POLITEKNIK MALAYSIA

SULTAN SALAHUDDIN ABDUL AZIZ SHAH

DEE50102 | PROJECT 2

FINAL REPORT FYP

SMART SAVE VAULT USING ARDUINO UNO

NAME: MOHAMMAD SYAWAL FITRI BIN RAHMAT

REGISTRATION NO: 08DEP22F1074

This report submitted to the Electrical Engineering Department in fulfillment of the requirement for a Diploma in Electrical Engineering

JABATAN KEJURUTERAAN ELEKTRIK

SESI 1 (2024/2025)

CONFIRMATION OF THE PROJECT

The project report titled "A Smart Save Vault using Arduino UNO" has been submitted, reviewed, and verified as a fulfills the conditions and requirements of the Project Writing as stipulated.

Checked by:

Supervisor's name : PUAN NOR ROFIZAH BINTI ABDUL MUTALIB

Supervisor's signature:

Date :

Verified by:

Project Coordinator name :

Signature of Coordinator :

Date :

"I acknowledge this work is my own work except the excerpts I have already explained to our source"

1. Signature :

Name : MOHAMMAD SYAWAL FITRI BIN RAHMAT

Registration Number : 08DEP22F1074

Date : 8 NOVEMBER 2024

DECLARATION OF ORIGINALITY AND OWNERSHIP

TITLE : A SMART SAVE VAULT USING ARDUINO UNO

SESSION: SESI 1 2024/2025

1. I, MOHAMMAD SYAWAL FITRI BIN RAHMAT, my matric number is 08DEP22F1074

   is a final year student of **Diploma in Electrical Engineering, Department of Electrical, Politeknik Sultan Salahuddin Abdul Aziz Shah**, which is located at **Persiaran Usahawan, 40150 Shah Alam, Selangor**.

2. I acknowledge that 'The Project above' and the intellectual property therein is the result of our original creation /creations without taking or impersonating any intellectual property from the other parties.

3. I agree to release the 'Project' intellectual property to 'The Polytechnics' to meet the requirements for awarding the **Diploma in Electrical Engineering (Communication)** to me.

Made and in truth that is recognized by;

) **MOHAMMAD SYAWAL FITRI BIN RAHMAT**)
(Identification card No: - 041119140299) ..……
MOHAMMAD SYAWAL FITRI BIN RAHMAT

In front of me, **PUAN NOR ROFIZAH BINTI ABDUL MUTALIB** (Click here to enter text.)) ....……
As a project supervisor, on the date: **PUAN NOR ROFIZAH BINTI ABDUL MUTALIB**

ACKNOWLEDGEMENTS

I have made efforts in this Project which encourage many people to make savings. However, it would not have been possible without the kind support and help of many individuals. I would like to extend my sincere thanks to all of them. I am highly indebted to Puan Nor Rofizah Binti Abdul Mutalib for her guidance and constant supervision as well as for providing necessary information regarding the Project & also for their support in completing the Project.

I would like to express my gratitude towards my parents & member of our project group under same supervisor for their kind co-operation and encouragement which help me in completion of this Project. I would like to express my special gratitude and thanks to industry persons for giving me such attention and time.

My thanks and appreciations also go to my colleague in developing the Project and people who have willingly helped me out with their abilities.

ABSTRACT

The "Smart Save Vault" is a smart IoT money box designed to enable users to track and manage their savings in real time. This project incorporates an Arduino Uno microcontroller, paired with an ESP8266 Wi-Fi module to facilitate seamless connectivity with the Blynk app for smartphone notifications. Using a TCS3200 color sensor, the system identifies Malaysian banknotes in denominations of blue for RM1, green for RM5, and red for RM10, while three infrared sensors detect coin denominations (10, 20, and 50 cents). When money is inserted into the vault, the value is counted, and the cumulative amount is displayed on a 16x2 LCD screen, providing immediate feedback to the user. Additionally, a buzzer activates as a confirmation alert each time banknotes or coins are detected by the sensors. Once a preset savings target is reached, users receive notifications on their smartphone via the Blynk app, helping them stay informed on their progress toward financial goals. To reset the total amount in the system after withdrawing the saved money, users can easily reset the balance in the Blynk app, keeping the device ready for continued use. The "Smart Save Vault" demonstrates a practical and innovative application of IoT and sensor technologies, combining automated money tracking and wireless communication to support personal financial management. This project highlights the potential for accessible IoT solutions to enhance everyday savings habits and financial awareness.

