University of Moratuwa
Department of Electronic and Telecommunication Engineering
EN1190 - Engineering Design Project

August 10, 2024

Project Report on Guardian Call
Group -Tech Wizards

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Contents

1 Abstract

GuardianCall is an adult caretaker assisting device designed to provide peace of mind to caregivers by notifying them through an app whenever assistance is required. The device also includes an alarm system to remind users about important medication schedules, ensuring comprehensive support for both the caretaker and the person in need. Key functionalities of GuardianCall include medication reminders, SOS alerts, offline alarms, and battery level indicators on the mobile app, all of which are designed to make caregiving more efficient and reliable.

2 Introduction

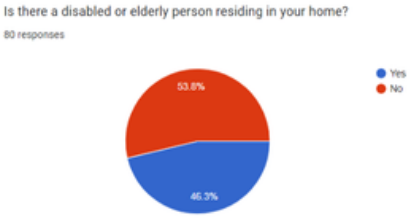
Caring for a disabled parent or loved one can be challenging, especially when you can't leave them alone without worrying. That's where **GuardianCall** comes in. This adult caretaker helping device ensures peace of mind by sending notifications to caretakers and relatives through our app whenever assistance is needed. Additionally, it includes an alarm system to remind the user about important medication schedules, providing comprehensive support for both the caretaker and the individual in need.

Functionalities of the GuardianCall include:

- Alarm the patient to take medicine during the given period.
- Keep records of medications taken by the patient.
- Allow the patient to send an SOS alert to the guardian via a dedicated button.
- Set alarms directly on the main device.
- Provide an offline alarm feature, ensuring alarms work even without an internet connection.
- Display a battery level indicator on mobile app.

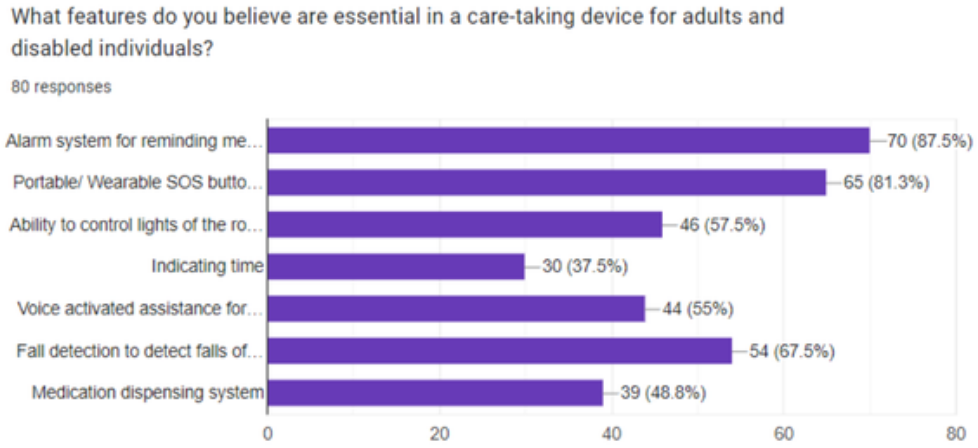
3 Market Research

To validate our product concept an extensive survey was conducted and we were able to gather data from around 80 individuals through an online survey using google forms. Key focus areas of our bedside companion was identified through the survey



- Almost 54% of the respondents had an elderly or a disabled person at their households to whom they provide regular care.
- After giving a product specification,92% have responded by mentioning that having such a product would ease the tasks of the caretakers, when they are not physically present with the bedridden person.

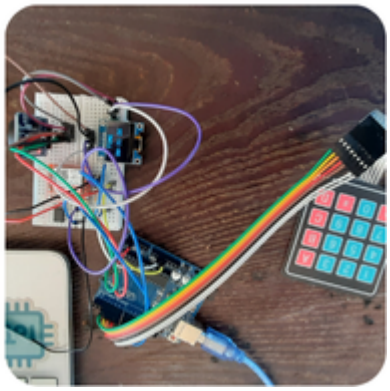
According to the survey, this is how the respondents assumed what feature will be most beneficial to them from our product.



