Faculty of Electrical and Electronic Engineering Technology

The Development of an Electronic Board Game of a Triple Triad Game for the Purpose of Testing Kindergarten Student of Numerical Concept

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Bachelor of Electronics Engineering Technology with Honours

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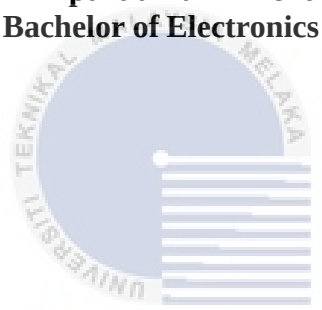
The Development of an Electronic Board Game of a Triple Triad Game for the Purpose of Testing Kindergarten Student of Numerical Concept

NIK MUHAMAD ARIF FAHMY BIN NIK AB AZIZ

A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electronics Engineering Technology with Honours



Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2022

APPROVAL

I approve that this Bachelor Degree Project 1 (PSM1) report entitled “The Development of an Electronic Board Game of a Triple Triad Game for the Purpose of Testing Kindergarten Student of Numerical Concept” is sufficient for submission.

Signature : 

Supervisor Name : AMAR FAIZ BIN ZAINAL ABIDIN

Date : 13 / 01 / 2023

APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electrical Engineering Technology with Honours.

Signature : 

Supervisor Name : AMAR FAIZ BIN ZAINAL ABIDIN

Date : 13 / 01 /2023

DEDICATION

I would like to express my gratitude to my parents for their support and education throughout this project. I also want to thank my supervisor and friends for their encouragement, guidance, and inspiration in completing this project.

ABSTRACT

Teaching and learning a arithmetic is a rigorous process, especially for young students who quickly grow bored, listless, and uninterested when they perceive a task to be difficult. As a result, to get the best outcomes in arithmetic acquisition, with this gameboard will create new way in study arithmetic. In this regard, games are regarded as an engaging and challenging activity to be used in the arithmetic classroom. However, it is not always simple to locate a game that fits into the arithmetic syllabus so, an useful option for the instructor would be to use a board game. For kindergarten students, math concepts typically include counting, number recognition, shapes, basic addition and subtraction, and measurement. The Development of an ElectronicBoard Game of a Triple Triad Game for the purpose of Testing Kindergarten Student of Numerical Concept is a project aims to create an electronic-based educational board game which called Triple Triad with the purpose as educational kit to test Kindergarten students' knowledge of numerical number. Implementing game-based learning in the educational system presents several challenges. The cost of producing and distributing game boards, as well as limited access to technology for some students, can be impediments to their widespread adoption. This is expected to be done by attaching each RFID reader to a Arduino Mega (Slave) and then connect to Arduino Mega (Master). The project outcomes are measured by running different scenarios to test the output of the electronic board game whichshould be equivalent to the original game and then run an oral survey towards target audiences (kindergarten teachers and students) on the effectiveness of the game in aiding thelearning process of the numerical concept.

ABSTRAK

Pengajaran dan pembelajaran aritmetik adalah proses yang ketat, terutamanya untuk pelajar muda yang cepat bosan, tidak bersemangat dan tidak berminat apabila mereka menganggap tugasan itu sukar. Hasilnya, untuk mendapatkan hasil terbaik dalam pemerolehan aritmetik, dengan papan permainan ini akan mewujudkan cara baharu dalam pengajian aritmetik. Dalam hal ini, permainan dianggap sebagai aktiviti yang menarik dan mencabar untuk digunakan dalam bilik darjah aritmetik. Walau bagaimanapun, tidak selalu mudah untuk mencari permainan yang sesuai dengan sukatan pelajaran aritmetik jadi, pilihan yang berguna untuk pengajar adalah menggunakan permainan papan. Bagi pelajar tadika, konsep matematik lazimnya merangkumi pengiraan, pengecaman nombor, bentuk, penambahan dan penolakan asas, dan ukuran. Pembangunan Permainan Papan Elektronik Permainan Tiga Tiga untuk tujuan Pengujian Konsep Berangka Pelajar Tadika adalah projek yang bertujuan untuk mencipta permainan papan pendidikan berasaskan elektronik yang dinamakan Triple Triad dengan tujuan sebagai kit pendidikan untuk menguji pelajar Tadika. pengetahuan tentang nombor berangka. Melaksanakan pembelajaran berasaskan permainan dalam sistem pendidikan memberikan beberapa cabaran. Kos pengeluaran dan pengedaran papan permainan, serta akses terhad kepada teknologi untuk sesetengah pelajar, boleh menjadi penghalang kepada penggunaan meluas mereka. Ini dijangka dilakukan dengan melampirkan setiap pembaca RFID pada Arduino Mega (*Slave*) dan kemudian menyambung ke Arduino Mega (*Master*). Hasil projek diukur dengan menjalankan senario yang berbeza untuk menguji output permainan papan elektronik yang sepatutnya setara dengan permainan asal dan kemudian menjalankan tinjauan lisan terhadap khalayak sasaran (guru dan pelajar tadika) tentang keberkesanan permainan dalam membantu proses pembelajaran konsep berangka.

ACKNOWLEDGEMENTS

I am deeply grateful to Allah for blessing me with the ability to successfully complete my Projek Sarjana Muda (PSM). I would like to express my sincere appreciation to Universiti Teknikal Malaysia Melaka (UTeM) for giving me the opportunity to further my studies in the Bachelor of Electronics Engineering Technology program at the Faculty of Electrical and Electronic Engineering Technology (FTKEE). I am also extremely thankful to my supervisor, En. Amar Faiz Bin Zainal Abidin, for his unwavering guidance, advice, encouragement, inspiration, and support throughout the development of my final year project, "The Development of an Electronic Board Game of a Triple Triad Game for the purpose of Testing Kindergarten Student of Numerical Concept." His constant support and interest were instrumental in enabling me to complete this project with full commitment and dedication. Additionally, I am very grateful to my family and friends for their unwavering support and encouragement throughout this project. Their moral support and care were greatly appreciated and helped me to achieve my goal. I hope that their kindness and generosity will continue to be blessed.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

In this chapter focuses on developing the framework and introducing of the project basic concept. It centered the project overview, outlining the objectives, briefly stating the issue statement, scope, and providing project outcomes.

1.2 Background

Children begin their education in elementary school with varying levels of mathematical proficiency [1]. Some have a solid grasp of the basics, such as numbers and mathematical concepts, while others may struggle with simple counting, identifying numbers, using symbols, distinguishing between quantities, and understanding basic addition and subtraction [1]. These foundational skills, often referred to as "number sense" or "early numeracy competencies," are crucial for students to master before advancing to more challenging mathematical concepts [1]. The motivation of doing this project is to test kindergarten students' knowledge of numerical number by using electronic gameboard based on Triple Triad. This game board will help student to understand more about numerical concept. Teaching and learning a arithmetic is a rigorous process, especially for young students who quickly grow bored, listless, and uninterested when they perceive a task to be difficult. As a result, to get the best outcomes in arithmetic acquisition. Electronic game board will be focus on kindergarten student to test the knowledge of numerical number. The students will be thought in the class by the teacher about the concept of numerical number. That will make the student understand the difference in value between numbers. The student will go through two session, first session will be theoretical, and second session will be test the understanding of the student by using the gameboard.

The lesson will take place in kindergarten with some of students. In theoretical session, teacher will explain the concept of numerical number to the students. In this session will be

seen that only a few students that focus and the other will getting tired, bored, and lost concentration. Kindergarten teacher will be face significant challenge while though kindergarten students by using the theoretical method cause nowadays students more interest in physical interaction. After the lesson, the students will be must to answer the question that was prepare by the teacher. Only a few students that can answer the question with the right answer meanwhile others student will answer the question with random answer.

1.3 Problem Statement

Implementing game-based learning in the educational system presents several challenges. The cost of producing and distributing game boards, as well as limited access to technology for some students, can be impediments to their widespread adoption. Additionally, there may be resistance to change from educators and students who are accustomed to traditional methods of teaching and learning. It is important to carefully consider these challenges and find ways to address them in order to effectively utilize game boards as a tool for improving education. This may require investing in the necessary technology and resources, as well as conducting research to ensure that game-based learning is an effective and efficient means of teaching and learning.

Overall, the incorporation of game boards into the educational system has the potential to greatly improve student engagement and learning outcomes. By finding ways to overcome the challenges and effectively utilize this technology, we can create a more dynamic and engaging learning environment for students.

1.4 Project Objective

The main aim of this project is to propose a systematic and effective methodology to estimate system. Specifically, the objectives are as follows:

a) To study how many connections RFID sensor can connect with one Arduino Mega 2560 in order to be able to determine how many RFID and Arduino mega will be used in this project.

b) To design an electronic-based educational board game base on game that called ‘Triple Triad’ with the purpose as educational kit to test kindergarten students’ knowledge of numerical number by using RFID sensor with the purpose as educational kit with a portable, durable, and affordable

c) To validate electronic-based educational board game base on game that called ‘Triple Triad’ with the purpose as educational kit by test through the student and teacher from kindergarten.

1.5 Scope of project

Project scope is a technique to establish project's limits and describe the specific objectives, timeframes, and project deliverables that be working toward. It’s may guarantee that will meet project goals and objectives without delay or overwork by specifying by project scope. In designing an electronic-based educational board game base on game that called ‘Triple Triad’ with the purpose as educational kit with the main goals of this project are to create a portable educational kit relevant to the kindergarten students. Weight will be around 1kg and 25cm x 30cm x 10cm of size. The durability of product will be test with a few methods such as drop from 0.5m. The cost of this product or educational kit when it develops will be around RM200.00 with the component such as RFID sensor, RGB, Arduino MEGA 2560 and jumper wire.

In this project will required to construct the circuit on PCB. This circuit design for easy to understand and to make the arrangement of component in neat. Will be use 4 Arduino mega as a microcontroller. 3 out of 4 Arduino mega will be act as a slave mean while the other one will be a master. For each of Arduino mega that act as a slave will control 3 RFIDsensor and it will send data to Arduino mega that act as master. The 9 RFID sensor will be arranged3x3 on the top of box. Which is the game will be play by two students facing each other and the 9 RGB that control by master will be the indicator who will start first. After the card had been put on the board RG LED will be indicator as the player own that space and the buzzer

will act as the card in the middle of fighting. For the prototype, will be using junction box because it will save the cost of product and durable.

For designing the rule of game will be use Arduino ide software. In this software will give the command who will start first, what will happen if player put the card on the board and who will win or lose the space on the board. In this software also will distinguish the numbers on the card that have been put on the board.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

To ensure the success of this project, we conducted thorough research and gathered information from various sources such as books, papers, journals, and websites. This information served as a guide to help us complete the project within the designated time frame. The research focused on major topics and those relevant to the project.

In this study, we conducted a literature review of articles from the Scopus website on instructional kits for teaching primary students about numerical number by using RFID sensor. The search terms "electronic gameboard" and "educational kit" were used to identify relevant articles. A total of ten articles were selected for this review, with five of them focusing specifically on the development of teaching kits for numerical number. The aim of this literature review is to evaluate the effectiveness of instructional kits as a tool for enhancing students' ability to understand and solve problems related to numerical number.

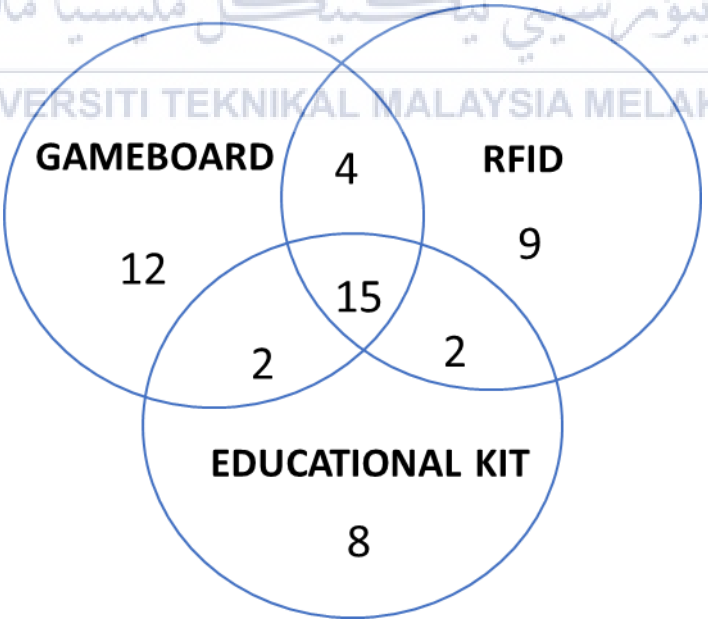


Figure 2.1 : Common type of related article.

In figure 2.2 the growth of paper by continent from 2002 to 2022. There are 4 total of continent that contribute in all of research paper. According to the figure Europe continent show the most percentage of developing a gameboard, meanwhile the percentage different Asia and Europe continent are 5%. This will show that Europe and Asia

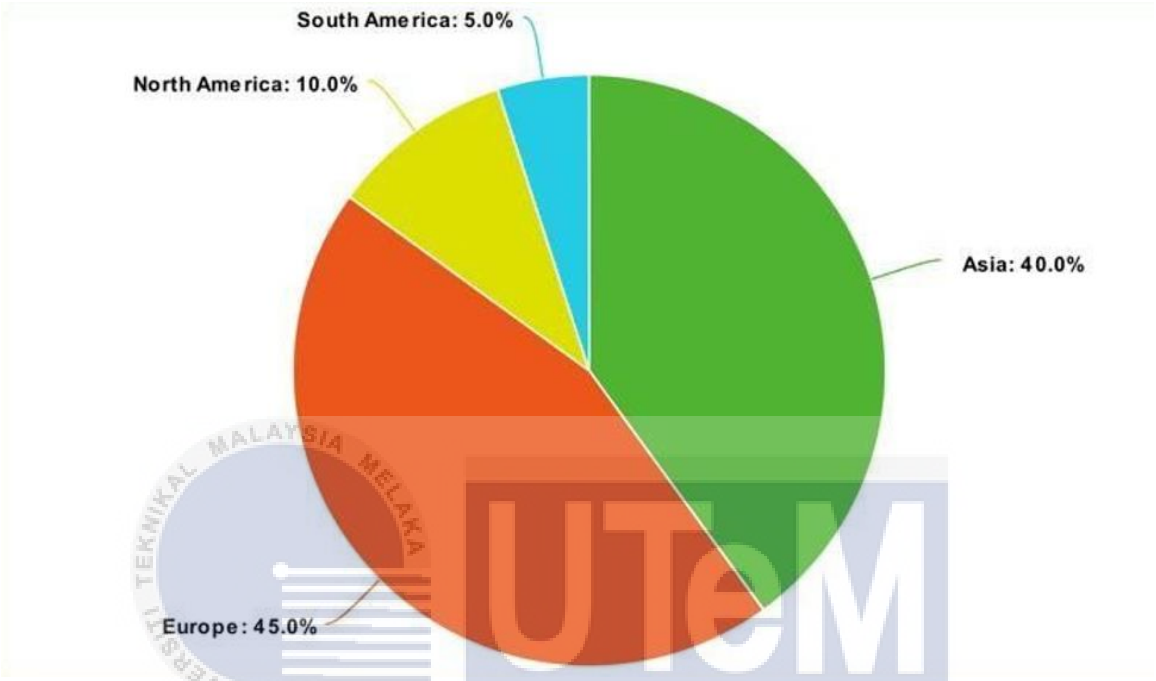


Figure 2.2 : The growth of paper by continent

In this figure 2.3 show the countries of origin of the paper researchers. The most origin researchers come from United State and Switzerland. that can conclude that United State and Switzerland had make more attention in this field or do more extensiveresearch for RFID and gameboard.

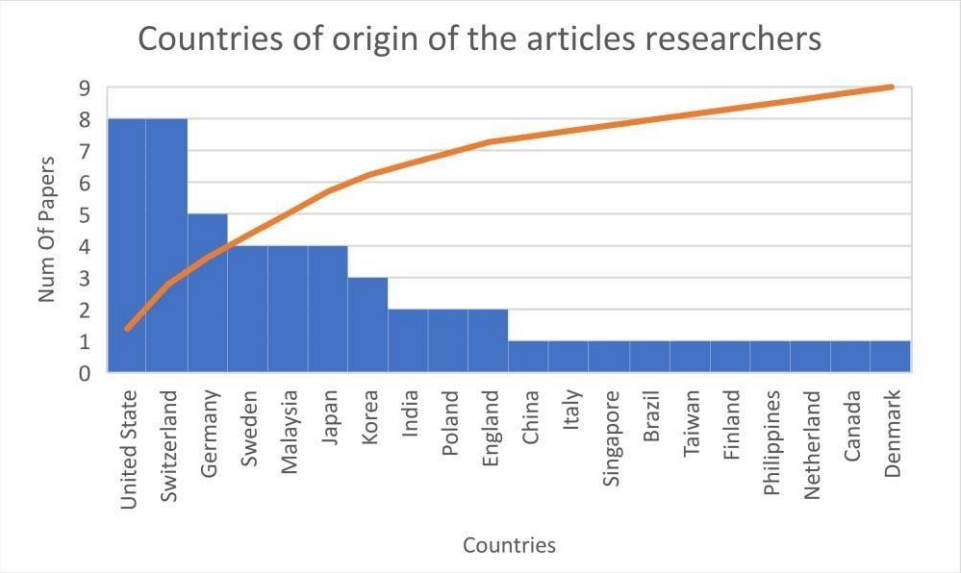


Figure 2.3 : Countries of origin of the paper researchers

The growth of research paper from 2002 to 2022 as in Figure 2.4. This show increase of research paper by year. In this figure show that in 2007 show the most

Figure 2.4 : Growth of research paper

This shows the distribution of the references by years. In this figure 2.5 show that the highest reference is from year 2020 with the reference is 64. This figure also shown that with the advancement of technology and the development of the internet the number references rapidly increase by year.

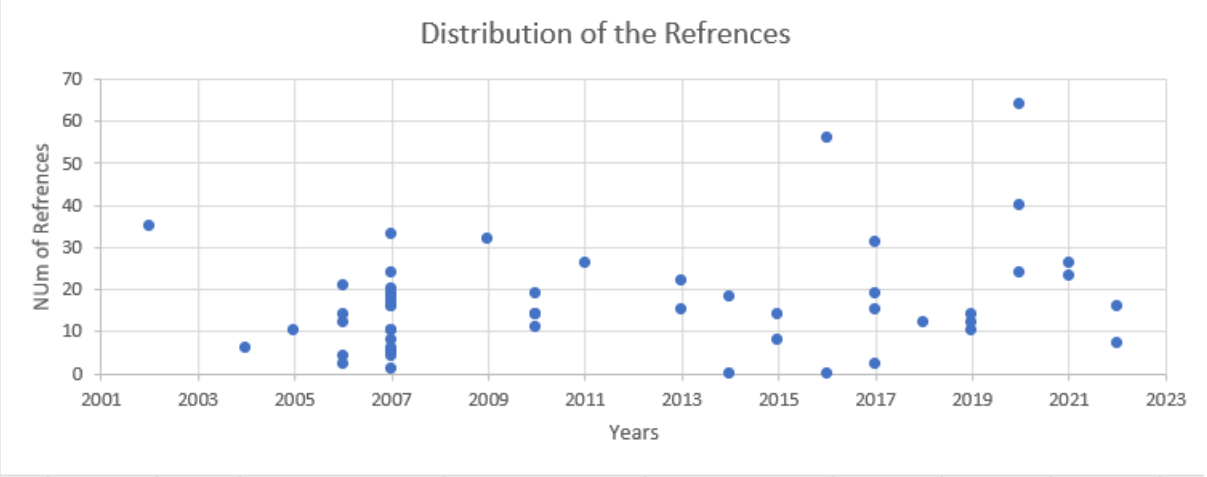


Figure 2.5 : Distribution Of References

In this figure 2.6 shown that the average number of references by year. In the graph show that average

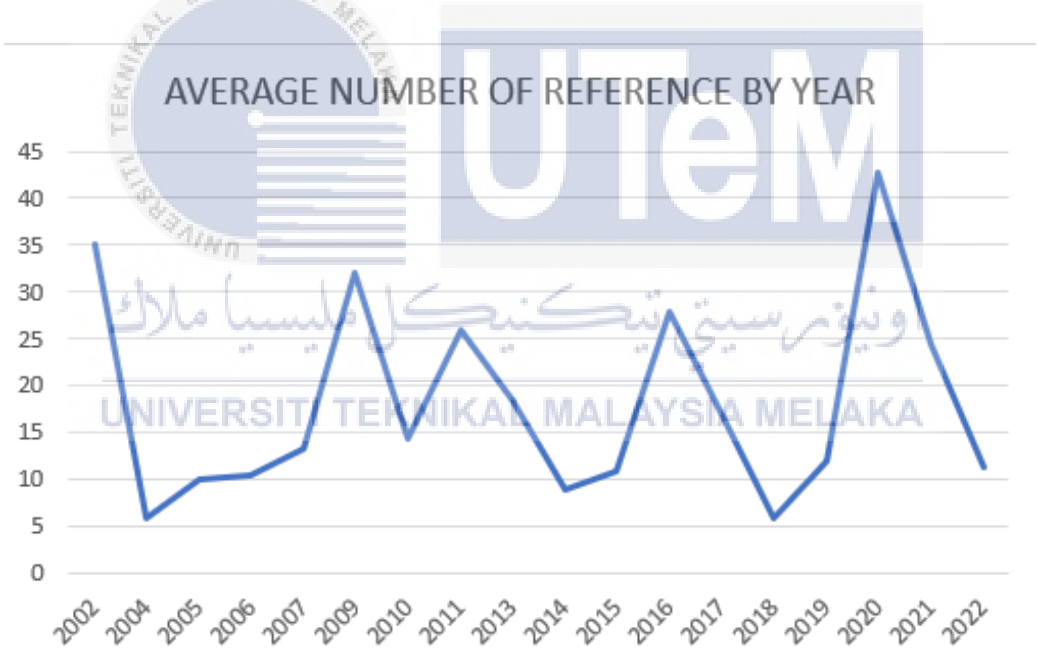


Figure 2.6 : Average of Reference

In figure 2.7 shown the keyword from papers in years 2002 until 2022 that had been described to tag cloud by using the tools in tagcrowd.com. as can see at the keywords that had been provide by the researcher the trend within games board and RFID.