ABSTRAK

Smart Save Vault" ialah kotak wang IoT pintar yang direka untuk membolehkan pengguna menjejak dan mengurus simpanan mereka dalam masa nyata. Projek ini menggabungkan mikropengawal Arduino Uno, dipasangkan dengan modul Wi-Fi ESP8266 V3 LOLIN untuk memudahkan sambungan lancar dengan aplikasi Blynk untuk pemberitahuan kepada telefon pintar. Menggunakan sensor warna TCS3200, sistem mengenal pasti wang kertas Malaysia dalam denominasi biru untuk RM1, hijau untuk RM5 dan merah untuk RM10, manakala tiga sensor inframerah mengesan denominasi syiling (10, 20, dan 50 sen). Apabila wang dimasukkan ke dalam tabung, nilai dikira dan jumlah terkumpul dipaparkan pada skrin LCD 16x2, memberikan maklum balas segera kepada pengguna. Selain itu, buzzer diaktifkan sebagai amaran pengesahan setiap kali wang kertas atau syiling dikesan oleh penderia. Setelah sasaran simpanan pratetap dicapai, pengguna menerima pemberitahuan pada telefon pintar mereka melalui apl Blynk, membantu mereka kekal dimaklumkan tentang kemajuan mereka ke arah matlamat kewangan. Untuk menetapkan semula jumlah amaun dalam sistem selepas mengeluarkan wang yang disimpan, pengguna boleh menetapkan semula baki dengan mudah dalam apl Blynk, memastikan peranti sedia untuk digunakan secara berterusan. "Smart Save Vault" menunjukkan aplikasi praktikal dan inovatif bagi teknologi IoT dan penderia, menggabungkan penjejakan wang automatik dan komunikasi tanpa wayar untuk menyokong pengurusan kewangan peribadi. Projek ini menyerlahkan potensi penyelesaian IoT yang boleh diakses untuk meningkatkan tabiat simpanan harian dan kesedaran kewangan.

TABLE OF CONTENTS

LIST OF TABLES

TABLE **TITLE** **PAGE**

LIST OF FIGURES

FIGURE **TITLE** **PAGE**

CHAPTER 1
1 INTRODUCTION

1.1 Introduction

In today's world, where financial literacy is essential and saving habits play a critical role in securing one's future, the concept of a "Money Box" stands out as a powerful tool for financial empowerment. More than just a container, a Money Box symbolizes a shift toward mindful wealth management and informed financial decisions. As technology advances and financial landscapes evolve, secure, efficient, and accessible methods of saving and managing finances have become increasingly important. While digital banking, cryptocurrency, and various investment platforms provide new opportunities for wealth growth, they also introduce challenges, particularly around asset security and accessibility.

The Internet of Things (IoT) offers an exciting path to modernize personal finance management by connecting physical devices with the digital realm, enabling real-time data collection, analysis, and communication. This project proposes the creation of an IoT-enabled smart money box, which merges the simplicity of traditional saving methods with the power of modern technology. The IoT money box is designed to provide users with an interactive and secure way to save money, offering valuable feedback that encourages healthier financial habits.

Equipped with sensors to detect coins and bills, a microcontroller to process this data, and wireless communication modules to connect to a mobile app, the smart money box enables users to track savings, set financial goals, and receive notifications and tips. This innovative approach not only makes saving easier but also more engaging, especially for younger users and families, promoting a culture of saving from an early age.

1.2 Background Research

Developing the Smart Save Vault, an IoT-enabled smart money box, requires thorough background research to create a product that meets user needs while integrating the latest technological advancements. This research spans several critical areas: existing market offerings, personal finance management trends, technological innovations, security standards, and user experience preferences. A key step in designing a competitive and innovative Smart Save Vault is analyzing current market products. Traditional money boxes, digital piggy banks, and smart saving devices each offer unique features, including coin and bill recognition, digital displays, and basic connectivity options. Studying these products provides insights into common functionalities, strengths, and potential limitations. Reviewing user feedback on these products reveals what features users value most and what improvements they desire. This analysis will inform the Smart Save Vault's design, enabling the development of features that not only meet but exceed user expectations, making it a standout solution in the realm of smart saving.

1.3 Problem Statement

In today's complex financial landscape, many people struggle to effectively track their savings and spending, often leading to a lack of transparency and accountability. Without a clear picture of where their money is going and how much they're saving, setting and achieving meaningful financial goals can feel out of reach. Compounding these challenges, the appeal of impulsive purchases can destabilize finances and derail saving efforts. The Smart Save Vault—a reimagined "Money Box"—is designed to tackle these pressing issues. Leveraging advanced technology, this innovative solution offers users a seamless platform to manage their finances. Through personalized goal-setting, real-time insights into saving and spending patterns, automated savings transfers, and intelligent spending limits, the Smart Save Vault empowers users to take control of their financial futures. It seeks to transform the way people approach saving by fostering accountability, making goals more attainable, and curbing impulsive spending. Ultimately, the Smart Save Vault promotes financial stability and well-being for all, encouraging a more secure financial future.

1.4 Research Objectives

The main objective of this Project is:

1. To develop an accurate system for detecting and counting currency using the TCS3200 color sensor for banknotes and the IR sensor for coins, ensuring precise tracking of deposited funds.

2. To design an automated savings monitoring and notification system that leverages the Arduino Uno and ESP8266 to send real-time updates via the Blynk app when the savings target is reached.

1.5 Scope of Research

This Project is focusing on leveraging smart technology to address challenges in personal finance management, specifically targeting the issue of inconsistent saving habits among individuals. The emphasis is on designing an intuitive and visually appealing user interface for the Smart Save Vault application to enhance user experience and engagement. The main controller of the Smart Save Vault application utilizes a combination of mobile app development frameworks, programming languages, and cloud-based technologies. Within predetermined budget and timeline constraints, while adhering to regulatory compliance and resource limitations, the project entails designing and manufacturing the physical Smart Save Vault device, developing software infrastructure for user interaction and data management, implementing automation features, and ensuring security and privacy measures. Thorough testing is also conducted. The project runs in less than a month, and hardware resources are available on Shopee and Lazada. The project's development cost was more than RM 400.