4 Product Development

4.1 Prototyping Attempt 01

Implementation using Arduino Uno(ATmega 328P)

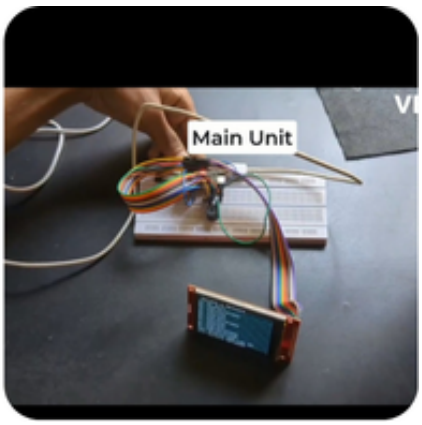


Why we had to shift to ESP32 from Arduino?
We initially tried to implement our design concept using arduino uno and GSM module RTC module, OLED display, keypad but we encountered network connectivity issues and memory insufficient issues.
due to that we decided to use ESP32 platform as it has inbuilt wifi capabilities, Real time clock and 520kb of SRAM to suffice our necessities and also it enabled us to introduce our product as a IoT device.

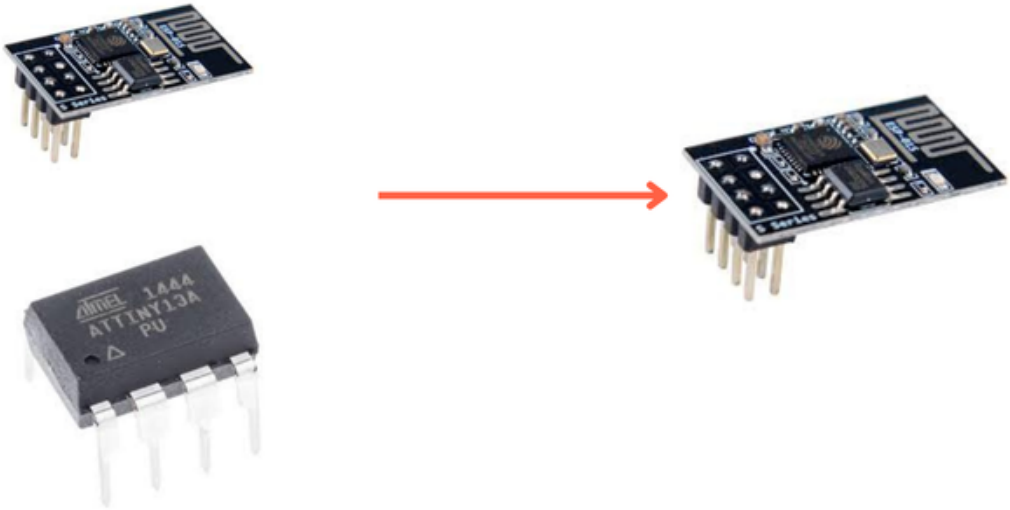
4.2 Prototyping Attempt 02

Implementation using ESP32(ESP32-WROOM-S3)

AS the ESP32 SoC has inbuilt wifi capabilities, real time clock, and it supports ESPNow protocol to communicate between nearby ESP devices we chose to employ an ESP01 module for the wearable button



Prototyping Button



Initially we planned to use a ATtiny 13a in combination with ESP01 as the ATtin13a works under about 50 µA in it's deep sleep mode, so that the ATtiny13a can turn off and on the button extending the battery life of the wearable button. But as per our testing and calculations, we found out that even without the ATtiny 13a, the deep sleep mode of the ESP01s consumes about 300µA elliminating the need of ATTiny13a to be used in our dessign.

5 Challenges We Encountered

1. ESPNow not working while connected to the external WiFi access point.

   Solution: Employing another ESP01 in the main unit, solely for communicating with the peer ESP01 of the buttons and using serial communication between ESP32 and the mentioned ESP01 to get the button press event data.

2. Due to lack of equipment and labs being closed, using locally available soldering accessories introduced difficulties in soldering SMD components (mainly the ESP32 SoC with QFN package).

   Solution: Purchasing a high-quality soldering iron with suitable tip-bits to solder SMD components.

