SMART MEDCARE DISPENSER: PERSONAL MEDICINE DISPENSER WITH NOTIFICATION FOR ELDERLY CARE IN NURSING HOME USING ESP32 INTEGRATED WITH MYSQL DATABASE

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PERSONAL MEDICINE DISPENSER WITH NOTIFICATION FOR ELDERLY CARE IN NURSING USING ESP32 INTEGRATED WITH MYSQL DATABASE

This report submitted in accordance with the
requirements of the MARA Japan Industrial Institute for the
Diploma In Electronics Engineering (Measurement & Control)

by

MUHAMMAD FIKRI BIN ZAHARUDIN

DEPARTMENT OF ELECTRONICS DATA TRANSMISSION & NETWORK

2024

“I hereby declare that we have read this project report and in my opinion this project report is sufficient in terms of scope and quality for the award of the Diploma of Electronics Engineering (Measurement & Control)

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This thesis is dedicated to my family, whose love, patience, and belief in me have been the foundation of my journey. To my parents, thank you for your endless sacrifices, for always standing beside me, and for showing me what it means to work hard and dream big. Your faith in me has been my guiding light through even the darkest moments.

And finally, to myself—I thank you for not giving up. For all the late nights, the doubts, and the struggles, you found the strength to carry on. This achievement is not just a milestone; it is a testament to resilience, courage, and the belief that anything is possible with heart and determination.

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ABSTRACT

Smart Medcare Dispenser is a device used to monitor the medication times of the elderly in nursing homes. It is equipped with safety features that use email notifications designed to inform caregivers on duty that the elderly need to take their medication at the scheduled times.

Additionally, administrators in the nursing home will input information on a website to send commands to an ESP32 with WiFi connectivity, which is installed along with a stepper motor to rotate a container with 4 medication storage compartments for up to 32 hours. The mechanism used to notify the elderly includes sound and light. When the elderly hear the sound or see the light on the device, it will inform them to take their medication according to the schedule.

After taking their medication, the elderly need to press a switch provided manually to send data to a MySQL database to store information about the date, time, and type of medication taken. In this way, the elderly in nursing homes who need to take medication do not need to worry about taking their medication or issues with medication management. This system ensures they receive their medication on time and facilitates caregivers and administrators in monitoring and managing medication intake more effectively.

ABSTRACT

Smart Medcare Dispenser ialah sebuah alat yang digunakan untuk memantau masa pengambilan ubat oleh orang tua di rumah orang tua. Ia dilengkapi dengan ciri-ciri keselamatan menggunakan notifikasi e-mel yang direka khas untuk memberitahu penjaga yang sedang bertugas bahawa orang tua akan mengambil ubat pada masa yang ditetapkan mengikut jadual.

Selain itu, pentadbir di rumah orang tua akan mengisi informasi di laman sesawang bertujuan untuk memberi arahan kepada ESP32 yang dilengkapi sambungan WIFI dipasang bersama stepper motor untuk memusingkan bekas yang mengandungi 4 bahagian penyimpanan ubat selama 32 jam. Mekanisma yang digunakan untuk menginformasikan orang tua melalui bunyi dan cahaya. Apabila orang tua mendengar bunyi atau melihat cahaya di alat yang disediakan, ia akan menginformasikan orang tua untuk mengambil ubat mengikut jadual yang ditetapkan.

Selepas orang tua mengambil ubat, beliau perlu menekan suis yang disediakan secara manual untuk menghantar data ke pangkalan data MySQL untuk menyimpan data tentang tarikh, masa, dan jenis ubat yang diambil. Dengan cara ini, orang tua di rumah orang tua yang perlu mengambil ubat tidak perlu risau tentang pengambilan ubat dan kes-kes pengaturan ubat di rumah orang tua. Sistem ini memastikan mereka mendapat ubat pada masa yang ditetapkan, dan memudahkan penjaga serta pentadbir untuk memantau dan menguruskan pengambilan ubat dengan lebih berkesan.

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	DECLARATION	**ii**
	DEDICATION	**iii**
	ACKNOWLEDGEMENTS	**4**
	ABSTRACT	**5**
	ABSTRACT	**6**
	TABLE OF CONTENTS	**vii**
	LIST OF TABLES	**x**
	LIST OF FIGURES	**xi**
	LIST OF ABBREVIATIONS	**xiv**
	LIST OF SYMBOLS	**xv**
	LIST OF APPENDICES	**xvi**
1	**INTRODUCTION**	**1**
	1.1 Background of Research	1
	1.1.1 Example of elder get medication error	4
	1.2 Problem Statement	5
	1.3 Project Aim & Objectives	7
	1.4 Scopes	8
2	**LITERATURE REVIEW**	**10**
	2.1 Related Previous Projects	11
	2.1.1 Using Pen And Paper	12
	2.1.2 Medication Management Using Arduino Uno	13
	2.1.3 Automatic Medicine Reminder Using Arduino Nano	15
3	**MATERIALS AND METHOD**	**17**
	3.1 Project Development	17
	3.2 Components Used / Requirement	19

3.2.1 Esp32 Devkit V1 20
3.2.2 Liquid Crystal Display LCD 16x2 With I2C 24
3.2.3 Light Emitting Diode (Led) 25
3.2.4 28Byj-48 5v Stepper Motor 27
3.2.5 ULN 2003 Driver Motor 29
3.2.6 Wires Jumper 30
3.2.7 Buzzer 31
3.2.8 Push Button 32
3.2.9 Dc Adapter 12V 33
3.2.10 PCB Board 34
3.2.11 : 3d Printed Model 35
3.3 Block Diagram 36
3.4 Project Flowchart 38
3.6 Costing 40
3.6.1 Miscellaneous Costing 41
3.6.2 Project Costing 42
3.7 Arduino Ide 43
3.8 Easyeda 44
3.9 Visual Studio Code 46
3.10 Onshape 48
3.11 Mysql Database 49

4 RESULTS AND DISCUSSION 50

4.1 Overall System Performance 52
4.1.1 Software Implementation 52
4.1.2 Hardware Implementation 52
4.1.3 Final Design and Operational Demonstrations 53
4.2 View Of 3d Design 63
4.3 Simulation 65
4.4 Circuit Measurement 66
4.5 PCB Design 70

5 CONCLUSION AND RECOMMENDATIONS 72

5.1 Conclusion 73
5.2 Future Developments 74

REFERENCES 75

LIST OF TABLES

TABLE NO	TITLE	PAGE
Table 2.1:	Previous Projects / Literatures	11
Table 3.1:	Requirement Component for Personal Medicine	19
Table 3.2	Connection Esp32	21
Table 3.3:	miscellaneous Costing	41
Table 3.4:	Total Project Costing	42

LIST OF FIGURES

FIGURE NO	TITLE	PAGE
Figure 1.1:	Observation at Pusat Jagaan Mahmudah	2
Figure 1.2:	Data from www.nursinghomeabuse.org	4
Figure 1.3:	Current Intake Database	5
Figure 1.4	Lack of medicine arrangement	6
Figure 2.1:	Nursing home record data using pen and paper	12
Figure 2.2:	Front Page of the Training Module	13
Figure 2.3	Meduino	15
Figure 3.1:	Esp32 Devkit V1	20
Figure 3.2:	Liquid Crystal Display LCD 16x2 With I2c	24
Figure 3.3:	Led	25
Figure 3.4:	Stepper Motor	27
Figure 3.5:	ULN 2003 Driver Motor	29
Figure 3.6:	Wires Jumper	30
Figure 3.7:	Buzzer	31
Figure 3.8:	Push Button	32
Figure 3.9:	Dc Adapter 12V	33
Figure 3.10:	PCB Board	34
Figure 3.11:	3d Printed Model	35
Figure 3.12:	Block Diagram	36
Figure 3.13	Product Diagram	37
Figure 3.14:	Flowchart	38
Figure 3.15	Arduino Ide	43
Figure 3.16	Easyeda	44

Figure 3.17	Vs Code	46
Figure 3.18	Onshape	48
Figure 3.19	Mysql	49
Figure 4.1:	Final Project Design	53
Figure 4.2:	Login Page	54
Figure 4.3:	Administrator Must register elder’s	54
Figure 4.4:	Administrator pages	55
Figure 4.5:	Administrator need to press the “Test Spin” Button	55
Figure 4.6	If Administrator has done press the “Test Spin” Button, Server has send data to Esp32	56
Figure 4.7	The ESP32 has already received the data string from the web application, and the stepper motor will rotate 90 degrees, causing the buzzer and LED to High	56
Figure 4.8	If someone triggers the push button, the LCD display will display “thank you”, followed by the current time.	57
Figure 4.9	Before submitting the form, the administrator must fill up the elder's details in the admin pages.	57
Figure 4.10	After administrator submit the form, Server will request to Esp32	58
Figure 4.11	Administrator need to press “Start Spin Worker” at Figure 4.7 so that Web application can send data every 3 second.	58
Figure 4.12	After ESP32 received data string from the web application, Stepper motor will rotate based on schedule and other component will work like Figure 4.7-4.8	59
Figure 4.13	Administrator can check the status to see if the elder has taken the medication yet. If the status has showed Green, then means Elder has taken the medicine.	59
Figure 4.14	Table for Admin detail	60
Figure 4.15	Table for register	60
Figure 4.16	Table for monitoring	61
Figure 4.17	Notification Status Using Gmail	62
Figure 4.18	Top View	63

Figure 4.19	Left View	63
Figure 4.20	Right View	64
Figure 4.21	Back View	64
Figure 4.22	Simulation	65
Figure 4.23	Voltage at Power Jack	66
Figure 4.24	Voltage at Capacitor1	66
Figure 4.25	Voltage at Regulator	67
Figure 4.26	Voltage at Capacitor2	67
Figure 4.27	Voltage at at Stepper motor	68
Figure 4.28	Voltage during rotation at stepper motor	68
Figure 4.29	Voltage at Buzzer and Led during High	69
Figure 4.30	Voltage at Push Button During Pressed	69
Figure 4.31	Back Design for PCB board	70
Figure 4.32	Top Design for PCD Board	70

LIST OF ABBREVIATIONS

mAh	-	milliampere-hour
USB	-	Universal Serial Bus
IoT	-	Internet of Things
Wi-Fi	-	Wireless Fidelity
LED	-	Light Emitting Diode
DC	-	Direct Current
kHz	-	kilohertz
API	-	Application Programming Interface
SMS	-	Short Message Service
FYP	-	Final Year Project
VCC	-	Voltage Common Collector
VIN	-	Voltage Input
GND	-	Ground
GPIO	-	General Purpose Input/Output
PVC	-	polyvinyl chloride
LAN	-	Local Area Network
R&D	-	Research & Development

LIST OF SYMBOLS

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
APPENDIX A	ARDUINO IDE CODING	76
APPENDIX B	GANTT CHART	83

CHAPTER 1

INTRODUCTION

1.1 Background of Research

Based on research and observations of nursing homes in Bangi which is Pusat Jagaan Mahmudah, it has been discovered that these facilities face issues with medicine arrangement and a lack of proper databases. These challenges often result in medication errors that may surprise elderly residents and compromise their health and safety. Additionally, the traditional method of data collection, which relies on pen and paper, further exacerbates the problem by being inefficient and prone to errors.

To address these challenges, a proposal has been developed for a *"Personal Medicine Dispenser with Notification for Elderly Care in Nursing Homes Using ESP32 Integrated with MySQL Database"*. This system is designed to resolve the current difficulties faced by nursing homes, streamline medication management, and provide real-time database updates to improve the overall experience for the elderly.

Figure 1.1: Observation at Pusat Jagaan Mahmudah

Pusat Jagaan Mahmudah is a well-known nursing home in Malaysia dedicated to providing care and assistance to the elderly. It serves as a safe haven for individuals who require specialized care due to aging, health conditions, or lack of familial support. The center focuses on enhancing the quality of life for its residents by addressing their physical, emotional, and medical needs in a compassionate environment. However, like many other nursing homes in Malaysia, Pusat Jagaan Mahmudah faces challenges in managing medication intake for its residents effectively.

One of the significant issues in elderly care, as observed in Pusat Jagaan Mahmudah, revolves around medication errors and inefficient record-keeping systems. Traditional methods, such as manual data entry using pen and paper, increase the likelihood of errors, delays, and mismanagement. Such practices can lead to severe consequences, including health deterioration among residents due to missed or incorrect dosages of medicine. These challenges underscore the need for modern, technology-driven solutions to ensure safety and efficiency in medication management.

The proposed *"Personal Medicine Dispenser with Notification for Elderly Care in Nursing Homes Using ESP32 Integrated with MySQL Database"* directly addresses these issues. This system automates medicine dispensing and integrates a digital database to record and monitor medication schedules in real time. For nursing homes like Pusat Jagaan Mahmudah, this solution offers a way to transition from traditional, error-prone systems to a streamlined, reliable approach. The integration of IoT and database technology ensures that caregivers have access to accurate, up-to-date information, reducing the chances of medication errors and improving the overall standard of care.

In addition, the project aligns with the goals of Pusat Jagaan Mahmudah by promoting resident safety, enhancing the efficiency of caregivers, and supporting the center's mission to provide quality elderly care. By implementing such technology, nursing homes can better meet the needs of their residents while fostering trust among families who rely on these facilities to care for their loved ones. This project represents a crucial step toward modernizing elderly care in Malaysia and ensuring a safer, healthier environment for the elderly.