1.6 Project Significance

1.6.1 Improved Saving Habits

The project aims to tackle the issue of inconsistent saving habits by offering personalized saving recommendations and insights into spending patterns. By promoting smarter saving behavior, Smart Save Vault can help users work towards achieving their financial goals and building long-term financial security.

1.6.2 Social Impact

Smart Save Vault has the potential to have a positive social impact by promoting financial health and stability among individuals and families. By helping users save more effectively and make smarter financial decisions, the project contributes to broader efforts to reduce financial inequality and promote economic resilience.

1.7 Chapter Summary

The introduction serves as a foundational overview of the Smart Save Vault project, presenting the "Money Box" as a symbol of financial empowerment and emphasizing the importance of intentional wealth management in today's complex financial landscape. It addresses key challenges individuals face, such as limited transparency and accountability in traditional saving methods and the appeal of impulsive purchases, which often undermine financial goals. This section defines the problem, establishing the need for a Smart Save Vault to provide a user-friendly platform that supports money management through personalized goal-setting and real-time insights into saving and spending patterns. The research objectives focus on creating interactive savings challenges, developing algorithms for personalized recommendations, and enhancing user engagement. The research scope includes leveraging smart technology to improve personal finance management, emphasizing user interface design and software development within set budget and timeline constraints. Finally, the chapter highlights the significance of this project in encouraging better saving habits, fostering social responsibility, and promoting financial well-being for individuals and families.

CHAPTER 2
2 LITERATURE REVIEW

2.1 Introduction

A literature review critically assesses and examines existing research on a particular topic, aiming to offer a thorough overview of current knowledge, highlight gaps, and propose future research directions. This process involves searching for relevant sources, assessing their credibility, summarizing key findings and arguments, identifying patterns and themes, and critically analyzing the strengths and weaknesses of the literature. By integrating multiple sources, a literature review provides valuable insights into the current state of knowledge on the topic, assisting researchers in building on existing studies, addressing unresolved questions, and contributing to the field's advancement.

2.2 IoT Piggy Bank for Money Saving Habit Instillation (Eng Yee Wei & Wee Bui Lin, 2021)

The main objective of this project is to develop an IoT Piggy Bank that serves as an innovative tool to instill saving behaviors in children. This project is developed by using Arduino UNO which relates to Cytron ESP8266 WiFi shield as a controller and communication module to become an integrated central component. For functional testing, there is a total of 11 test cases that have been carried out across 6 use cases. Out of 11 test cases, 10 had passed and only one failed. The coin detection test case failed due to the coin falling position escaped away from the IR sensor detection and caused an inaccurate result as discussed in the previous section.

2.3 Automatic Safety Electronic Saving Box (Khairul Fikri & Umi Fadlillah, 2020).

This project creates a secure saving box to protect essential and valuable items. It employs an ESP8266 microcontroller with a waterproof temperature sensor, power supply, LCD, keypad, solenoid door lock, and switch. The LCD's initial display reads "Electronic Safe Box," followed by temperature readings and the status "Temperature Normal," ensuring safety in the surrounding environment.

2.4 IoT-based banknotes saving automation system (Muhammad Haekal Alfarisi1, Anggunmeka Luhur Prasasti1 & Reza Rendian Septiawan, 2022).

The aim of this IoT-based banknote storage system is for recording the amount of savings, the authenticity of the banknotes, and the nominal value of banknotes automatically into the mobile application. This tool is based on Arduino Mega which consists of several components, namely Arduino Mega, NodeMCU, GY-33 TCS34725, Keypad Pin 4x4, LCD 16x2, Selenoid Door Lock, UV High Power LED, Servo Motor MG90S. To identify the nominal value of banknotes, it is necessary to test the values of red, green, and blue so that the system can read each nominal on banknotes.

2.5 Design of Digital Secured Box Using IoT with Raspberry Pi (R. Ramprakash, K. Subbareddy & P. Praveen, 2020).

This digital secured box is an alternative for safeguarding delivery packages, particularly for home deliveries. The system uses Raspberry Pi, with an ultrasonic sensor and keypad as input and an LCD display as output. When the delivery reaches

the address, the delivery person contacts the customer for the password to open the secured box.

2.6 Development of an Electronic Smart Safe Box Using Private Blockchain Technology (Chibli Joumaa & Abdulrahman Alotaibi, 2022).

This project designs a smart security box to address issues such as forgetfulness, unauthorized access, and security vulnerabilities in traditional safe boxes. The main components include Arduino UNO, PIR sensor, RFID, battery, keypad, fingerprint scanner, facial recognition, buzzer, LCD, and speaker. The system was tested for facial recognition using registered and unregistered faces to validate access.