3. Most of the SMD components that were used in our design were not available from local suppliers.

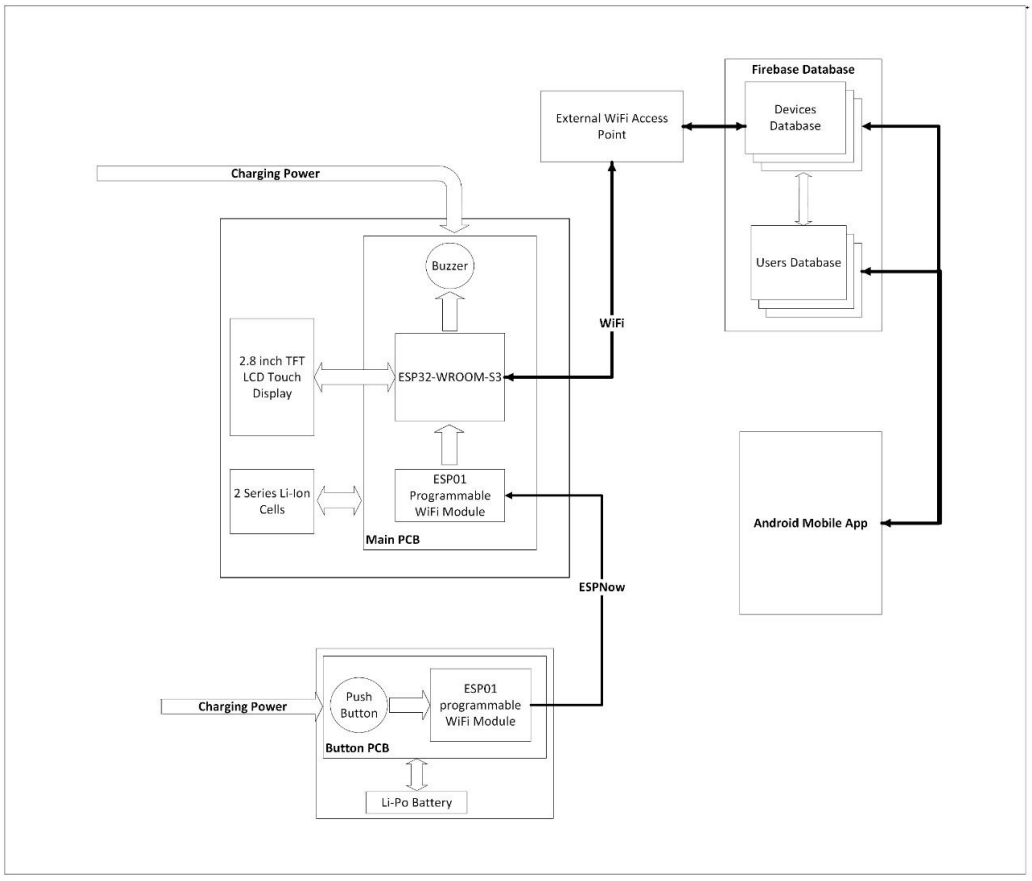
   Solution: To meet previously agreed timelines, we had to import all the SMD components from online marketplaces soon after the PCB design process was over.

6 Bill of Materials

Component	Quantity	Price (LKR)
Buzzer	1	50
2.8 TFT LCD Display	1	3300
ESP 01s	2	390
Step-Up Boost Convertor Module	1	350
BMS	1	485
Buck Convertor Module	1	160
Type-C USB Socket	1	75
Li-Po battery 150mAh	1	480
ESP32-S3-WROOM	1	1600
Boost & Buck 3.3V regulator module	1	80
Li-Po Charger Module	1	70
18650 Battery Case	1	60
18650 Li-Ion battery	2	380
Enclosure 3D Print	1	3500
PCBs + Tax	1	1000
Other Components	1	340
Total		**13090**

