the local WIFI network. The NodeMCU will detect all of the sensors and sense their parameters once the connection is established. The RFID Reader, for example, will detect the voter's MyKad as well as vote counts from the infrared sensor. After that, all of these readings will be sent to the NodeMCU, which will then send them to the IOT Cloud. These data can be viewed in detail in the Blynk App on a mobile phone. When the RFID Reader detects the eligible voter's MyKad, an LED light will illuminate. The voter will next vote by waving his or her hand over the infrared sensor. Finally, the results will be displayed on the LCD monitor that is connected to the machine.

4.5 Hardware Design

4.5.1 Hardware Flowchart

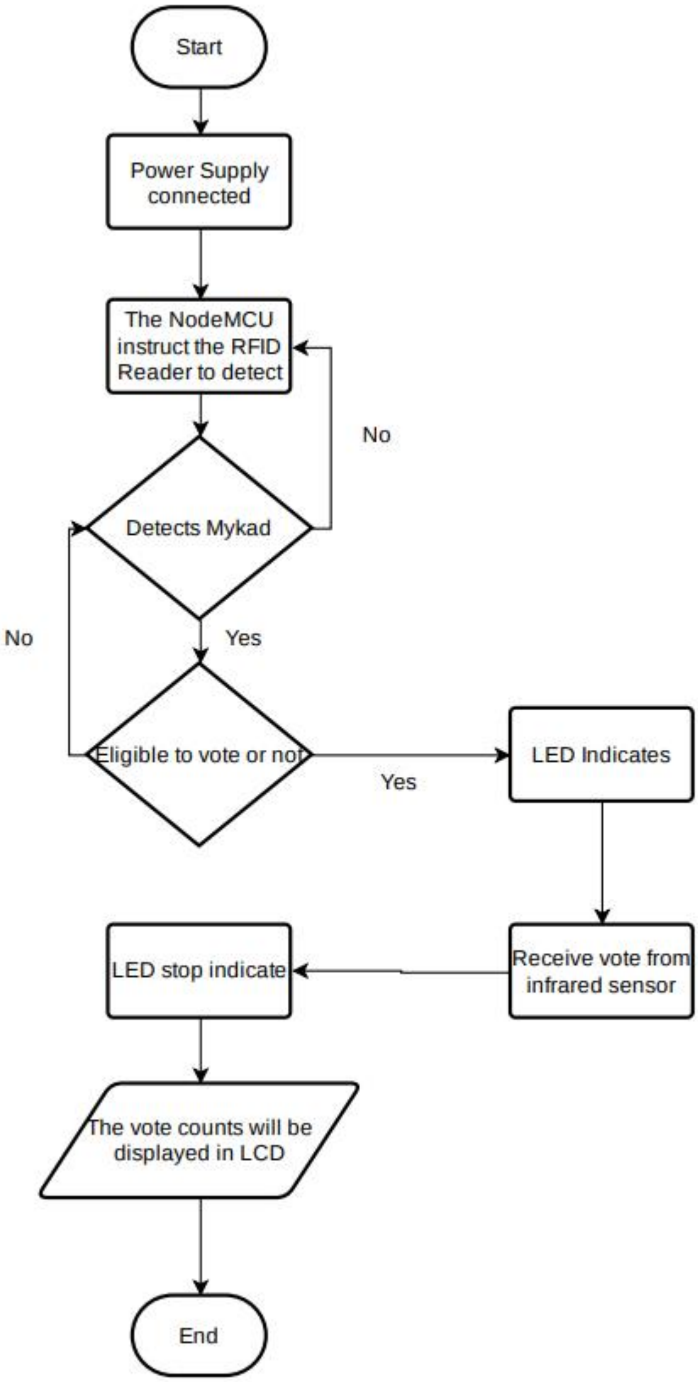


Figure 22-Hardware Flowchart

The flowchart shown in the image above demonstrates how the NodeMCU and other hardware components operate without the aid of any third-party software. The primary goal of this project is to design and create an Electronic Voting Machine with RFID characteristics that is extremely safe. To detect MyKad hex number and obtain vote from voter, there will be two inputs: RC522 RFID module (RFID Reader) and also Infrared Sensor. The IOT cloud will get these data. The results of the vote will be displayed on the LCD Module that is attached to the voting machine.