2.7 Smart Save Vault (Mohammad Syawal Fitri bin Rahmat, 2024).

The objective of this project is to create interactive challenges, achievements, and progress milestones to encourage users to achieve their savings goals. It develops algorithms to analyze financial goals, spending habits, income streams, and savings patterns, providing personalized recommendations and insights. The system uses two microcontrollers (Arduino UNO and NodeMCU) with inputs from a TCS3200 color sensor, three infrared sensors, and a mobile app. Outputs include an LCD display and buzzer. IR sensors detect coins, while the color sensor identifies banknotes. When the set amount is reached, a notification is sent via a smartphone app.

2.8 Chapter Summary

This section is split into two parts: the first covers preliminary research, providing foundational insights and referencing five relevant articles for Project 1. The second part, concluding Chapter 2, includes a comparison of electronic components and an explanation of the primary components used in the project, establishing a solid technical basis.

CHAPTER 3

3 RESEARCH METHODOLOGY

3.1 Introduction

Methodology in research involves the organized procedures and strategies employed by researchers to carry out their inquiries. This includes deciding on research design, methods for collecting data, approaches to sampling, techniques for analyzing data, ethical standards, measures for validation, selection of research tools, and interpretation of results. It acts as a structured framework that directs every stage of the research journey, starting from crafting research questions to sharing findings, with the aim of ensuring precision, authenticity, and consistency in the study's results. Through meticulous planning and implementation of methodology, researchers can effectively pursue research goals, contribute to the advancement of knowledge, and provide a basis for making informed decisions grounded in evidence within their respective fields.

3.2 Project Design and Overview.

As mentioned in the previous chapter, the designed controller uses a closed-loop system with Arduino as the main controller. The design of the controller circuit using Arduino is realized using Proteus Software and then convert to PCB circuit.

3.2.1 Block Diagram of the Project 2

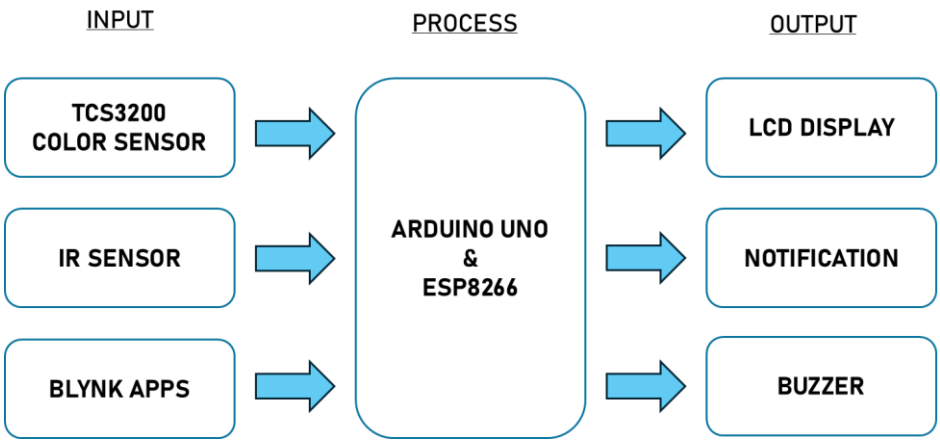


Figure 3.2.1 Block diagram for proposed project

3.2.2 Flowchart of the Project 2

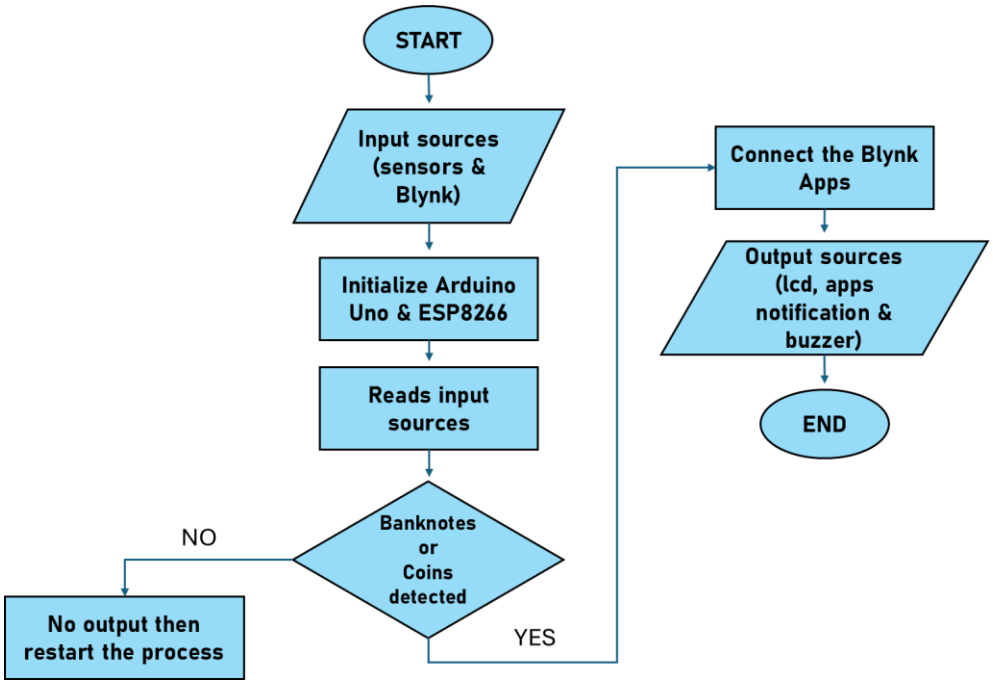


Figure 3.2.2 shows the flowchart of the project

3.2.3 Project Description

3.3 Project Hardware

As mentioned in the previous chapter, the designed controller is using Arduino UNO & ESP8266. Then, the lcd will display the input amount when either color or ir sensor detected the banknotes or coins and the buzzer will emit if the sensors sense. Also, the amount can be checked through the Blynk apps. To reset the total amount, use the button in Blynk apps.