Table 1: Component List and Prices

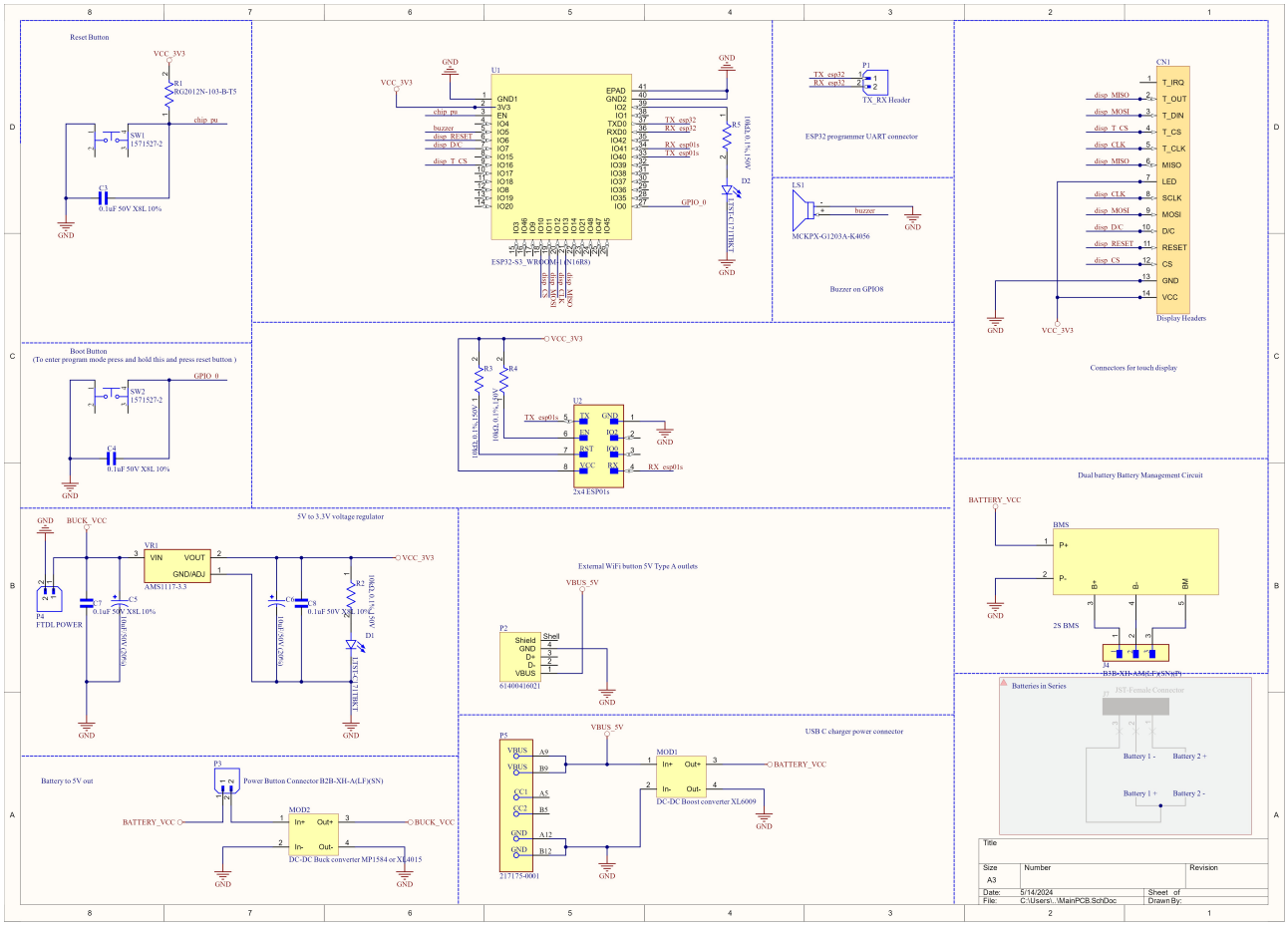
7 System Block Diagram



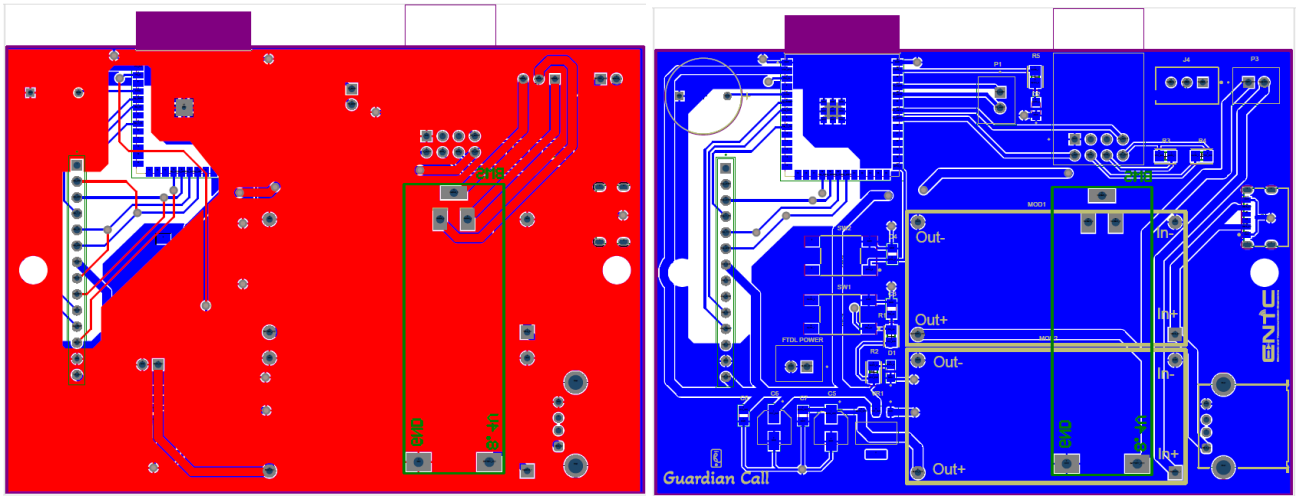
8 PCB Design

Altium designer was used in Educational license format to design both the PCBs.(Its professionalism was usefull)