1.1.1 Example of elder get medication error

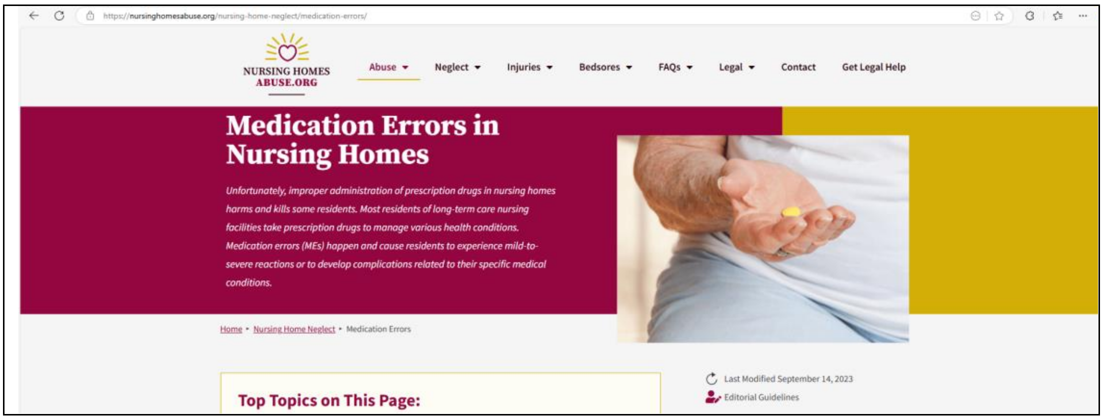

Figure 1.2: Data from www.nursinghomeabuse.org

Medication errors in nursing homes are a significant issue, with an estimated 7,000 to 9,000 deaths annually in the United States due to such errors and countless others suffering adverse reactions or complications. According to NursingHome.org, common errors include administering the wrong medication, incorrect dosages, or failing to ensure medication intake, often stemming from understaffing, lack of training, or communication gaps. These preventable mistakes result in life-threatening situations, wrongful deaths, and billions in healthcare costs. Addressing medication errors is crucial to safeguarding nursing home residents, particularly the elderly, who are more vulnerable to these events.

1.2 Problem Statement

Nursing homes face significant challenges in the arrangement and management of medication for their elderly residents. One of the primary issues is the lack of an efficient database system. Currently, nursing homes rely on traditional methods, such as paper and pen, to record medication intake. This outdated system is prone to errors, including misinterpretation of handwriting, misplaced records, and difficulties in tracking and retrieving information.

Figure 1.3: Current Intake Database

The lack of a digital database also complicates the monitoring and reporting processes. Administrators and caregivers have difficulty in generating accurate and timely reports on medication compliance, which are essential for medical reviews and audits. This situation highlights the urgent need for a modern, automated system to streamline medication management and improve the accuracy and accessibility of medication records in nursing homes.

Figure 1.4 Lack of medicine arrangement

Furthermore, managing medication schedules manually is cumbersome and increases the risk of missed or incorrect doses. Caregivers often struggle to ensure that each resident receives their medication at the correct times, especially when handling multiple residents with different medication needs. This inefficiency can lead to serious health risks for the elderly, such as adverse drug reactions or deterioration of health conditions due to missed doses.

1.3 Project Aim & Objectives

The aim of this project is to develop a prototype of a pillbox that notifies the elderly to take their medications and integrates a web application to facilitate seamless communication for caregivers regarding prescriptions. This project seeks to improve medication management in nursing homes by providing a reliable notification system and an efficient platform to enhance caregiving efficiency and ensure the health and safety of elderly residents.

This objective focuses on developing a smart pillbox with an automated dispenser integrated with a web application to ensure accurate and timely medication dispensing for elderly users. The dispenser will be controlled by a microcontroller, enabling real-time monitoring and management of prescriptions. The web application will allow caregivers to efficiently input and update medication schedules, providing reliable data and notifications to ensure adherence. This system aims to enhance medication management and improve the quality of care for elderly residents in nursing homes.

The second objective is to implement a notification system that alerts elderly residents to take their prescribed medication on time. This system will utilize a buzzer and LED as reminders, activated according to a predefined schedule. By ensuring timely notifications, the system aims to support adherence to medication routines, addressing challenges faced by elderly individuals in managing their prescriptions effectively.

1.4 Scopes

The proposed medicine dispenser is designed to target elderly individuals who require regular intake of medication pills and caregivers, such as nurses, who manage the care of older patients. By addressing the challenges faced by this demographic, the dispenser aims to simplify the medication management process, ensuring that users adhere to their prescribed schedules efficiently and reliably. This solution is particularly beneficial in nursing homes, where caregivers oversee multiple patients and require effective tools to ensure medication adherence.

The medicine box is programmable, allowing caregivers to customize it based on individual patient needs. It includes four partitions, each capable of accommodating medication schedules for up to eight hours. Caregivers can specify the pill quantity for each partition through a user-friendly web application. This level of programmability enhances the dispenser's versatility, making it suitable for diverse medical routines and ensuring that the system is adaptable to varying prescription requirements.

To ensure adherence to medication schedules, the medicine dispenser employs a combination of sound and light notifications to remind elderly users when it is time to take their medicine. These reminders are automated and triggered according to the schedule set by the caregiver through the web application. By integrating sound and light alerts, the dispenser ensures that the reminders are effective and accessible, even for users with hearing or visual impairments. This comprehensive approach improves the overall efficiency of medication management and supports caregivers in providing better care.

Additionally, the current alert system's reliance on siren functionality presents another constraint. The siren, which emits only a flashing red light without accompanying sound, limits its effectiveness in notifying residents over longer distances or in noisy environments. This visual-only alert system may be inadequate during nighttime or adverse weather conditions when visibility is reduced. Enhancing the alert system to include audible alarms alongside visual cues would improve its overall reliability and ensure timely evacuation notifications during emergencies.

CHAPTER 2

LITERATURE REVIEW

A description of the existing approaches available or being developed to solve the challenges or concerns raised in the project is provided in the literature review chapter. Understanding and explaining past researchers' work, including their methodology, theories, and approaches to problem-solving, as well as the accompanying benefits and drawbacks, difficulties, and challenges, is crucial. For instance, the gadgets already available on the market that are utilized to address the difficulties or issues covered in the project should be highlighted in this chapter. This chapter can build a knowledgeable awareness of the present market environment by focusing on the distinctive characteristics or advantages of these gadgets over competing models. Additionally, by highlighting the technological developments that led to the widespread use of these gadgets, this chapter might encourage students to experiment with and develop new uses for this technology. This may result in a greater comprehension of the skills and procedures needed to produce innovation.

2.1 Related Previous Projects

Table 2.1: Previous Projects / Literatures

Author	Year	Purpose / Objective	Weakness
PUSAT JAGAAN MAHMUDAH Lot 495/5 Kampung Sungai Purun 43500 Semenyih Selangor	2012	Using Pen And Paper	Human Error Don't Have Database
Bilal, M. (2023) *Automatic pill dispenser: Arduino-powered medication management*, *Use Arduino for Projects*. Available at: https://duino4projects.com/automatic-pill-dispenser/ (Accessed: 24 November 2024).	2023	Medication Management Using Arduino Uno	Box material is not food grade Don't Have Database
MeDuino: Smart Automatic Medicine Reminder. (2018). Arduino Project Hub. https://projecthub.arduino.cc/ashraf_minhaj/meduino-smart-automatic-medicine-reminder-12ffd4	2018	Automatic Medicine Reminder Using Arduino Nano	Only Focus On Reminder and don't have Database

2.1.1 Using Pen And Paper

Figure 2.1: Nursing home record data using pen and paper

At Pusat Jagaan Mahmudah in Bangi, the traditional pen-and-paper method for managing residents' prescribed medications through the **Medication Administration Record (MAR)** is still widely practiced. Caregivers or nurses manually document vital details such as medication names, dosages, and administration times on the MAR sheet. Each time medication is administered, they record the date and time, along with their initials or signature, to verify the task's completion. While this system ensures accountability, it is time-consuming and prone to human error, particularly in environments like Pusat Jagaan Mahmudah, where caregivers manage multiple residents with varying medication schedules. Modernizing this process with automated solutions could significantly enhance efficiency and reduce the risk of errors. After observation, the table has been take note as method to create the website.

2.1.2 Medication Management Using Arduino Uno

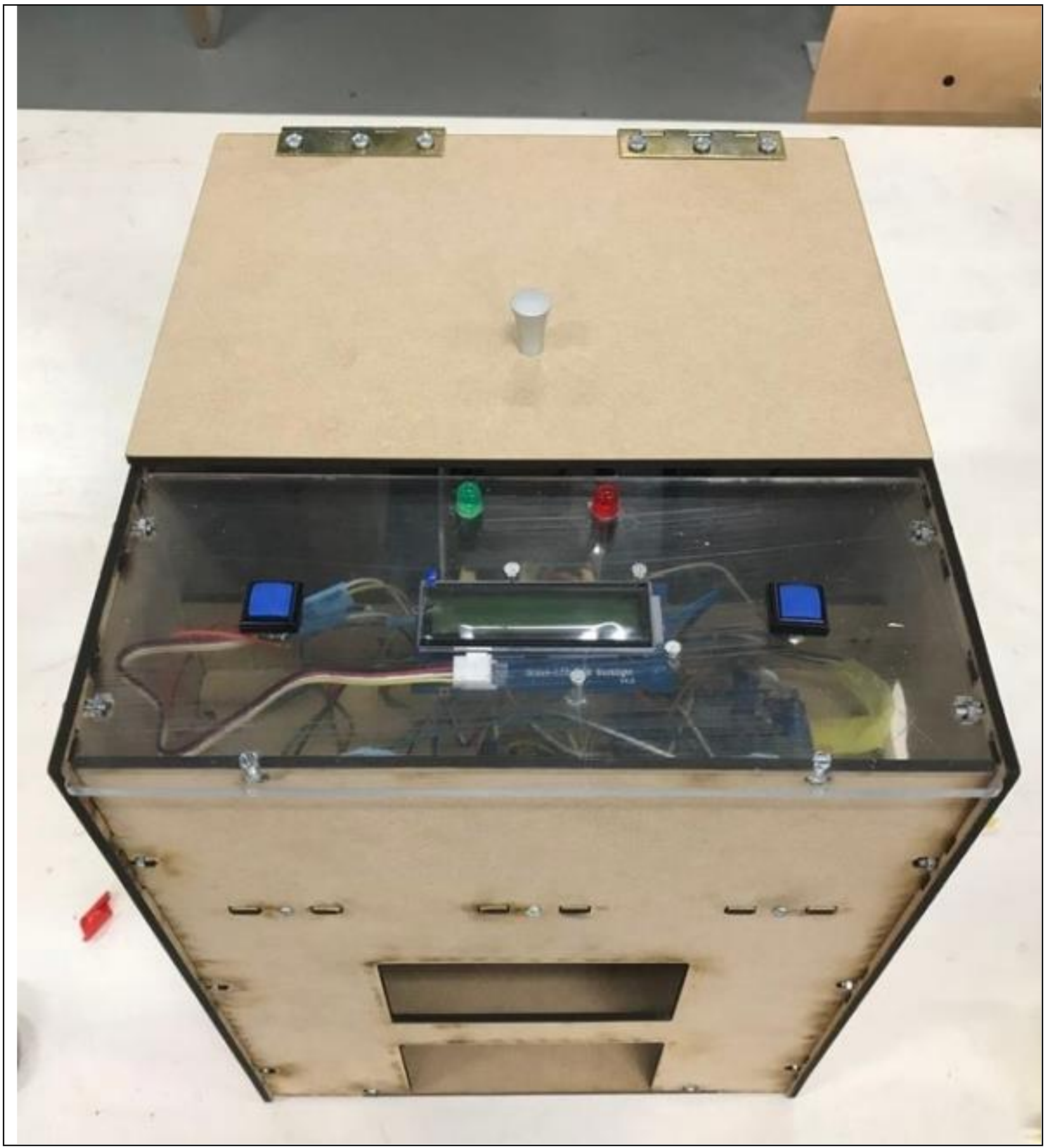

Figure 2.2: Front Page of the Training Module

This project, originally designed and implemented by Bruface Mechatronics with group member of Federico ghezzi, Andrea Molino, Giulia Ietro, Mohammad Fakih and Mouhamad Lakkis for Project Group 2, serves as a comprehensive guide for developing a pill dispenser robot. The project provides step-by-step instructions on building and programming the device, with features such as automated pill dispensing and refill mechanisms, Bluetooth connectivity, and user interaction through an application. These functionalities are vital for enhancing the efficiency and reliability of medication management, particularly for elderly patients and caregivers.

The project highlights the advantages of using stepper motors, a Motor Shield, and a Real-Time Clock (RTC) module to ensure precise and timely pill dispensing. The integration of humidity and temperature sensors, along with an LCD display, further improves the usability and reliability of the dispenser. The use of PIR sensors adds an extra layer of functionality by detecting user interaction, ensuring that pills are dispensed accurately and received by the patient. These components are essential for creating an efficient and user-friendly device.

However, the literature also discusses potential limitations in the system design, such as the focus on specific hardware components like the Arduino UNO and Bluetooth modules. This restricted scope may limit the exploration of alternative or more advanced technological solutions that could further optimize the dispenser. Addressing these challenges could lead to more robust designs, ensuring the dispenser meets a wider range of user needs, including those at facilities like **Pusat Jagaan Mahmudah**, where medication management is critical. Based on the evaluation of this project, improvements were identified, including the use of food-grade materials and the implementation of a database for the personal medicine dispenser with notifications for elderly care in nursing homes, utilizing an ESP32 integrated with a MySQL database.