3.3.1 Schematic Circuit

Figure 3.3 shows the overall circuit diagram of this Project **"Smart Save Vault."**

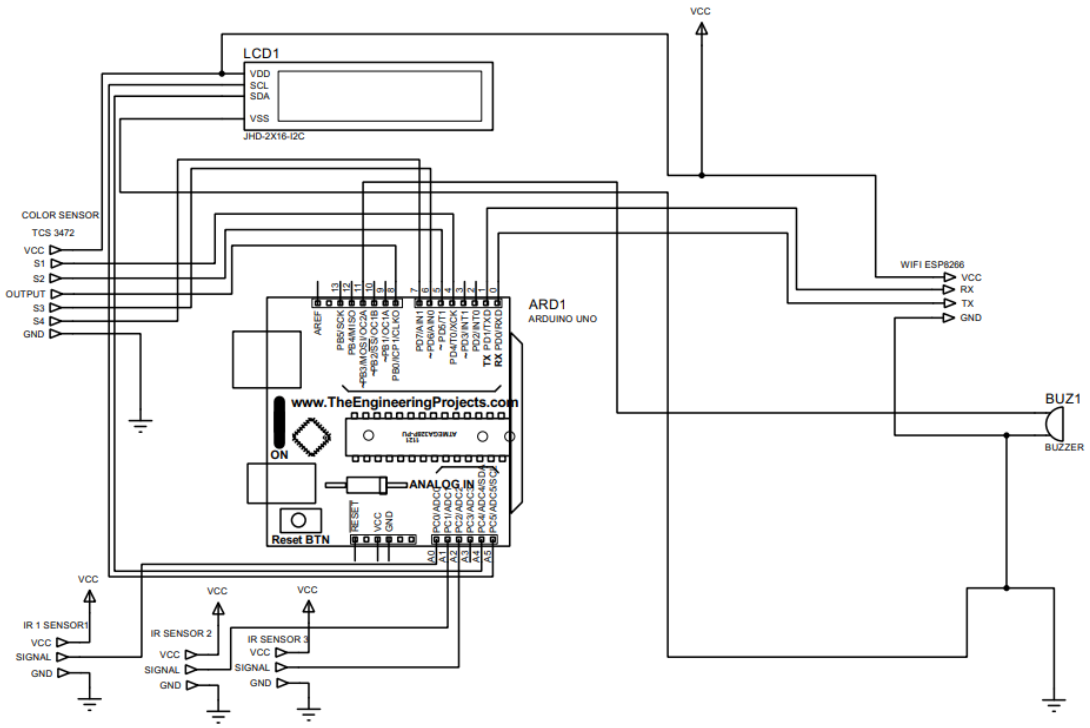


Figure 3.3.1 shows the schematic circuit diagram for this project

3.3.2 Description of Main Component

3.3.2.1 Arduino UNO

The Arduino Uno stands as a cornerstone in the realm of microcontroller boards, renowned for its accessibility, versatility, and user-friendly design. At its core lies the ATmega328P microcontroller chip, boasting a robust 8-bit AVR CPU operating at 16 MHz. This chip provides an array of features, including a multitude of digital and analog input/output pins, PWM outputs, and analog input channels, facilitating seamless interaction with a wide range of electronic components and peripherals. Powered by either USB connection, a DC power jack, or an external power supply, the Arduino Uno operates at a standard voltage of 5V, ensuring compatibility with various devices and accessories. Its integrated USB interface enables effortless connectivity to a computer for programming and communication, thanks to the inclusion of a USB-to-serial converter chip. Programming the Arduino Uno is a breeze, thanks to the Arduino Integrated Development Environment (IDE), which simplifies code writing, compilation, and uploading processes, utilizing a language based on C and C++ that caters to both novices and seasoned developers. The Arduino Uno's versatility knows no bounds, finding applications across domains like robotics, home automation, IoT, wearable tech, and interactive art, owing to its simplicity, affordability, and extensive community support. Embracing an open-source ethos, its hardware design, firmware, and software libraries are freely available for modification and distribution, fostering collaboration and innovation within the vibrant Arduino community. In essence, the Arduino Uno epitomizes a blend of power, accessibility, and community-driven development, empowering makers of all skill levels to turn their electronic visions into reality.