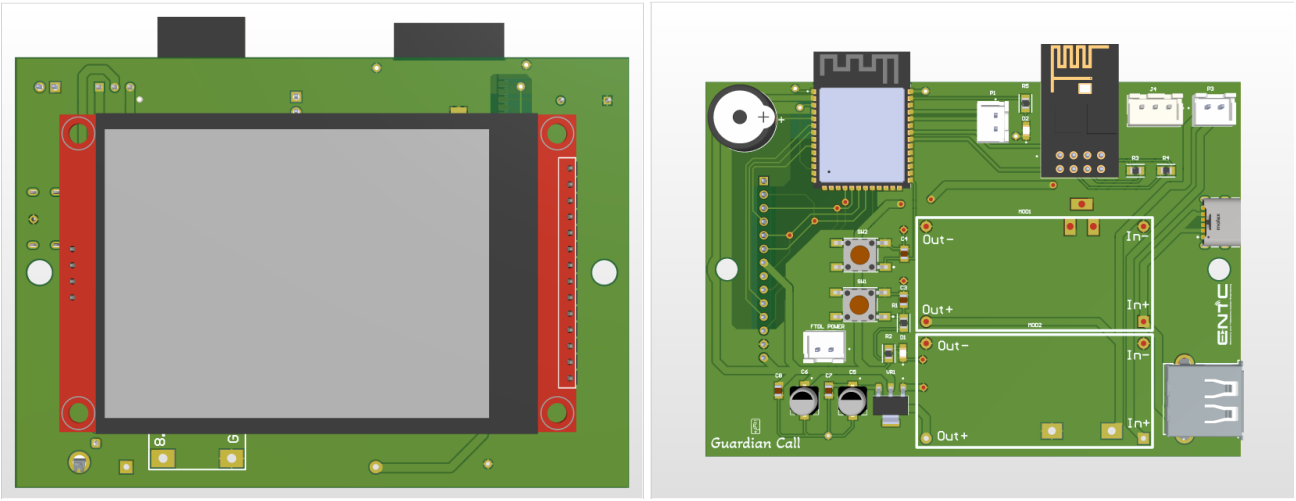
8.1 Main PCB



Main PCB schematic

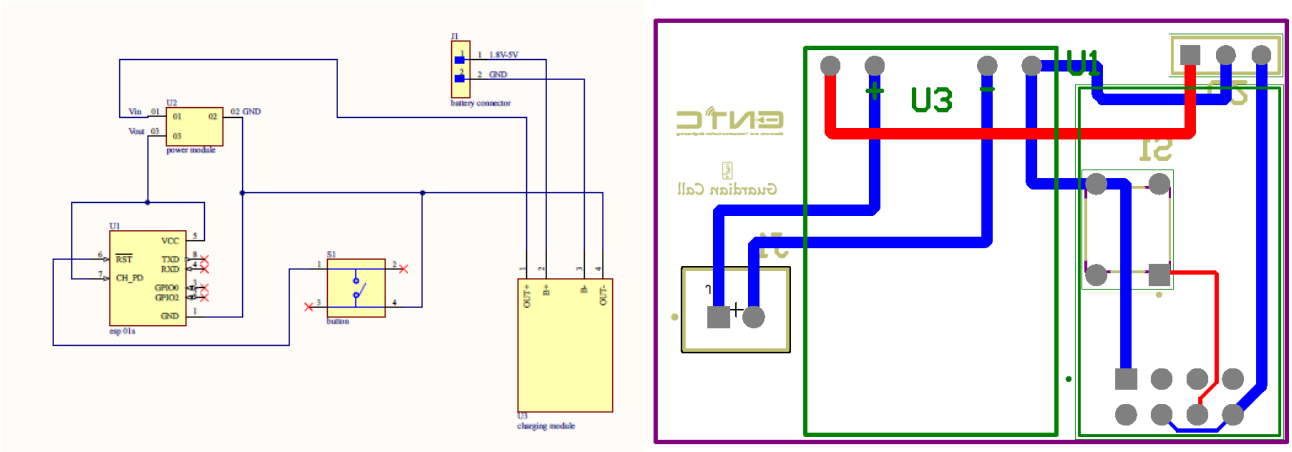


Main PCB layout

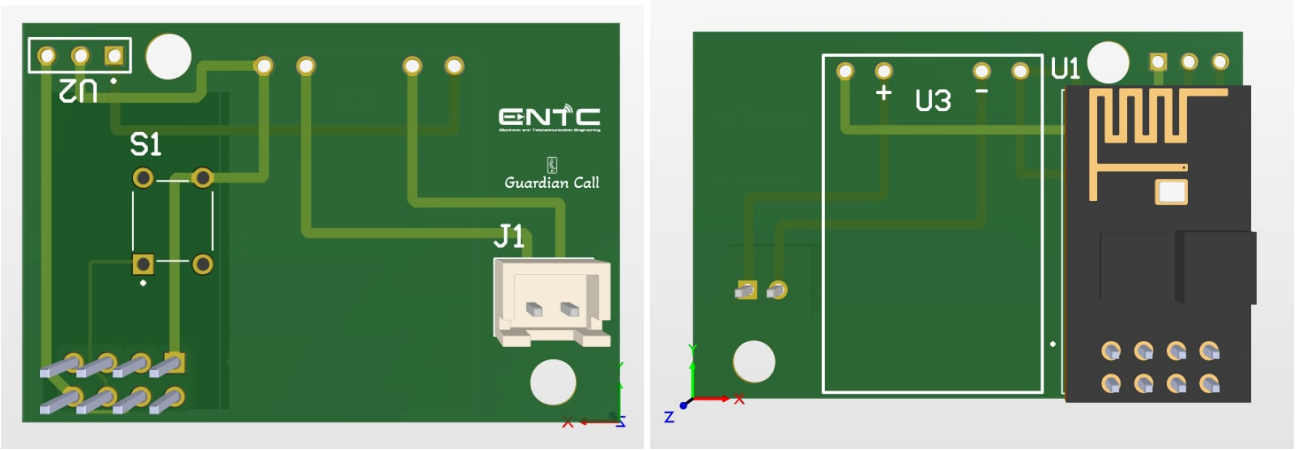


Main PCB 3D view

8.2 Button PCB



Button PCB schematic and layout



Button PCB 3D view

9 Application Development

9.1 UI/UX Design

The initial phase of our app development involved the implementation of the UI/UX design utilizing Figma. Following this, we proceeded to develop the interface based on the finalized design.

9.2 Front End Development

