IN 1901 - Microcontroller Based Application Development Project

PROJECT FINAL REPORT

ALERT WAY GUARDIAN

Child and Women Safety Device

Submitted by: IT Group 06

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1. Introduction

The protection of women and children remains a critical issue in today's world, especially given the rising concerns around harassment, assault, and abduction in urban areas or during solo travel. The urgency for practical and reliable safety measures has never been more evident. To address this pressing challenge, the "Alert Way Guardian" project focuses on developing a cutting-edge, microcontroller-driven device aimed at enhancing the safety of women and children. This innovative tool is designed to boost confidence and security by offering advanced safety features tailored to their specific needs.

The "Alert Way Guardian" incorporates modern technologies such as gyroscope sensors, emergency alert mechanisms, video and audio capture, and GPS tracking, ensuring comprehensive protection during emergencies. Its compact, easy-to-use design ensures accessibility across all age groups, making it an ideal tool for personal security.

By promoting a sense of safety, this initiative seeks to positively impact society, encouraging women and children to engage in their everyday activities with greater assurance. The "Alert Way Guardian" stands as a key step toward building safer environments and reducing vulnerability, empowering users to live more freely and fearlessly.

2. Literature Survey

The safety of women and children is crucial for the overall well-being of society. When individuals feel safe, they can focus better on their education, work, and personal growth. By addressing safety concerns, we aim to contribute to building a community where everyone can thrive without fear. This project goes beyond just creating a device; it's about fostering a sense of security that allows women and children to explore the world with confidence and pursue their dreams without limitations.

3. Problem Overview

Women and children often face higher risks of personal safety threats, such as harassment, assault, and abduction. In Sri Lanka, these issues have become more prevalent, with reports showing a sharp rise of about 30% in related incidents over the last year. These dangers can arise in everyday situations, especially when individuals are alone or in unfamiliar locations.

Traditional safety precautions, such as avoiding certain areas or depending on nearby people for help, often fail to provide the necessary protection. Many available safety devices are limited, lacking crucial features like real-time tracking or effective communication tools during critical moments. As a result, women and children may feel exposed and unable to access help when they need it most.

The "Alert Way Guardian" project aims to resolve this by developing a device tailored for the specific needs of women and children. Key features include GPS for location tracking, a panic button for instant alerts, and both video and audio recording capabilities. This comprehensive set of tools is designed to offer swift assistance in emergencies, enhancing the overall security and peace of mind for users as they go about their daily routines.

4. Solution Overview

To enhance personal safety for women and children, we propose a compact, microcontroller-based device that is both portable and affordable. This device incorporates a range of sensors to monitor the environment, and in case of an emergency, it automatically alerts a designated contact. Additionally, it offers a user-friendly panic button, enabling users to swiftly send real-time data to their emergency contact, while also emitting a loud alarm to deter potential attackers.

Key Components and Features:

- **Touch Sensor:** A touch sensor activates the device when the user engages with it. This acts like an emergency button that can be triggered when the user feels threatened or unsafe.
- **GPS Module:** This component continuously tracks the user’s location, sending real-time updates to ensure immediate location data is available during an emergency.
- **Accelerometer:** Sudden movements or falls are detected by the accelerometer, indicating a possible emergency, which prompts the device to take action automatically.
- **Microphone:** The built-in microphone captures audio, allowing the user to record important conversations or evidence during a distressing situation.
- **Camera Module:** The camera captures visuals of the surroundings, which can either be still images or video recordings that may serve as crucial evidence in case of an incident.

Unlike typical safety solutions, this device is designed to operate even if the user is unable to take any action, such as in situations where they may fall unconscious or be physically harmed. If the touch sensor detects that contact with the user has been lost, the device automatically activates its emergency features, such as sending alerts and starting audio and video recordings.

This solution offers women and children the ability to go about their daily lives with a heightened sense of security. The device is cost-effective, making it accessible to a broad range of users, without compromising on essential safety functions.

5. Aims and Objectives

Aim

The primary goal of the "Alert Way Guardian" project is to create a dependable and user-friendly safety device specifically designed for women and children. By incorporating advanced technologies, the device aims to enhance personal safety, offering real-time protection and quick emergency responses.