3.3.2.2 TCS3200 (Color Sensor)

The TCS3200 color sensor is an optical sensing device equipped with an array of photodiodes and light filters, allowing it to accurately detect and distinguish a wide spectrum of colors by measuring the intensity of red, green, blue, and clear (unfiltered) light. Utilizing frequency-to-voltage conversion techniques, it translates detected light intensity into electrical signals, providing precise color data outputs proportional to each detected color's intensity. With its various color sensing modes, including RGB and Grayscale, and standard digital interface for easy integration with microcontrollers, the TCS3200 sensor finds applications in color detection, sorting, calibration, and automation across industries such as robotics, industrial automation, and product quality control.

3.3.2.3 Infrared sensor

An infrared sensor (IR sensor) is a radiation-sensitive optoelectronic component with a spectral sensitivity in the infrared wavelength range 780 nm to 50 µm. IR sensors are now widely used in motion detectors, which are used in building services to switch on lamps or in alarm systems to detect unwelcome guests. In a defined angle range, the sensor elements detect the heat radiation (infrared radiation) that changes over time and space due to the movement of people. It had 3 pins, OUT, GND and VCC. The two led it represents: white LEDs is transmitter, while Black LEDs is receiver.

3.3.2.4 ESP8266

The ESP8266 is a compact and affordable Wi-Fi microcontroller module, featuring an integrated 32-bit microcontroller core and built-in Wi-Fi connectivity. It enables wireless communication with other devices and servers over the internet, making it ideal for IoT applications. Despite its small size, it offers GPIO pins, UART, SPI, I2C, and analog inputs for interfacing with various sensors and actuators. Programmed using the Arduino IDE or other environments, it is widely used in DIY projects, home automation, industrial monitoring, and smart appliances. Known for its

low power consumption, it's suitable for battery-powered devices. Its popularity and ongoing community support ensure its continued relevance in IoT development.

3.4 Chapter Summary

The TCS3200 color sensor is an optical sensing device adept at detecting and distinguishing a wide spectrum of colors through the measurement of red, green, blue, and clear light intensity, while the infrared (IR) sensor specializes in detecting infrared radiation emitted or reflected by objects, commonly employed in applications such as motion detection, proximity sensing, and object detection; on the other hand, the Arduino Uno serves as a widely-utilized microcontroller board renowned for its versatility, featuring an array of digital and analog input/output pins and programmable through the Arduino IDE, whereas the ESP8266 stands out as a compact and cost-effective Wi-Fi microcontroller module facilitating wireless communication for a diverse array of IoT applications.

CHAPTER 4

4 PROJECT MANAGEMENT AND COSTING

4.1 Introduction

This project entails the procurement of various components and materials throughout its execution. The components include an Arduino UNO kit, a buzzer, a TCS3200 color sensor, an infrared sensor, jumper cables, an ESP8266 module, model casing and LCD display. These items are acquired through online purchasing for the sake of convenience and cost efficiency. The overall estimated budget for this project implementation is approximately RM400, with additional expenses such as postage costs amounting to RM20, as detailed in section 4.4. Given this budget, the project can be regarded as relatively economical compared to others that may incur expenses exceeding a thousand ringgit. Moreover, the project's cost aligns with the desirable characteristic of being cost-effective while ensuring high-quality outcomes. The project's activities are depicted in a Gantt Chart spanning from week one to week 14, as outlined in section 4.2.