2.1.3 Automatic Medicine Reminder Using Arduino Nano

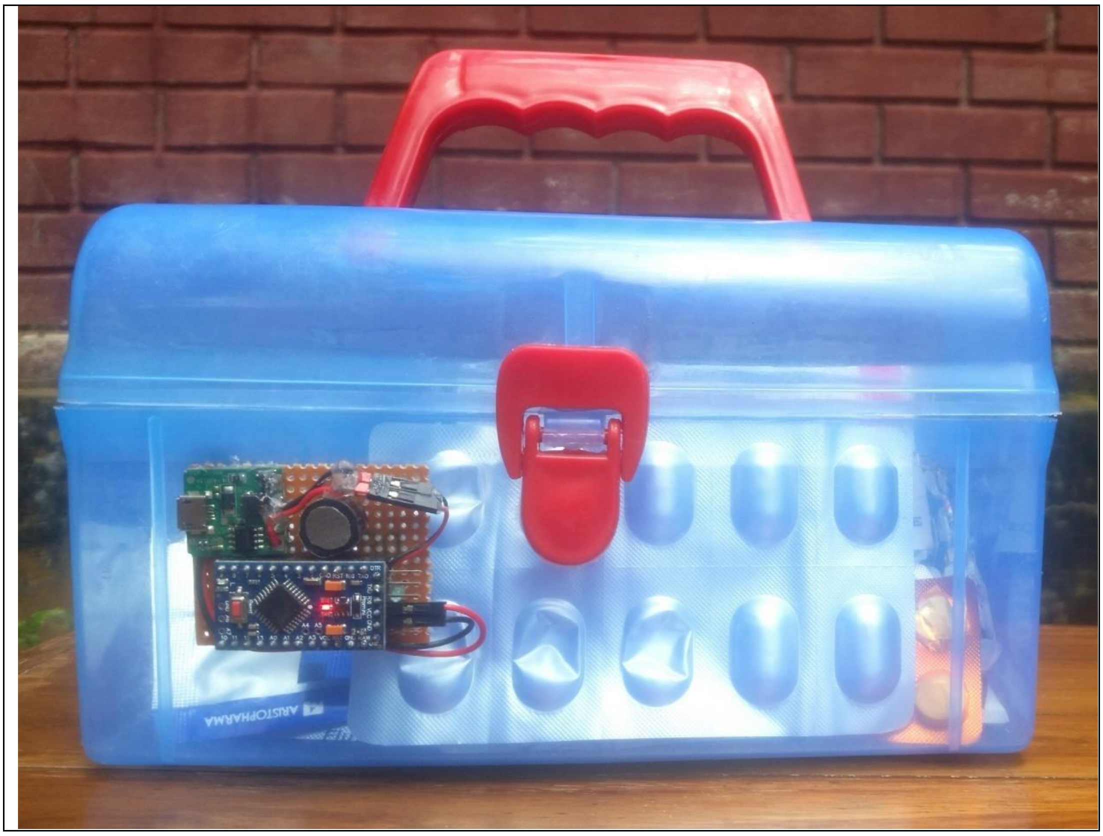

Figure 2.3 Meduino

The Smart Medcare Dispenser project is designed to create a simple and affordable medication reminder system using Arduino technology. The primary goal is to ensure timely medication intake, which is particularly beneficial for the elderly and individuals with complex medication regimens. By emitting periodic alarms, the system effectively prompts users to take their medications on schedule, helping to prevent missed doses and improving overall health outcomes.

Smart Medcare Dispenser is characterized by its minimalistic design and customizable settings, which make it user-friendly and flexible. The straightforward operation of the device ensures that it can be easily used by individuals with varying levels of technical expertise. The project's use of low-cost components and its open-source nature further enhance its accessibility, allowing a wide range of users to benefit from its functionality.

For caregivers, Smart Medcare Dispenser provides peace of mind by ensuring that their loved ones adhere to their medication schedules, even when they cannot be present. This practical solution not only supports better medication adherence but also contributes to improved health and well-being for users. From this project take reminder as benchmark to incorporate in this project

CHAPTER 3

MATERIALS AND METHOD

3.1 Project Development

The project development for the medicine dispenser system follows a structured process, spanning 17 weeks in FYP1 and 19 weeks in FYP2, designed to address medication management challenges for elderly residents in nursing homes, particularly at Pusat Jagaan Mahmudah. Initially, the project involved planning and ideation, with a briefing on final year projects and a discussion of potential topics aimed at community impact. Early tasks included selecting a project title, identifying key components, and setting project objectives. Researching medicine dispensing solutions, the team examined various ESP32 capabilities, including the use of a stepper motor to accurately dispense pills.

In the following weeks, industry research and panel feedback were gathered to ensure the project's relevance and applicability. Key components, such as the stepper motor, push buttons, and LCD display, were procured, and caregivers at nursing homes were interviewed to understand real-world needs. Development then advanced to testing individual components like the stepper motor and LCD display, followed by integrating the ESP32 microcontroller with the dispenser modules. Circuit and block diagrams were created to visualize the setup and operational flow, using software tools.

In FYP2, focus shifted to user interface and project refinement. Continuous testing and system enhancements were conducted to ensure reliable performance in medication scheduling and dispensing scenarios. A web application was implemented to allow caregivers to manage prescriptions remotely, while an alarm system was designed for notifying elderly patients when it is time to take their medication. Daily testing was carried out leading up to the final demonstration. This approach underscores the importance of structured project stages, from initial concept to testing, to achieve an effective medicine dispenser system for community use.

3.2 Components Used / Requirement

During the process of completing the project, some hardware and software was used to undergo the process. These tools were used and had their purposes and was compiled together to complete the project.

Table 3.1: Requirement Component for Personal Medicine Dispenser With Notification For Elderly Care In Nursing Home Using Esp32 Integrated With Mysql Database

NO	COMPONENT	QUANTITIES
1	Esp32 Devkit V1	1
2	Liquid Crystal Display LCD 16x2 With I2c	1
3	Light Emitting Diode (Led)	3
4	28Byj-48 5v stepper motor	1
5	Uln 2003 Driver Motor	1
6	Wires Jumper	8
7	Buzzer	1
8	Push Button	1
9	Dc Adapter 12v	1
10	Pcb Board	5
11	3D Printed Model	1

3.2.1 Esp32 Devkit V1

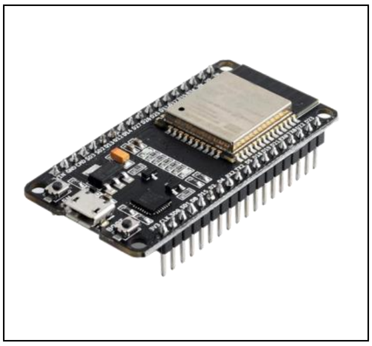

Figure 3.1: Esp32 Devkit V1

The ESP32 DevKit V1 is a development board built around the ESP32 microcontroller, known for its integrated Wi-Fi and Bluetooth capabilities. This makes it an ideal platform for developing IoT and embedded systems projects. The board features a powerful dual-core processor with a 32-bit architecture, allowing it to handle complex tasks efficiently. It also comes with multiple GPIO pins, enabling easy interfacing with various sensors, actuators, and other peripherals. The built-in antenna simplifies wireless communication, eliminating the need for external hardware.

One of the key strengths of the ESP32 DevKit V1 is its versatility. It supports multiple programming environments, including the Arduino IDE, MicroPython, and Espressif's own ESP-IDF framework, catering to developers of different expertise levels. The board provides a wide range of connectivity options, such as I2C, SPI, UART, and PWM, which facilitate seamless integration with other devices. With ample onboard flash memory and SRAM, it is well-suited for projects requiring significant computational resources.

The compact design of the DevKit V1 makes it a great choice for projects with size constraints. Its easy-to-use layout is compatible with breadboards, and the integrated USB-to-serial converter simplifies programming and debugging. With a wide input voltage range (5V to 12V), the board is adaptable to various power supplies. The ESP32 DevKit V1 continues to be a popular choice for both hobbyists and professionals in building connected devices and smart

Table 3.2 Connection Esp32

No	Pin	Connection
1	Vcc	Stepper Motor
2	Gnd	
3	D13	
4	D12	
5	D14	In1
6	D27	In2
7	D26	In3
8	D25	In4
9	D33	
10	D32	

11	D35	
12	D34	
13	VN	
14	VP	
15	EN	
16	D23	
17	D22	SCL Lcd display
18	TX	
19	RX	
20	D21	SDA Lcd display
21	D19	Led
22	D18	Buzzer
23	D5	
24	TX2	
25	RX2	

26	D4	Push Button
27	D2	
28	D15	
29	GND	
30	3V3	Push Button

3.2.2 Liquid Crystal Display LCD 16x2 With I2C

Figure 3.2: Liquid Crystal Display LCD 16x2 With I2c

The 16x2 Liquid Crystal Display (LCD) with I2C interface is a widely used module in embedded systems and microcontroller projects, featuring two rows of 16 characters each, perfect for displaying text, numbers, and simple symbols. This LCD uses liquid crystal technology, which is energy-efficient and operates with low power. The backlit screen enhances visibility in various lighting conditions, making it ideal for applications requiring a clear user interface, such as home appliances, digital meters, and DIY electronics projects.

The 16x2 LCD's I2C interface offers significant advantages in terms of simplicity and ease of use. Unlike standard LCDs that require 6 to 10 GPIO pins, the I2C version only needs two: one for the clock (SCL) and one for the data (SDA). This reduces wiring complexity, freeing up more GPIO pins for other components, and simplifying circuit design, making it accessible for beginners and efficient for advanced projects.

The LCD is usually paired with a small I2C backpack containing an I2C expander chip (typically a PCF8574), which converts I2C signals into parallel signals required by the LCD. The I2C interface also supports multiple devices on the same bus, enabling complex systems with various I2C components. Libraries for platforms like Arduino IDE make it easy to control the display, adjust backlight brightness, and create custom characters, making the 16x2 LCD with I2C a versatile solution for a wide range of electronic projects.

3.2.3 Light Emitting Diode (Led)

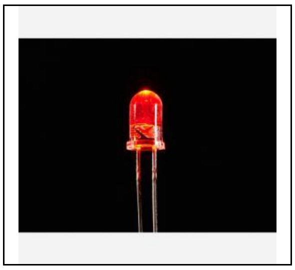

Figure 3.3: Led

A Light Emitting Diode (LED) is a semiconductor device that emits light when an electric current passes through it. Unlike traditional incandescent bulbs, which generate light by heating a filament, LEDs produce light through electroluminescence. This process involves electrons recombining with holes in the semiconductor material, releasing energy as photons. LEDs are highly energy-efficient, producing minimal heat and consuming less power than other lighting technologies. They come in various colors, such as red, green, blue, and white, and can be used individually or combined to create multicolor displays or emit specific wavelengths of light.

LEDs are renowned for their durability and longevity, often lasting tens of thousands of hours. Their long lifespan and low energy consumption make them an environmentally friendly and cost-effective lighting option. As solid-state devices, LEDs are more resistant to shock and vibration than traditional light sources, making them suitable for harsh environments. Their compact size offers design flexibility, allowing their use in everything from small indicator lights to large-scale displays and automotive lighting.

Beyond simple illumination, LEDs have diverse applications in modern electronics. They are used as indicator lights, in digital displays, and in communication systems like fiber-optic networks. The precise control of LED intensity and color has led to their adoption across various industries, including consumer electronics, automotive, medical devices, and art installations.

Advancements in LED technology continue to drive the development of energy-efficient and versatile lighting solutions globally.

3.2.4 28Byj-48 5v Stepper Motor

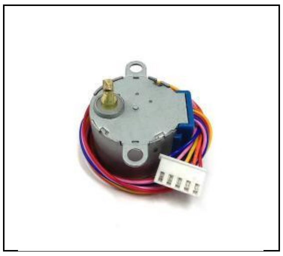

Figure 3.4: Stepper Motor

The 28BYJ-48 5V stepper motor is a popular, cost-effective choice for hobbyist projects and small automation tasks. Designed for precise control of angular position, it is ideal for applications requiring accurate movement, such as in robotics, 3D printers, and CNC machines. As a unipolar stepper motor, it features four coils that are energized in sequence to rotate the shaft in small, discrete steps. Operating at 5V, it is compatible with many microcontrollers, including Arduino and ESP32.

A key feature of the 28BYJ-48 is its internal gearing mechanism, which enhances torque while reducing speed. With a step angle of 5.625 degrees and a 64:1 gear reduction ratio, the motor achieves 32 steps per revolution of the output shaft, requiring 2048 steps for a full rotation. This high step count enables precise control, making it suitable for applications like camera positioning or sewing machine needles.

The 28BYJ-48 is typically paired with the ULN2003 driver module, which simplifies control by interfacing the motor's four coils with a microcontroller. This combination is favored for its affordability, ease of use, and reliability in low-power applications. The 28BYJ-48 and ULN2003 are widely used in DIY and educational projects due to their effective performance and availability.

3.2.5 ULN 2003 Driver Motor

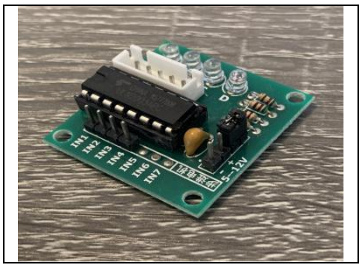

Figure 3.5: ULN 2003 Driver Motor

The ULN2003 driver module is a widely used integrated circuit designed to control stepper motors, relays, and other high-current loads. It contains seven high-current Darlington transistor pairs, which allow it to switch high voltages and currents with ease. The module is often used in conjunction with stepper motors, such as the 28BYJ-48, to provide the necessary current to drive the motor's coils. Its robust design makes it capable of handling currents up to 500mA per channel, with a total current rating of 2.5A across all channels.

One of the primary features of the ULN2003 driver module is its ability to interface with low-voltage microcontrollers, such as those found in Arduino and ESP32 boards. The module is equipped with input pins that connect to the microcontroller, and output pins that connect to the motor or other loads. When a signal is sent from the microcontroller, the ULN2003 amplifies the current and switches it to the load, enabling precise control of high-current components without risking damage to the microcontroller.

The ULN2003 module typically includes a built-in flyback diode protection circuit, which safeguards against voltage spikes caused by inductive loads like motors and relays. This protection ensures the longevity and reliability of both the module and connected components. Due to its simplicity, reliability, and ability to handle higher currents, the ULN2003 driver module is a popular choice in various electronic projects and applications.

3.2.6 Wires Jumper

Figure 3.6: Wires Jumper

Jumper wires are essential components in electronics prototyping and circuit building. These flexible, insulated wires are used to make temporary connections between different parts of a circuit, allowing for easy experimentation and modification. They come in various lengths and colors, which helps in organizing and managing connections on a breadboard or other circuit board. Jumper wires are especially useful for connecting microcontrollers, sensors, actuators, and other electronic components during the design and testing phases of a project.

Jumper wires are typically available in two main types: male-to-male and female-to-female. Male-to-male wires have connectors on both ends that can be inserted directly into a breadboard or other pin headers. Female-to-female wires, on the other hand, have sockets on both ends and are used to connect pins or headers that are already in place. Some jumper wires also come in male-to-female configurations, providing additional flexibility in connecting different types of components or interfaces.