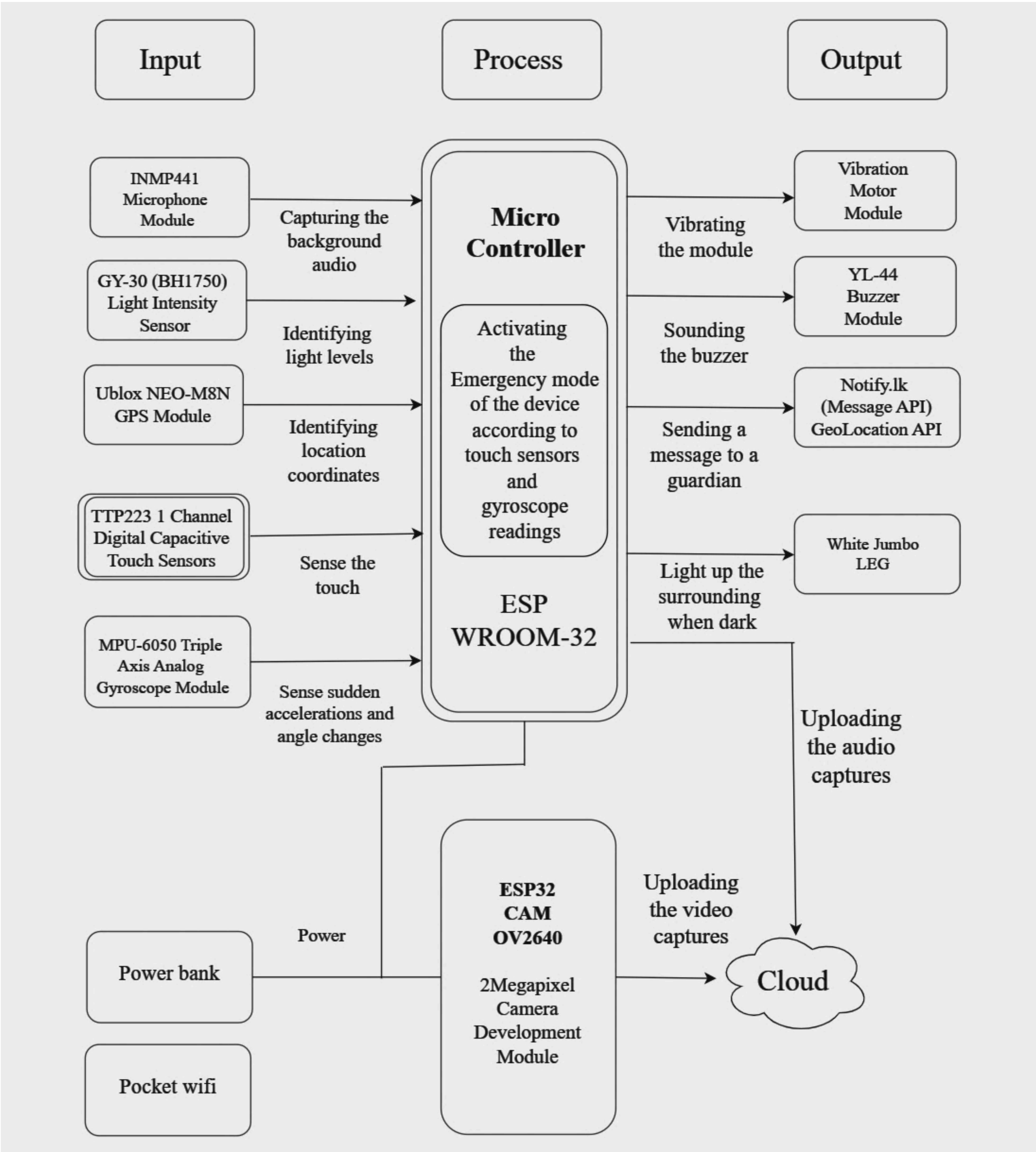
Objectives

1. **Emergency Alert System**
    - **Objective:** Implement a panic button to send immediate alerts to pre-set contacts.
    - **Details:** Pressing the panic button triggers an emergency SMSI with GPS coordinates and a distress message, ensuring timely action by family or emergency services.
2. **Real-time Location Tracking**
    - **Objective:** Integrate GPS to allow continuous real-time tracking.
    - **Details:** The device will transmit the user's location to a secure cloud, accessible to authorized contacts for fast tracking during emergencies.
3. **Video Recording**
    - **Objective:** Include a camera to record video during alerts.
    - **Details:** The built-in camera will record high-quality video when triggered, storing the footage securely in the cloud for evidence or further assessment.
4. **Audio Recording**
    - **Objective:** Enable audio recording during emergencies.
    - **Details:** A microphone will capture audio when the panic button is activated, with the recording saved in the cloud to aid in understanding the situation.