4.6 Software Design

4.6.1 Flowchart of Software Process

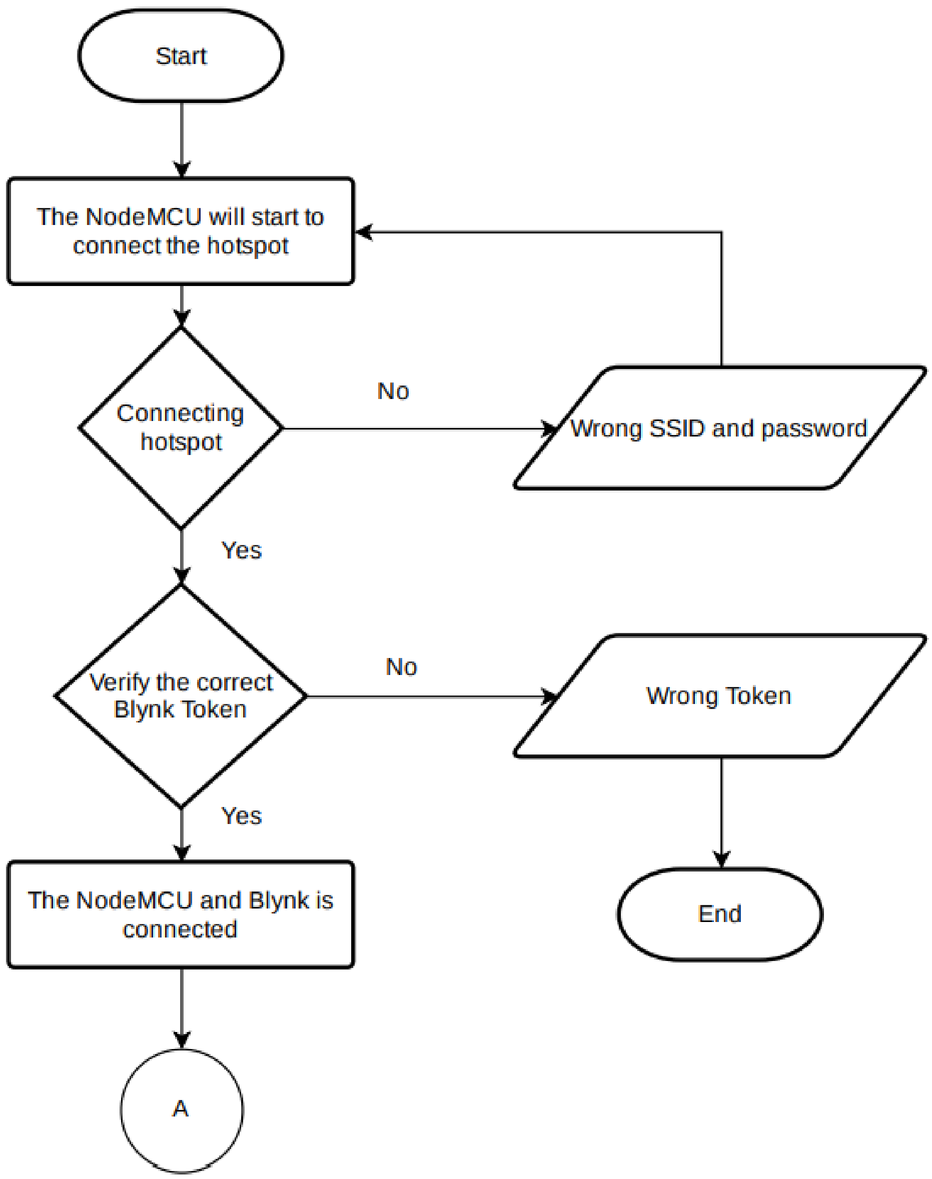


Figure 23-Software Flowchart 1

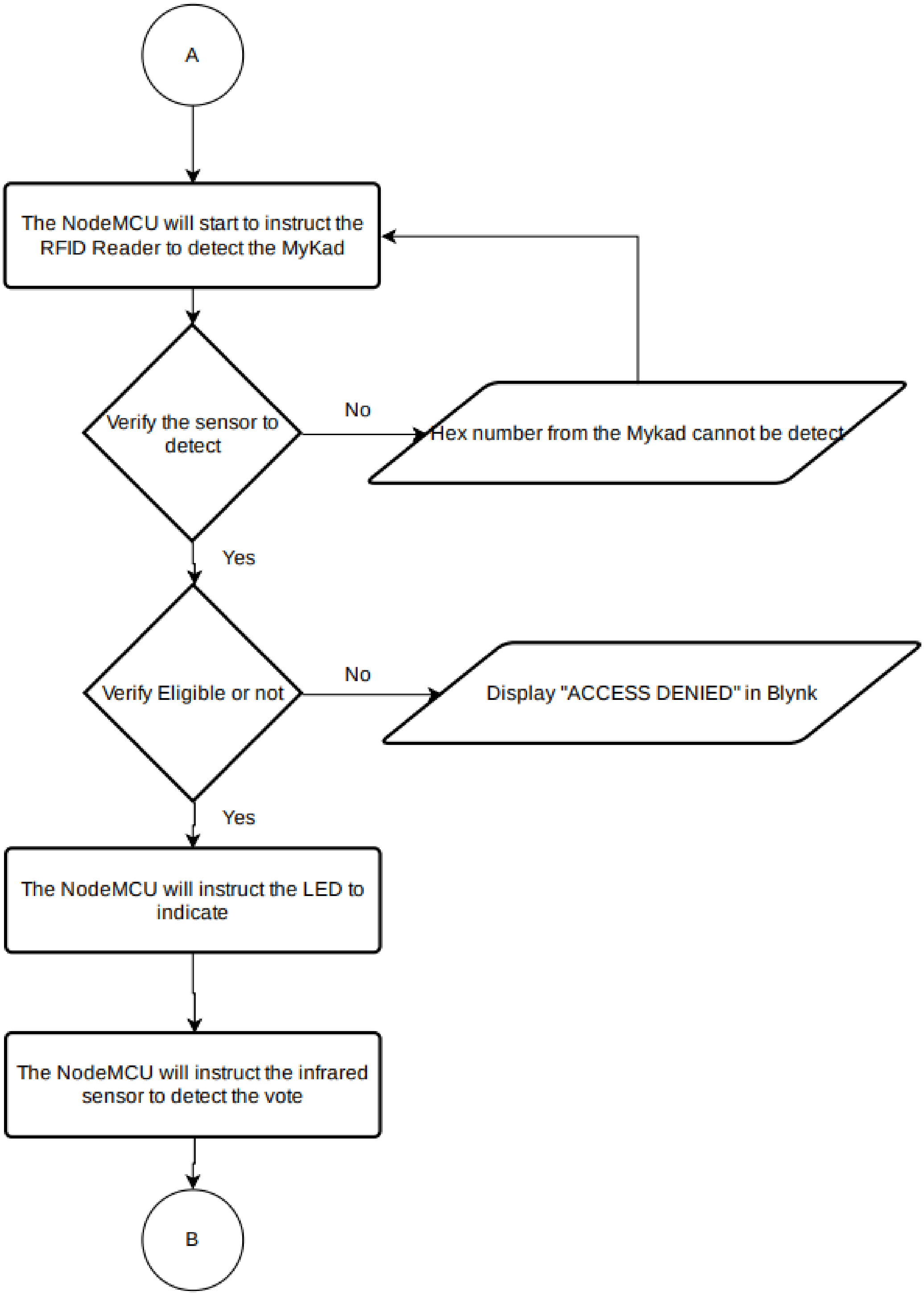


Figure 24-Software Flowchart 2

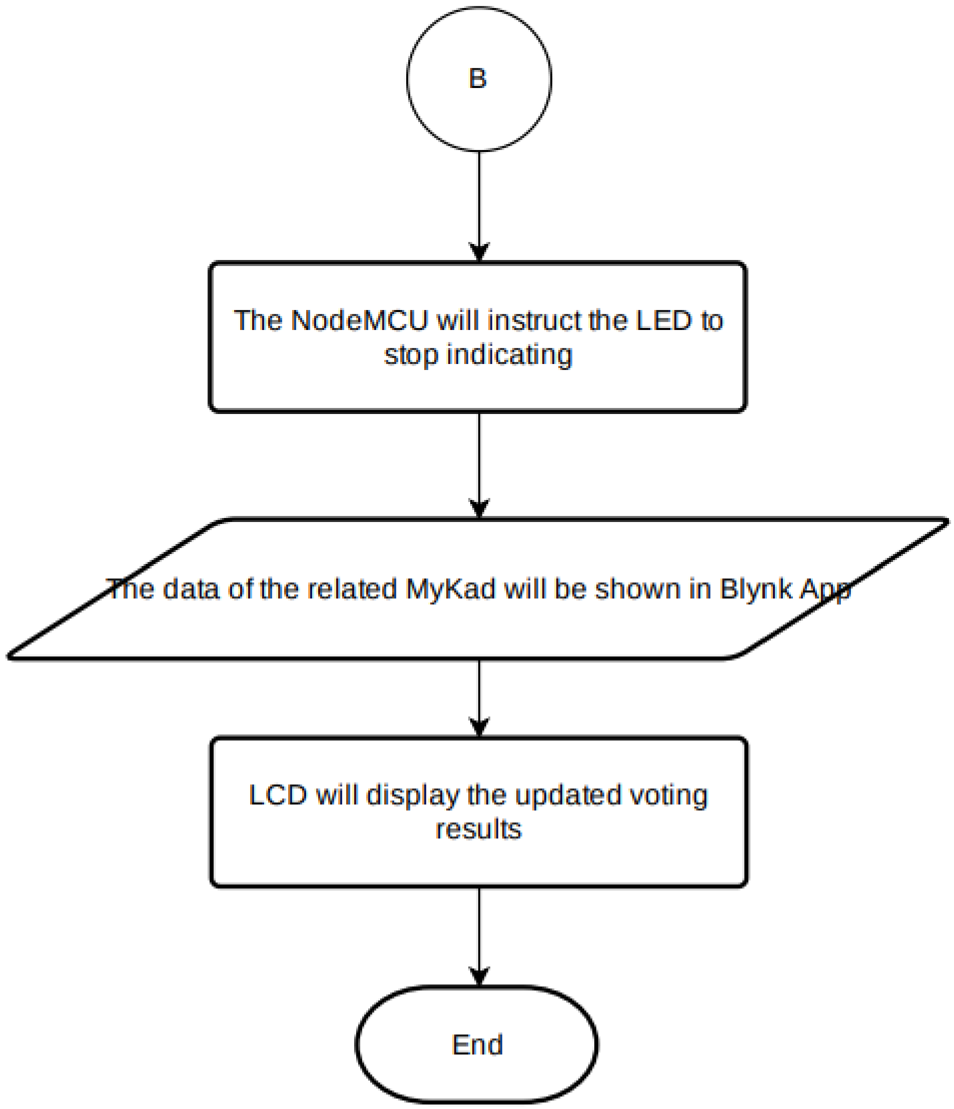


Figure 25-Software Flowchart 3

The NodeMCU with Blynk App workflow is depicted in the flowchart above. Using the open-source firmware and development kit, NodeMCU, developers may construct prototypes for Internet of Things (IoT). IOS and Android apps may be used with the Blynk App to control Arduinos, Raspberry Pis, and other devices via the Internet using the ESP8266 Wi-Fi SoC from Expressif System. This project will have a graphical user interface that we can design by dragging and dropping widgets into place on a dashboard. A user hotspot or personal Wi-Fi network is required to get started with the NodeMCU. The Blynk App will open if the device is connected to a hotspot or Wi-Fi. There is an issue with the log-in credentials if the NodeMCU fails to connect to a hotspot or Wi-Fi. When a power source is attached, the LED on the NodeMCU will light up.

4.7 Circuit Operation

4.7.1 Operation of Circuit (Hardware)

This method generates cloud data that may be used to monitor vote outcomes in timely manner. To begin, the 5V supply is connected to the NodeMCU. MyKad and votes are now being detected by sensors because the code has already been uploaded. A blue LED in NodeMCU blinks every time something is detected by the sensors. This lets the users know that all of the sensors are operating properly.

4.7.2 Operation of IOT

4.7.2.1 Blynk App

Blynk is an IoT software that simplifies the creation of hardware-oriented programming. Drag-and-drop IOT programming has never been easier than with Blynk. Data may be seen or monitored on Blynk. Even if the Blynk's design is impressive, it can only be viewed by a single individual with a unique id and password. Furthermore, it only permits one user to log in at a time. Blynk has several drawbacks, yet its notification function sets it apart from other IOT platforms.