4.2 Gant Chart and Activities of the Project 2

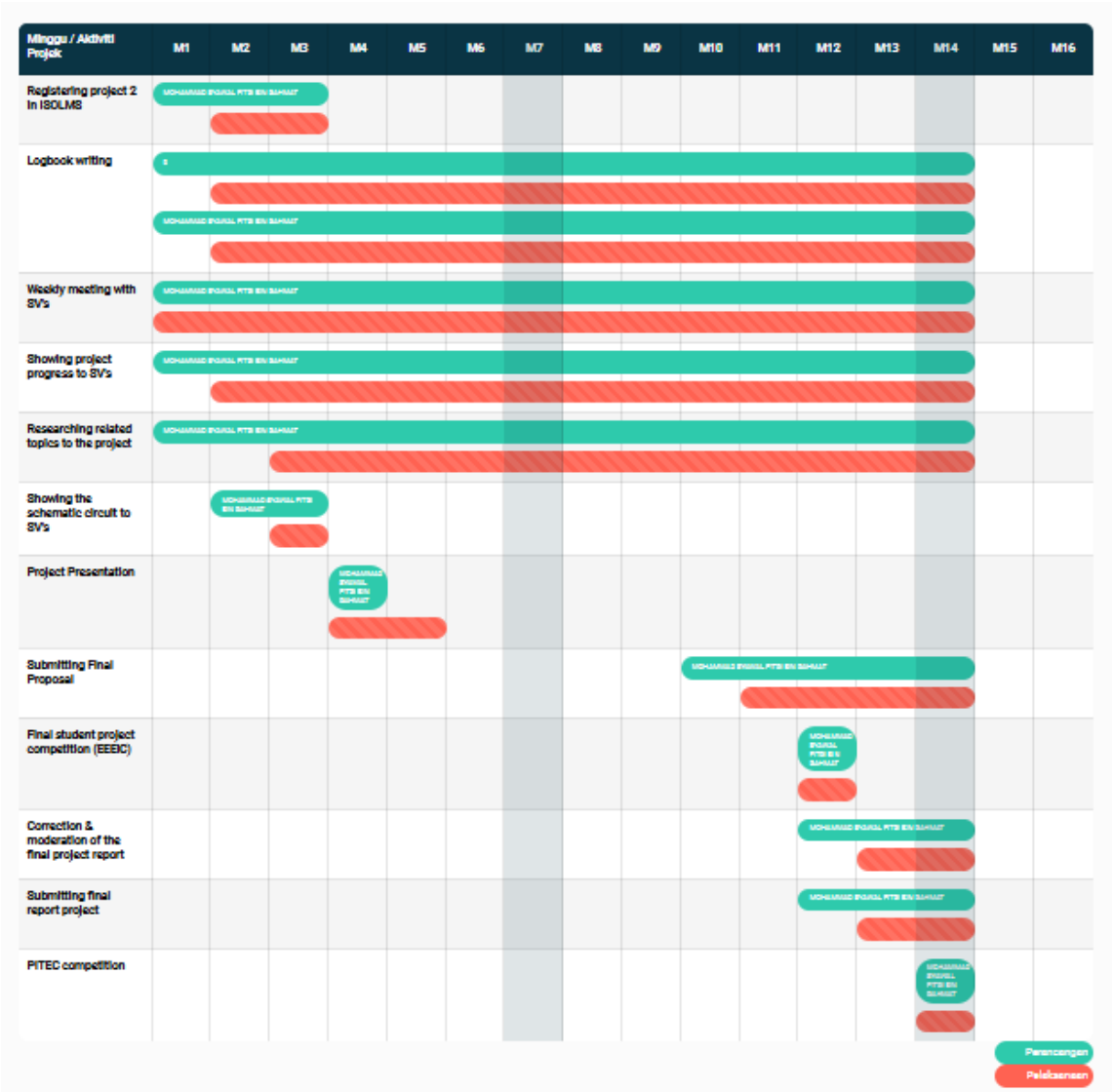


Figure 4.2 shows the Gant Chart for this project

4.3 Cost and Budgeting

No.	Component and materials	The unit price	Quantity	Total
1	Arduino UNO set	RM 42.90	1	RM 42.90
2	ESP3266 module	RM 10.00	1	RM 10.00
3	Model casing	RM 20.00	1	RM 20.00
4	TCS3200 color sensor module	RM 10.00	1	RM 10.00
5	IR sensors	RM 2.00	3	RM 6.00
7	Buzzer	RM 1.85	1	RM 1.85
8	LCD Display	RM 8.40	1	RM 8.40
9	Jumper wire	RM 8.00	1	RM 8.00
			Total :	**RM 107.15**
	List of other costing			
1	Transportation			
2	Postage			
3	Craft Work			
4	Internet			
5	Application			
6	Electrical Source			
			Total :	**RM 250**
			Overall total	**RM 357.15**

4.4 Chapter Summary

Chapter 4 presents a 14-week Gantt chart outlining the systematic progression of my project, helping allocate time for each task. It also includes a breakdown of expenses, covering component costs, shipping, transportation, and internet usage. The total estimated cost for developing the Smart Save Vault with IoT system is approximately RM 357.15, reflecting balanced and efficient resource use.

5 CONCLUSIONS

This chapter will summarize the results of the tests that have been carried out, including the achievement of objectives and the effectiveness of the system developed in the Smart Save Vault project. In this chapter, it will include an evaluation of how well the project achieved its objectives and an analysis of the system's overall effectiveness in fulfilling the intended goals.

5.1 Conclusion

In conclusion, the implementation of the Smart Save Vault, developed using Arduino Uno and NodeMCU, has successfully achieved the main objectives of the project. The system detects coins and banknotes using sensors, triggers a buzzer, and displays the amount on an LCD screen. Additionally, the total savings are updated in real-time within the Blynk app, allowing users to track how much has been deposited. The system also includes a convenient reset feature accessible through the Blynk app, ensuring ease of use and seamless management. This project not only meets user needs but also promotes smart and organized saving habits.

5.2 Chapter Sumarry

In summary, the Smart Save Vault project has successfully fulfilled the objectives of providing a smart and interactive savings management system. Testing and analysis show that the system functions effectively and reliably, from detecting deposits to updating the Blynk app with accurate totals. With its notification and reset features, the system offers a practical and user-friendly solution for modern savings management, encouraging financial discipline and improved saving habits among users.

6 REFERENCES

[1] "IoT Piggy Bank for Money Saving Habit Instillation | Journal of IT in Asia," publisher.unimas.my, Nov. 2021, Available: https://publisher.unimas.my/ojs/index.php/JITA/article/view/2860

[2] Khairul Fikri and Umi Fadlillah, "Automatic Safety Electronic Saving Box," Emitor, vol. 20, no. 1, pp. 56–61, Oct. 2019, doi: https://doi.org/10.23917/emitor.v20i1.8777.