5. **Fall Detection and Motion Sensing**
    - **Objective:** Use accelerometers and gyroscopes to detect falls or unusual movements.
    - **Details:** Sudden impacts or irregular movements will automatically trigger alerts to contacts, providing the user's location and recorded data.
6. **User-Friendly Design**
    - **Objective:** Ensure the device is easy to use for all age groups.
    - **Details:** The device will feature a simple interface, with minimal buttons, and will be lightweight and portable for daily use.
7. **Affordability**
    - **Objective:** Make the device affordable and accessible.
    - **Details:** The project will prioritize cost-effective production without compromising essential features, ensuring the device is available at a reasonable price.

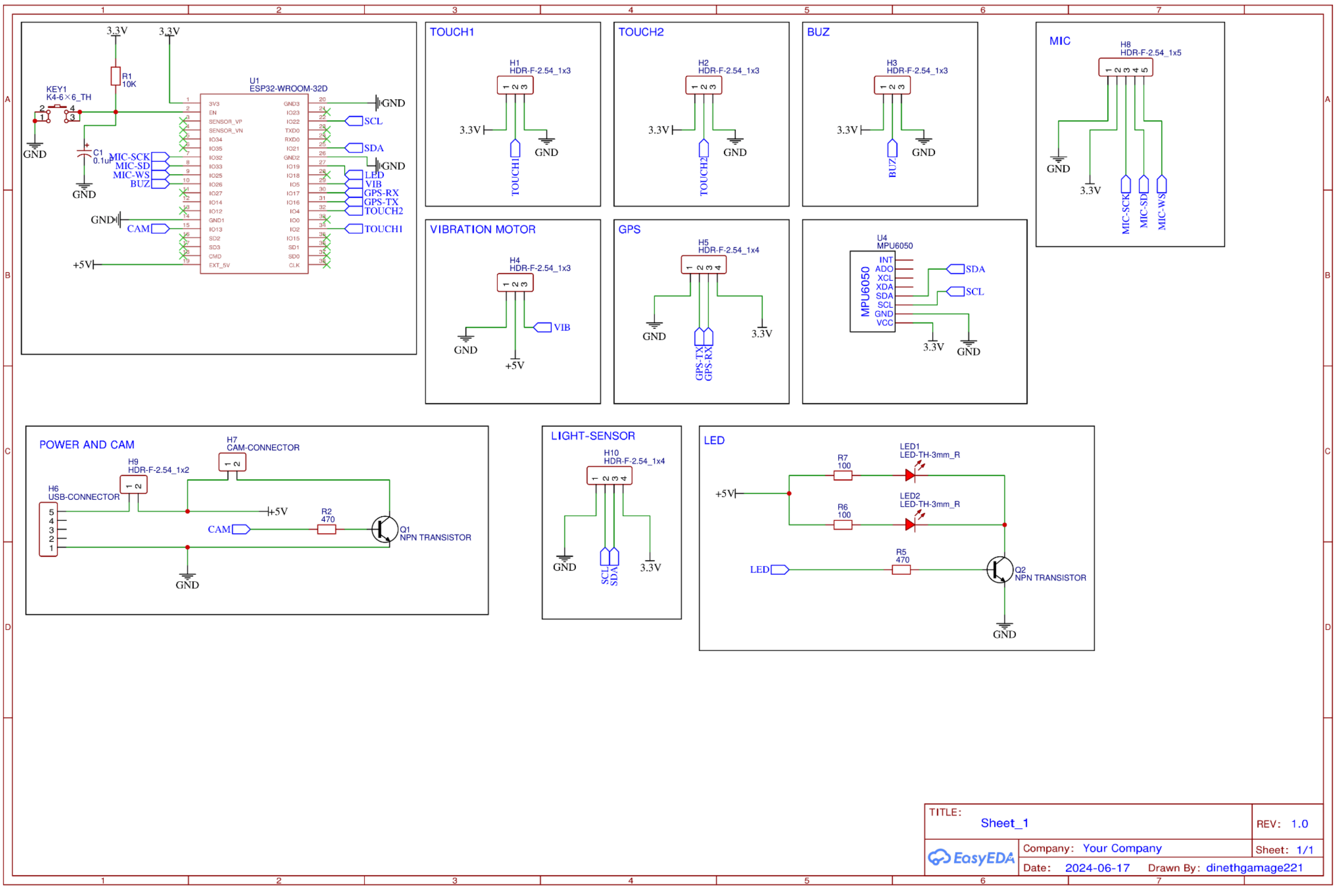
By fulfilling these objectives, the "Alert Way Guardian" project aims to deliver a practical solution that improves the safety and confidence of women and children in their everyday lives.