The front-end development of the Android application was carried out using Android Studio.

9.3 Back End Development

Firebase served as the backend for our application, facilitating user management, and the storage of alarm details and button statuses.

9.4 Features

- Rings in Emergancy
- Alarm system to remind the patient to take medicine during the given period.
- Battery Level indication of button.

9.5 App Testing

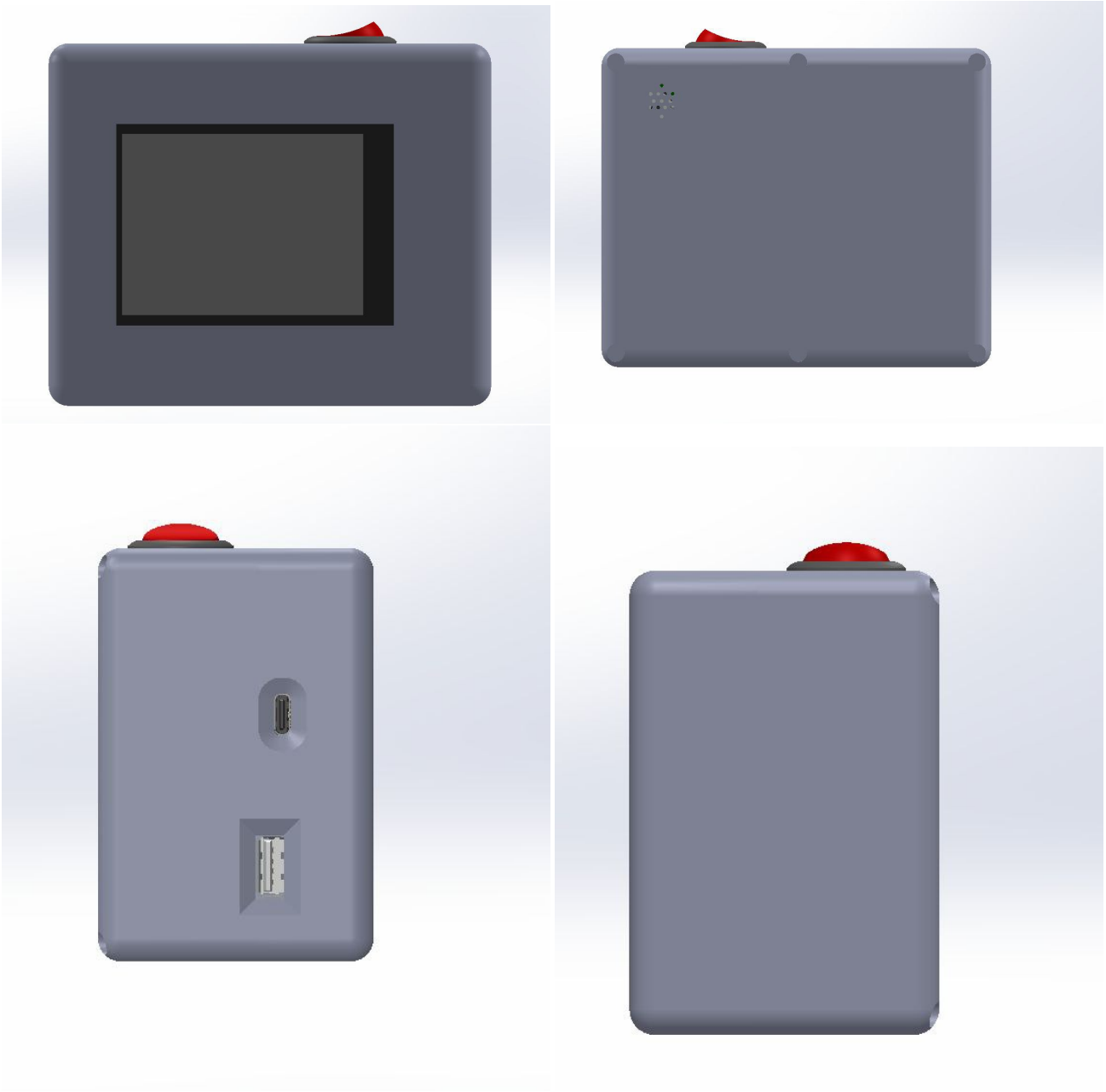
The application was thoroughly tested on multiple devices and emulators to ensure its functionality, during which several issues were identified and resolved.