The ease of use and versatility of jumper wires make them an indispensable tool for hobbyists, engineers, and educators alike. They facilitate quick and efficient connections without the need for soldering, making them ideal for prototyping and iterative development. Jumper wires allow for rapid adjustments and modifications, which is crucial for troubleshooting and refining electronic designs

3.2.7 Buzzer

Figure 3.7: Buzzer

A buzzer is an electronic component used to produce sound or audio signals in various devices and systems. It operates by converting electrical energy into acoustic energy, generating sound through vibration or resonance. Buzzers are commonly used in alarms, notifications, and alerts in electronic devices, such as household appliances, car systems, and computer hardware. They come in different types, including piezoelectric buzzers and electromagnetic buzzers, each offering distinct sound characteristics and operating principles.

Piezoelectric buzzers use a piezoelectric crystal to generate sound. When an alternating voltage is applied to the crystal, it vibrates, producing sound waves. These buzzers are known for their high efficiency, compact size, and ability to generate a wide range of frequencies. They are often used in applications where space is limited and clear, sharp sound is needed, such as in timers, alarm systems, and small electronic devices.

Electromagnetic buzzers, on the other hand, utilize an electromagnet and a diaphragm to produce sound. When an electric current passes through the electromagnet, it attracts and releases a diaphragm, creating sound waves. These buzzers are typically used in applications requiring louder and more resonant sounds, such as in large alarm systems and industrial equipment. Both types of buzzers are valued for their reliability and effectiveness in delivering auditory signals across various applications.

3.2.8 Push Button

Figure 3.8: Push Button

A push button is a simple yet essential component in electronic circuits and devices, used to provide user input or control various functions. It consists of a mechanical switch that, when pressed, completes an electrical circuit, allowing current to flow and triggering a specific action or response in the connected system. Push buttons are commonly found in everyday devices such as keyboards, remote controls, appliances, and industrial machinery, where they serve as the primary means for user interaction and command input.

Push buttons come in various styles and configurations, including momentary and toggle types. Momentary push buttons, also known as push-to-make switches, only complete the circuit while being pressed and return to their default state when released. These are used in applications where a temporary action or signal is needed, such as in reset functions or short bursts of input. Toggle push buttons, on the other hand, latch in an "on" or "off" position after being pressed, suitable for functions that require a persistent state, like powering a device on or off.

The versatility and simplicity of push buttons make them a popular choice for user interfaces and control systems. They can be found in a range of sizes and designs, from small tactile buttons on a circuit board to large, rugged buttons used in heavy machinery. Their ease of use, reliability, and adaptability make them a fundamental component in both consumer electronics and industrial applications.

3.2.9 Dc Adapter 12V

Figure 3.9: Dc Adapter 12V

A DC adapter, also known as a power adapter or power supply, is an essential component used to convert alternating current (AC) from a wall outlet into a direct current (DC) suitable for powering electronic devices. The 12V DC adapter is specifically designed to provide a stable 12-volt DC output, which is commonly required for a wide range of electronic equipment and gadgets, including routers, LED lighting, and various types of consumer electronics.

The primary function of a 12V DC adapter is to ensure that electronic devices receive a consistent and reliable power supply. It typically consists of a transformer that steps down the high voltage AC from the mains to a lower AC voltage, followed by a rectifier and voltage regulator that convert and stabilize the output to a precise 12V DC. This process ensures that sensitive electronics receive the correct voltage, preventing damage and ensuring proper operation.

DC adapters come in various form factors, including wall-mounted units and desktop power bricks. They usually feature a connector or plug that fits the device's power input socket. The versatility and widespread use of 12V DC adapters make them a crucial component in both residential and commercial settings, providing a dependable power source for numerous electronic devices.

3.2.10 PCB Board

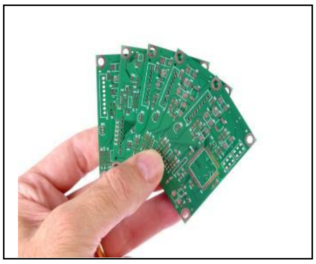

Figure 3.10: PCB Board

A printed circuit board (PCB) is a fundamental component in modern electronics, providing the structural and electrical foundation for assembling electronic components. It consists of a flat board made from insulating material, typically fiberglass or composite epoxy, with conductive pathways etched or printed onto its surface. These pathways, made of copper, create electrical connections between different components mounted on the board. The PCB serves as the backbone of most electronic devices, from simple gadgets to complex computers and industrial machinery.

PCBs come in various types, including single-sided, double-sided, and multi-layered boards. Single-sided PCBs have components and conductive pathways on one side, while double-sided boards feature layers on both sides. Multi-layered PCBs contain several layers of conductive material separated by insulating layers, allowing for more complex and compact designs. These different types of PCBs cater to varying needs, from basic applications to advanced, high-density electronics requiring intricate circuit designs and high performance.

The design and manufacturing of PCBs involve several steps, including layout design, etching, soldering, and testing. Modern PCB design software allows engineers to create precise circuit layouts, which are then transferred to the board through processes such as photolithography and chemical etching. Once manufactured, PCBs are populated with electronic components and tested to ensure proper functionality.

3.2.11 : 3d Printed Model

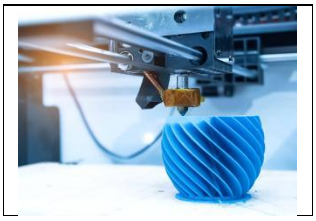

Figure 3.11:3d Printed Model

A 3D-printed model is a physical object created using additive manufacturing technology, where material is deposited layer by layer to build up the final shape. The process begins with a digital 3D model, which is designed using computer-aided design (CAD) software or scanned from an existing object. This digital model is then sliced into thin cross-sections, which guide the 3D printer in constructing the object layer by layer. Materials used in 3D printing include various types of plastics, metals, and resins, depending on the printer and the application.

One of the primary advantages of 3D printing is its ability to produce complex geometries and customized parts that would be difficult or impossible to create with traditional manufacturing methods. This technology allows for rapid prototyping, enabling designers and engineers to quickly test and iterate on their designs. It also supports the creation of intricate details and custom features, which is valuable in fields such as medical implants, automotive parts, and consumer products.

3D-printed models are used in a wide range of applications, from industrial prototypes and functional parts to artistic sculptures and personalized items. The flexibility of 3D printing makes it a popular choice for both small-scale production and one-off customizations. As the technology advances, it continues to expand its applications, offering new possibilities for innovation and design across various industries.

3.3 Block Diagram

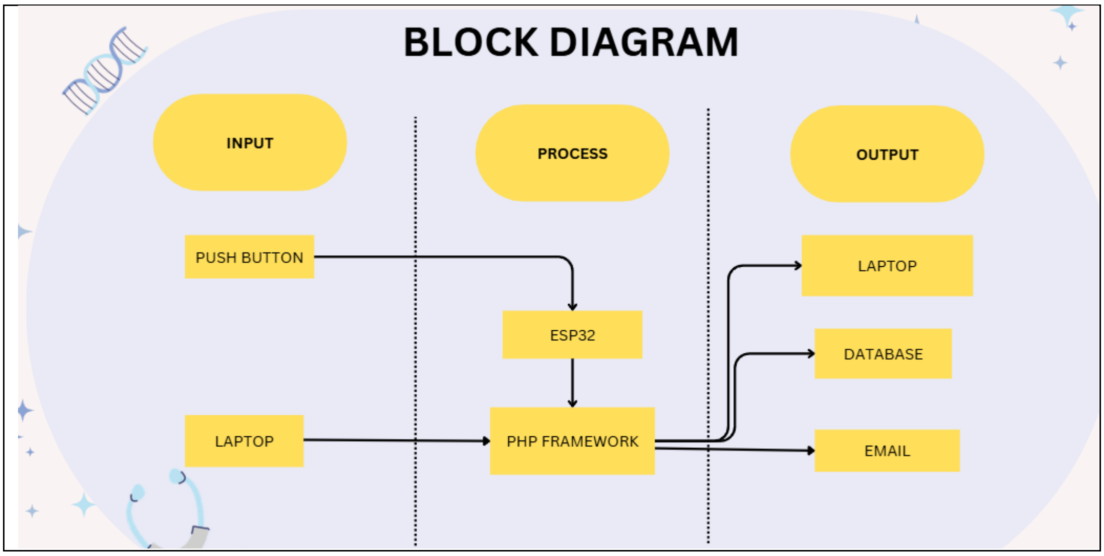

Figure 3.12: Block Diagram

This block diagram represents the architecture of the medicine dispenser system designed to ensure efficient and accurate medication management.

In the **Input** section, the system receives input through a **push button**, which allows manual triggering, and a **laptop**, which is used to manage and input data into the system. These inputs serve as the starting point for the system's operation.

The **Process** section is powered by the **ESP32 microcontroller**, which serves as the core processor. The ESP32 is responsible for handling the input signals and sending them to the **PHP framework** for further processing. The PHP framework manages data storage and communication with other system components.

In the **Output** section, processed data is sent to three destinations:

1. **Laptop** – for displaying real-time information or alerts.
2. **Database** – for storing medication schedules and records.
3. **Email** – for sending notifications or alerts to caregivers or users.

This design ensures seamless integration of hardware and software, allowing for real-time monitoring, manual control, and remote notifications to enhance the system's usability and reliability

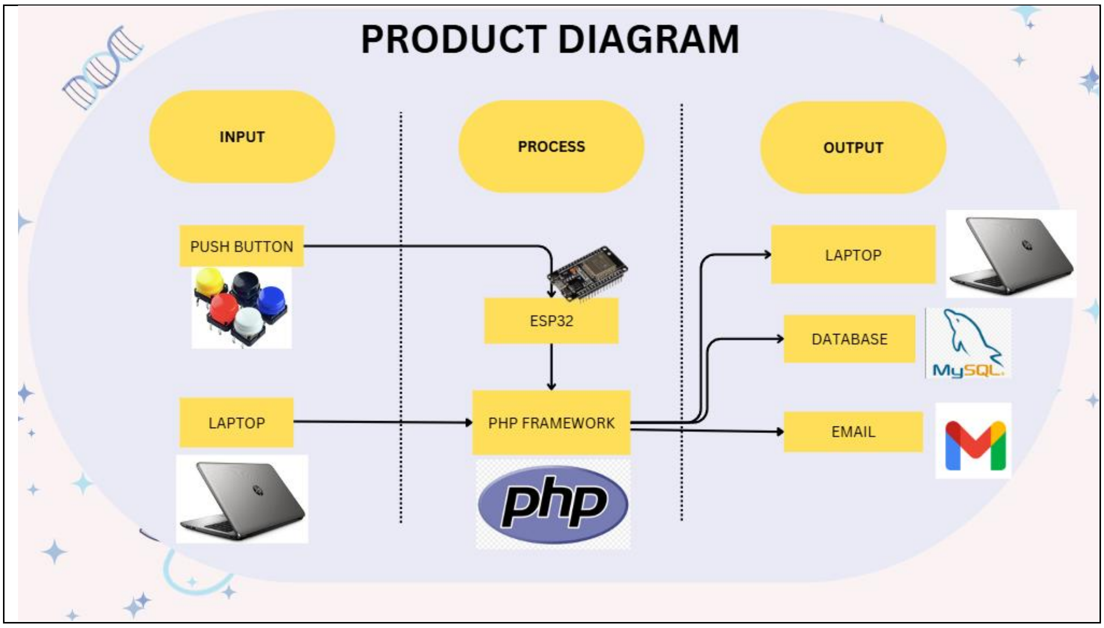

Figure 3.13 Product Diagram

3.4 Project Flowchart

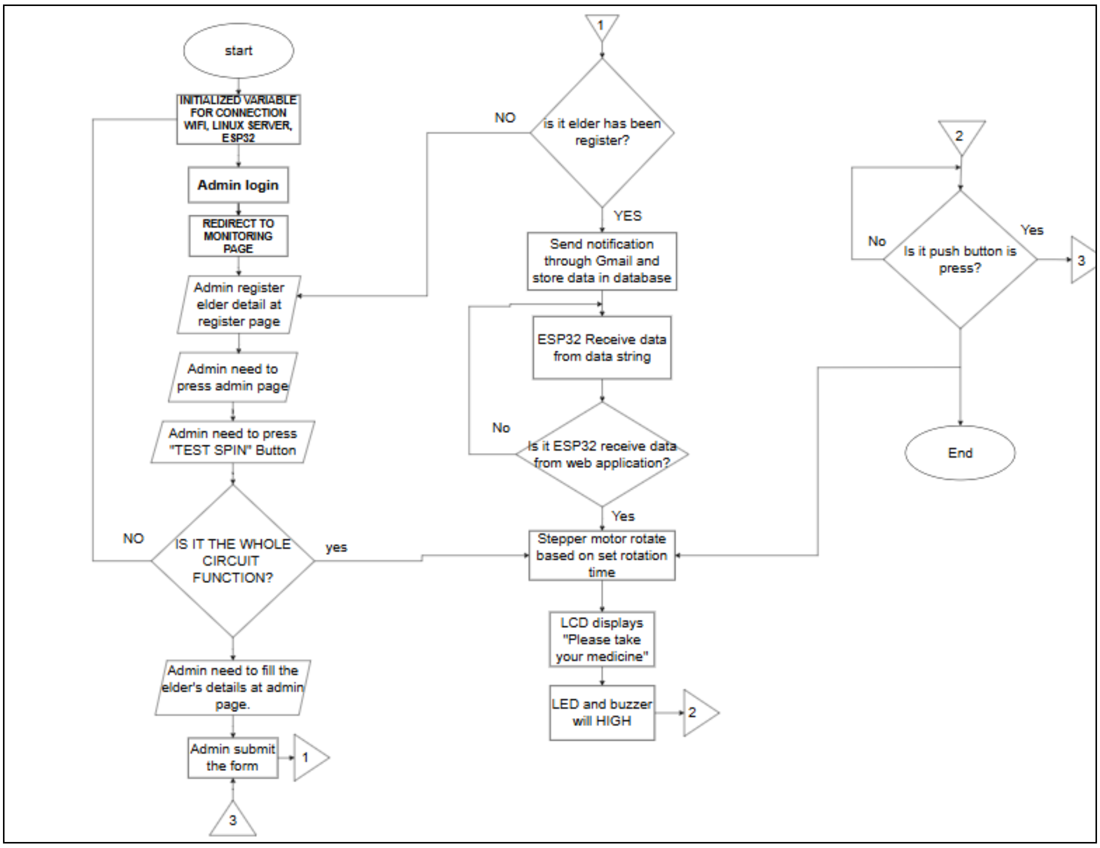

Figure 3.14: Flowchart

This flowchart represents the operation of a medicine dispenser system. The process begins with the initialization of variables for connecting the system to Wi-Fi, a Linux server, and the ESP32 microcontroller. The admin logs in and is directed to the monitoring page, where they can register an elder's details. Afterward, the admin presses a "TEST SPIN" button to check if the system components, such as the stepper motor, LCD, LED, and buzzer, are functioning correctly.