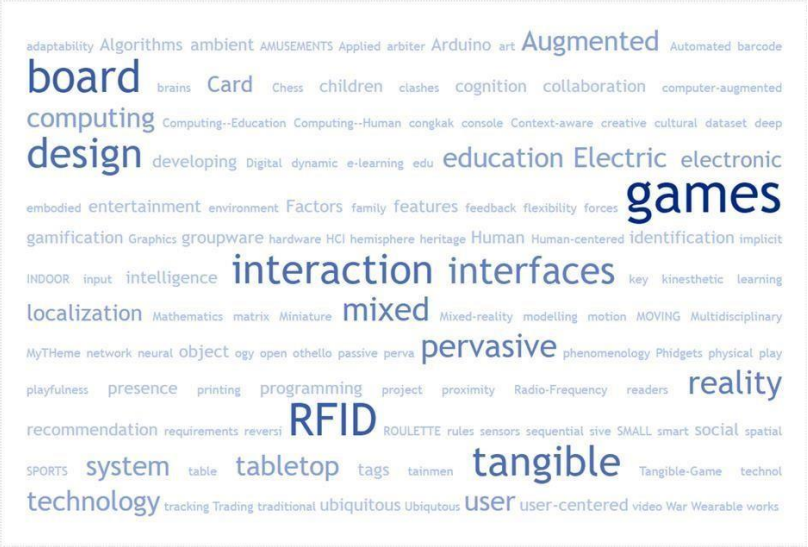


Figure 2.7 : Tag Cloud

In figure 2.8 k-chart for gameboard.

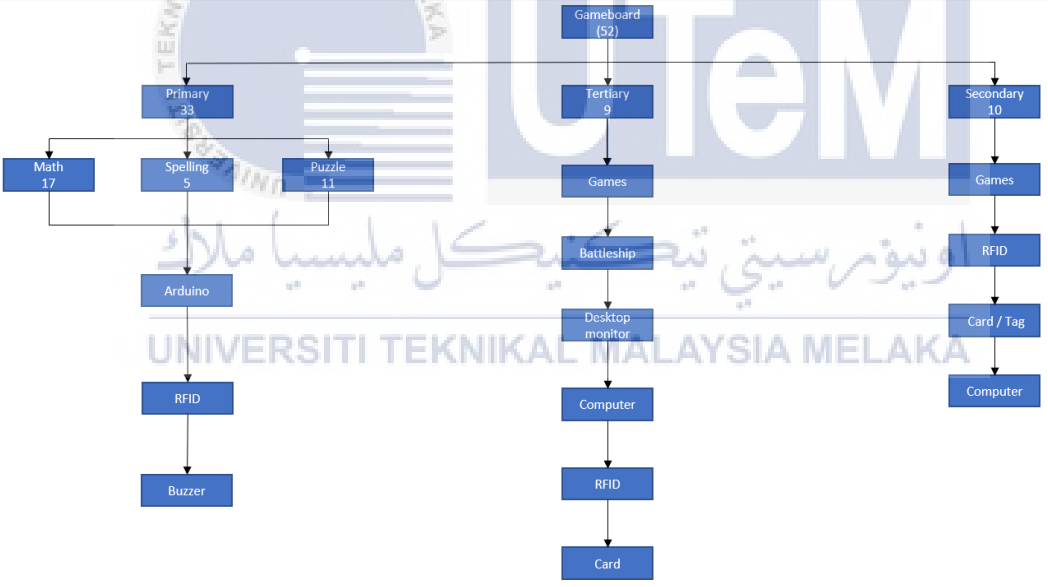


Figure 2.8 : k-chart

2.2 Literature Review

The research will focus on game board for educational purposes and RFID sensor. The selection of research materials will depend on the product and equipment used to construct the venture. The sources must be satisfactory in terms of format, such as authorized books, journals, articles, and websites.

2.2.1 Rfid-based digital board game platforms

In 2010, a research study was published in South Korea that focused on the development of a digital board game platform using radio-frequency identification (RFID) technology. The platform consisted of physical objects, such as game pieces, that had RFIDtags embedded in them, as well as RFID reader boards and a game board that served as input devices [2]. The purpose of the platform was to create a library for recognizing and tracking the data, locations, and movements of the physical game objects[2]. The paper described the design and development of three prototypes of educational games for young children, all of which were intended to provide an interactive and engaging experience. The platform was built on the RFID technology, which allowed for the recognition and tracking of the physical game objects through the use of the RFID tags and reader boards[2].

Advantage when multiple RFID tags are present in the range of the reader, they can all be read at the same time.

Disadvantage bar code technology and RFID are similar in that they can be read without contact, but they differ in that RFID tags have writable, invisible data and can store more information than bar codes, which have visible, unchangeable data.

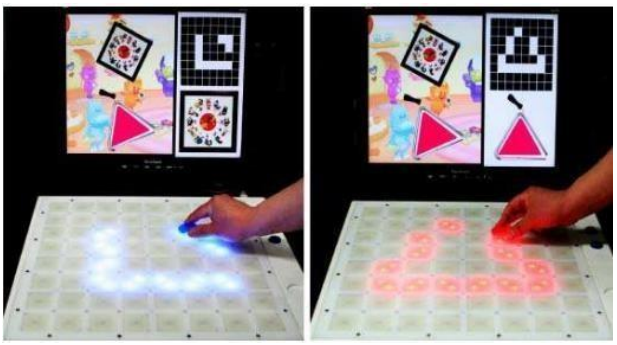


Figure 2.9 : Digital Board Game

2.2.2 A design of augmented tabletop game based on rfid technology

In 2015, a research paper was published and the origin from China that examined the potential for integrating context-aware technology into traditional tabletop games. The goal of this exploration was to create a more innovative and engaging playing experience for players. The study focused on an augmented tabletop game, in which two experienced players and four experts in the field of human-computer interaction (HCI) participated [3]. During the game, these experts were able to discuss their thoughts and present opinions on the usability of the prototype, as well as offer suggestions for improvement. An experimenter was also present to record the experts' observations and answer any questions they had. The augmented tabletop game provided a valuable opportunity to examine the potential use of ubiquitous computing in this context[3].

Figure 2.10 : Tabletop Game

2.2.3 Development of an electronic-based educational game board for teaching kindergarten kid basic number through game using arduino

In 2022, a paper was published in Malaysia detailing the design of an electronic educational game board for teaching basic math concepts to kindergarten students through interactive games using an Arduino Uno microcontroller. The board utilizes an I2C LCD display to present questions, which students can answer by placing the correct RFID card on the board [4].When a correct answer is given, a yellow LED turns on, and a red LED turns on for incorrect answers [4]. The game can also be accessed on a smartphone through the MIT app, providing.

An additional way for students to learn and practice math skills while having fun. This project aims to improve problem-solving skills and understanding of math concepts in a enjoyable way for kindergarten students [4].

Figure 2.11 : Numerical Game

2.2.4 Developing an educational board game using information technology

This work, published in 2017, originated in Poland and introduces a board game called the Architectural Jewel of Lublin. The purpose of the game is to educate players about the locations and histories of the architectural monuments in the historic center of Lublin [5]. Players must place three-dimensional models of the most important architectural monuments on a map. The game also utilizes an Arduino Mega and an RC522 [5].

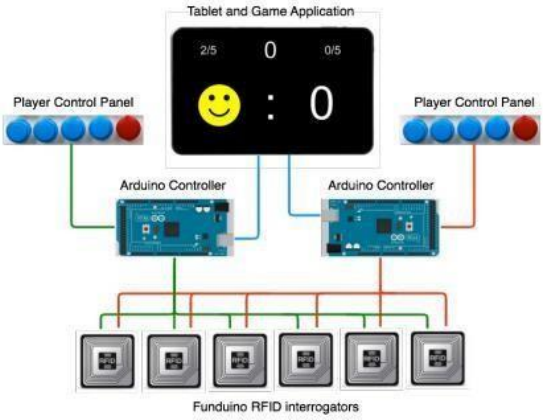


Figure 2.12 Educational Board Game

2.2.5 Bridging digital and physical educational games using rfid/nfc technologies

This paper, published in 2014, originated in Italy and describes the workings of RFID/NFC technology and its potential use in connecting digital and physical didactic materials through a hybrid approach. The paper also introduces the board game Block Magic, an educational game based on the well-known logical block material from an European project [6].The game includes a tablet that can recognize RFID tags and transmit the signal to a PC or tablet [6]. Children can interact with the game by placing logical block tags with RFID on the magic board. When the tags interact with the sensor, the signal is transmitted to the PC or tablet, and the software provides the appropriate response[6].

Figure 2.13 : Block Magic

2.2.6 Technique processes rfid signals rapidly for real-time interactivity

This paper was publish on year 2016. The origin of this paper from United State. In this paper talk about how does RFID work. RFID tags also could be incorporated into durable objects, such as interactive pop-up books and toys, in which batteries or wires would be inconvenient or infeasible [7].

Advantage develop a framework, called RFID, that interprets the signals by weighing possibilities rather than always waiting on confirmation

Disadvantage tags return signals in random order and tags don't always return signals. Waiting for confirmation through multiple "tag reads" slows response time enough to limit many interactions.

Figure 2.14 : Gameboard

2.2.7 A method for computerized olfactory assessment and training outside oflaboratory or clinical settings

The paper, published in 2021 and originating from Sweden, introduces a portable olfactory display that is designed to be used outside of a laboratory environment. This device can be operated using a personal computer and includes the use of Radio Frequency Identification (RFID) tags, which are attached to various odor stimuli [8]. These RFID tags are read by an MFRC522 module RFID reader/antenna, which encodes the odors and presents them as adaptive challenges to the user [8].

Figure 2.15 : Odor Simulation

2.2.8 Applications of rfid in interactive board games

In 2013, a group of researchers from India published a paper on a new type of chess board that they had developed. This chess board was special because it used a technology called RFID, or Radio Frequency Identification, to keep track of the chess pieces [9]. This meant that the chess board could detect where the pieces were on the board and what moves were being made [9]. To make the RFID chess board, the researchers used small sensors that could sense when a chess piece was nearby [9]. They also used a special computer called a microcontroller to help the chess board keep track of the game [9]. The chess board could be connected to a computer, which would allow people to use it in different ways [9]. For example, people could use it to learn how to play chess, or they could use it to play against other people in a competition [9].

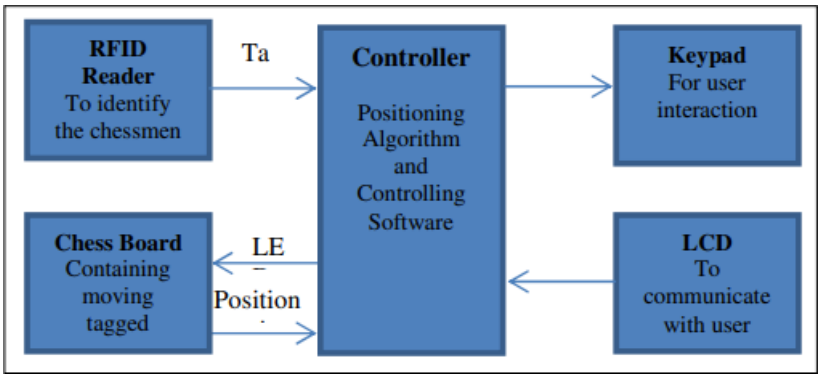


Figure 2.16 : Block Diagram

2.2.9 Do children understand binary numbers by electric card game?

This paper was published in 2007. The origin of this paper from Japan. This paper is about a computer game that helps children learn how to convert binary numbers (numbers using only 0 and 1) to decimal numbers [10]. The game is like a card game called Concentration, but it uses RFID card as an substitute [10]. The authors of the paper made a prototype of this game and tested it with children at an educational event [10]. The children had fun playing the game and seemed interested in learning about binary numbers [10].

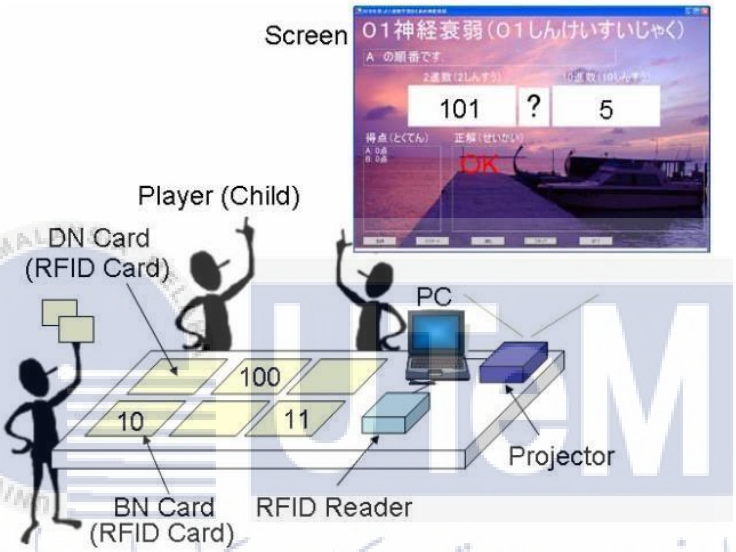


Figure 2.17 : How game Work

2.2.10 Development of a rule-based arbiter for games of the generals' pieces ranking detection using rfid

This paper was published in 2020. The origin of this paper from Philippines. In this paper focus on develop an automated Game the general "GG" which is a board game [11]. The goal was to eliminate the need for an arbiter, who is a person responsible for making decisions in the game, by developing a system that could accurately detect the rank of each GG piece [11]. The system was tested and was found to have 100% accuracy in detecting the ranks of the pieces. The system also has the ability to show which pieces have been played and to display the result of each game, using RFID technology. The system uses a rule-based algorithm to make decisions about which player's piece wins, loses, or draws in each encounter with other pieces [11].

Figure 2.18 : Game the general “GG”

2.2.11 Examining actual effects of a tangible tool on children’s collaboration

The paper, published in 2002, was written by researchers in Germany and introduces a collaborative tool called SpellBoard. The tool is designed to help people work together to spell words and consists of several components [12]. The first component is a board with six positions where letter blocks can be placed [12]. The tool also includes 20 letter blocks, which can be arranged on the board to spell words[12]. In addition to the board and letter blocks, the tool includes a laptop that displays spelling tasks for users to complete. The board of the SpellBoard tool also has several technological components [12]. These include an ESP32, which is a microcontroller that can be programmed to perform various tasks, six RFID readers, which are used to read information stored on RFID tags, six reed connectors, which are used to control the flow of electricity, six RGB LEDs, which are usedto display different colors, and a button [12]. There is also cabling that connects these components to one another and allows them to function properly. One of the key features ofthe SpellBoard tool is the inclusion of RFID readers and reed connectors [12]. The RFID readers are attached to six positions on the board, and the reed connectors are included to reduce power consumption. The reed connectors enable the RFID readers to only read information from RFID tags when the circuit at the magnet connector is closed, which helps to conserve energy. Overall, the SpellBoard is a innovative and useful tool for collaborative spelling.

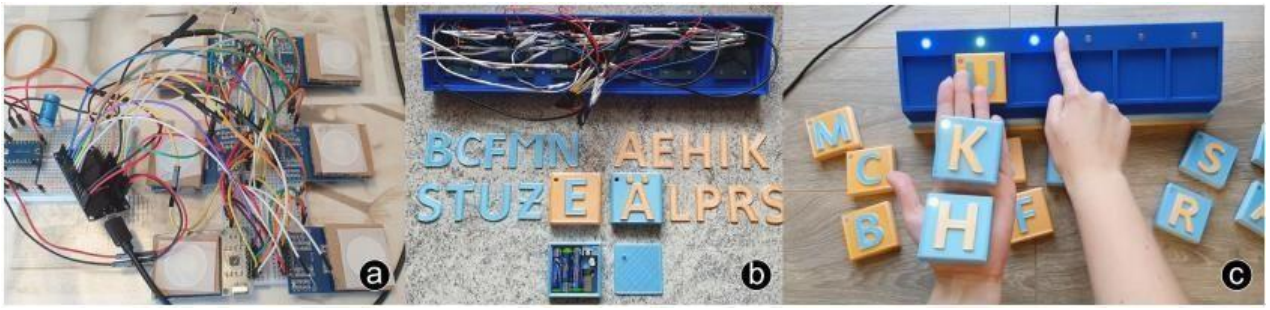


Figure 2.19 : Spell Board

2.2.12 The use of rfid technology to control a 3d model realising the gamification paradigm

This paper, published in 2017, discusses the creation of a 3D board game that uses RFID technology. The game was developed in Poland and incorporates digital wireless RFID technology to facilitate the gamification process [13]. The study conducted tests in two scenarios one with the RFID devices alone and another with plywood placed between the devices [13]. The focus of the research was on examining the impact of the material on communication between the RFID tag and interrogator [13].

Figure 2.20 : 3D model

2.2.13 Trading card game exploiting rfid and 3d graphic

In 2010, researchers from Korea published a paper about a game framework that uses RFID technology and 3D graphics to make playing games more immersive and fun[14]. The framework uses special game cards with RFID tags that are detected by RFID readers when placed on the gaming table. The game then displays 3D graphics on the table's screen. The

researchers found that this framework was better than traditional card games based on surveys they conducted [14]. One issue they had to solve was making sure the RFID readers correctly detected the RFID tags on the game cards. They did this by experimenting with the distance between the RFID readers [14].

Figure 2.21 : Electronic card game

2.2.14 E-othello: the development of an electronic-hardware version of traditional othello board game

The focus of this paper, published in 2019, is the creation of an electronic version of the board game Othello, which originated in Malaysia. The electronic board game is powered by an Arduino Mega controller and utilizes RG LEDs and shift registers to coordinate the game [15]. It also includes a buzzer to produce sounds, a push button to stop and reset the game, and joysticks for players to move and place their game pieces on the board.

Figure 2.22 : Othello

2.2.15 E-congkak: the development of an electronic congkak board game to promote traditional board game to younger malaysian generation

This paper was published in 2018. The purpose of this paper was to introduce a new electronic version of the traditional board game called Congkak, which is popular in Malaysia [16]. The electronic version, known as E-Congkak, utilizes an Arduino Mega microcontroller to facilitate gameplay[16]. Each hole on the board is represented by two seven-segment displays, which show the number of pebbles contained within [16]. Players can use push buttons to select the hole they wish to move their pebbles from or to enhance the gameplay experience, the E-Congkak also includes two LEDs to indicate which player's turn it is and a buzzer to give the sound effect of pebbles being picked up and placed in the holes [16]. This updated version of the classic board game provides a modern twist on a beloved traditional game [16].

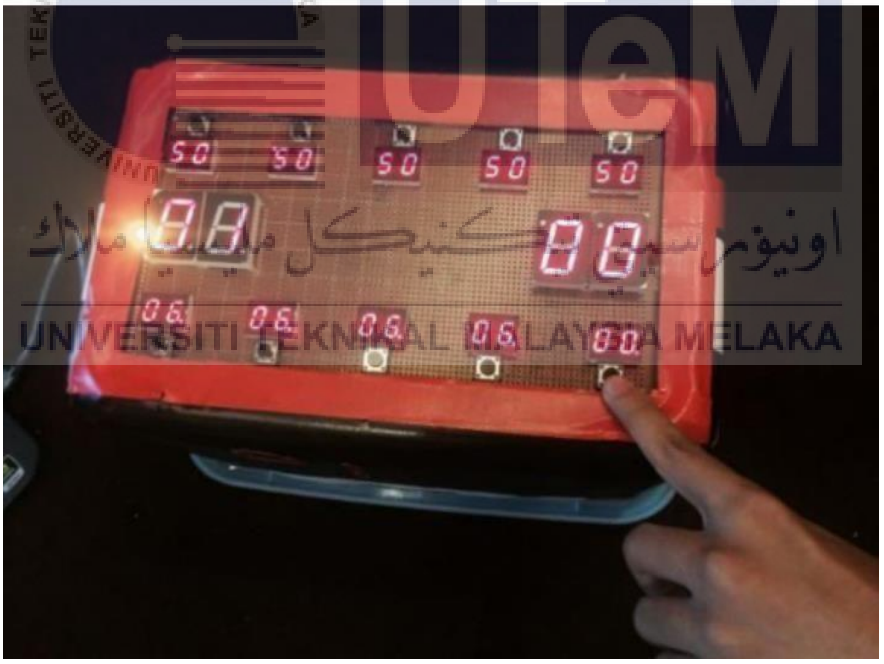


Figure 2.23 : E-Congkak

2.3 Comparison.

In table 2.1 will show the advantage and disadvantage of each paper that had been read.