Figure 26-Blynk App Homepage

Figure 27-Blynk App Screen 1

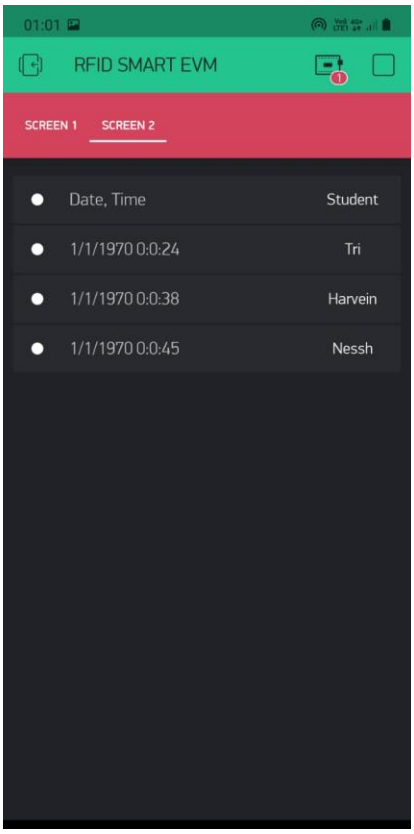


Figure 29-Blynk App Screen 2

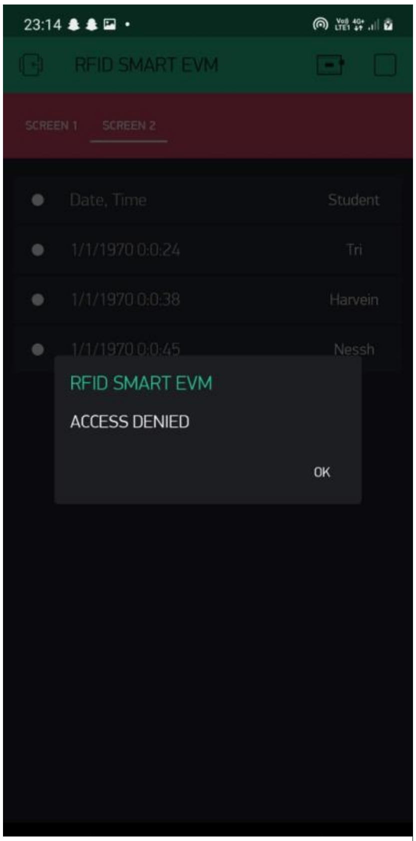


Figure 28-Blynk App Error Message

4.8 Prototype

A prototype RFID Smart Electronic Voting Machine has been developed to illustrate the system's components and outputs in greater detail. SPINNE SPN150 junction box was used as the primary body of prototype design. With the RC522 RFID Reader module and two infrared sensors on top of the prototype, each of the two parties can be identified (Gold&Blue). Voters will be able to see a LED light positioned in front of the machine. NodeMCU was neatly mounted within the junction box along with all of its associated wire. In order to test the system, the code was uploaded to the NodeMCU and successfully tested. Finally, all of the components were put in their proper locations. The images below show a variety of perspectives on the prototype:

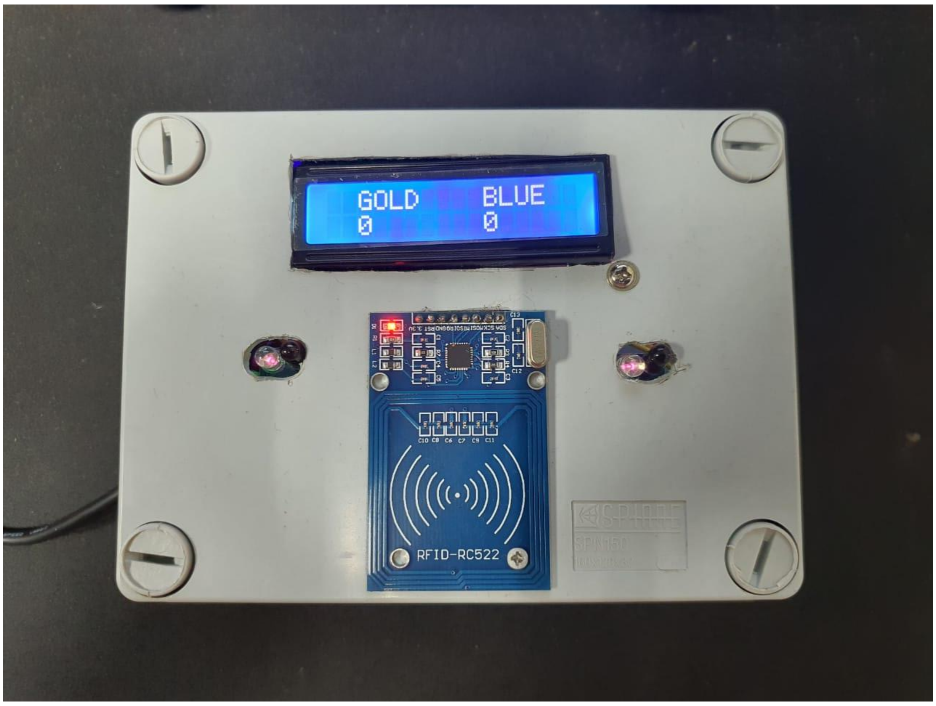


Figure 30-Prototype Top view

Figure 31-Prototype Front View

Figure 32-Prototype Power Supply

4.9 Overall Discussion

The Technology System Acceptance Modelling method was used in the design of this project system. The readings from the sensors are shown graphically in the application. A smart voting system employing the Malaysian identity card, known as MyKad, is already in place and functioning successfully in accordance with the original goal, which was to develop, construct, and test a smart voting system using the MyKad.

Once the development process is complete, the sensor's performance is tested, and the device is found to be faultless. The Blynk platform's real-time database indicates that sensor readings are accurate. Unregistered MyKad hex codes detected by the RFID scanner will be immediately alerted to the registered user's smartphone through the Blynk App. Power consumption, time necessary for maintenance and complexity were all reduced by using this new system. In addition, it offers a unique and accurate way to continue the voting process.

Accomplices that arose over the process of creating this project have been resolved. To begin, Android Studio was supposed to be used to develop an Android App synchronised with Google Firebase; however, due to programming problems, this was not possible, and Blynk App was added to the project as a workaround. UTP's future elections will benefit greatly from the proposed system, which is prepared to play a key role in improving growth and voting efficiency within UTP.

Chapter 5

Conclusion and Future Work

5.1 Conclusion

An electronic voting system improves the efficiency, reliability, and transparency of these elections for these organisations. The UTP's election costs will be reduced as a consequence of a reduction in the logistics and staff involved in the election. A Smart Electronic Voting Machine has been defined in terms of its specifications and architecture. The platform takes care of a wide range of security and fault-tolerance issues, freeing the application designer to concentrate on the design. It's a breeze to design and distribute applications using this way. It has long been believed that the closed-source nature of voting equipment manufacturers' systems makes them even more safe. Such a system's code shows that voting machine code is created in much the same manner that commercial company code is generated. Indeed, we believe that an open approach would lead to more cautious development, since more scientists, software engineers, political activists, and others who care about democracy would be worried about the quality of the software used in the elections. One of the goals of the EVM project is to create an open source voting system that can be verified by the public. There is no way to have faith in the outcome of our elections until we overhaul the process of building voting systems. Individual vendors writing proprietary code to manage our elections looks to be untrustworthy. It is in our best interest to ensure that the UTP's democracy is protected through robust and well-designed election systems.

5.2 Future Work

The RFID Smart Electronic Voting Machine (EVM) has a lot of opportunity for development in the future so that it is more practical and dependable for UTP students and staff members during elections. In the future, there are a few features and factors that might be considered which is: -

- To improve the machine's functioning so that it is more visible and can be automated more easily than it is today.
- Android Studio and Google Firebase may be used to create a customised Android app that is more efficient and comfortable for the UTP management to receive results and input data into the database.

If this project is used to its maximum potential, a large number of loopholes that make the process of creating a wonderful election difficult will be avoided and the UTP management's job will be reduced throughout the election.

Reference

[1] Prepared by American School of Classical Studies at Athens is collaborating with JSTOR to digitize, preserve, and extend access to Hesperia, https://www.ascsa.edu.gr/uploads/media/hesperia/147360.pdf

[2] Douglas, J. (2003). A Brief Illustrated History of Voting http://homepage.divms.uiowa.edu/~jones/voting/pictures/

[3] Spratt, W. (2007). Improvement in Voting Apparatus https://patents.google.com/patent/US158652

[4] Beranek, C. (2011). Voting Apparatus https://patents.google.com/patent/US248130

[5] Site officiel de l'Etat de Geneve, http://www.geneve.ch/evoting/english/presentation projet.asp

[6] Bob, M. (2006). http://www.it-director.com/article.php?id=3508

[7] Gillies, B. (2006). http://www.elections.state.md.us/citizens/voting systems/

[8] "Voting After Florida: No Easy Answers," Lorrie Faith Cranor, December 2000, http://lorrie.cranor.org/.