Once the elder's details are entered and registered, the system sends a notification to the admin via Gmail and stores the elder's data in a MySQL database. The ESP32 receives the data from the database or from a web application, triggering the system to perform its tasks. The stepper motor rotates based on the predefined rotation time, and the LCD displays the message "Please take your medicine." Additionally, the LED and buzzer are activated to alert the elder that it is time to take their medicine. The system ends when the push button is pressed.

3.6 Costing

Accurate cost calculations are crucial for project management as they are the foundation for financial management and decision-making throughout the pro

ject's lifecycle. They enable project managers to allocate resources efficiently, track expenses, and ensure the project stays on budget. This helps in making informed financial decisions and monitoring the project's financial health. Accurate cost calculations also enable wise spending, budget adherence, purposeful spending, price comparison, and prudent spending. By identifying critical elements that require funding and managing them more economically, project teams can optimize resource allocation and achieve project objectives without overspending. By conducting price comparisons and making informed financial decisions based on accurate cost calculations, project teams can ensure the project's financial stability and success.

3.6.1 Miscellaneous Costing

Table 3.3: miscellaneous Costing

No	Items / Components	Quantity	Cost per unit (RM)	Total Cost
1	ESP32 Devkit v1	2	15.00	30.00
2	Push Button	2	4.00	8.00
3	Stepper Motor 28-byj	2	8.50	17.00
4	ULN2003	2	4.50	9.00
5	LCD 16x2	1	11.50	11.50
6	Led	5	1.00	5.00
7	Adapter 12V	1	9.00	9.00
8	Wires Jumper	3	8.00	24.00
9	Battery 9V	1	2.30	2.30
10	3D design model	2	94.00	188.00
11	Breadboard	1-Set	9.00	9.00
12	Capacitor	5	0.50	2.50
13	Smd component	1	10.00	10.00
14	Linux server	1	100.00	100.00
15	PCB Board	5	11.00	55.00
16	Payment of Services	1	90.00	90.oo
Total				570.30

3.6.2 Project Costing

Table 3.4: Total Project Costing

No	Items / Components	Quantity	Cost per unit (RM)	Total Cost
1	ESP32 Devkit v1	1	15.00	15.00
2	Push Button	1	4.00	4.00
3	Stepper Motor 28-byj	1	8.50	8.50
4	ULN2003	1	4.50	4.50
5	LCD 16x2	1	11.50	11.50
6	Led	2	1.00	2.00
7	Adapter 12V	1	9.00	9.00
8	Wires Jumper	1	8.00	8.00
9	Battery 9V	1	2.30	2.30
10	3D design model	1	94.00	94.00
12	Capacitor	2	0.50	1
13	Smd component	1	10.00	10.00
14	Linux server	1	100.00	100.00
15	PCB Board	1	11.00	11.00
Total				**280.80**

3.7 Arduino Ide

Figure 3.15 Arduino Ide

In this Final Year Project (FYP), the Arduino IDE plays a crucial role in developing and programming the embedded system. It provides a platform for writing and uploading code to the Arduino-based microcontroller used in the project. Its user-friendly interface and wide range of libraries enable efficient prototyping and integration of hardware components, such as sensors, motors, and displays, essential for the functionality of the project. The Arduino IDE's compatibility with the project's hardware ensures smooth communication and control, making it an ideal tool for implementing the IoT features and automation required in this FYP.

3.8 Easyeda

Figure 3.16 Easyeda

EasyEDA is an essential tool for designing printed circuit boards (PCBs) in this Final Year Project (FYP). It offers an intuitive, web-based interface for creating and simulating schematic circuits and laying out PCBs. EasyEDA simplifies the process of integrating components like microcontrollers, sensors, and actuators into a compact and reliable PCB design, ensuring the project's hardware is organized and efficient. Its library of components and ability to generate manufacturing files, such as Gerber files, make it ideal for producing custom PCBs tailored to the project's requirements. By using

EasyEDA, the FYP achieves a professional and scalable hardware solution that enhances reliability and performance.

3.9 Visual Studio Code

Figure 3.17 Vs Code

Visual Studio Code (VS Code) is a powerful and versatile code editor that can significantly enhance the development process for this Final Year Project (FYP). With its extensive support for various programming languages and customizable extensions, such as PlatformIO, VS Code enables seamless programming and debugging of microcontrollers like the ESP32 or Arduino boards. Its features, including intelligent code completion, syntax highlighting, and integrated version control, streamline the coding workflow. VS Code's adaptability and efficiency make it an excellent choice for managing complex FYP tasks, such as implementing IoT functionalities or integrating advanced software logic, ensuring the project's software development is both efficient and professional.

3.10 Onshape

Figure 3.18 Onshape

Onshape is a cloud-based computer-aided design (CAD) platform used for creating 3D models and collaborative design work. It provides a robust set of tools for sketching, parametric modeling, and assembly creation, enabling precise and efficient 3D design workflows. In this Final Year Project (FYP), Onshape was utilized to design the 3D prototype of the medicine dispenser, ensuring that the dimensions and structure met the project's requirements. Its cloud-based features allowed for easy access, version control, and collaboration, making it an ideal tool for developing and refining the dispenser's design for 3D printing and practical implementation.

3.11 Mysql Database

Figure 3.19 Mysql

MySQL is an open-source relational database management system (RDBMS) widely used for storing and managing structured data efficiently. In this Final Year Project (FYP), MySQL is integrated to handle the database for the medicine dispenser, storing critical information such as medication schedules, patient details, and notification logs. Its reliability, scalability, and compatibility with ESP32 and web applications make it ideal for ensuring seamless data management and retrieval. By utilizing MySQL, the project achieves a robust backend system that supports real-time updates and secure data storage, enhancing the overall functionality and user experience of the dispenser system.

CHAPTER 4

RESULTS AND DISCUSSION

Throughout the development of this project, several challenges and issues were encountered. The initial concept for the medicine dispenser was designed for elderly individuals in nursing homes, with the goal of creating a system that could notify them when to take their medications. It also aimed to integrate a web application that would allow caregivers to easily communicate and manage prescriptions. Initially, the project considered using a web application operated on a Linux server for this purpose. However, after discussions with my supervisor, it was deemed that this approach was efficient and also I opted for a simpler manual mechanism using a push button, which the elderly could press after taking their medication, sending the data to a MySQL database.

Another challenge was selecting the appropriate microcontroller for the project. Initially, I chose the ESP32 DevKit V1 for its adequate number of I/O pins to support multiple components, as well as its cost-effectiveness, which was suitable for the project. Additionally, the project involved configuring a Wi-Fi connection to store item information in the database. However, using a hotspot for the ESP32's Wi-Fi connection introduced the problem of changing IP addresses, which affected the system's ability to communicate consistently. To address this issue, I had to manually press the reset button each time the circuit was configured to ensure that the IP address remained stable, preventing interruptions in the system's operation.

4.1 Overall System Performance

4.1.1 Software Implementation

This project's software worked completely, finishing the circuit schematic diagram and programming the project code in quickly time. The software utilised was important to the project's operation, therefore its success depended on its ability to function.

4.1.2 Hardware Implementation

In this section, a more detailed examination of earlier research findings' shortcomings is conducted and discussed. The functionality of the project aligns with the initial predictions, which are ESP32 successfully receives data string from the web-application, matches the input coding in the microcontroller at Arduino IDE and Visual Studio Code, and produces the intended output. This output includes the medicine dispenser’s ability to dispense the medicine based on administrator set, edits or delete in web-application.

4.1.3 Final Design and Operational Demonstrations

4.1.3.1 Final Project Design

Figure 4.1: Final Project Design

The “Personal Medicine Dispenser With Notification For Elderly Care In Nursing Home Using Esp32 Integrated With Mysql Database” has been successfully developed and working effectively. Figure 4.3 is the final design for this project. This project can dispense the medicine based on schedule that administrator has been set in web application. Not only dispense the medicine, ESP32 also can send data to database such as time and date after elder press the push button manually. This project also come with features Mysql database before and after medicine has been taken.

4.1.3.2 Smart Medcare System Flow

For the first step administrator need to do is access the login pages and register the elder detail. It is means that database need to record the detail before execute.

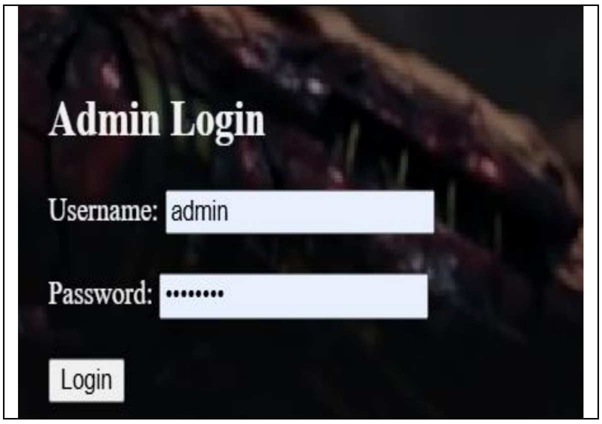

Figure 4.2: Login Page

Figure 4.3: Administrator Must register elder's

The second step requires the administrator to get through to the login admin pages and press the "TEST SPIN" button. If the administrator presses the "TEST SPIN" button, the ESP32 will receive and rotate the stepper motor 90 degrees, the buzzer and led will be high, and if someone presses the push button, the buzzer and led will be low, and the LCD display will display "thank you" followed by the current time. If all of the operations follow the flowchart (Figure), the circuit will run correctly

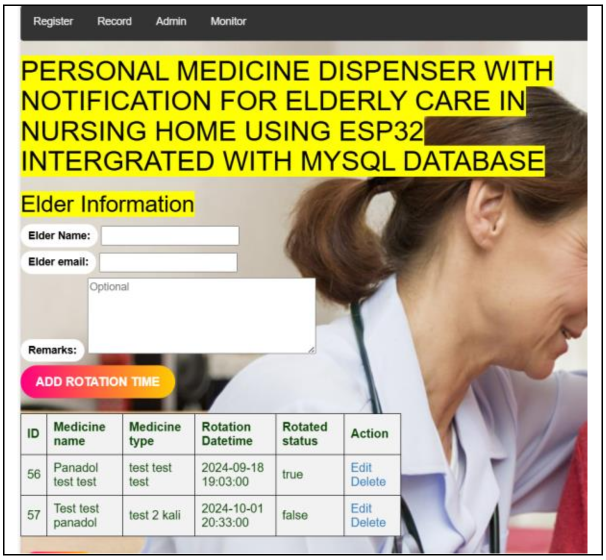

Figure 4.4: Administrator pages

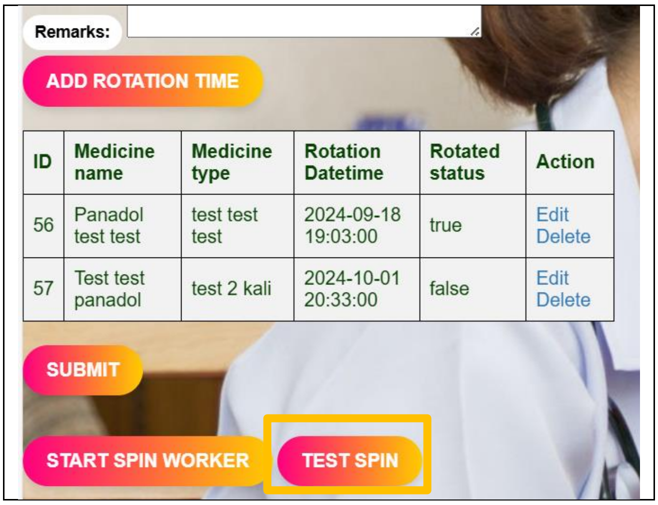

Figure 4.5: Administrator need to press the “Test Spin” Button

Figure 4.6 If Administrator has done press the “Test Spin” Button, Server has send data to Esp32

Figure 4.7 The ESP32 has already received the data string from the web application, and the stepper motor will rotate 90 degrees, causing the buzzer and LED to High

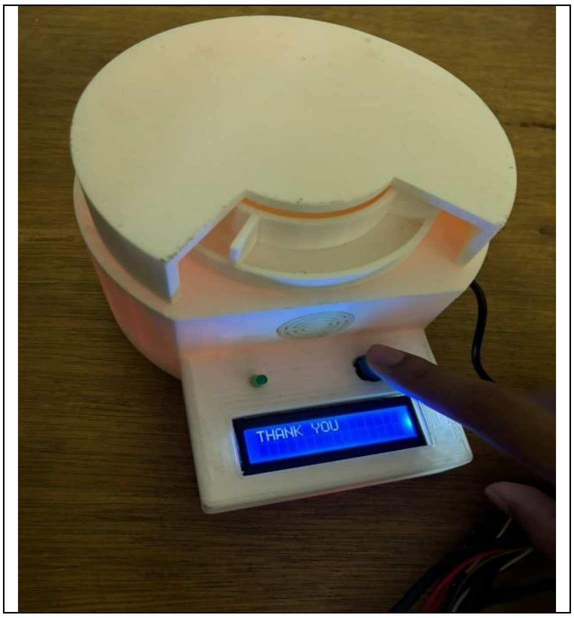

Figure 4.8 If someone triggers the push button, the LCD display will display "thank you", followed by the current time.