[3] Anggunmeka Luhur Prasasti, Reza Rendian Septiawan, and Muhammad Haekal Alfarisi, "IoT-Based Banknotes Saving Automation System," [CEPAT] Journal of Computer Engineering Progress Application and Technology, vol. 2, no. 01, pp. 1–1, Feb. 2023, doi: https://doi.org/10.25124/cepat.v2i01.5499.

[4] "Design of Digital Secured box using IoT with Raspberry Pi," International Journal of Engineering and Advanced Technology, vol. 9, no. 3, pp. 2659–2663, Feb. 2020, doi: https://doi.org/10.35940/ijeat.c5813.029320.

[5] B. Alothman et al., "Development of an Electronic Smart Safe Box Using Private Blockchain Technology," Applied Sciences, vol. 12, no. 13, p. 6445, Jan. 2022, doi: https://doi.org/10.3390/app12136445.

7 APPENDICES

APPENDIX A- DATA SHEET

TCS3200 (COLOR SENSOR DATASHEET)

[1] "TCS3200, TCS3210 PROGRAMMABLE COLOR LIGHT-TO-FREQUENCY CONVERTER S0

1 S1 2 OE 3 GND 4 TCS3210," 2009. Available:

https://www.mouser.com/catalog/specsheets/TCS3200-E11.pdf

INFRARED SENSOR DATASHEET

[2] "IR Proximity Sensor." Available:
https://components101.com/sites/default/files/component_datasheet/Datasheet%20of%20IR%20%20Sensor.pdf

ARDUINO UNO DATASHEET

[3] "Arduino® UNO R3." Available: https://docs.arduino.cc/resources/datasheets/A000066-datasheet.pdf

LCD 16X2 DISPLAY DATASHEET

[4] "MECHANICAL DATA." Available: https://www.vishay.com/docs/37484/lcd016n002bcfhet.pdf

ESP8266 MODULE DATASHEET

[5] "ESP8266EX Datasheet." Available:
https://www.espressif.com/sites/default/files/documentation/0a-esp8266ex_datasheet_en.pdf

BUZZER DATASHEET

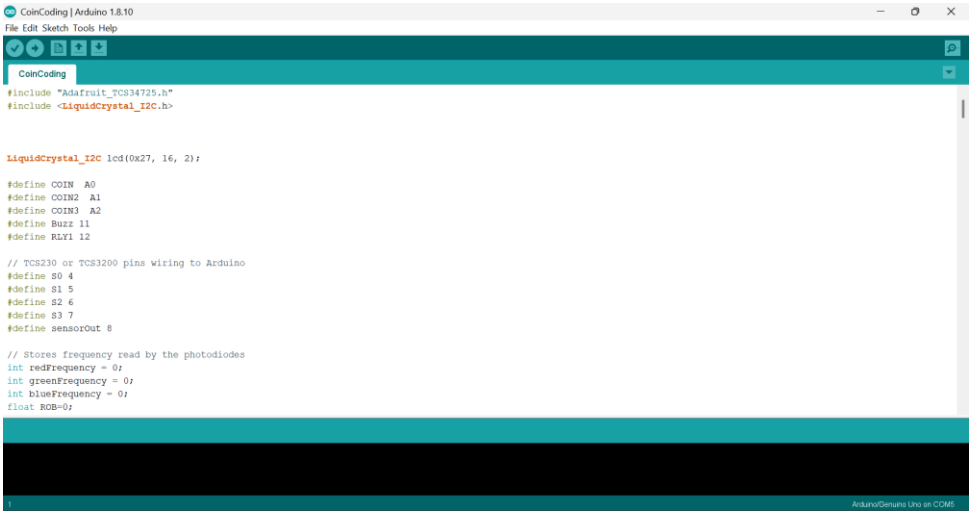
[6] "Piezoelectronic Buzzers Pin terminal/Lead Without oscillator circuit." Available:
https://www.mouser.com/datasheet/2/400/ef532_ps-13444.pdf

APPENDIX B- PROGRAMMING & APPS

ARDUINO IDE SOFTWARE

[1] Arduino, “Software,” www.arduino.cc, 2023.

https://www.arduino.cc/en/software

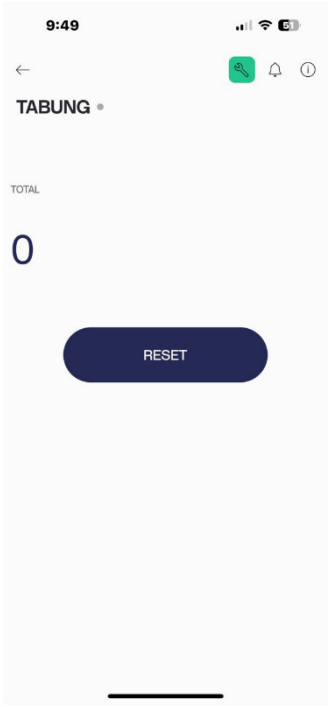


PROJECT CODING

https://drive.google.com/drive/folders/1Kb3lFtjsN9SSzWDEvdsCy6Whag4DW_Gu?usp=drive_link

BLYNK APPS

[2] “Introduction | Blynk Documentation,” Blynk.io, Mar. 07, 2024. https://docs.blynk.io/en



APPENDIX C- PROJECT RESULT