Table 2.1 : Advantage vs Disadvantage

No	Paper	Advantage	Disadvantage
1	Rfid-based digital board game platforms	RFID tags can be used to identify and track game pieces on a board, making gameplay more accurate.	RFID technology in a digital board game can make it harder to create.
2	A design of augmented tabletop game based on rfid Technology	RFID technology allows for creating games with different scenarios, making them more fun to play again	RFID technology can be hard to use which can make the game hard to understand for players.
3	Development of an electronic-based educational game Board for teaching kindergarten kid basic number Through game using arduino	The game helps children learn by allowing them to actively participate, which makes them understand and remember better.	The game may be hard for young children to understand, making it hard for them to learn and enjoy it.
4	Developing an educational board game using Information technology	IT tools such as graphic design software can be used to create visually appealing game boards and pieces.	Technical issues such as software bugs or compatibility problems can cause disruptions in gameplay.
5	Bridging digital and physical educational games using rfid/nfc technologies	The use of RFID/NFC technologies in educational games can help to personalize learning and provide immediate feedback, which can	RFID/NFC technologies can be complex to set up and maintain, and may require specialized

		improve learning outcomes.	expertise to troubleshoot and repair.
6	Technique processes rfid signals rapidly for real-time interactivity	Faster processing of RFID signals, allowing for quick and efficient tracking of items or individuals	Limited range, as RFID signals can be blocked or weakened by physical obstacles such as walls or metal objects.
7	A method for computerized olfactory assessment and training outside of laboratory or clinical settings	The computerized system allows for assessments and training to be repeated, which can be useful for tracking progress over time.	The computerized method may not be able to fully replicate the sensory experience of smelling an odor, which could impact the accuracy of the results.
8	Applications of rfid in interactive board games	RFID technology can eliminate the need for manual tracking of game pieces, which can lead to fewer errors and a more efficient game.	RFID technology can add complexity to board games, which may make them less accessible to some players, especially those who are not familiar with technology.
9	Do children understand binary numbers by electric card game?	The interactive nature of the game may hold children's attention and make the learning experience more enjoyable.	The game may not cover all aspects of binary numbers, and children may not get a complete understanding of the concept.
10	Development of a rule-based arbiter for games of the generals' pieces	The use of a rule-based arbiter eliminates the need for a human arbiter,	The rule-based arbiter may be complex and difficult to understand for some players, which

	ranking detection using rfid	allowing for faster and more efficient game play.	can lead to confusion or frustration.
11	Examining actual effects of a tangible tool on children's collaboration	The ability to identify specific features of a tool that are most beneficial for promoting collaboration.	The challenge of accurately measuring collaboration, which is a complex and multidimensional construct.
12	The use of rfid technology to control a 3d model realizing the gamification paradigm	Increased engagement and immersion for players, as they are able to interact with the 3D model in a more realistic and dynamic way.	Limited range of RFID technology, which may restrict the size and scope of the 3D model and gameplay.
13	Trading card game exploiting rfid and 3d graphic	RFID technology can be used to improve game mechanics by allowing cards to interact with each other in new ways and providing players with more strategic options.	The use of RFID technology and 3D graphics can make the game more complex for new players and may require a steeper learning curve.
14	E-othello: the development of an electronic-hardware version of traditional othello board game	the electronic version can automatically keep track of the score, eliminating the need for manual counting and reducing the chance of errors.	the electronic version requires a power source and functional electronic hardware, which can be a disadvantage in case of power failure or hardware malfunction.
15	E-congkak: the development of an electronic congkak board game to promote	The use of technology in the game could enhance the player's experience and	The use of technology in the game may also increase the chances of players getting

	traditional board game to younger malaysian generation	increase engagement with the game	distracted and not fully engaging in the game.

2.4 Summary

In this chapter have discover the journal and article that have found that their project have using RFID sensor but they using a different rule for their gameboard. But for this project will apply simple arithmetic for gameboard that easy to understand for kindergarten.

CHAPTER 3

METHODOLOGY

3.1 Introduction

In this chapter, will provide an overview of the research technique used in this study and explain how the research was conducted. We will also outline the strategy that will be employed in the initial stage of the project. The following step will involve the application of various tools and methods until the project is completed. This chapter will also detail the workflow and design requirements of the processes involved in creating this project.

3.2 Project Overview

The following flowchart outlines the steps for the capstone project, which is divided into two parts called Final Year Project 1 and 2. The first step in completing this project is to find a supervisor. Next, the primary goals and scope of the project should be determined. Then, research on relevant computer hardware and software as well as past projects will beconducted as part of the literature review. Based on this review, the necessary hardware and software can be selected. These steps will be completed during the first year of the plan.

The hardware design for this project will be developed during the second fiscal year of the plan. The circuit has been designed using components purchased in the first year and was tested for continuity and faults. Using the Proteus software, a simulation of the circuit was run. The circuit layout was then etched, and the components were soldered onto it. This resulted in a working prototype of the hardware. The project's coding and application design were completed after the hardware was finished. Both the software and hardware will be integrated into a single system. Performance assessments will be conducted to evaluate the effectiveness of the project, and debugging will be performed if necessary. The student and professor will review the project to ensure its accuracy.

3.3 Project Block Diagram

Proper system design is crucial in the planning phase of a project. It allows for a clear understanding of the project's goals and objectives and helps to identify the necessary steps for a successful outcome. The design process includes both hardware and software components, and often starts with the creation of a block diagram to provide a visual representation of the overall design, such as the one shown in Figure 3.2.

In this project, several hardware components are used to accomplish the task. One ofthe key input components is the RFID sensor RC522, which is used to read data from RFID cards. Jumper wires are also used as input components and serve the purpose of connecting different parts of the circuit together. The output component of this project is an RG LED. This LED will be used as an indicator to show who will start the game and to differentiate between player one and player two. The LED will change colour or blink depending on the state of the game, making it easy for users to understand the status. In addition to these input and output components, the project also utilizes a connection method called "master-slave" to connect four Arduino Mega boards together. In a master-slave connection, one board acts as the "master" and controls the communication between the other boards, which are called "slaves." This allows for multiple boards to work together to accomplish a single task.

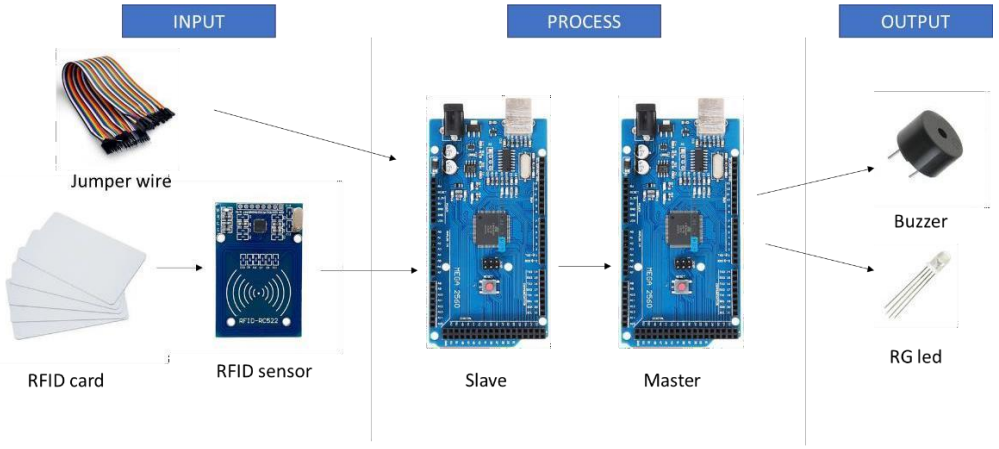


Figure 3.1: Block Diagram

3.4 Project Layout

Figure 3.3 presents the detailed design layout for the Tapop Game Board, a unique and interactive game designed for students. The game board comprises of several key components that act as both input and output devices. The key input device used in this game is an RFID card, which is utilized by the students to play the game. The game board has RFID sensors that are responsible for detecting the RFID cards, allowing students to engage with the game seamlessly. The game board also features RG LED displays, which are crucial for displaying the output and providing students with visual feedback of their progress. This feature is essential for students to understand their status in the game, and to know if they own a particular slot. Lastly, the game board has a push button that is used to reset the game. This feature is useful for students who want to start the game anew and for teachers who want to set the game board back to its initial state.

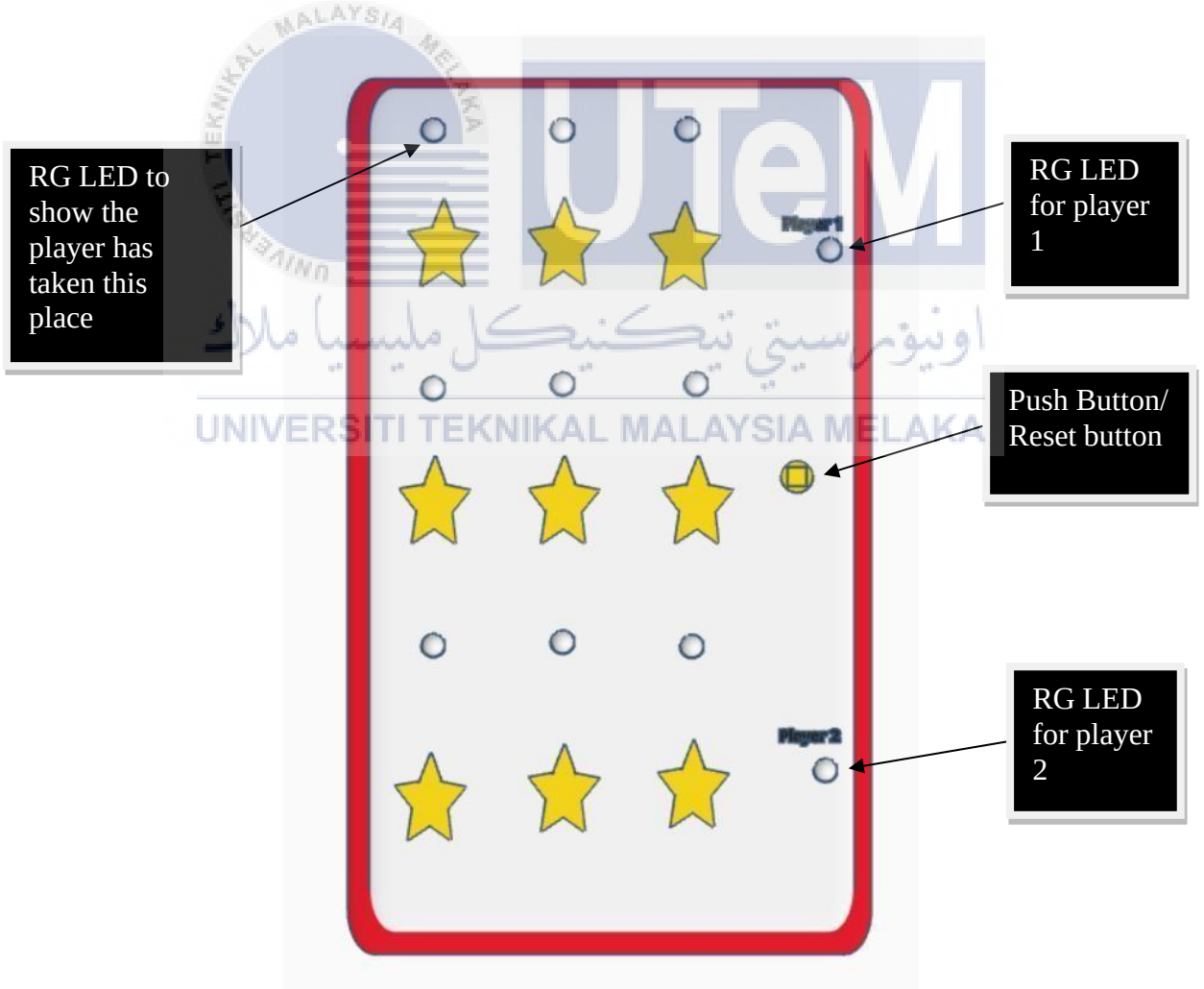


Figure 3.2 : Project layout

The 3D design of the Tapop Game Board, as depicted in Figure 3.4, was created using thepopular software Tinker Cad. The design features a total of 9 RG LED indicators, which are used to indicate the spaces for the RFID sensors. Each of these LED indicators represents one RFID sensor, which is an integral part of the game board's functionality. The 9 RFID sensors are arranged in a 3x3 configuration on the game board, with the purpose of ensuring that cards can be compared with their surrounding cards. This is an important aspect of the game, as it allows for players to determine the relative positions of their cards and make strategic decisions accordingly. The RFID sensors also enable the game board to detect whena card is placed on the board, and to compare it with the cards that are already present. Furthermore, the use of Tinker Cad software allows for the creation of a highly detailed andprecise design of the game board, with the ability to make adjustments and refinements as needed. This ensures that the game board is functional and visually appealing, providing anenjoyable experience for players. Overall, the 3D design of the Tapop Game Board is a crucial element of the game, with the combination of the Tinker Cad software, the 9 RFID sensors arranged in a 3x3 configuration, and the RG LED indicators used to indicate the spaces for the RFID sensors, make sure that the game board is able to function correctly andprovide an engaging experience for players.

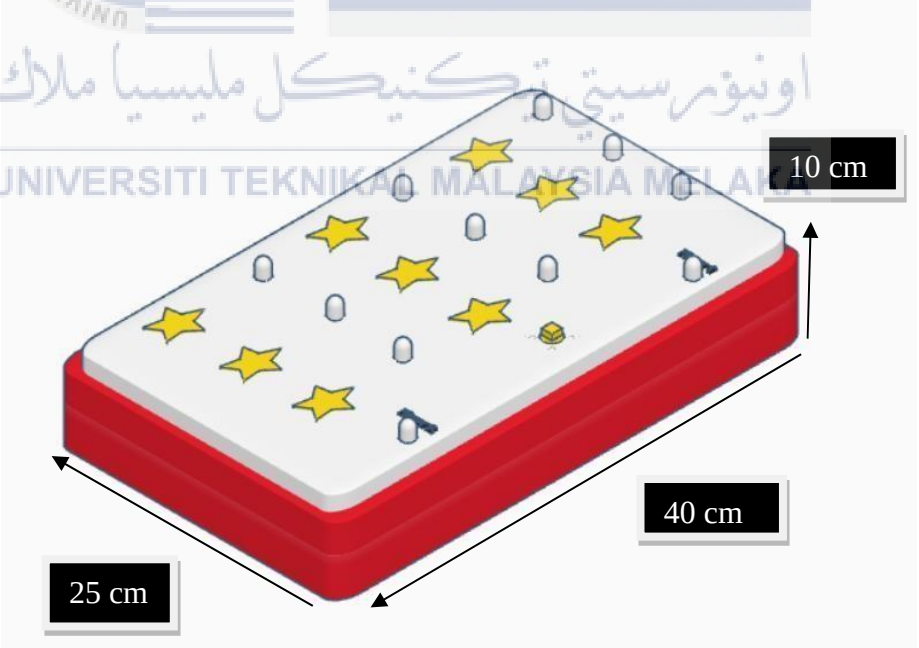


Figure 3.3 : Prototype of Game Board of Tapop

Figure 3.4 : Actual design

3.5 Circuit Layout

In this section, will go in the details of circuit simulation and the specific pin connections for each component to the Arduino. This information is crucial for understanding the overallfunctionality of the system and ensuring that it is set up correctly. As seen in Figure 3.6, the circuit connections have been clearly illustrated for ease of understanding. To further aid in understanding the connections, Table 3.3 shows the connection for the Arduino master pin with the RG LED, buzzer, and push button. This table provides a detailed breakdown of howeach component is connected to the master pin, making it easy to follow along and check forany potential issues. Additionally, Table 3.4 illustrates the connections for the Arduino slave pin to which three RFID sensors are connected in each Arduino slave, and Table 3.5 illustrates the connection of the Arduino master to the Arduino slave. Together, these tables provide a comprehensive guide for setting up and troubleshooting the circuit connections.

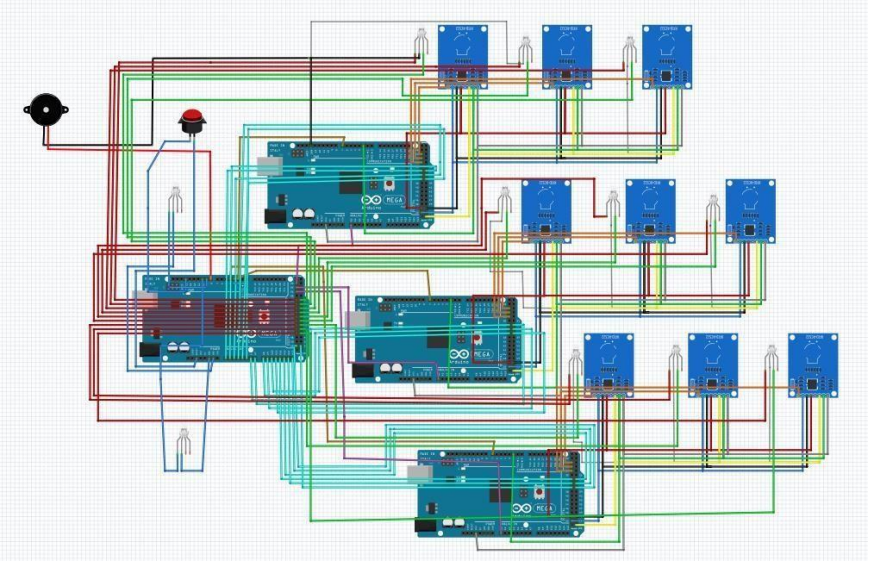


Figure 3.5 : Circuit Layout

Table 3.3 : Arduino Master Pin

Components	Components pin	Arduino Pin
Buzzer	Vcc(+)	8
	GND(-)	GND
RG led 1	Red pin	30
	Green pin	31
GND	GND	G
RG led 2	Red pin	32
	Green pin	33
	GND	G
RG led 3	Red pin	34
	Green pin	35
	GND	G

RG led 4	Red pin	36
	Green pin	37
	GND	G
RG led 5	Red pin	38
	Green pin	39
	GND	G
RG led 6	Red pin	40
	Green pin	41
	GND	G
RG led 7	Red pin	42
	Green pin	43
	Ground	G
RG led 8	Red pin	44
	Green pin	45
	GND	G
RG led 9	Red pin	46
	Green pin	47
	GND	G
RG PLAYER ONE	Red pin	10
	GND	G
PLAYER TWO	Green pin	9
	GND	G
PUSH BUTTON	VCC	RESET
	GND	GND

Table 3.4 : Arduino Slave pin

Components	Components pin	Arduino Pin
RFID 1	SDA	24
	SCK	52
	MOSI	51
	MISO	50
	GND	GND
	RST	2
	3.3V	3.3V
RFID 2	SDA	26
	SCK	52
	MOSI	51
	MISO	50
	GND	GND
	RST	2
	3.3V	3.3V
RFID 3	SDA	28
	SCK	52
	MOSI	51
	MISO	50
	GND	GND
	RST	2
	3.3V	3.3V

Table 3.5 : Connection Arduino Master with Arduino Slave

No. Slave	Arduino Slave pin	Arduino Master pin
Slave 1	7	2
	A0	22
	32	A0
	33	A1
	34	A2
	35	A3
	36	A4
	37	A5
Slave 2	7	3
	A0	24
	32	A6
	33	A7
	34	A8
	35	A9
	36	A10
	37	A11
Slave 3	7	4
	A0	26
	32	A12
	33	A13
	34	A14
	35	A15
	36	53
	37	52

3.6 PCB Layout

A printed circuit board, often known as a PCB, is a kind of board that has pads and lines printed on it to link different places together. It is possible for signals and power to be transmitted between different physical devices thanks to traces, which are electrical connections that physically link various connectors and components to one another. Putting a circuit's design onto a printed circuit board (PCB) helps keep the circuit organized and cuts down on errors.

TOP VIEW

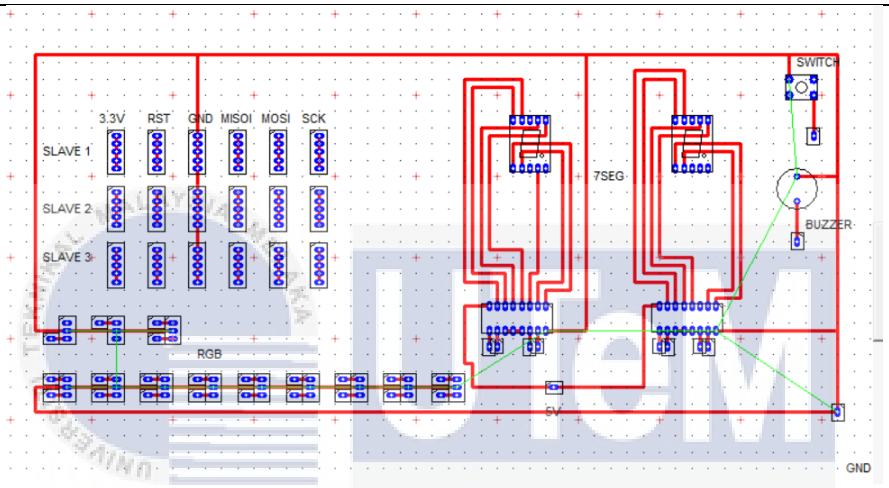


Figure 3.6 : Top View

BOTTOM VIEW

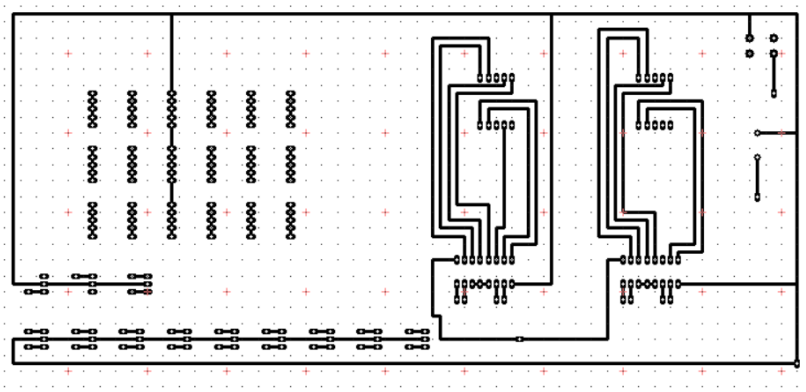


Figure 3.7 : Bottom View

After design the PCB circuit, the circuit will be going for etching process. After etchingprocess, the component will be solder on the PCB circuit. Solder is the metal that makes the electrical connections between the surface of the PCB and the electronic components.Being metal, solder also serves as a strong mechanical adhesive.