For the third step is administrator need to do is fill the form at admin pages to schedule the time taken of medicine for elderly. It is means that it will record to Mysql and it will send data to Esp32 to executed

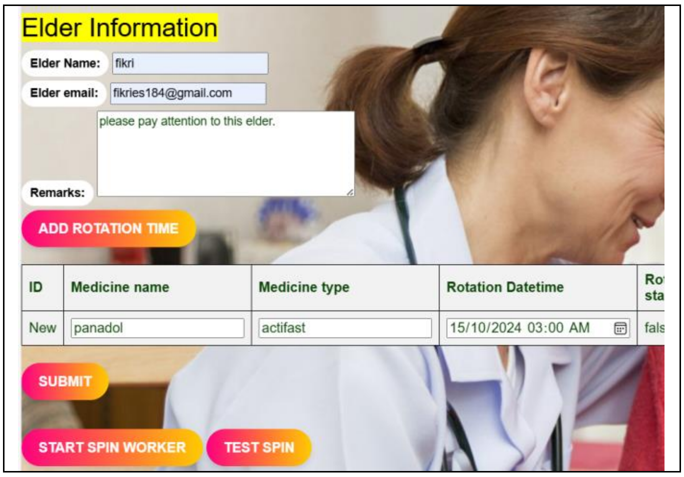

Figure 4.9 Before submitting the form, the administrator must fill up the elder's details in the admin pages.

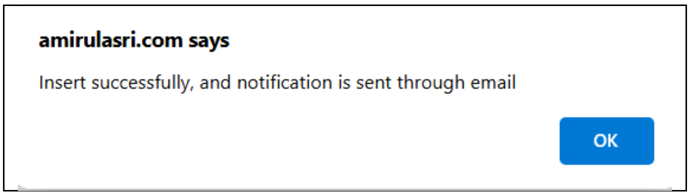

Figure 4.10 After administrator submit the form, Server will request to Esp32

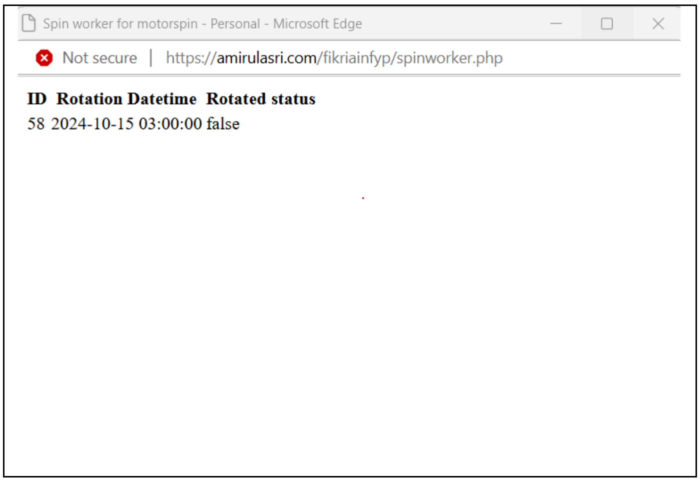

Figure 4.11 Administrator need to press "Start Spin Worker" at Figure 4.7 so that Web application can send data every 3 second.

Figure 4.12 After ESP32 received data string from the web application, Stepper motor will rotate based on schedule and other component will work like Figure 4.7-4.8

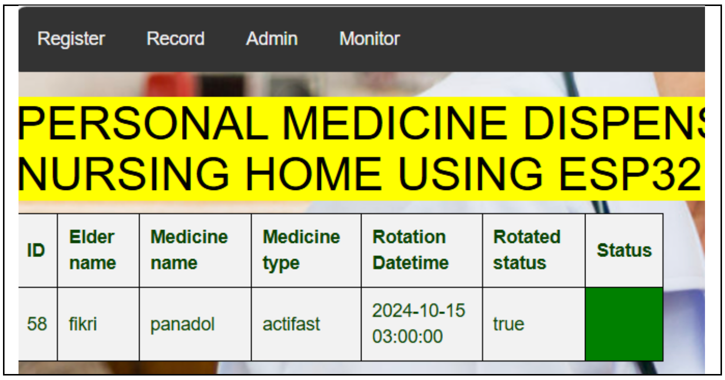

Figure 4.13 Administrator can check the status to see if the elder has taken the medication yet. If the status has showed Green, then means Elder has taken the medicine.

In the final stage, the administrator can access all data from the web application and ESP32 in the MySQL database. It signifies that all of the operations in the flowchart have been completed successfully