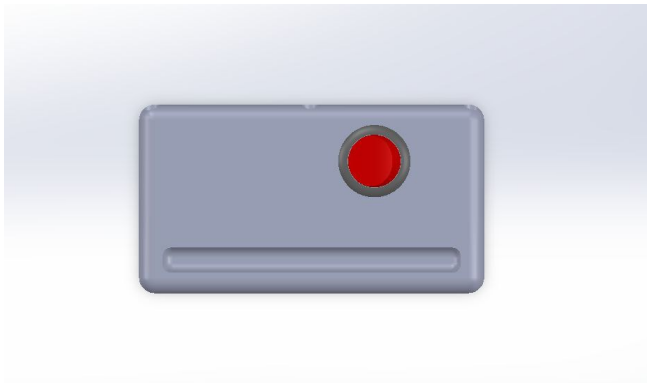
9.6 Mobile Interface

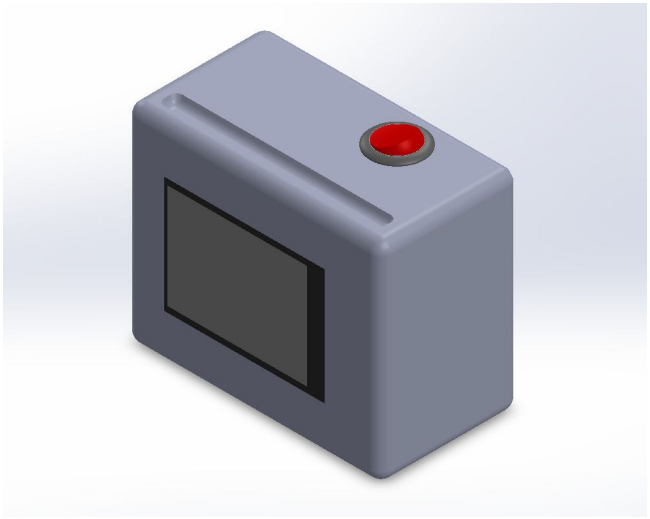
10 Enclosure Design

Solidworks 2023 Was used for Designing the 3D models of the enclosure.