3.7 Flow Chart of The Program

The flowchart illustrated in Figure 3.9 demonstrates the flow of the program project that has been coded using Arduino Mega. As the game board is turned on, an initial sound or music will play, signaling the start of the game. Once the music ends, player one can begintheir turn by moving or placing their card on the designated game board. The game board isequipped with 9 RFID sensors, which are strategically placed to provide a variety of optionsfor the players to place their cards. As player one places their card, the program will immediately check if there is already a card present in the vicinity of the newly placed card. If there is, the program will begin comparing the two cards and determining a winner based on the pre-programmed rules. The winning player will then be awarded a point or slot.

Player two will then take their turn, placing their card anywhere on the game board that they choose. This process will continue until one player has gained the majority of the slots on the game board. The game can be quite intense, as players will need to strategize and make calculated moves in order to come out victorious. Once a player has achieved victory, the RG LED present on the game board will change to the color of the winning player, indicating that the game has come to an end. This serves as a visual indication of the winner, and adds an extra layer of excitement to the game

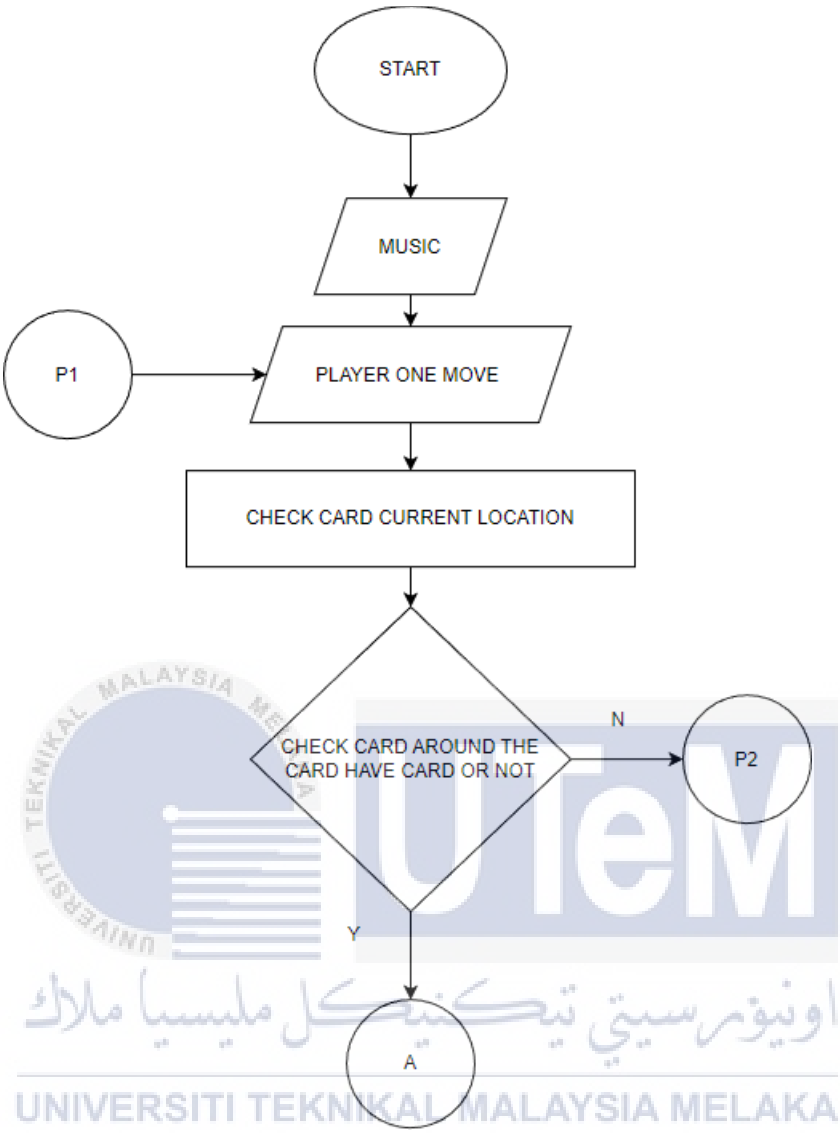


Figure 3.8 (a) : Flow Chart of program

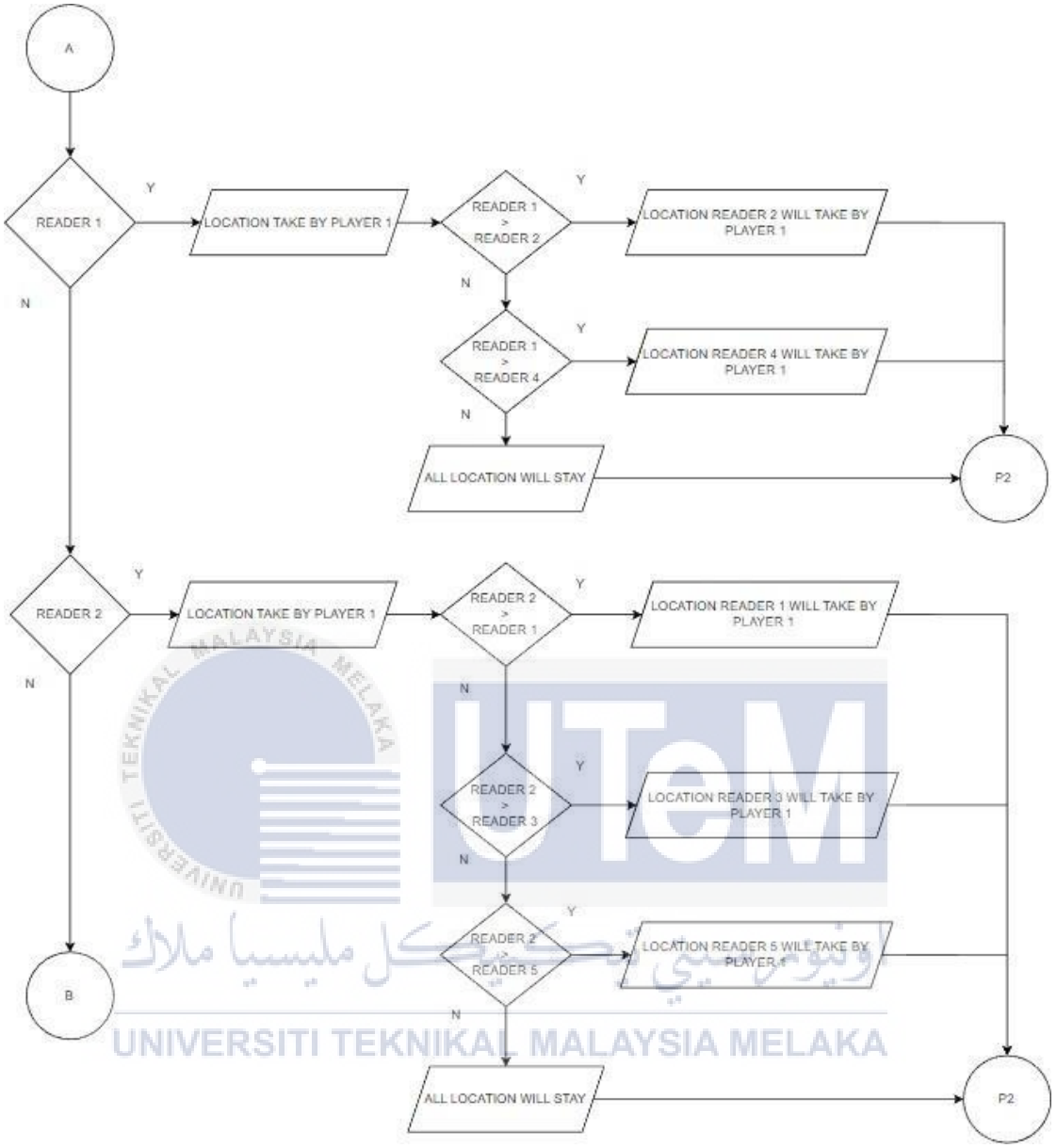


Figure 3.8 (b) : Flow Chart of program

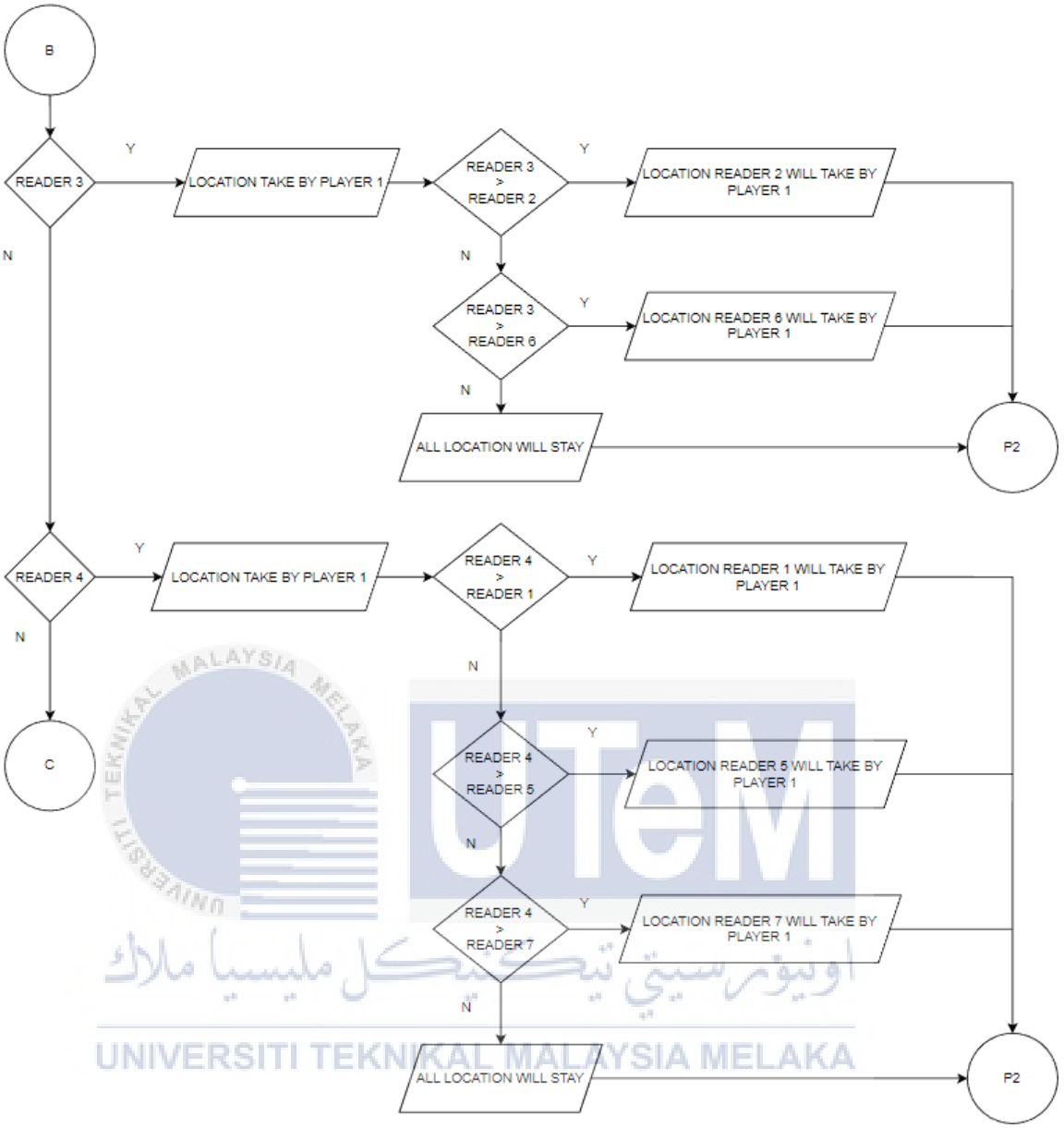


Figure 3.8 (c) : Flow Chart of program

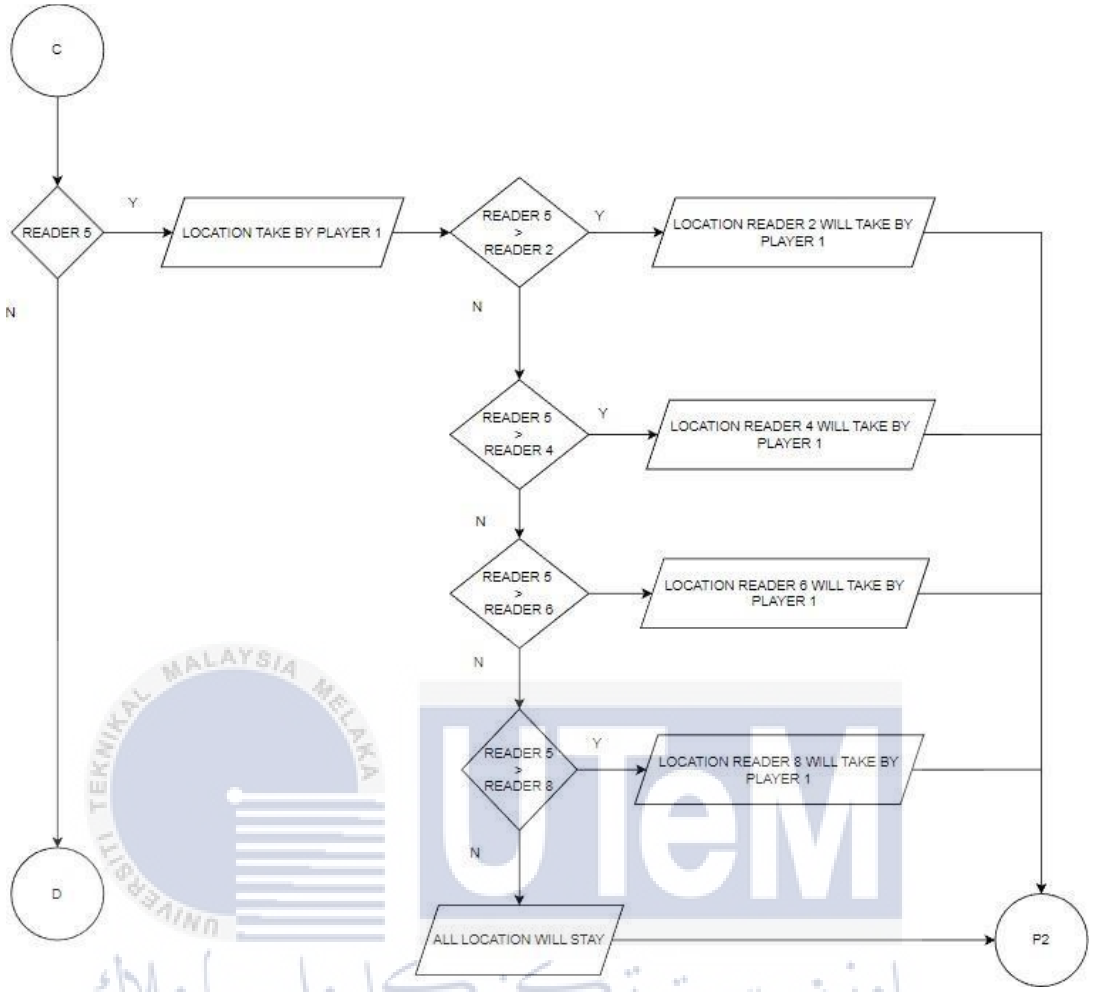


Figure 3.8 (d) : : Flow Chart of program

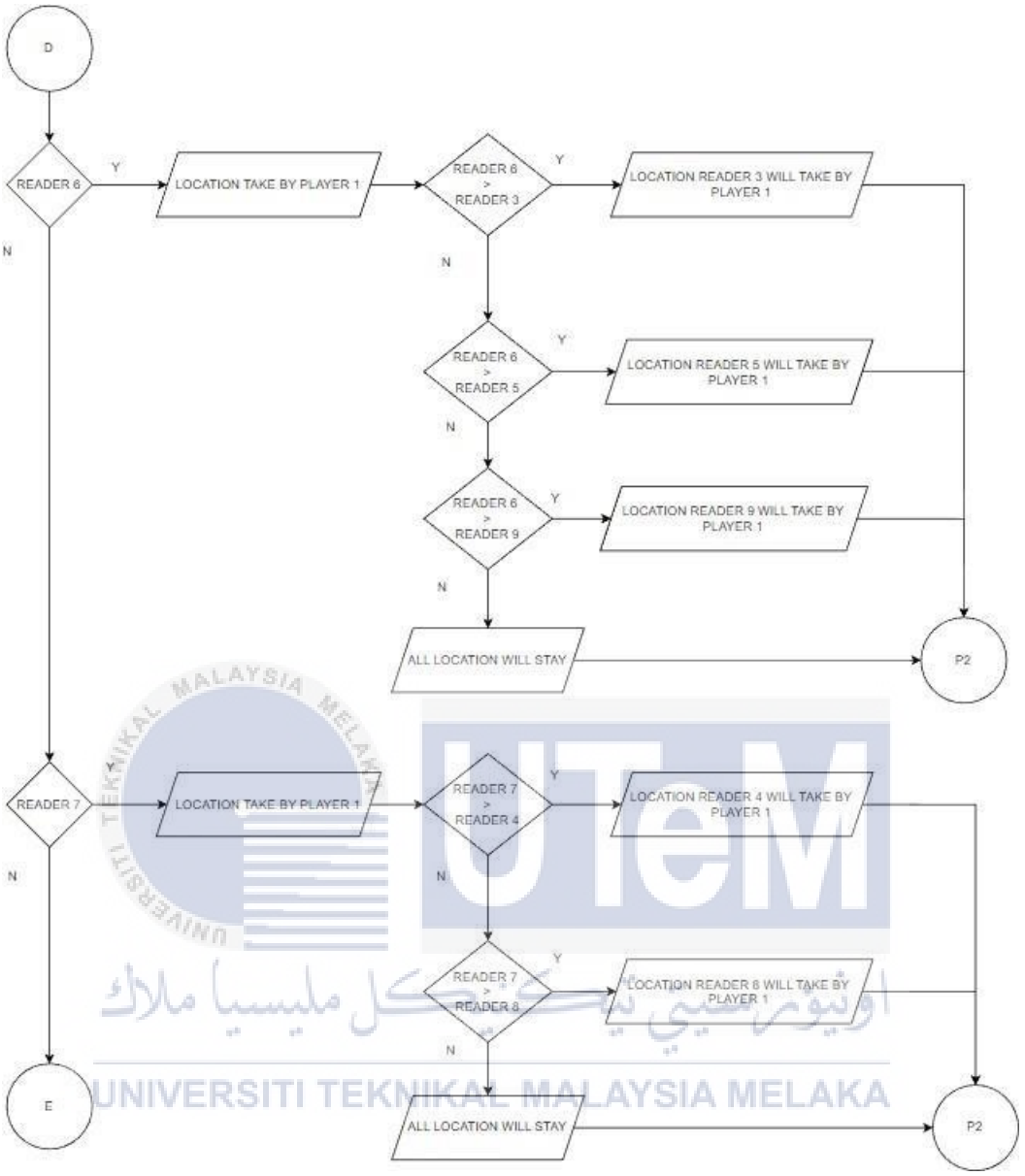


Figure 3.8 (e) : Flow Chart of program

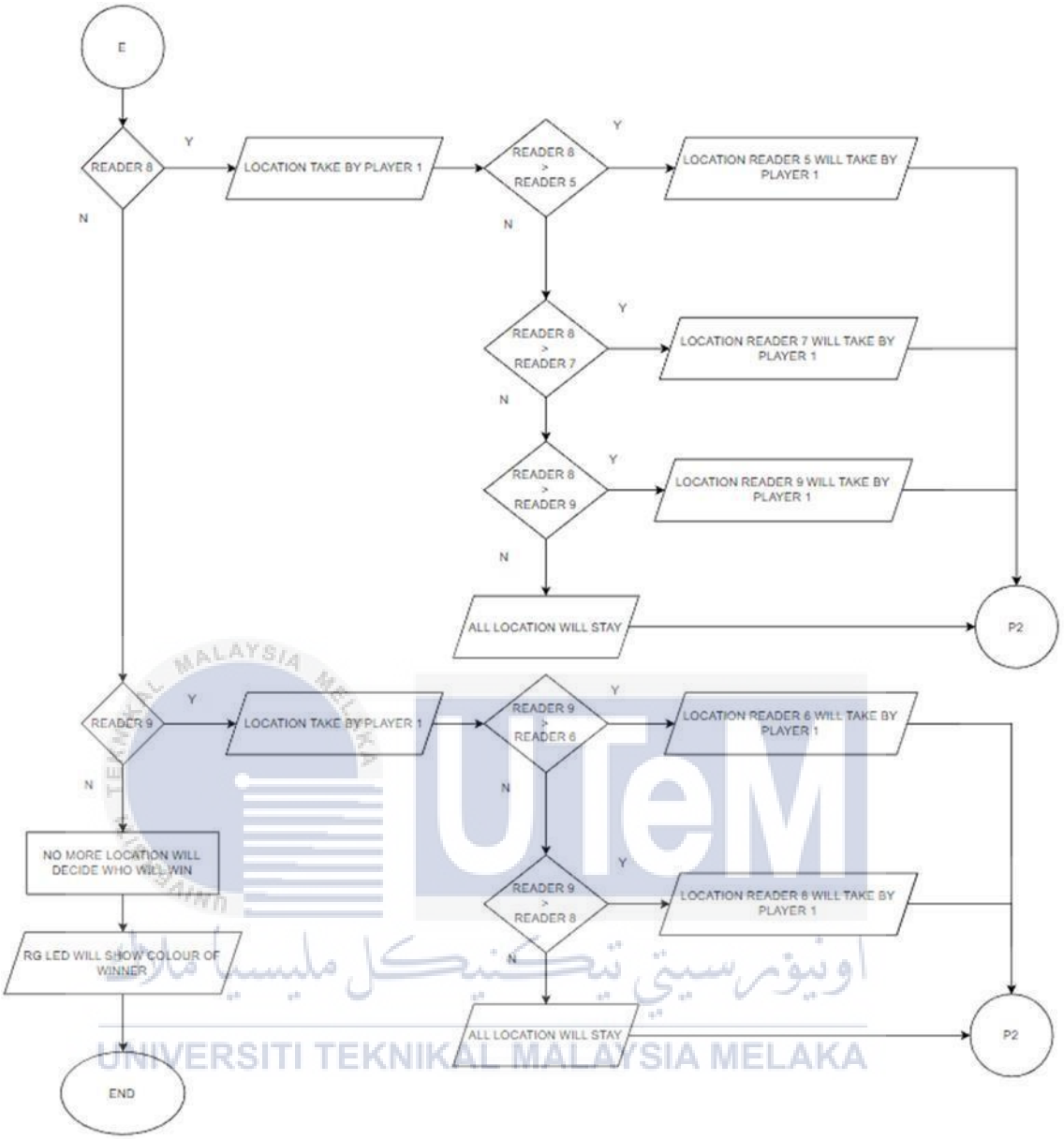


Figure 3.8 (f) : Flow Chart of program

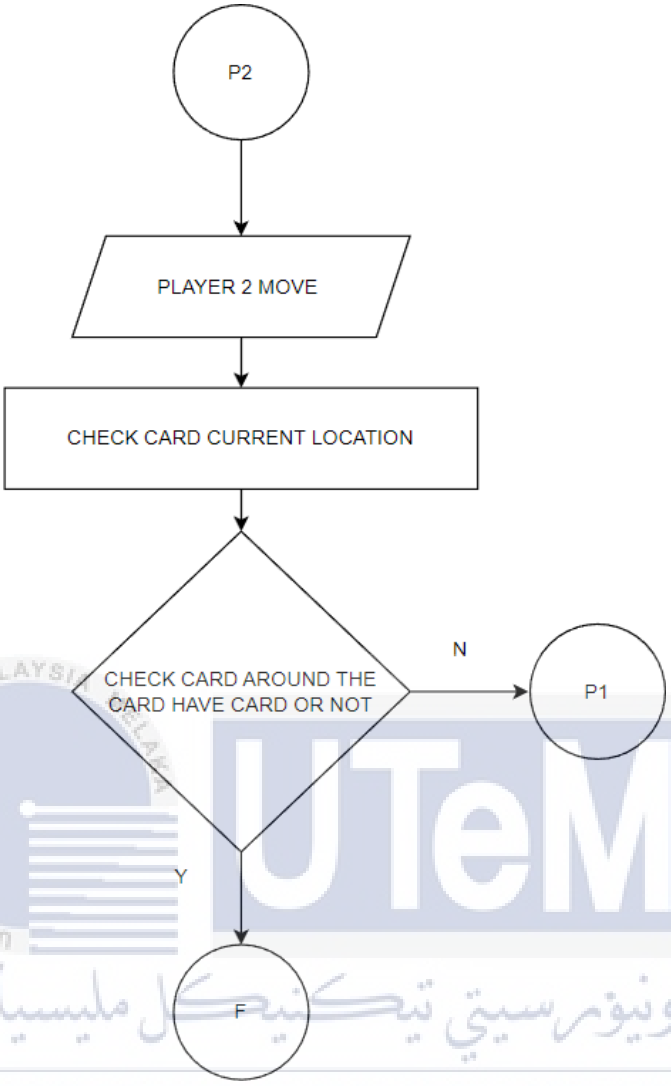


Figure 3.8 (g) : Flow Chart of program

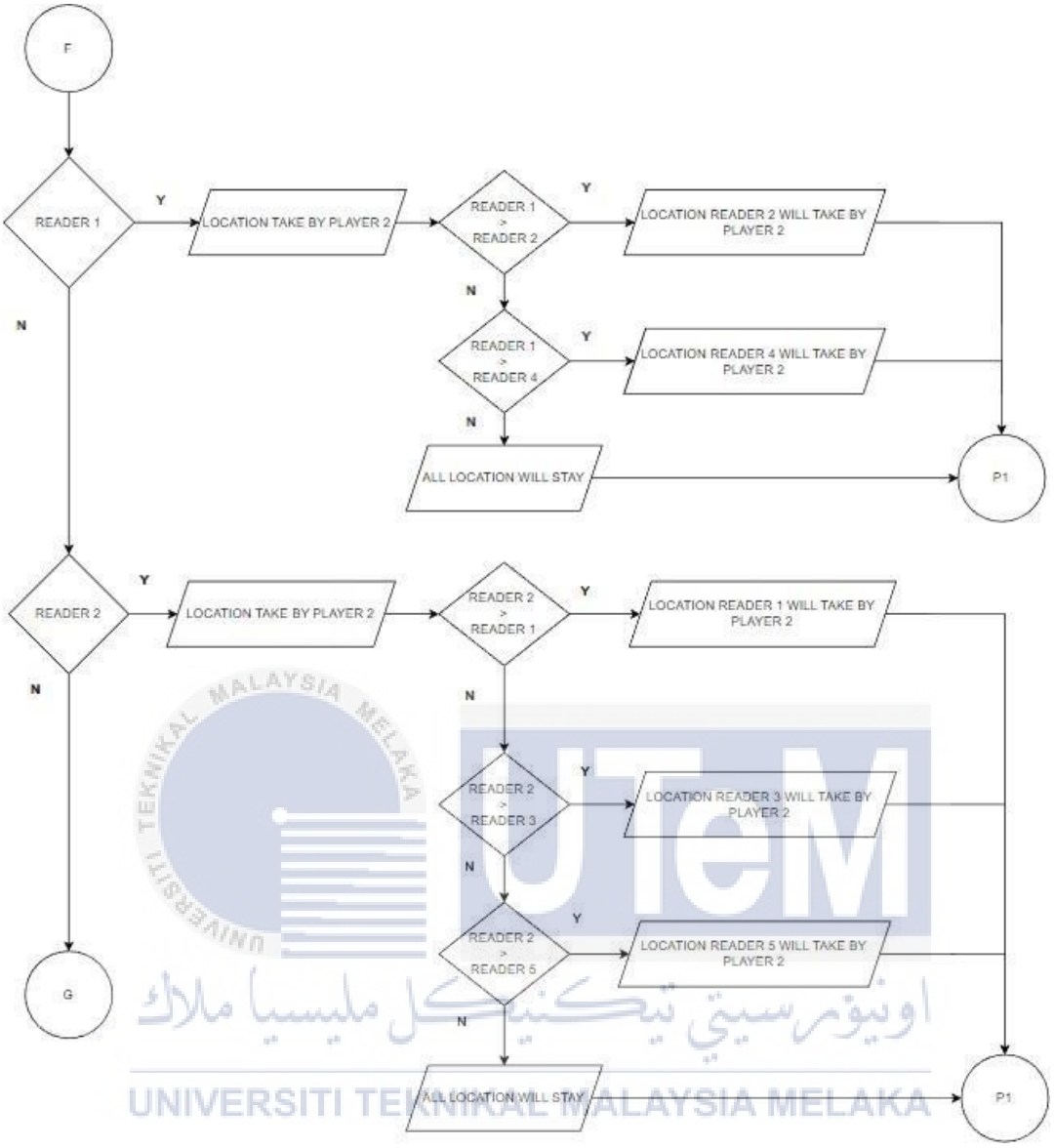


Figure 3.8 (h) : Flow Chart of program

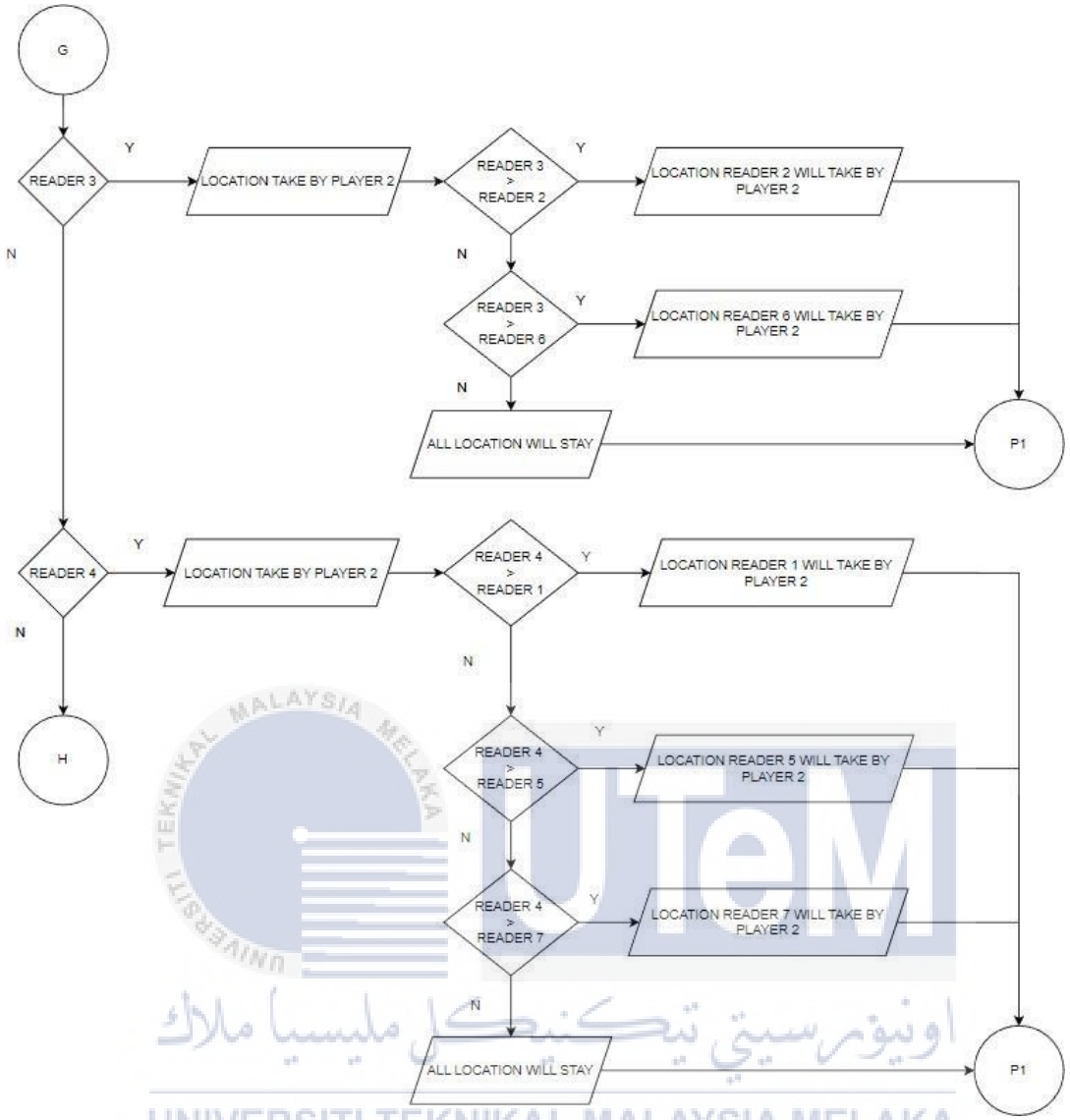


Figure 3.8 (i) : Flow Chart of program

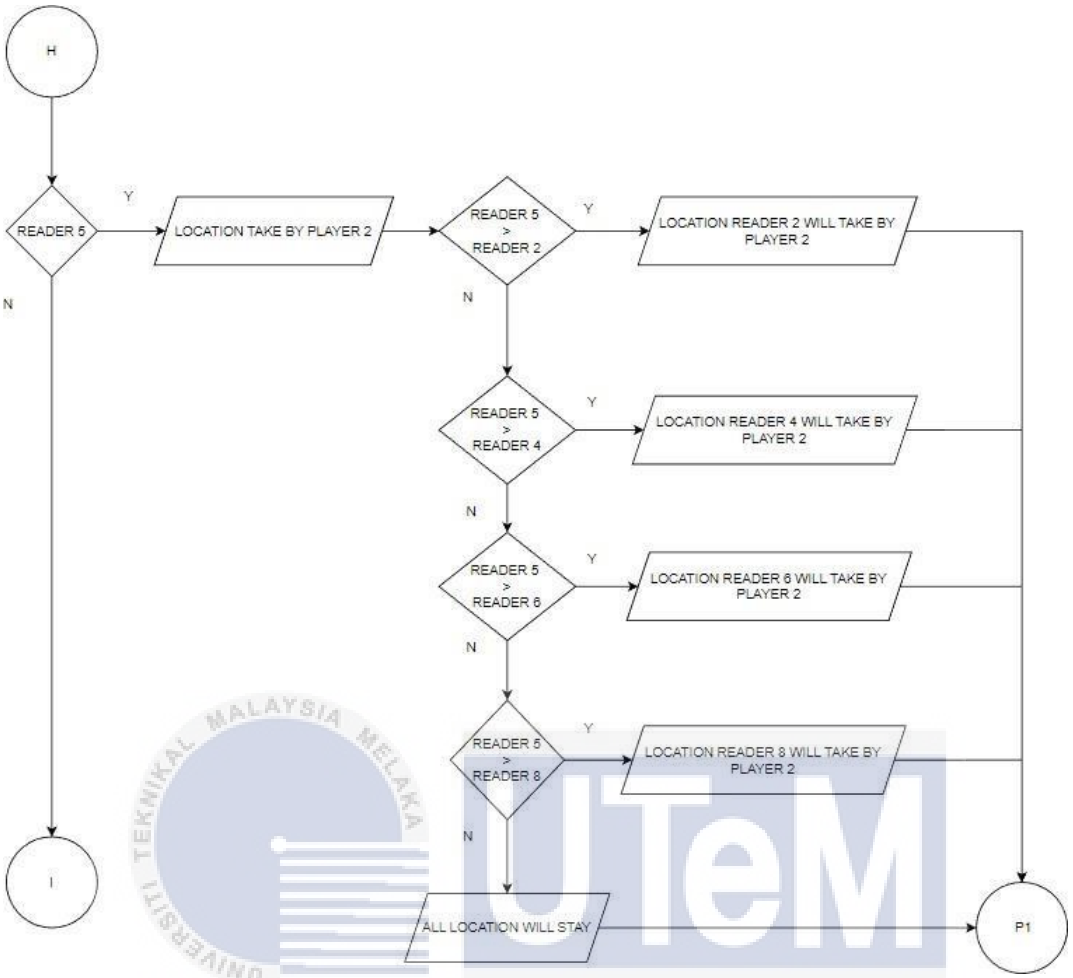


Figure 3.8 (j) : Flow Chart of program

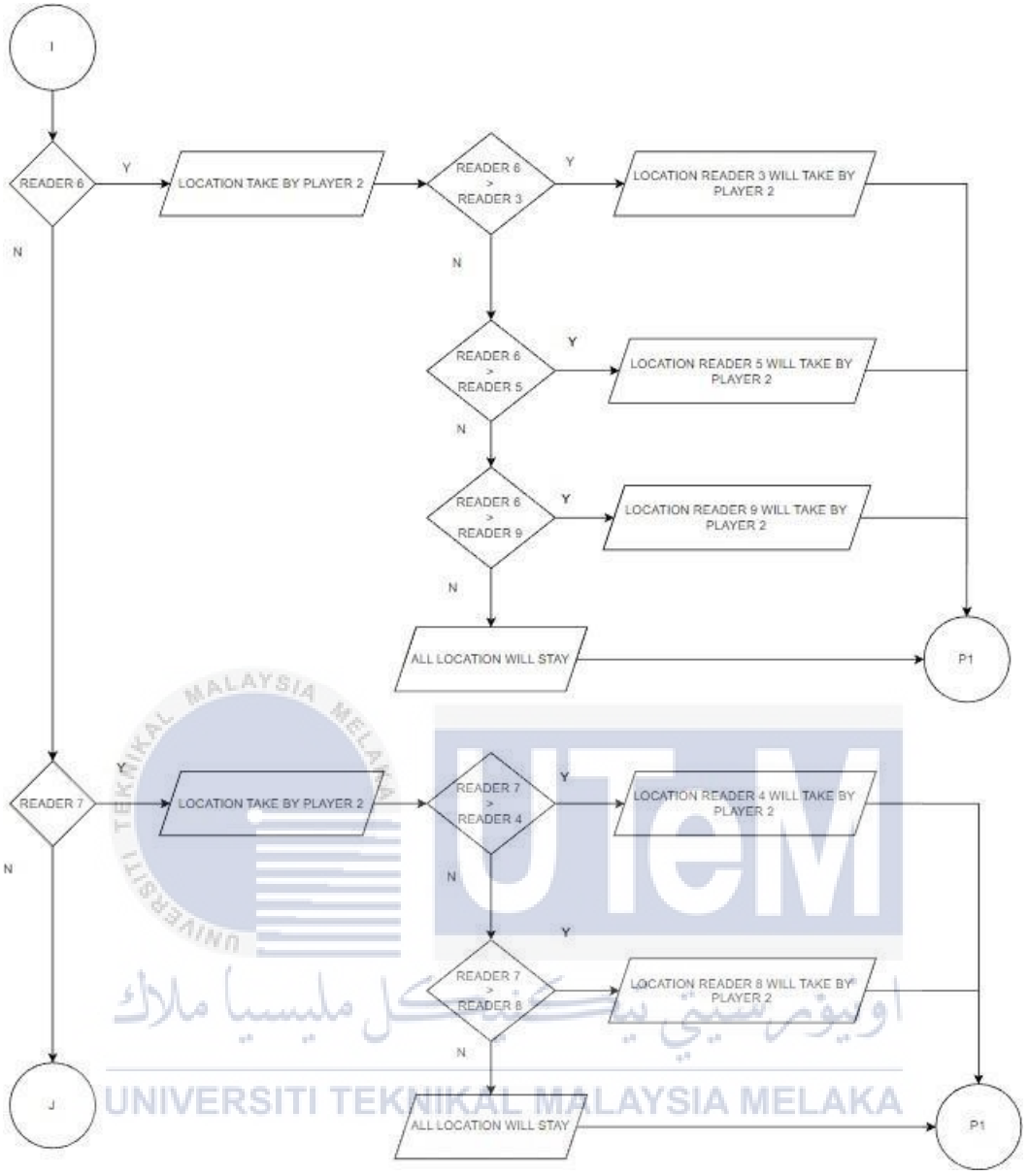


Figure 3.8 (k) : Flow Chart of program

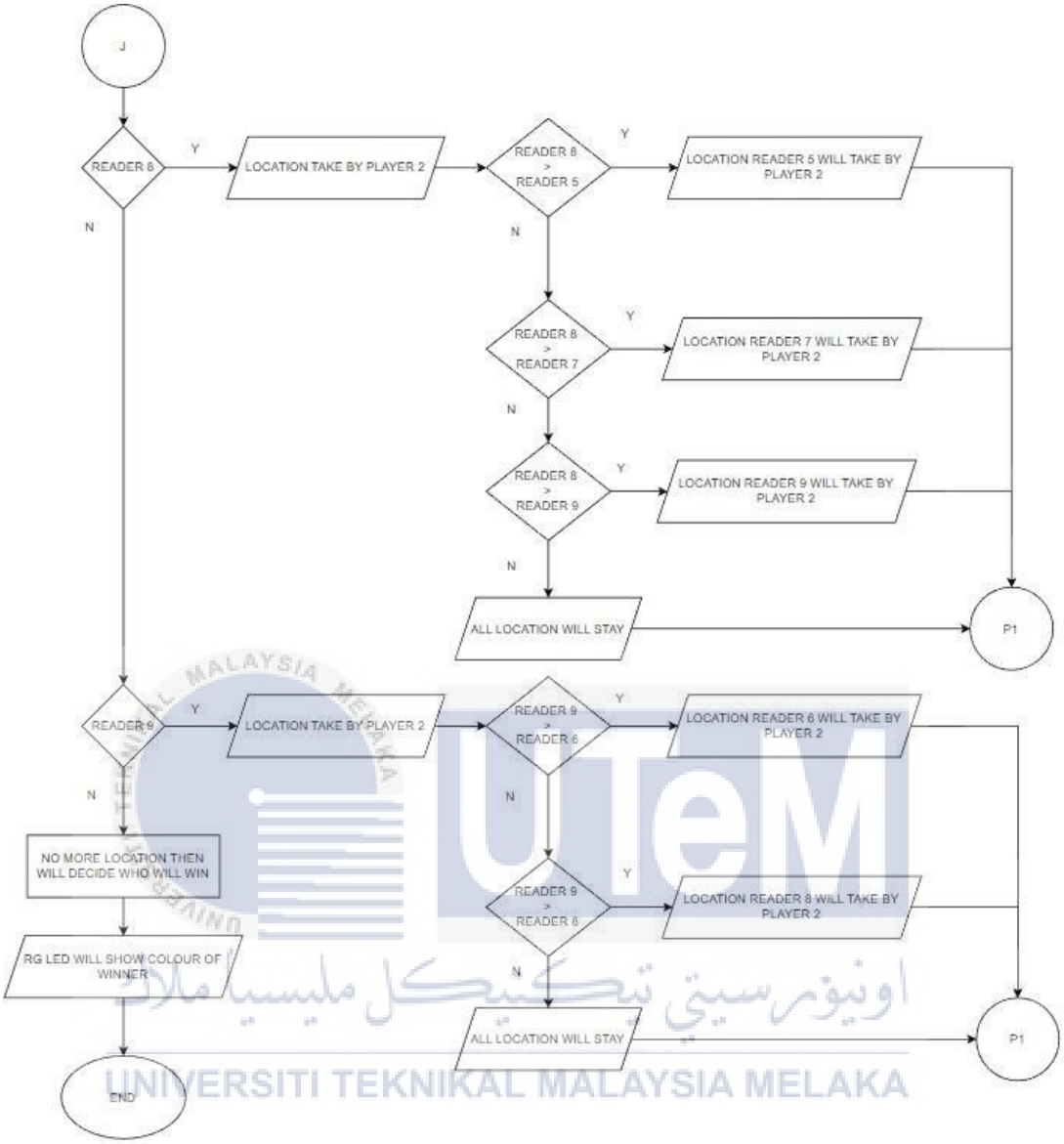


Figure 3.8 (l) : Flow Chart of program

3.8 Card Design

Figure 3.10 illustrates the design of the cards that will be utilized in the game board. Eachcard features a number in the top right corner that is essential for the game. The student mustanalyze this number in order to devise a successful strategy.