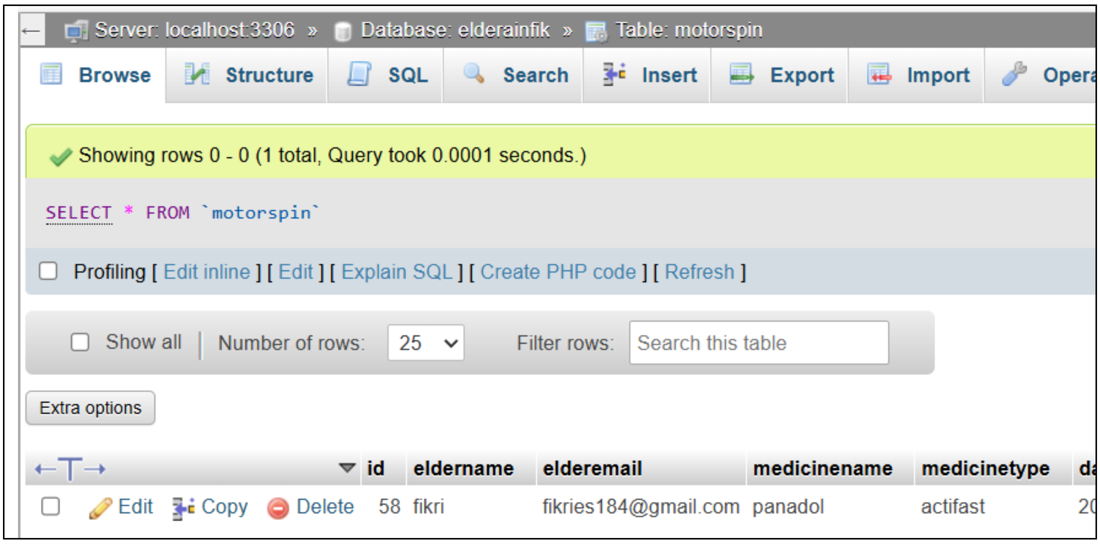

Figure 4.14 Table for Admin detail

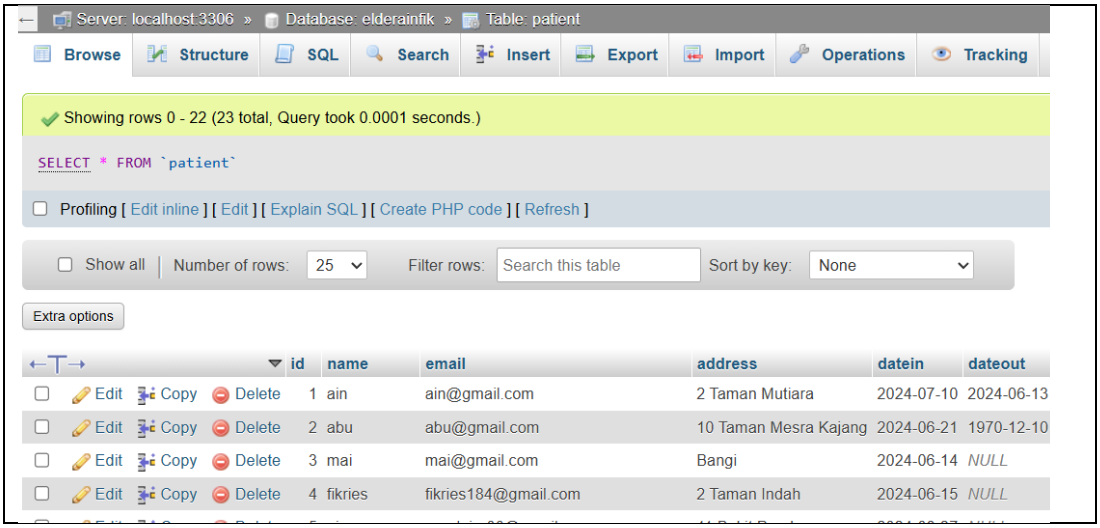

Figure 4.15 Table for register

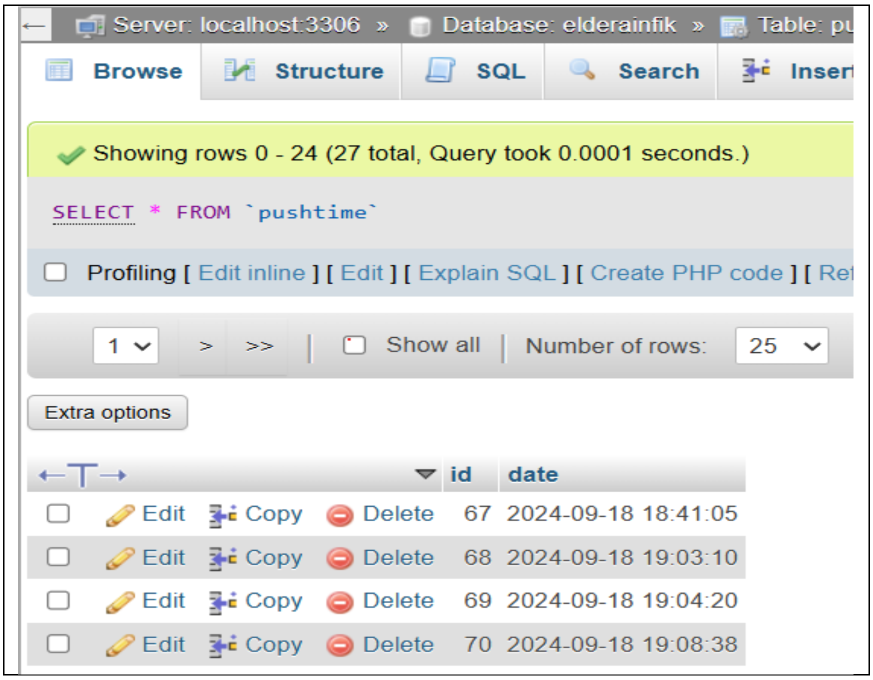

Figure 4.16 Table for monitoring

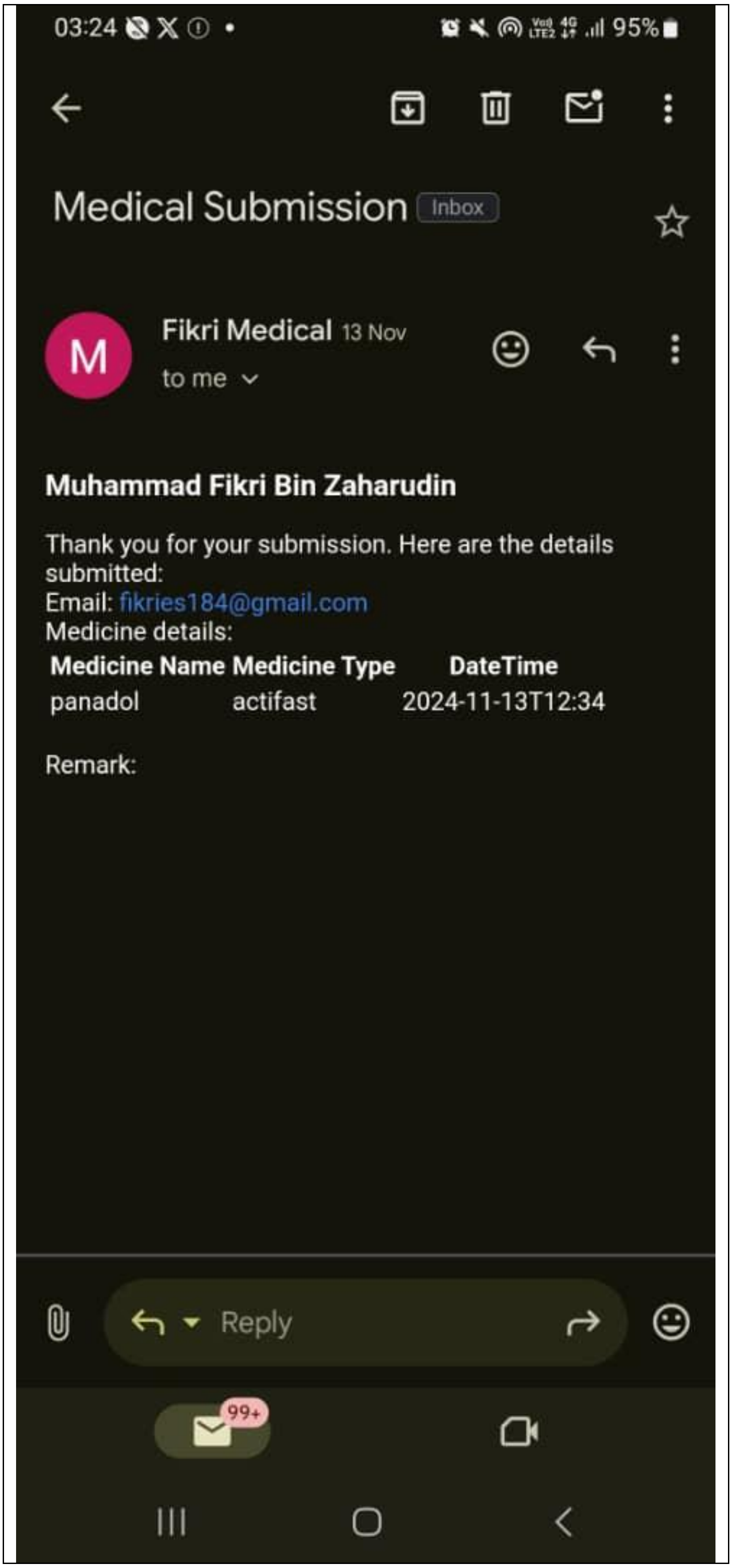

Figure 4.17 Notification Status Using Gmail

4.2 View Of 3d Design

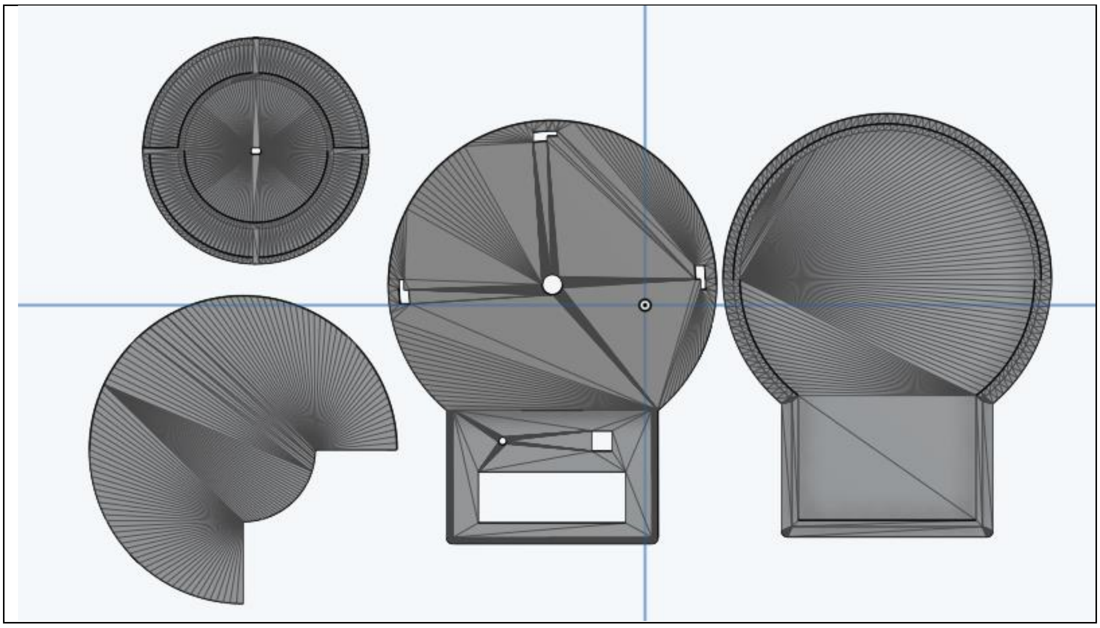

Figure 4.18 Top View

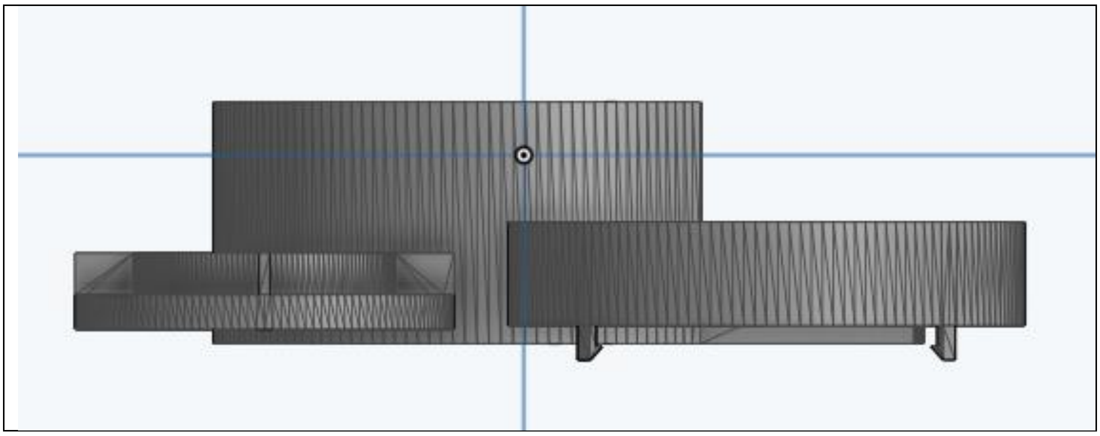

Figure 4.19 Left View

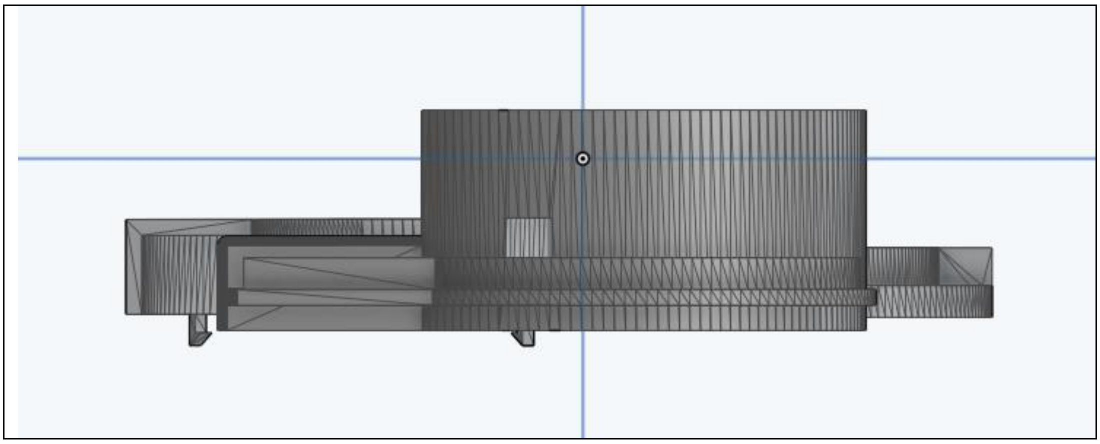

Figure 4.20 Right View

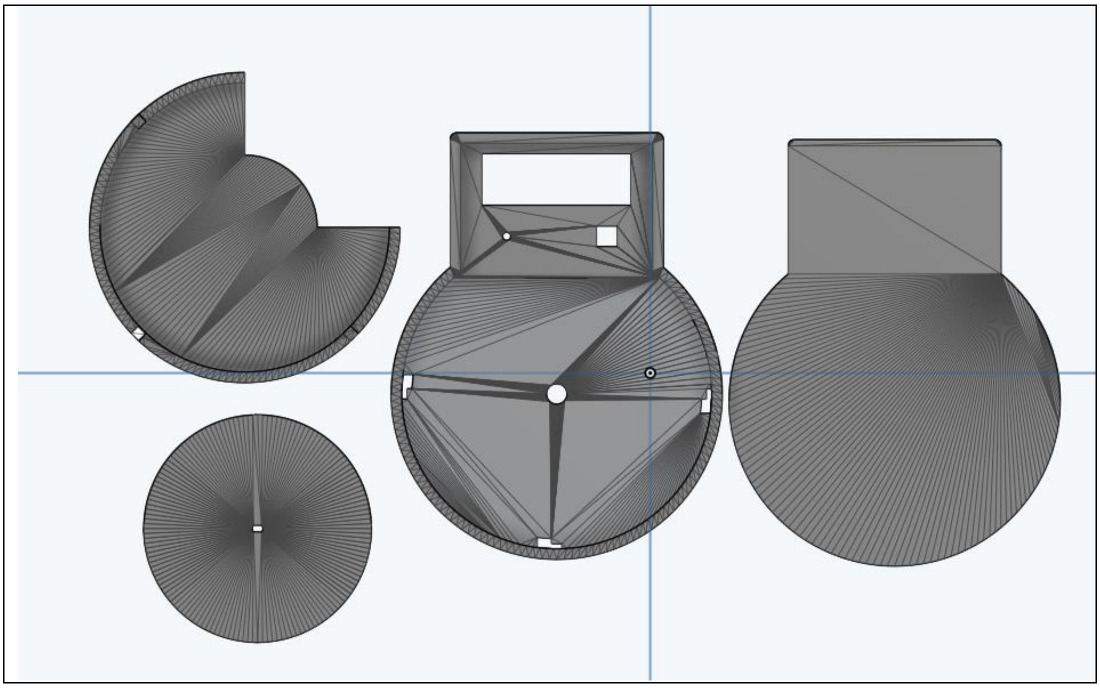

Figure 4.21 Back View

4.3 Simulation

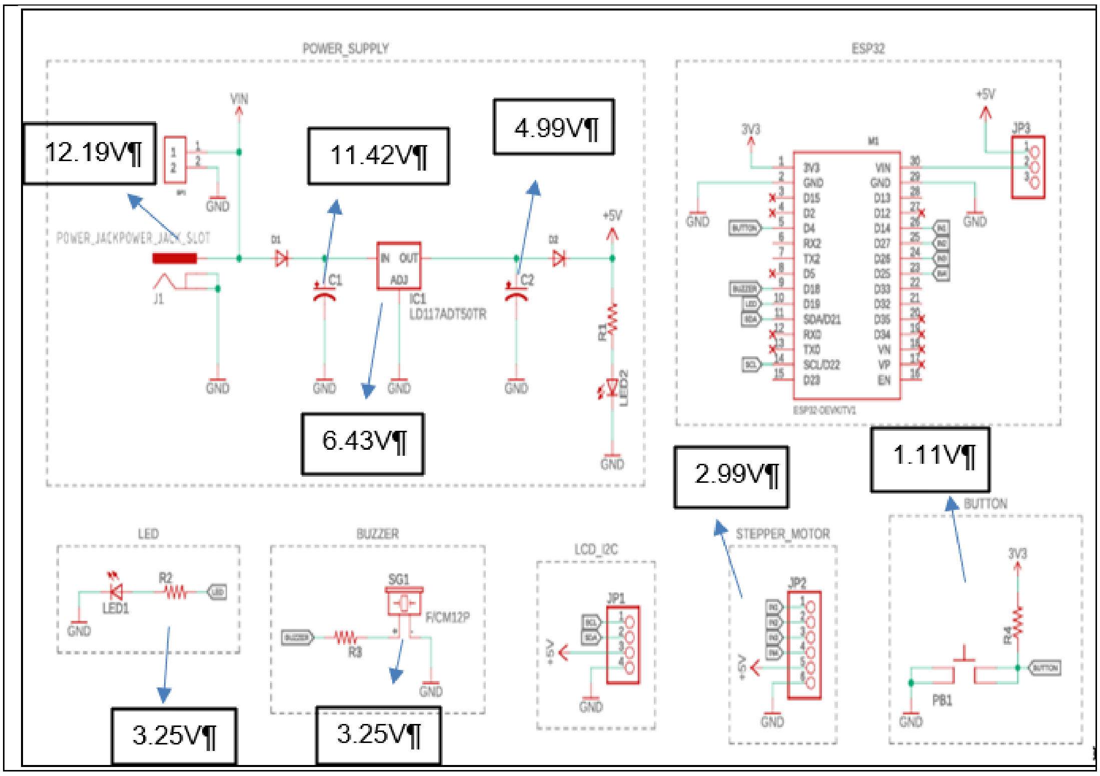

Figure 4.22 Simulation

4.4 Circuit Measurement

Figure 4.23 Voltage at Power Jack

Figure 4.24 Volatage at Capacitor1

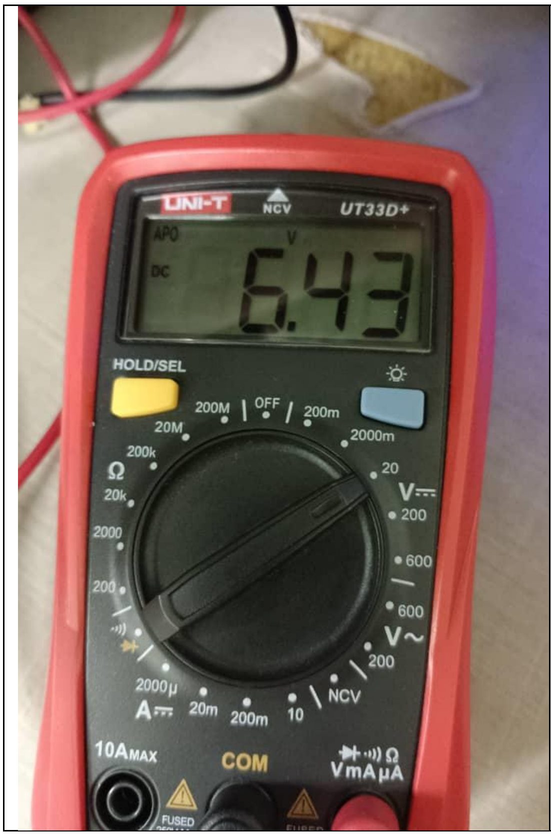

Figure 4.25 Voltage at Regulator

Figure 4.26 Voltage at Capacitor2

Figure 4.27 **Voltage at at Stepper motor**

Figure 4.28 **Voltage during rotation at stepper motor**

Figure 4.29 Voltage at Buzzer and Led during High

Figure 4.30 Voltage at Push Button During Pressed

4.5 PCB Design

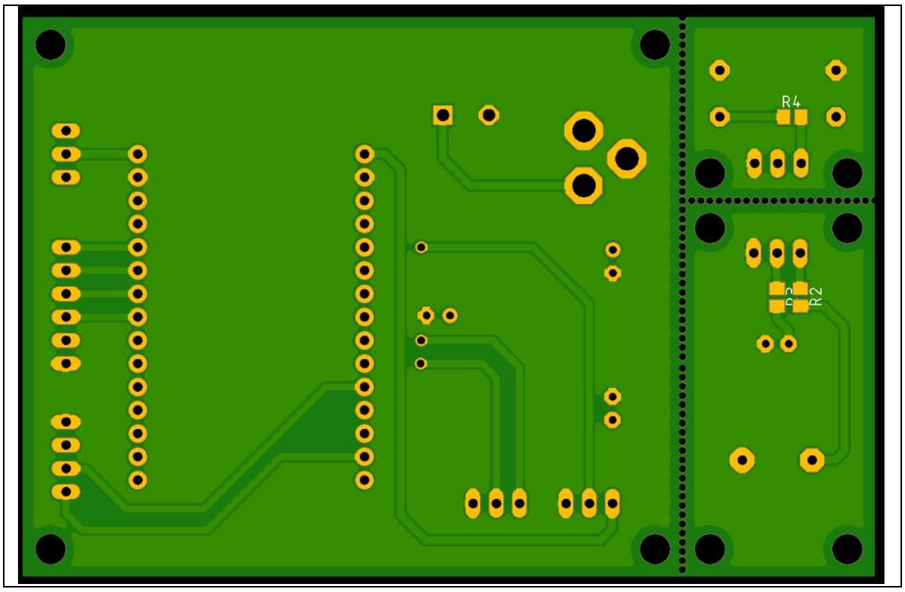

Figure 4.31 Back Design for PCB board

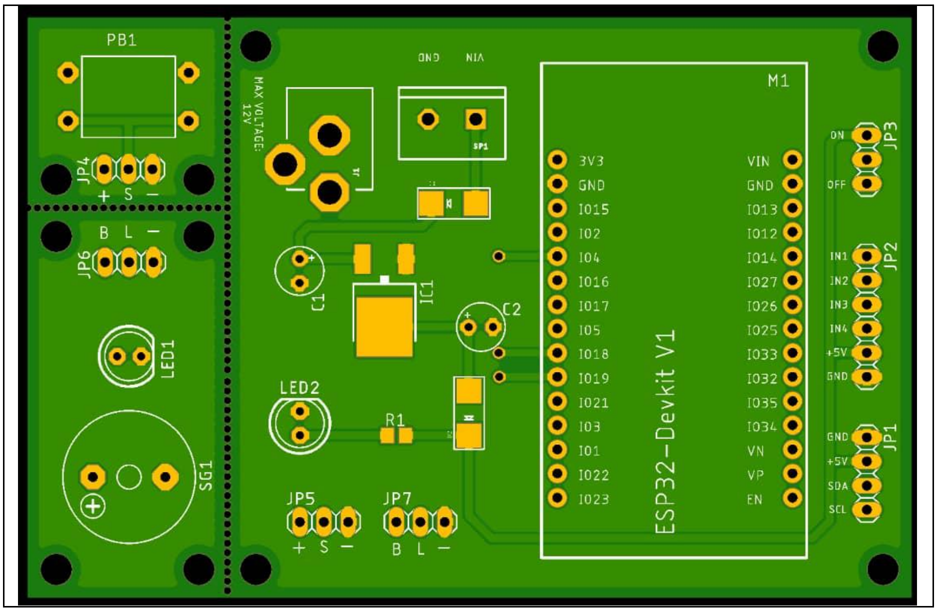

Figure 4.32 Top Design for PCD Board

In Figures 4.27 and Figure 4.28, the final circuit design for this project is presented. The PCB design is crafted with a 2-layer circuit, featuring connections on both the top and bottom layers. This approach facilitates seamless circuit connections across all boards and provides enhanced visibility of space and traces, enabling easier identification of any potential defects in the PCB design. Additionally, variations in size are incorporated for power supply, ground, and other connections. Specifically, the power supply and ground wired connections are sized differently to ensure that if there is an overpower situation, the PCB design circuit remains undamaged, with only the individual component at risk.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