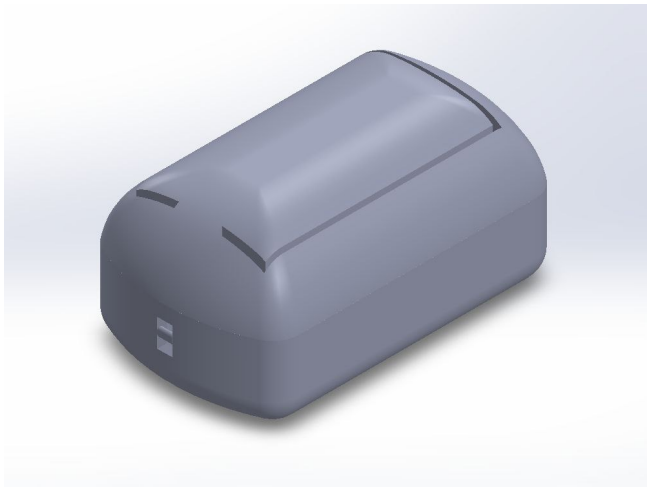
10.1 Main Unit

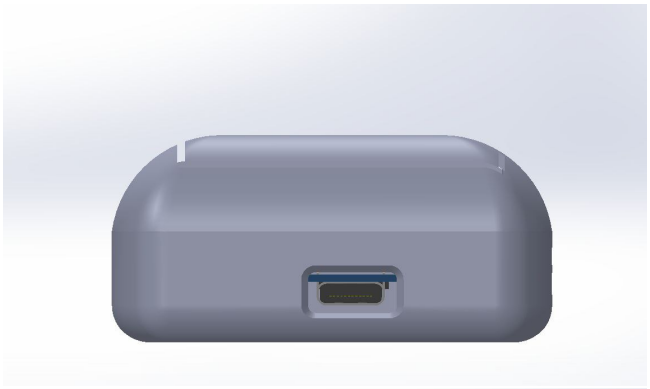


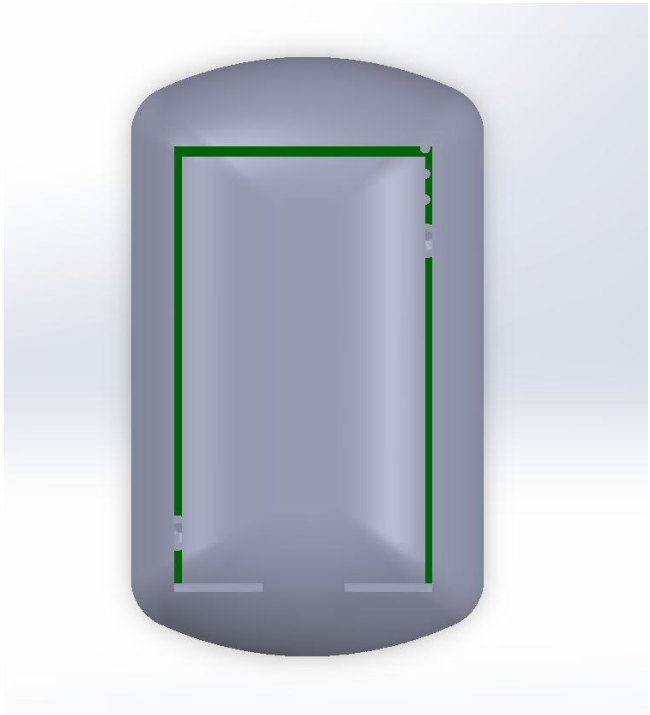




10.2 Button







11 Specifications

Specification	Main Unit	Button
Weight	290 g	25 g
Height	90 mm	28 mm
Width	60 mm	35 mm
Length	110 mm	60 mm
Charging Time	-	12 min
Battery Life	18 h	20 days
Battery Capacity	3600 mAh	150mAh
Operating Voltage	8.4-6.0 V	4.2-3.0 V
Operating Current	200 mA	Button Press - 140.6 mA (1.1 Seconds) Deep Sleep - 300uA
Power Consumption	1.68 W	1.3 mW
Range	-	-

Table 2: Combined Specifications of Main Unit and Button

12 Task Allocation

Gunasekara VGV 220193M	Gunathilaka KL 220197E	Ilukkumbura IMEIB 220235V	Priyanjana TPIM 220495P
Research survey	PCB design of Main unit	3D enclosure design (Main device, Button)	PCB design of the Button
App development	App development	App development	App development
Documentation	Programming micro-controller	Assembling	Programming micro-controller
Testing	Soldering	Documentation	Soldering

Table 3: Team Member Responsibilities

13 Conclusion

Our project began with a solid understanding of how to identify a solvable question and conduct thorough research on the Optimal Design Solution (ODS). We successfully designed our own prototypes and delved into various aspects of development, including PCB design, 3D modeling, coding, and communication technologies. Our implementations aligned well with our expectations, and we managed to meet most of our goals.

However, we encountered challenges with the charging module, which remains an area for further improvement. Despite this, our experience has highlighted potential avenues for future development. We are committed to continuing the enhancement of this product, building on the foundation we've established.