To win the game, the student must carefully analyze the numbers on each card and use this information to develop a winning strategy. These numbers are key to success in the game and will play a crucial role in determining the outcome.

Figure 3.9 : Game board card

3.9 Bill Of Material

To create the product, all necessary information is listed in the bill of materials (BOM). The BOM typically includes descriptions of parts, their names, and the quantities needed to assemble the product. Figure 3.10 below show the bill of the material for Tapop Game Board.

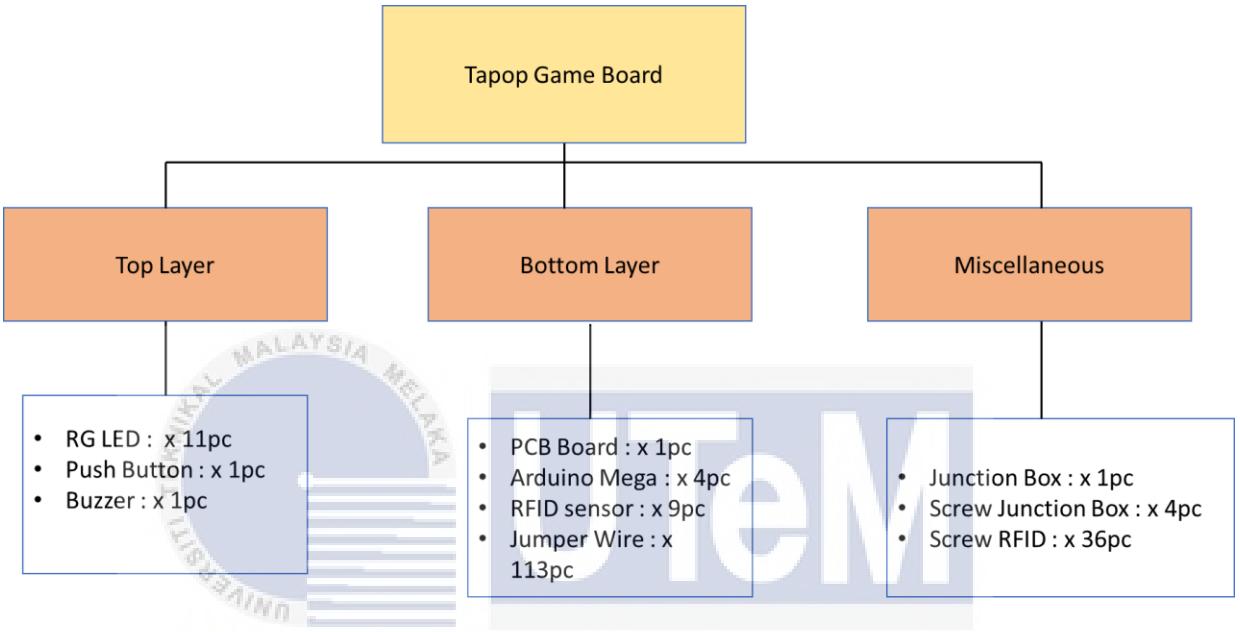


Figure 3.10 : Bill of material

3.10 Project Costing

Table 3.6 : Costing table

NO	COMPONENT	SUPPLIER	UNIT	TOTAL PRICE(RM)
1	ARDUINO MEGA	SHOPEE	4	199.60
2.	RFID reader	SHOPEE	9	44.91
3.	RGB led	SHOPEE	20	10.90
6.	BUZZER	SHOPEE	1	1.50
7.	FEMALE TO FEMALE WIRE	SHOPEE	40	3.20
8.	MALE TO FEMALE WIRE	SHOPEE	100	9.20
9.	UV BOARD	PRO SINE	2	18.00
10.	PROJECT BOX	HARDWARE STORE	1	30
11.	PUSH BUTTON	PRO SINE	1	1.00
	TOTAL			318.31

CHAPTER 4

RESULT AND DISCUSSION

4.1 Introduction

In this chapter, we will delve into the outcome and examination of our research. Following the completion of the hardware and software project, a series of reliability tests were conducted to determine the effectiveness of the hardware based on its condition. The resultsof the flow program will be analyzed by comparing the expected results to the actual resultsin the given scenario. Additionally, a survey was conducted to gather user feedback and assess the overall effectiveness of the project.

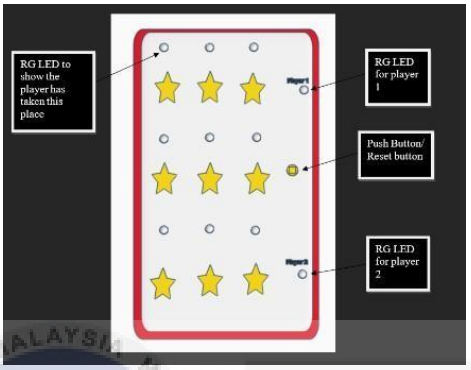
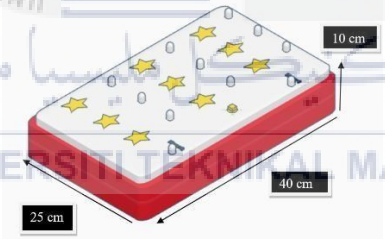
4.2 Result of project

This section will discuss the differences between the predicted outcomes and the actual outcomes, taking into account factors such as the design of the hardware, the design of the software, and the overall flow of the program.

4.2.1 Project Desing

Table 4.5 show different between expected and actual design.

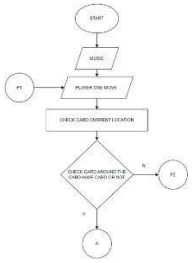
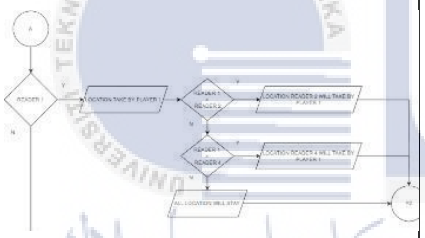
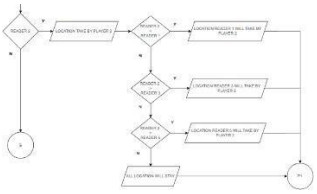
Table 4.1 Project design

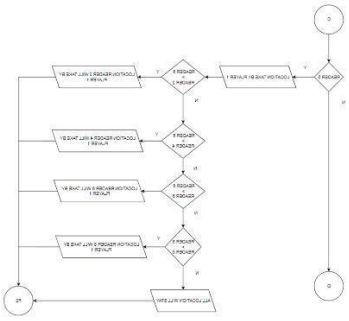
DESCRIPTION	EXPECTED	ACTUAL
Layout on the top of game board	 Figure 4.1 : Top View design	 Figure 4.2 : Top View design
Hardware prototye	 Figure 4.3 : 3D view	 Figure 4.4 : Full view

4.2.2 Design flow of the project

Table 4.6 show three scenario and flowchart that has in this project

Table 4.2 Design flow of the project

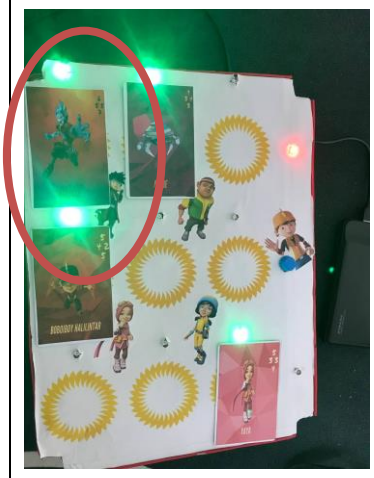
NO	SCENARIO AND FLOWCHART	BEFORE	AFTER
1	In this scenario show what happen when a card detect 	 Figure 4.5 : when no card detect	 Figure 4.6 : when card detected
2	For this scenario show that how player can take two slot by using one card 	 Figure 4.7 : Two slot need to take	 Figure 4.8 : Two slot taken
3	For this scenario show that how player can take three slot by using one card 	 Figure 4.9 : Three slot need to take	 Figure 4.10 : Three slot had been taken

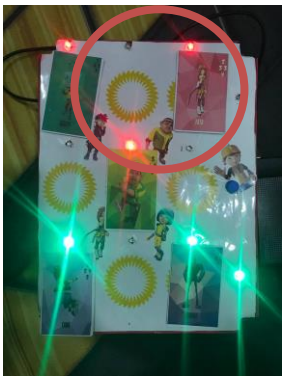
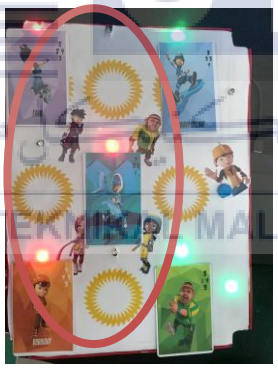
4	For this scenario show that how player can take four slot by using one card 	 Figure 4.11 : Four slot need to take	 Figure 4.12 : Four slot had been taken

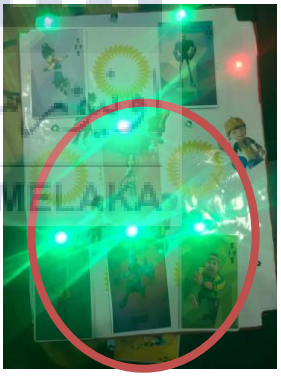
4.2.3 Prototype and Probability that can occur

Table 4.7 show 9 probability that can occur in this game board.

Table 4.7 Probability

NO	CONDITION AND EXPLANTION	PLACE NEED TO WIN	WIN SITUATION
1	If reader 1 are bigger than reader 2 and reader 4		

2	If reader 2 are bigger than reader 1, reader 3 and reader 5		
3	If reader 3 are bigger than reader 2 and reader 6		
4	If reader 4 are bigger than reader 1, reader 5 and reader 7		
5	If reader 5 are bigger than reader 2, reader 4, reader 6 and reader 8		
6	If reader 6 are bigger than		

	reader 3, reader 5 and reader 9		
7	If reader 7 are bigger than reader 4 and reader 8		
8	If reader 8 are bigger than reader 5, reader 7 and reader 9		
9	If reader 9 are bigger than reader 6 and reader 8		

4.3 Result and Analysis

In this part reliability testing is performed to ensure that a high-quality product is delivered to the user. This is done through methods such as drop testing and aging testing. Also surveywill conduct.

4.3.1 Drop Test

Table 4.1 show process of drop test by using two height which is drop from height 0.5m and 1.0m, it to measure the endurance of the kit.

Table 4.1 : Drop test

NO	HIGH	CONDITION	PICTURE
1.	0.5m	Project still function and no defect	 **Figure 4.13 : Drop from 0.5m**

2.	1.0m	Project still function but a wire will not connect properly.	 **Figure 4.14 : Dtop from 1.0m**

Aging Test

Table 4.2 displays the results of an aging test, where the kit is exposed to conditions that are beyond the typical usage or storage conditions, and the test data is collected within a shorter period of time.

Table 4.2 : Aging Test

NO	CONDITION	BEFORE	AFTER
1.	The project will place outside the house with the hot weather from 3.30pm until 5:30pm, the project still function		

		Figure 4.15 : Before test temperature in hot weather	**Figure 4.16 : After test temperature in hot weather**
2.	The project is stored in the refrigerator for four hours, starting at 4:30 PM and ending at 8:30 AM. Despite being placed in the refrigerator, the project remains functional.	 **Figure 4.17 : Temperature test in cold**	 **Figure 4.18 : Temperature test in cold**

4.3.2 Functionality Testing

Functionality testing was conducted on this testing phase to ensure that the kit is fully operational before it is used by the user.

Unit Testing And Integration Testing

In this section, both unit testing and integration testing are conducted. Unit testing involvestesting individual components of the application, while integration testing is done after all components have been developed and integrated to ensure that there are no issues when thedifferent modules interact with each other to create the overall system.

Table 4.3 : Unit testing

COMPONET	METHOD TEST	EXPECTED OUTCOME	ACTUAL OUTCOME
Buzzer	By using Arduino mega and put the audio coding.	Buzzer will make a audio that has been code.	Buzzer make the same audio that has been code.
Push Button	Use some code in Arduino that instruct when push button has been push LED ON.	LED will ON when push button has been push.	LED ON when the push button press.
RG LED	Make a simple code in Arduino to make RG LED blink.	RG LED will blink.	RG LED blink.
RFID sensor	By put code in Arduino to detect the presence of card when its card touch the sensor.	In serial monitor of software Arduino ide will show unique serial number of RFID card.	The serial number of RFID card shown in serial monitor.

Table 4.4 : Integration testing

COMPONENT	METHOD TEST	EXPECTED OUTCOME	ACTUAL OUTCOME
Combine buzzer, RFID sensor and RG LED	By using a code on Arduino mega	RG Led and buzzer will turn ON when card RFID touch the sensor	Buzzer and RG LED will turn ON after the RFID card touch the sensor and it is functioning well.

4.3.3 Survey Question

A survey was conducted with 30 participants, including primary and secondary students, lecturers, and other learners, to gather feedback and assess the effectiveness of a game board used in mathematics education. The game board was shown to and used by each participant before they completed a survey, with the demonstration and trial period lasting between 10 and 15 minutes.

Question 1 : How useful do you think an electronic board game of Tapop game would be for testing kindergarten students on numerical concepts?

As depicted in Figure 4.19, a significant majority of respondents, specifically 60%, have expressed their strong agreement with the statement that the electronic game of Tapop will be highly beneficial for students in terms of their learning and educational development. Onthe other hand, a relatively small proportion of respondents, amounting to only 10%, have stated that they are neutral with regards to the usefulness of the said electronic game for students.

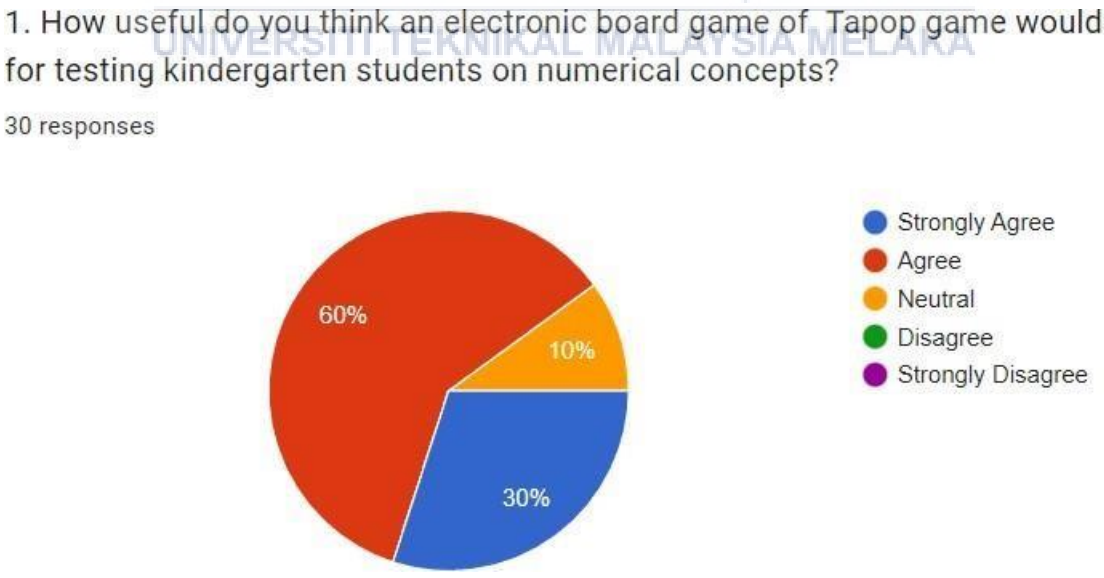


Figure 4.19 Question 1

Question 2 : Do you believe that an electronic board game of Battle Tapop would be a more effective way to teach numerical concepts to kindergarten students compared to traditional methods?

In figure 4.20 indicate that a significant portion of the respondents, specifically 30%, strongly believe that utilizing the board game 'Battle Tapop' as a teaching tool for numerical concepts among kindergarten students would be significantly more effective in comparison to traditional methods of instruction. Furthermore, it is notable that an additional 46.7% of the respondents expressed agreement with this sentiment, while 16.7% remained neutral on the matter. On the other hand, a small group of 6.7% of respondents disagreed with the idea of using the game as an educational tool.

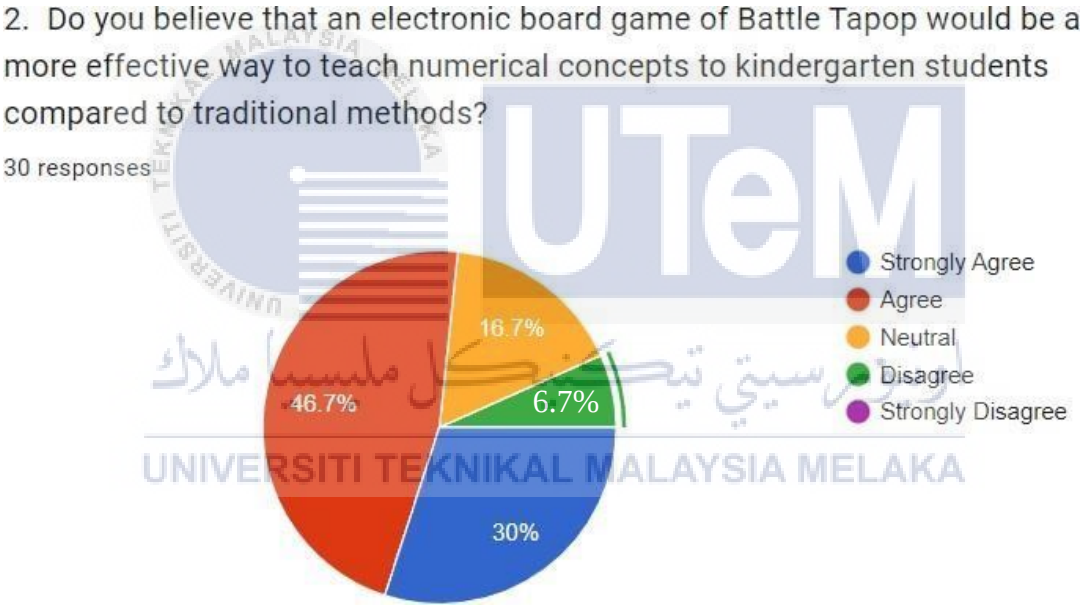


Figure 4.20 Question 2

Question 3 : Do you think that kindergarten students would be more engaged and motivated to learn numerical concepts through an electronic board game of Tapop game?

In Figure 4.21, it is evident that a significant proportion of respondents believe that utilizing an electronic board game, such as Tapop, as a method of teaching numerical concepts to students would lead to increased engagement and motivation among learners. Specifically, 40% of those surveyed strongly agreed with this statement, indicating a high level of conviction in the effectiveness of this approach. Additionally, an additional 46.7% of respondents agreed with this assertion, indicating a general consensus among those surveyedregarding the potential benefits of using electronic board games in the classroom. On the other hand, a minority of 13.3% of respondents were neutral on this issue, indicating that they neither agree nor disagree with the statement. Overall, the data presented in Figure 4.21 suggests that there is a strong belief among a majority of respondents that electronic board games, such as Tapop, can be an effective tool for improving student engagement and motivation in the learning of numerical concepts.

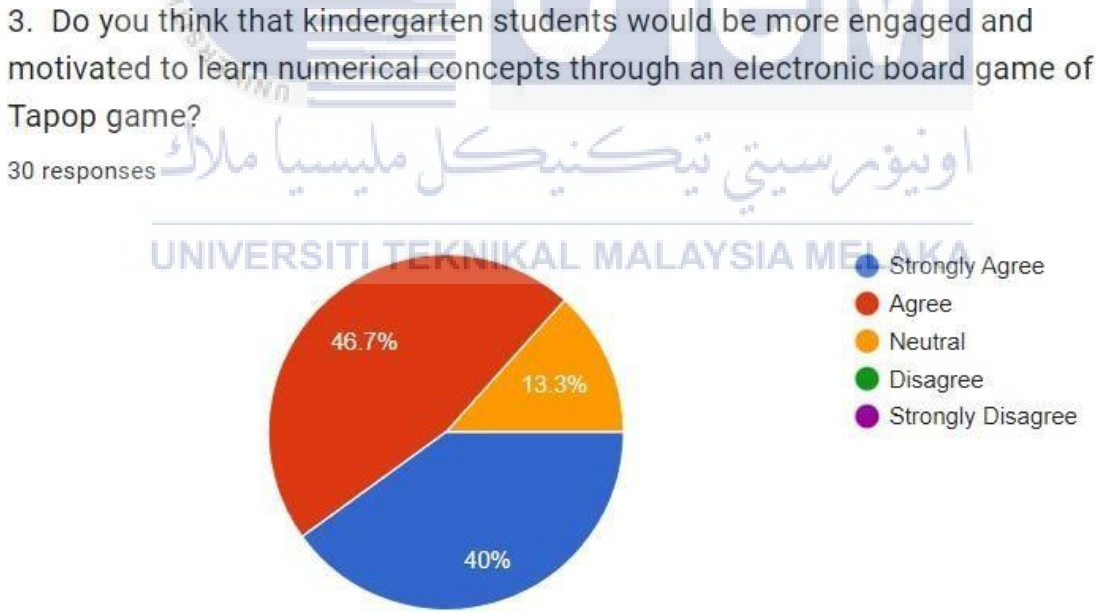


Figure 4.21 Question 3

Question 4 : How likely would you be to recommend an electronic board game of Tapop game to other educators as a tool for teaching numerical concepts to kindergarten students?