This chapter aims to evaluate the effectiveness and reliability of the medicine dispenser system based on the data collected during the testing phase. By examining the performance of key components, such as the medicine dispensing mechanism, notification system using Gmail, and web application integration, this chapter assesses the system's functionality and identifies any limitations. The insights gathered will provide a foundation for evaluating the project's objectives, the impact of real-time notifications on elderly care in nursing homes, and potential improvements for future iterations.

Conclusion

5.1 Conclusion

In summary, the objectives of this project, which include develop a smart pillbox with automated dispenser integrated with web application, notify elderly in adhering (Buzzer and Led) to take prescription timely per schedule, have been successfully achieved. This project addresses a critical issue highlighted in Chapter 1, primarily affecting elder, wherein nursing home often face the challenge that proper management medicine and also lack of database. This lack of awareness poses a risk, potentially leading to misprescription can harm the elderly in nursing home.

The medicine dispenser also has a lot of benefits. It has an easy-to-use push button built in and notification to make sure that elder press the button to make sure data is send to MYSQL database and Alert the caregiver to ensure they check whether the elderly person has taken their medication or not.

Lastly, the design of the medicine dispenser improves its time management and capability, enabling it to dispense the medicine base on schedule that administrator set it from web-application With these characteristics, the medicine dispenser with notification for elderly care in nursing home solves common nursing home concerns and provides a safe and time manage for dispense medicine based on schedule.

5.2 Future Developments

To enhance the usability and effectiveness of the medicine dispenser for elderly nursing home residents, I recommend integrating an emergency push button for nurses. This feature allows elders to seek help immediately if they encounter difficulties with their medication, ensuring a safer environment. Notifications can be sent directly to caregivers for swift action, potentially reducing health risks.

Furthermore, designing multiple sub-containers for medication ensures inclusivity and flexibility. These sub-containers allow tailored solutions for various residents and their unique medical needs. Adopting such features will significantly improve the system's functionality and ensure that it is user-friendly and reliable for all stakeholders in a nursing home setting.

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APPENDIX A
ARDUINO IDE CODING

```
#include <WiFi.h>
#include "time.h"
#include "sntp.h"
#include <WiFiClient.h>
#include <WebServer.h>
#include <Stepper.h>
#include <HTTPClient.h>
#include <Wire.h>
#include <LiquidCrystal_I2C.h>

const char* ssid = "t";
const char* password = "fikri280012";

const char* ntpServer1 = "my.pool.ntp.org";
const char* ntpServer2 = "asia.pool.ntp.org";
const long gmtOffset_sec = 28800;
const int daylightOffset_sec = 0;

const int lcdColumns = 16;
const int lcdRows = 2;
LiquidCrystal_I2C lcd(0x27, lcdColumns, lcdRows);

bool medicineMessageDisplayed = false;
unsigned long stepperRotateTime = 0;
const unsigned long buttonTimeout = 60000;  // 1 minute timeout
bool timeoutWarningShown = false;
bool stepperRotated = false;

void printLocalTime() {
  if (medicineMessageDisplayed) {
```

```
  return;  // Do not update time if medicine message is displayed
}

struct tm timeinfo;
if (!getLocalTime(&timeinfo)) {
  Serial.println("No time available (yet)");
  return;
}
lcd.clear();
lcd.setCursor(0, 0);
lcd.print("Date: ");
lcd.print(timeinfo.tm_year + 1900);
lcd.print("-");
if (timeinfo.tm_mon < 9) {
  lcd.print("0");
}
lcd.print(timeinfo.tm_mon + 1);
lcd.print("-");
if (timeinfo.tm_mday < 10) {
  lcd.print("0");
}
lcd.print(timeinfo.tm_mday);
lcd.setCursor(0, 1);
lcd.print("Time: ");
if (timeinfo.tm_hour < 10) {
  lcd.print("0");
}
lcd.print(timeinfo.tm_hour);
lcd.print(":");
if (timeinfo.tm_min < 10) {
  lcd.print("0");
}
lcd.print(timeinfo.tm_min);
lcd.print(":");
```

```
  if (timeinfo.tm_sec < 10) {
    lcd.print("0");
  }
  lcd.print(timeinfo.tm_sec);
}
void timeavailable(struct timeval* t) {
  Serial.println("Got time adjustment from NTP!");
  printLocalTime();
}

#define IN1 14
#define IN2 27
#define IN3 26
#define IN4 25
const int stepsPerRevolution = 2048;

const int ledPin = 19;
const int buzzerPin = 18;
const int buttonPin = 4;

WebServer server(80);  // Create a web server listening on port 80
Stepper myStepper(stepsPerRevolution, IN1, IN3, IN2, IN4);

int currentState;   // the current reading from the input pin
int previousState;  // the previous reading from the input pin

void setup() {
  Serial.begin(115200);
  pinMode(ledPin, OUTPUT);
  pinMode(buzzerPin, OUTPUT);
  pinMode(buttonPin, INPUT_PULLUP);
  lcd.init();
  lcd.backlight();
  sntp_set_time_sync_notification_cb(timeavailable);
```

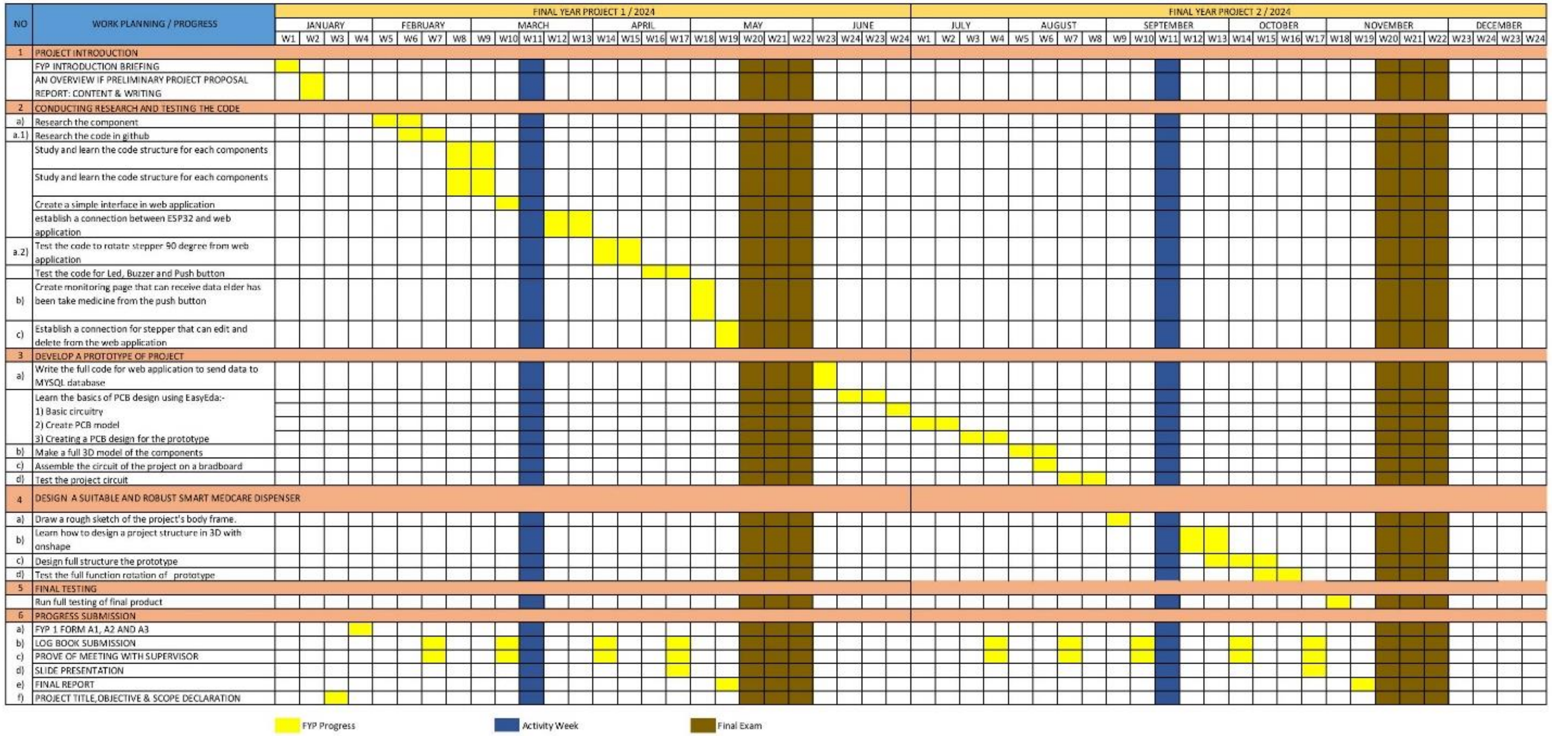
```
  configTime(gmtOffset_sec, daylightOffset_sec, ntpServer1, ntpServer2);

  Serial.printf("Connecting to %s ", ssid);
  WiFi.begin(ssid, password);
  while (WiFi.status() != WL_CONNECTED) {
    delay(500);
    Serial.print(".");
  }
Serial.println(" CONNECTED");

  myStepper.setSpeed(5);

  Serial.println("WiFi connected.");
  Serial.println("IP address: ");
  Serial.println(WiFi.localIP());

  // Define server routes
  server.enableCORS();
  server.enableCrossOrigin();
  server.on("/index.html", HTTP_GET, handleRequest);

  server.begin();
  Serial.println("HTTP server started.");

  previousState = digitalRead(buttonPin);
}

void loop() {
  server.handleClient();

  int buttonState = digitalRead(buttonPin);

  // Check for button press to reset LCD
  if (buttonState == LOW && previousState == HIGH) {
```

```
    digitalWrite(ledPin, LOW);
    digitalWrite(buzzerPin, LOW);
    sendButtonRequest();
    if (medicineMessageDisplayed) {
      // Reset states after button press
      medicineMessageDisplayed = false;
      timeoutWarningShown = false;  // Reset timeout warning
      stepperRotated = false;       // Reset stepper rotated flag
      lcd.clear();
      lcd.setCursor(0, 0);
      lcd.print("THANK YOU");
      delay(5000);       // Display "THANK YOU" for 5 seconds
      medicineMessageDisplayed = false; // Ensure the message is marked off
    }
    printLocalTime();  // Return to displaying the current time
  }

  previousState = buttonState;

  if (!medicineMessageDisplayed) {
    delay(1000);
    printLocalTime();
  }
}

void handleRequest() {
  server.send(200, "text/plain", "Executed");
  rotateStepperAndShowMessage();
}

    rgb.setPixelColor(0, 0, 0, 0); // off RGB light

    rgb.show();
    delay (500);
```

```
  }

  if (distance_cm < 10){
    rgb.setPixelColor(0, 255, 0, 0);  // show color Red

    digitalWrite(RELAY_PIN, HIGH);

    rgb.show();
    delay (2000);

    rgb.setPixelColor(0, 0, 0, 0); // off RGB light

    rgb.show();
    delay (500);
  }
  digitalWrite(RELAY_PIN, LOW);
}
void rotateStepperAndShowMessage() {
  // Move the stepper motor 90 degrees
  int stepsToRotate = (stepsPerRevolution * 90) / 360;
  myStepper.step(stepsToRotate);

  // Turn on LED and buzzer for 10 seconds
  digitalWrite(ledPin, HIGH);
  digitalWrite(buzzerPin, HIGH);

  // Display medicine message on LCD
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Please take your");
  lcd.setCursor(0, 1);
  lcd.print("medicine");
  medicineMessageDisplayed = true;
```

```
  // Update timing for timeout warning
  stepperRotateTime = millis();
  stepperRotated = true;  // Set flag indicating stepper has rotated
}

void sendButtonRequest() {
  if (WiFi.status() == WL_CONNECTED) {
    HTTPClient http;

    // Your target URL for the GET request
    http.begin("https://amirulasri.com/fikriainfyp/submitbutton.php");

    int httpCode = http.GET();

    if (httpCode > 0) {
      String payload = http.getString();
      Serial.println(httpCode);
      Serial.println(payload);
    } else {
      Serial.println("Error on HTTP request");
    }

    http.end();
  }
}
```

APPENDIX B
GANTT CHART



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