[9] "Electronic Voting," Ronald L. Rivest, Technical Report, Laboratory for Computer Science, Massachusetts Institute of Technology.

[10] "Report of the National Workshop on Internet Voting: Issues and Research Agendas," Internet Policy Institute, sponsored by the National Science Foundation, Conducted in cooperation with the University of Maryland and hosted by the Freedom Forum, March 2001.

[11] "e-Voting Security Study," E-Democracy Consultation, U. K. Cabinet Office, http://www.edemocracy.gov.uk/library/papers/study.pdf.

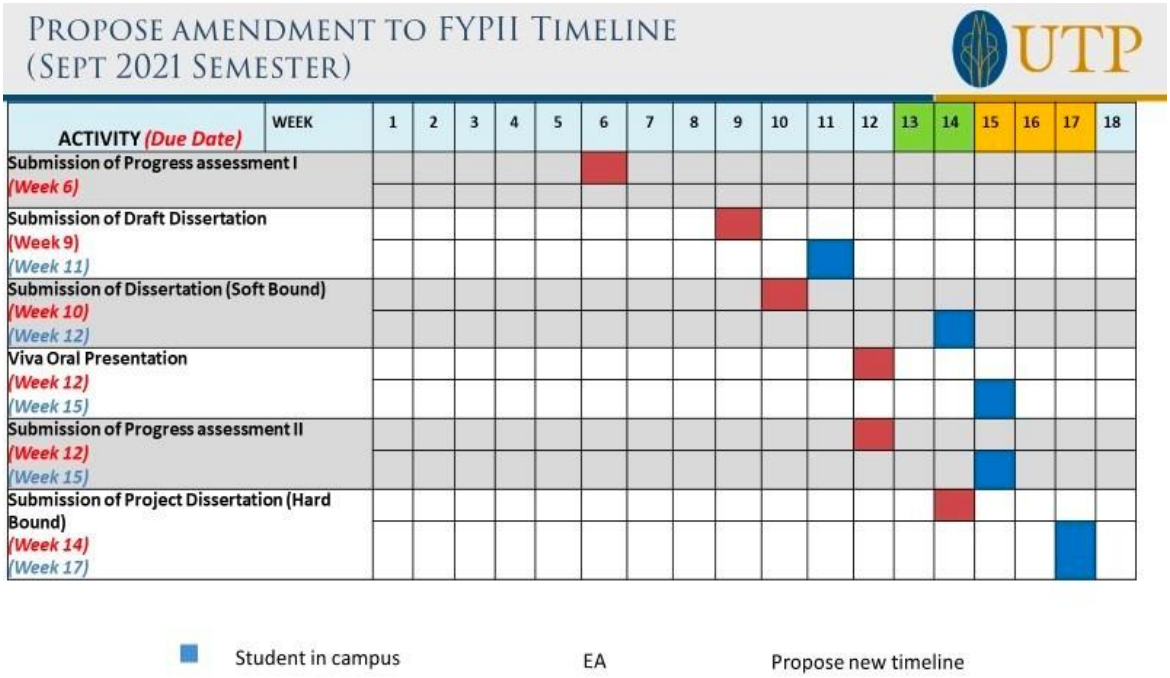
[12] "An Untraceable, Universally Verifiable Voting Scheme," Professor Philip Klein, Seminar in Cryptology, December 12, 1995.

I. Ashok, K. & Ummal, S.B. (2018) Electronic voting machine — A review https://ieeexplore.ieee.org/document/6208285/authors#authors

II. International Institute for Democracy and Electoral Assistance (2011), Introducing Electronic Voting: Essential Considerations https://www.corteidh.or.cr/tablas/28047.pdf

APPENDICES

Appendix 1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(SEPT 2021 SEMESTER)
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ACTIVITY (Due Date)
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Submission of Progress assessment I
(Week 6)
Submission of Draft Dissertation
(Week 9)
(Week 11)
Submission of Dissertation (Soft Bound)
(Week 10)
(Week 12)
Viva Oral Presentation
(Week 12)
(Week 15)
Submission of Progress assessment II
(Week 12)
(Week 15)
Submission of Project Dissertation (Hard Bound)
(Week 14)
(Week 17)
Student in campus
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Propose new timeline