In Figure 4.22, it is clearly depicted that a majority of the respondents, specifically 53.3%, agreed to recommend the electronic board game Tapop as a valuable tool for teaching numerical concepts to kindergarten students. Furthermore, an additional 33.3% of the respondents expressed strong agreement towards using this game as a teaching tool. However, it is worth noting that a small percentage of respondents, 13.3%, were neutral in their stance on the matter and did not express either agreement or disagreement.

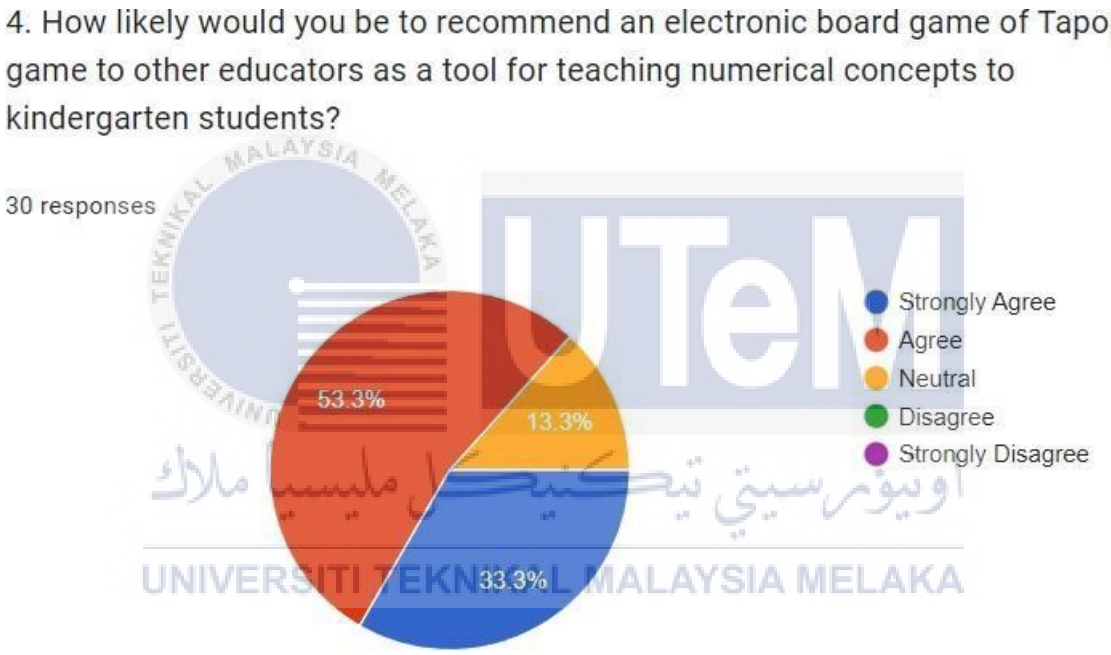


Figure 4.22 Question 4

Question 5 : Do you think that an electronic board game of Tapop game would be a good fit for the learning style of most kindergarten students?

As can be seen in Figure 4.23, a significant proportion of the respondents, specifically 50%,expressed agreement towards the idea that the electronic board game Tapop would be a suitable fit for the learning style of most kindergarten students. Additionally, an additional 33.3% of the respondents expressed strong agreement towards this statement, indicating a high level of support for the use of this game as a teaching tool for kindergarten students. However, it's worth noting that a small percentage of respondents, 16.7%, were neutral in their stance on the matter and did not express either agreement or disagreement.

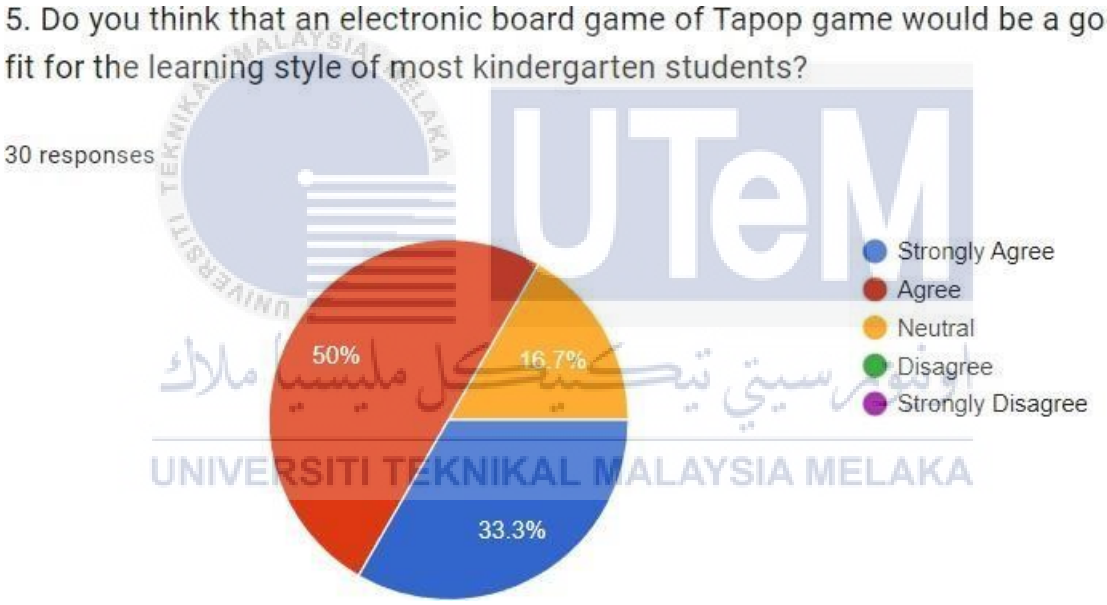


Figure 4.23 Question 5

Question 6 : How do you think an electronic board game of Tapop game could be used most effectively to teach numerical concepts to kindergarten students?

According to the results presented in Figure 4.24, a significant portion of respondents agreed that an electronic board game of the Tapop game could be used effectively to teach numerical concepts to kindergarten students. Specifically, 43.3% of respondents agreed with this statement, while an additional 33.3% strongly agreed. On the other hand, 23.3% of respondents were neutral on the matter. These findings suggest that a majority of respondents believe that the Tapop electronic board game has potential as a teaching tool for young students.

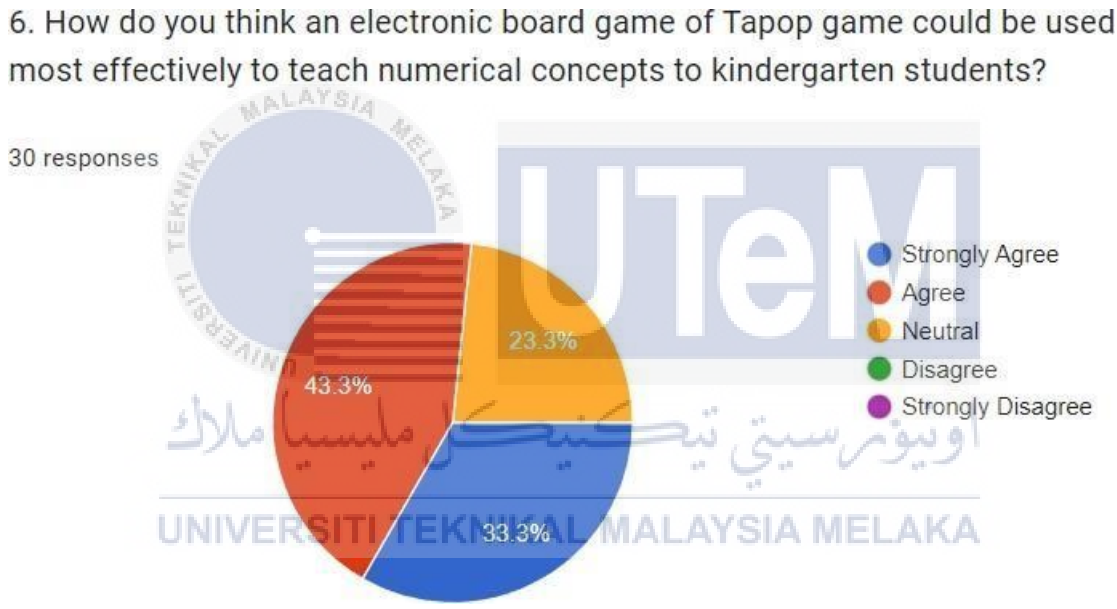


Figure 4.24 Question 6

Question 7 : Do you think that an electronic board game of Tapop game would be more or less effective for teaching numerical concepts to kindergarten students compared to traditional board games?

The results of the survey conducted as depicted in Figure 4.25, indicate that a significant proportion of the respondents, 36.7% to be precise, agreed that utilizing an electronic version of the game "Tapop" would be more or less effective for teaching numerical concepts to kindergarten students when compared to traditional board games. Furthermore, a considerable proportion of 30% of the respondents strongly agreed with this statement, which suggests that they have a positive perspective towards the effectiveness of electronicboard games in teaching numerical concepts. On the other hand, there were also 30% of respondents who were neutral on the matter, which implies that they neither agreed nor disagreed with the statement. However, it is worth noting that there was a small group of 3.3% of respondents who disagreed with the statement, suggesting that they believe that electronic board games may not be as effective as traditional board games in teaching numerical concepts to kindergarten students.

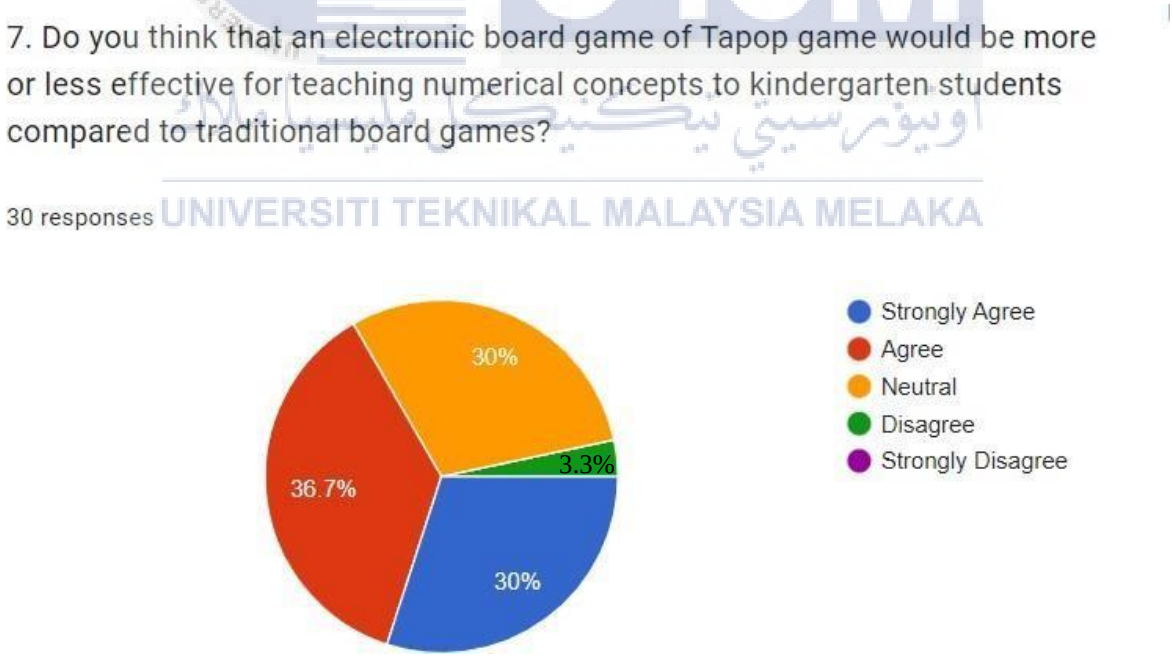


Figure 4.25 Question 7

Question 8 : Do you believe that an electronic board game of Tapop would be more or less expensive to use as a teaching tool compared to traditional methods?

According to the data presented in Figure 4.26, it can be seen that a significant portion of the respondents believe that an electronic board game of Tapop would be more or less expensiveto use as a teaching tool compared to traditional methods. Specifically, 36.7% of the respondents indicated that they agree with this statement, and an additional 23.3% stated that they strongly agree with this belief. This suggests that a majority of the respondents believe that using an electronic board game as a teaching tool could potentially be more cost- effective than traditional methods. However, it's worth noting that a substantial portion of the respondents, 30%, stated that they are neutral on this matter, neither agreeing nor disagreeing with the statement. On the other hand, 6.7% of the respondents disagreed with the statement, and a small percentage, 3.3%, strongly disagreed with the belief that an electronic board game would be more or less expensive to use as a teaching tool.

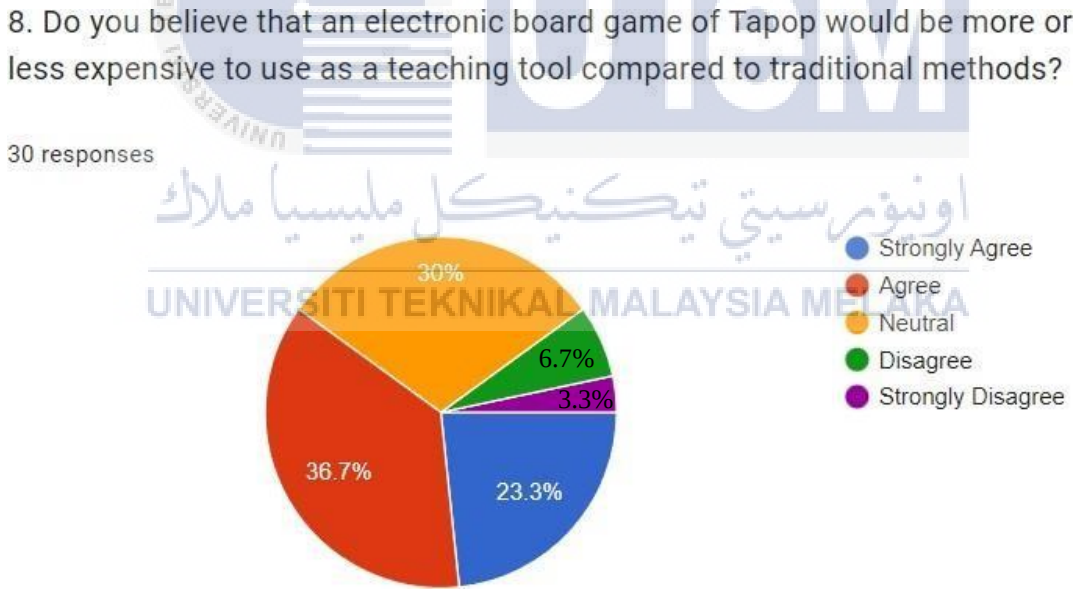


Figure 4.26 Question 8

Question 9 : How important do you think it is to use interactive and technology-based learning tools like an electronic board game of Tapop game to teach numerical concepts to kindergarten students?

In Figure 4.27, it can be seen that a significant percentage of respondents, 46.7%, believe that utilizing interactive and technology-based learning tools, such as an electronic board game or the Tapop game, is crucial for effectively teaching numerical concepts to kindergarten students. Additionally, a notable portion of the respondents, 30%, expressed a strong agreement with this statement. On the other hand, a considerable number of respondents, 23.3%, were neutral on the matter, neither agreeing nor disagreeing with the importance of using these types of learning tools. Overall, the data presented in Figure 4.27 suggests that a majority of respondents see value in incorporating interactive and technology-based learning methods in the instruction of numerical concepts to kindergarten students.

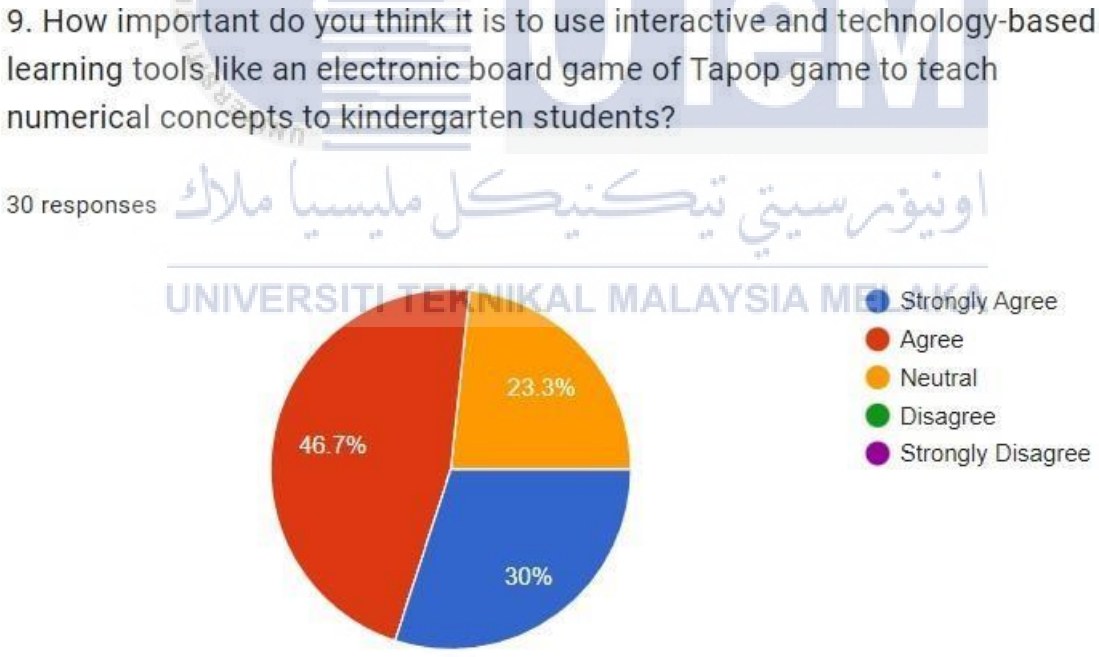


Figure 4.27 Question 9

Question 10 : Do you think that an electronic board game of Tapop game would be more or less time-consuming to use as a teaching tool compared to traditional methods?

As can be seen in Figure 4.28, a significant portion of respondents expressed their opinion on the potential use of an electronic board game version of the popular game Tapop as a teaching tool. Specifically, 50% of the respondents agreed that this method of instruction may be more or less time-consuming when compared to traditional teaching methods. Furthermore, an additional 30% of the respondents expressed strong agreement with this sentiment, indicating a high level of confidence in the potential effectiveness of this approach. On the other hand, 20% of the respondents were neutral on the matter, neither agreeing nor disagreeing with the statement. This data provides valuable insight into the potential use of electronic board games as a teaching tool and the perception of their effectiveness among a group of respondents.

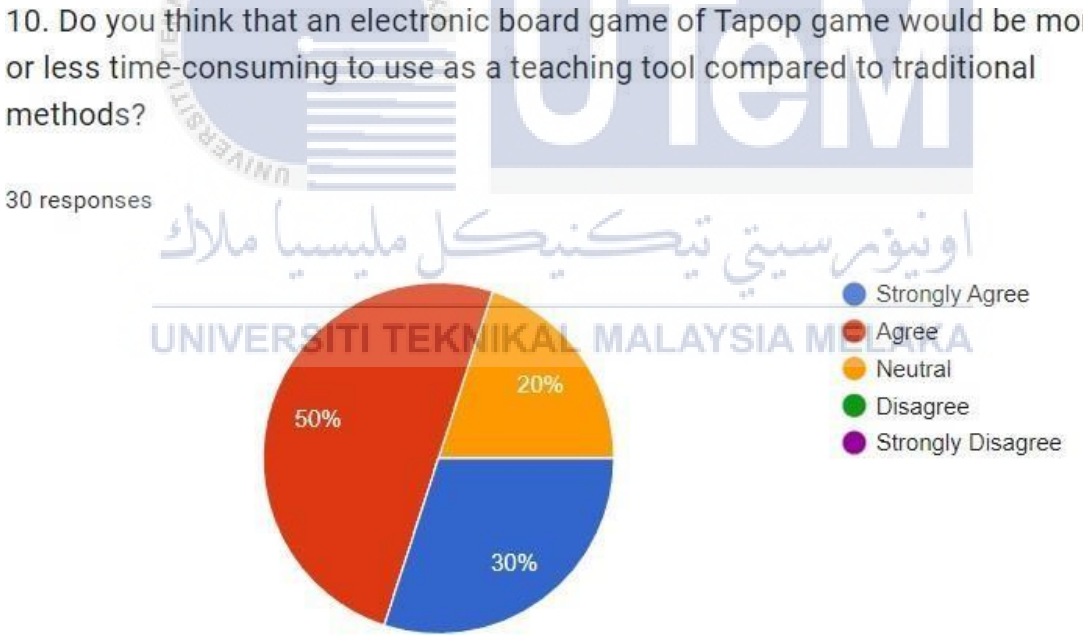


Figure 4.28 Question 10

Question 11 : In your opinion, what are the potential drawbacks of using an electronic board game of Tapop game to teach numerical concepts to kindergarten students?

According to the data presented in Figure 4.29, it appears that a significant portion of respondents have a nuanced view on the potential drawbacks of using an electronic board game such as Tapop to teach numerical concepts to kindergarten students. Specifically, 50% of respondents indicated that they agree with the idea that there may be some drawbacks to using this type of technology in the classroom. Additionally, a noteworthy 23.3% of respondents went one step further and stated that they strongly agree with this statement. However, it is important to note that not all respondents hold this view, as 20% of respondents indicated that they are neutral on this topic and only 6.7% of respondents disagreed with the statement altogether. Overall, the data suggests that while some individuals have concerns about the potential drawbacks of using electronic board games in the classroom, the majority of respondents are open to the idea.

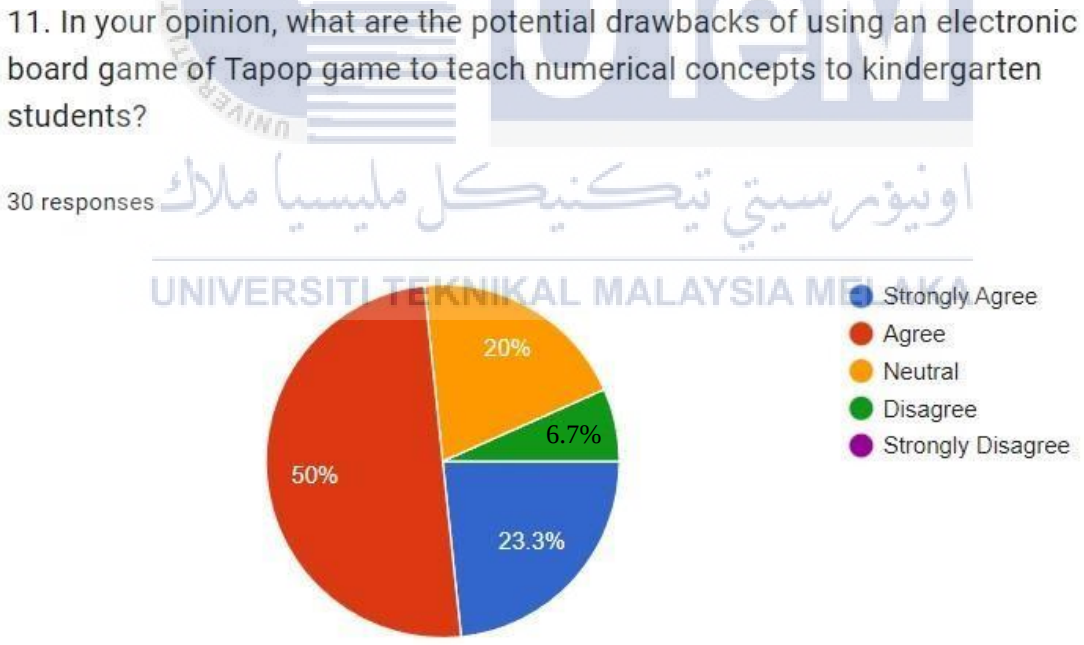


Figure 4.29 Question 11

Question 12 : Do you think that an electronic board game of Tapop game would be more or less flexible to use as a teaching tool compared to traditional methods?

According to the data presented in Figure 4.30, a significant portion of the respondents, 43.3%, expressed agreement with the idea that an electronic board game version of the Tapop game would be flexible as a teaching tool compared to traditional methods of instruction. Furthermore, a considerable number of respondents, 36.7%, strongly agreed with this statement, indicating a high level of conviction in the potential of electronic board games as an effective teaching tool. On the other hand, a small group of respondents, 6.7%, disagreed with this statement, potentially due to a lack of understanding or experience with electronic board games as a teaching tool. Additionally, 13.3% of respondents indicated that they were neutral on this issue, possibly indicating a lack of strong opinions or experience with electronic board games as a teaching tool.

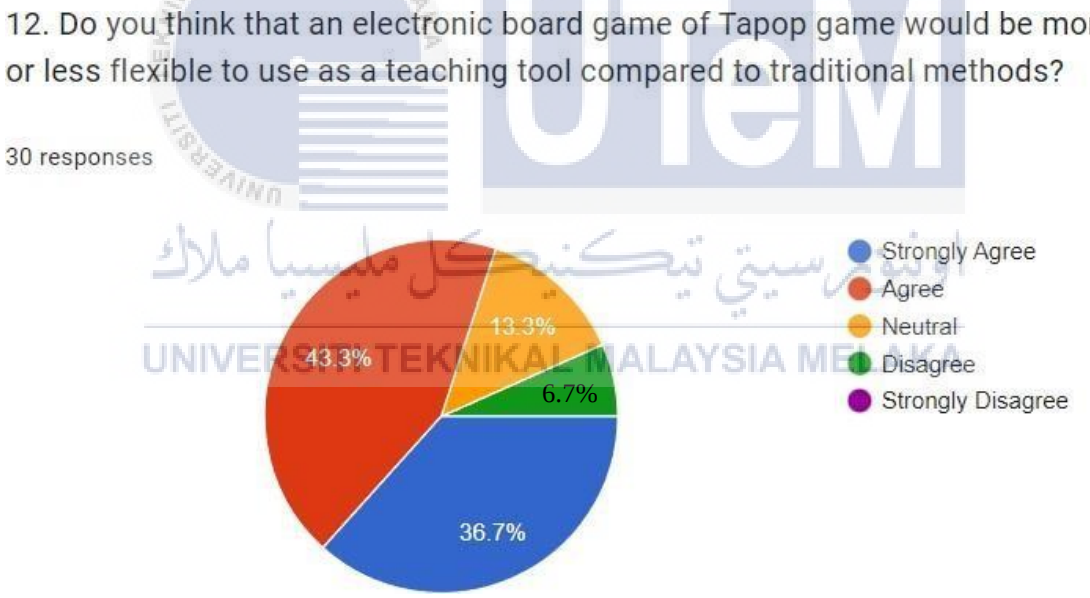


Figure 4.30 Question 12

Question 13 : How well do you think an electronic board game of Tapop game would align with the curriculum and learning goals for teaching numerical concepts to kindergarten students?

According to the results presented in Figure 4.31, a significant proportion of respondents, 43.3% to be exact, expressed their agreement with the idea that the electronic board game Tapop is well-suited to align with the curriculum and learning goals for teaching numerical concepts to kindergarten students. Furthermore, an even greater percentage, 40%, of respondents indicated that they strongly agree with this statement, which highlights the potential effectiveness of this game as a teaching tool. However, it is worth noting that there is also a portion of the respondents, 16.7%, who stated that they were neutral on this matter,indicating that further research and evaluation may be necessary to fully understand the effectiveness of this game in this context.

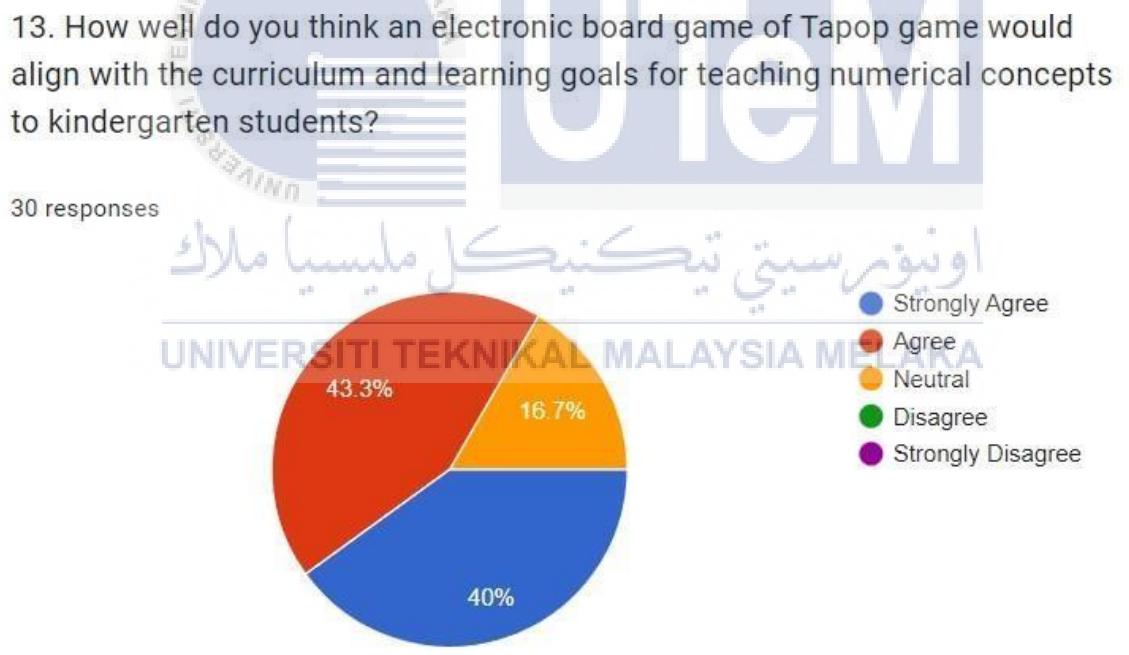


Figure 4.31 Question 13

Question 14: Do you think that an electronic board game of Tapop game would be appealing to kindergarten students compared to traditional board games?

As demonstrated in Figure 4.32, a significant portion of the respondents, 50%, expressed their agreement that an electronic board game of the Tapop game would be more appealingto kindergarten students in comparison to traditional board games. Furthermore, an additional 20% of the respondents went on to express their strong agreement with this statement, indicating that **most of** the respondents believe that electronic board games would be a more engaging and appealing option for young children. However, it is also worth noting that a significant portion of the respondents, 26.7%, expressed neutrality on the topic, and only a small portion, 3.3%, disagreed with the statement. This data suggests that while most of the respondents believe that electronic board games would be a more appealing option for kindergarten students, there is still a notable portion of the population that is not fully convinced or has a neutral stance on the matter.

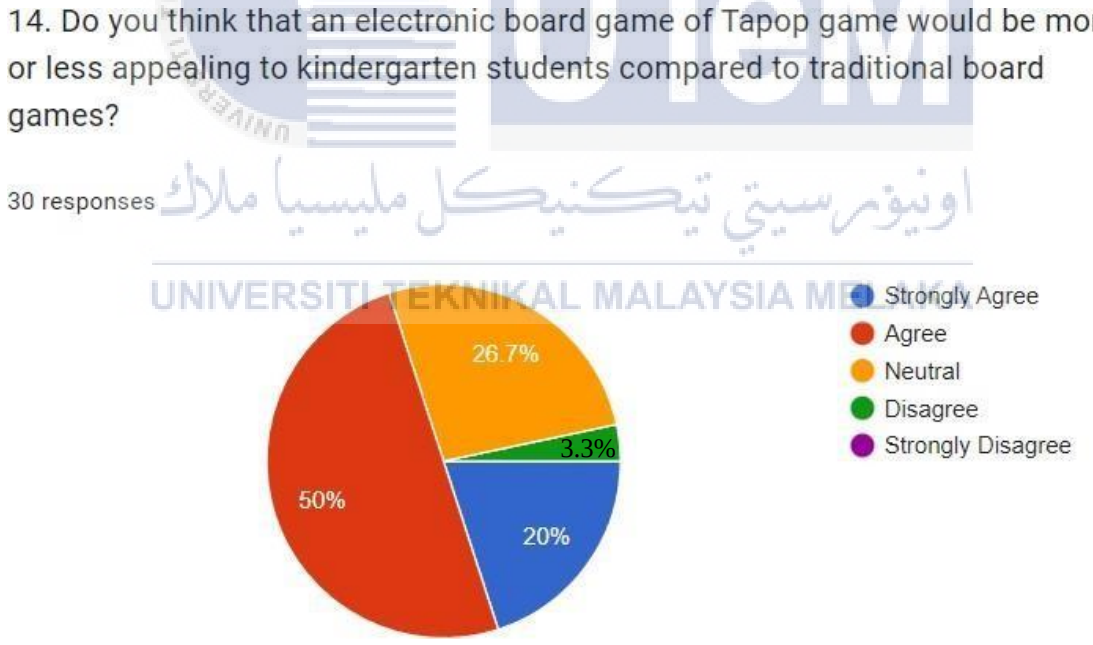


Figure 4.32 Question 14

CHAPTER 5

CONCLUSION

5.1 Conclusion

The project aimed to design of an electronic-based educational board game that would be suitable for use in a kindergarten classroom setting. The game, which is based on the popular game known as "Triple Triad," was created with the primary purpose of serving as an educational kit, providing an interactive and engaging way for students to test and improve their knowledge of numerical numbers. One of the key features of this game is the integration of RFID sensor technology, which enables the tracking and recording of students' progress and performance, allowing teachers to monitor their students' understanding and identify areas where additional support may be required. The game was designed to be portable, durable, and affordable, making it accessible to a wide range of students and teachers. The game is easy to use and provides an enjoyable learning experience for all users. Through hard work and dedication, the successful design of a fun and effective educational tool that can help to enhance the learning experience for kindergarten students was achieved.

In this project, an important aspect that was also taken into consideration is the number of connections that can be made between an RFID sensor and an Arduino Mega 2560. This information was crucial in determining the number of RFID and Arduino Mega that would be required for the successful execution of the project. Based on findings, it was determined that three RFID sensors would need to be connected to each Arduino Mega (slave) and 4 Arduino mega need in order to achieve the desired outcome.

After extensive research and development, an electronic-based educational board game based on the popular game 'Triple Triad' has been successfully created. The primary goal of creating this game was to develop an interactive and engaging educational tool that could be used by kindergarten students and teachers. To ensure the effectiveness of this product, thorough testing and evaluations were conducted with a diverse group of students and teachers. The results of these tests were overwhelmingly positive, with 90% of participants agreeing that the game was a useful educational tool and 10% remaining neutral. This

feedback has provided validation and confidence that the electronic-based educational board game, based on the game 'Triple Triad', can be a valuable and effective tool for helping young students learn and grow.

5.2 Future work

In the future, as technology and innovation continue to advance, it is important to stay aheadof the curve by constantly looking for ways to improve current systems and products. One potential area for improvement is in the adding of new features or the changing of existing components. For instance, the consideration of adding more RFID cards to the current system to increase its functionality and versatility. Additionally, the consideration of making the board bigger in order to accommodate these new cards and any other new components that may be added in the future.

On the other hand, the consideration of changing certain components of the system in order to make it more cost-effective. One potential change is the switching out of three Arduino Mega boards for Arduino Uno or Arduino Nano boards. This would not only save money on the cost of the boards themselves, but it would also reduce the overall power consumption of the system, making it more energy-efficient.

Furthermore, the consideration of adding more rules to the system such as the ability to read RFID cards from a vertical position. This would greatly increase the flexibility and usabilityof the system, making it more convenient for users. With these and other potential changes in mind, it is important to constantly look for ways to improve products and stay ahead of the curve in the ever-evolving field of technology.

5.3 Potential

This game board is an ideal tool for kindergarten students to learn numerical concepts through play, as it not only enhances their understanding of numbers but also teaches them strategies for winning the game. The incorporation of game boards into the educational system has the potential to greatly improve student engagement and learning outcomes. By finding ways to overcome the challenges and effectively utilize this technology, we can create a more dynamic and engaging learning environment for students.

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APPENDICES

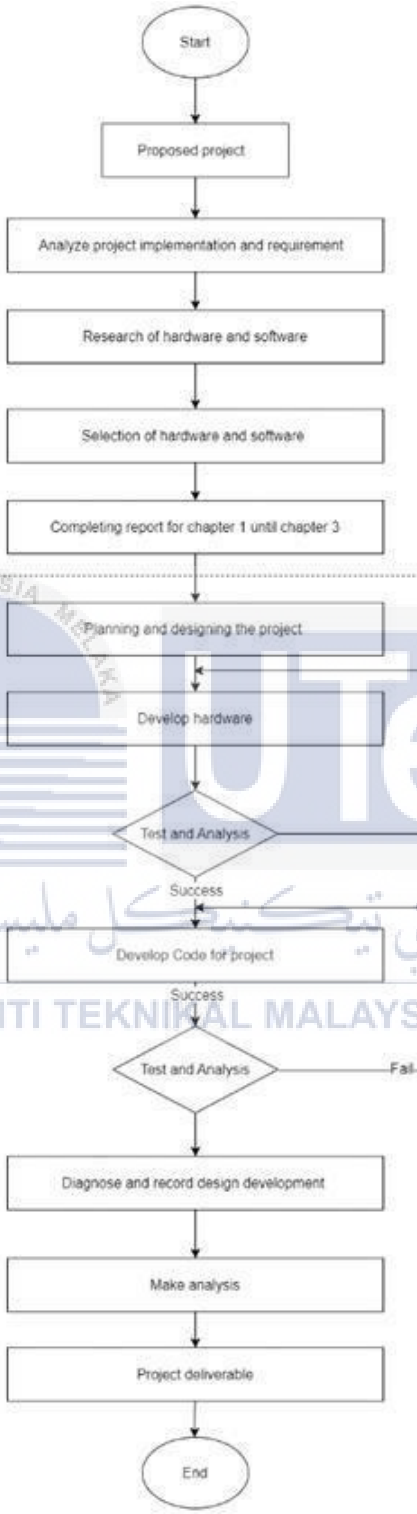

Table 3.1 : Gantt Chart of Final Years Project 1

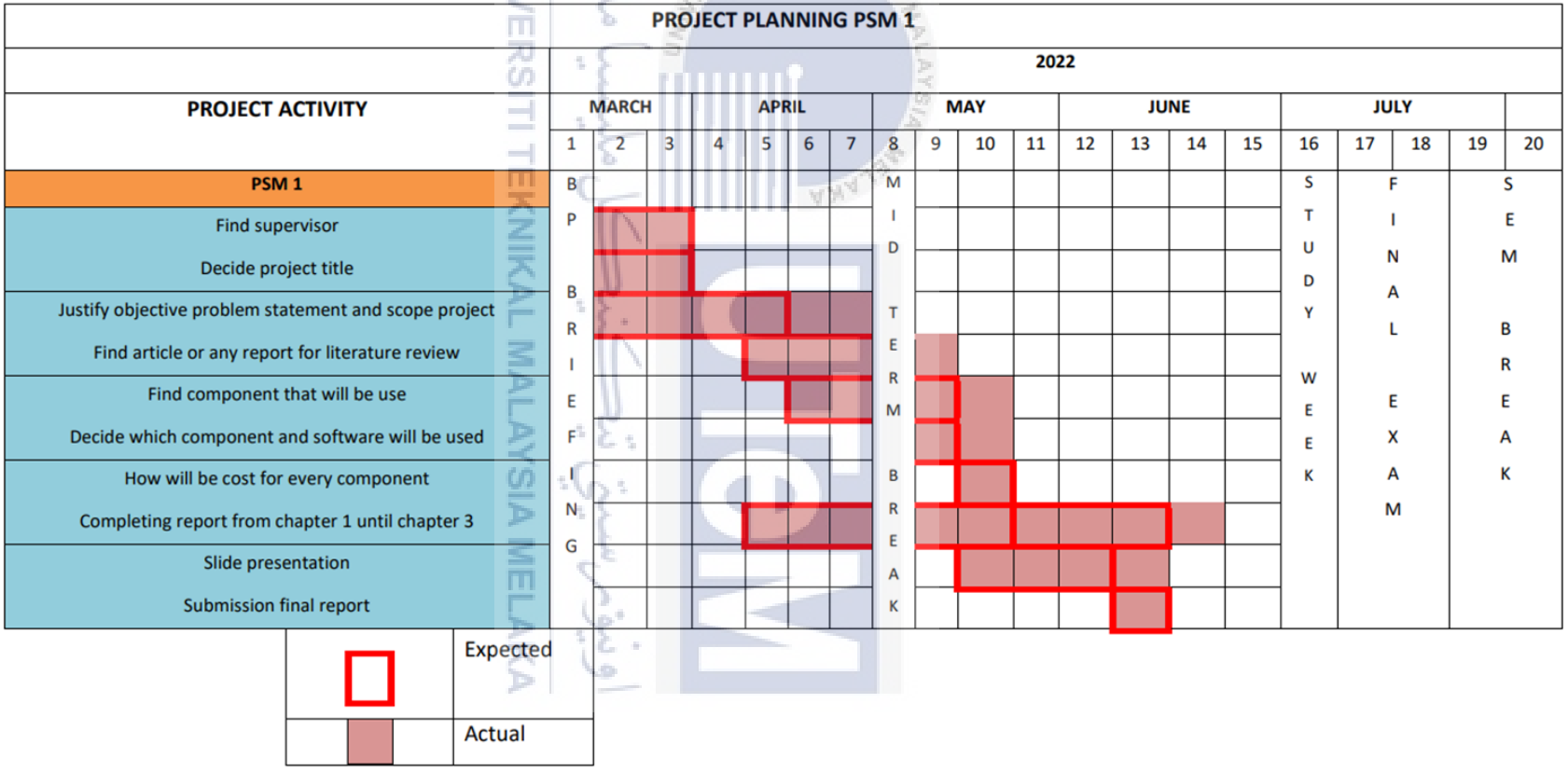

Table 3.2 : Gantt Chart of Final Years Project

PROJECT PLANNING PSM 2																					
	2022												2023								
PROJECT ACTIVITY	OCTOBER				NOVEMBER				DECEMBER				JANUARY				FEBUARY				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
PSM 2								M													
Purchase component & interfacing component	B							I								S		F			
Troubleshoot design	P							D								T		I		S	
Etching PCB																U		N		E	
Solder component	B							S								D		A		M	
	R							E								Y		L			
Coding for component interfacing	I							M												B	
Troubleshoot coding	E															W		E		R	
Prepare survey question	F							B								E		X		E	
Analysis survey	I							R								E		A		A	
Completing report	N							E								K		M		K	
Turnitin report	G							A													
Presentation preparation								K													
Submit final report																					