6. Analysis and Design

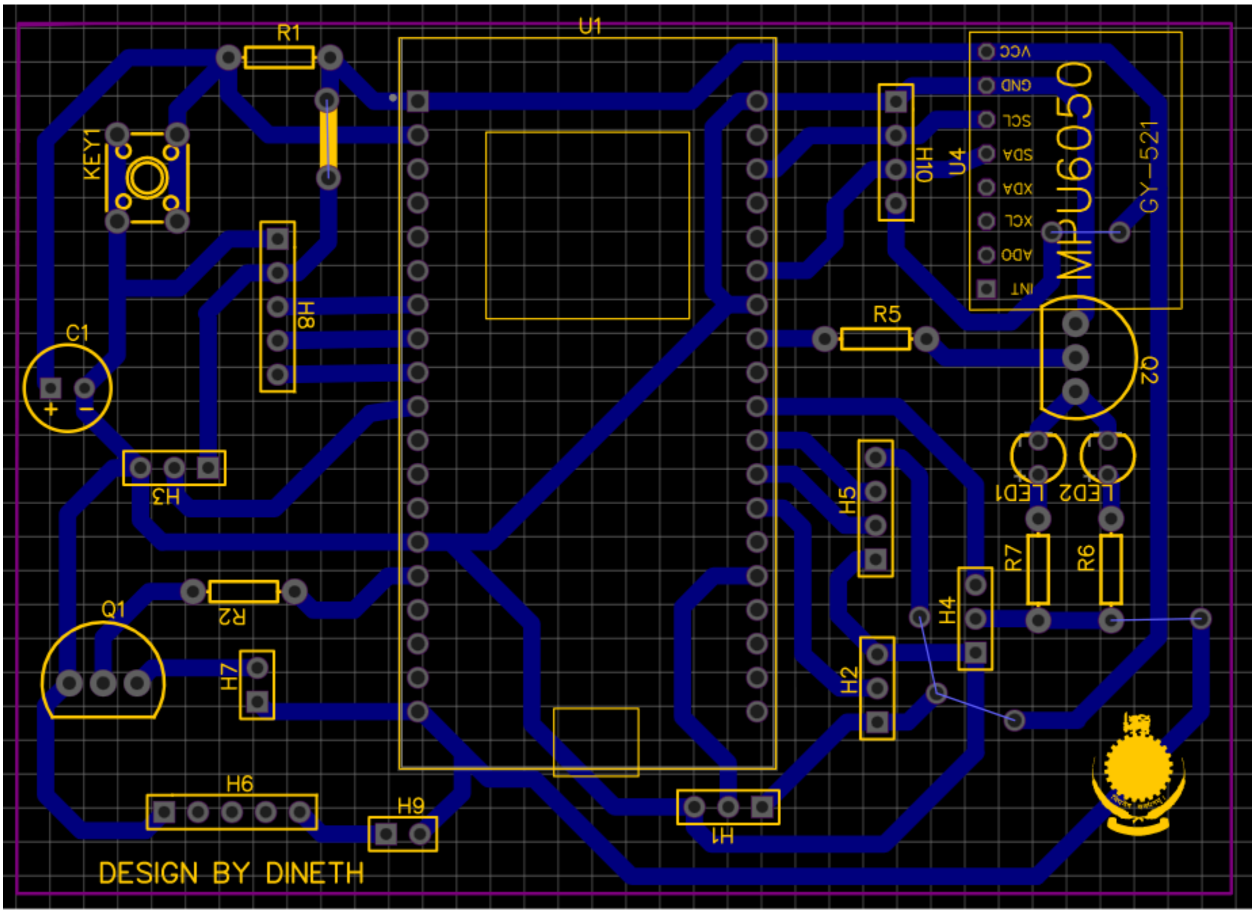
6.1. Block Diagram

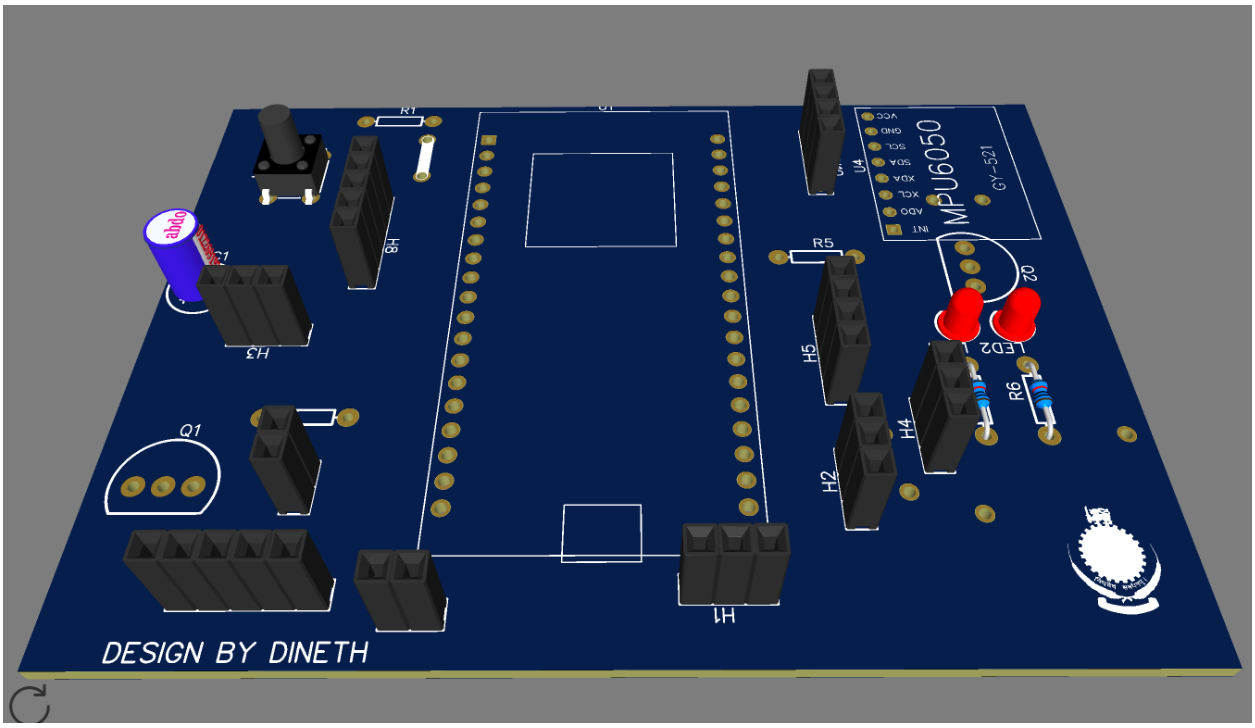


6.2. Schematic Diagram

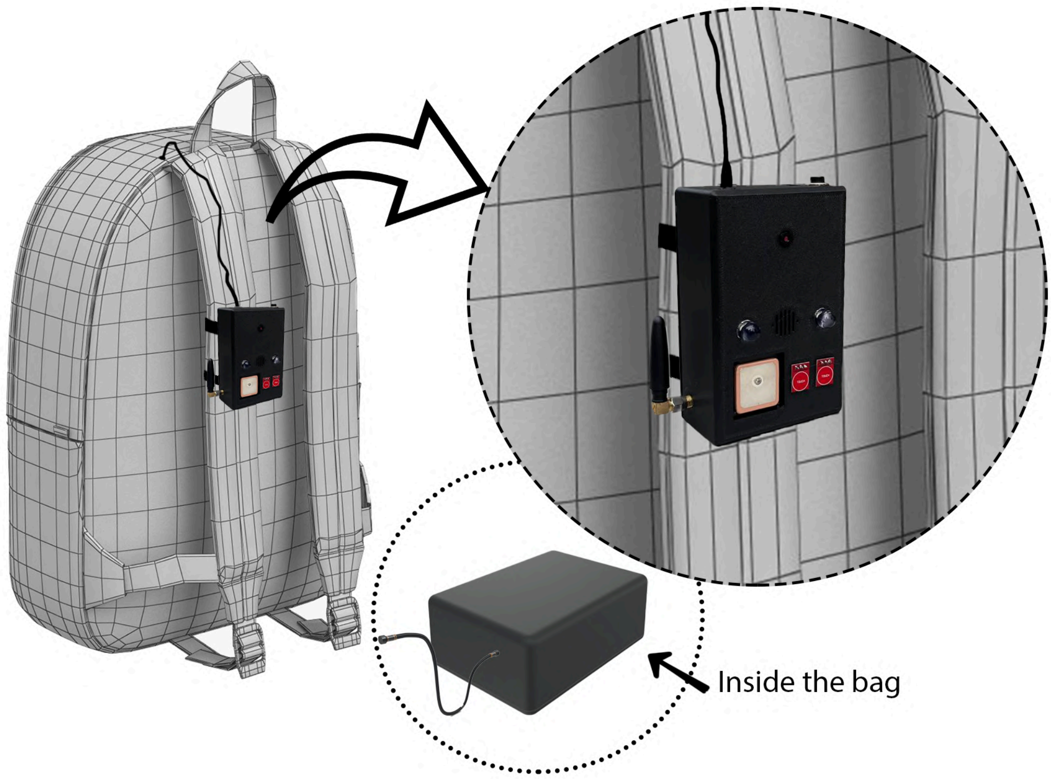


6.3. PCB Design

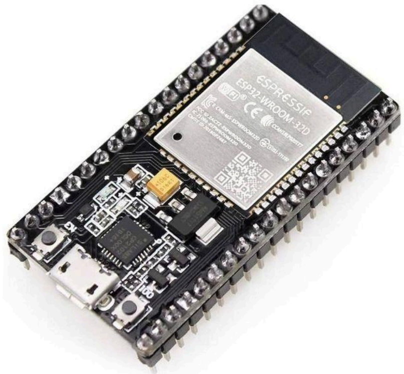




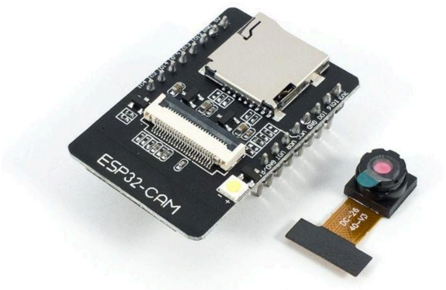
6.4. 3D View and Design



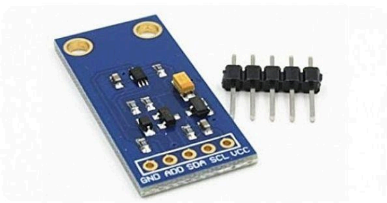
6.5. Modules and Components



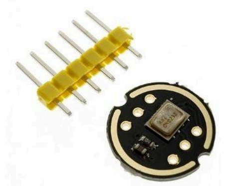
ESP32 WROOM 32U



ESP32 CAM Development Board

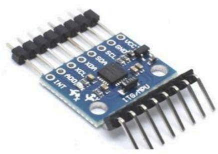


GY-30 Light Intensity Sensor



INMP441 Microphone Sensor Module

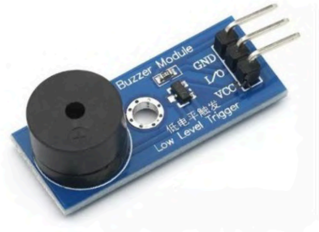
Ublox NEO-M8N GPS Module



MPU-6050 Triple Axis Analog Gyroscope Module

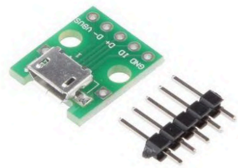
TTP223 1-Channel Digital Capacitive Touch Sensor

Vibration Motor Module



YL-44 Buzzer Module

Jumbo LEDs



Micro USB Connector

Pocket Router

Power Bank

7. Testing and Implementation

7.1. Testing and Implementation

The testing and implementation phase was a critical step in ensuring the "Alert Way Guardian" functioned as intended, meeting all the requirements outlined in the project proposal. A structured approach was followed to validate the system's functionality, identify potential issues, and refine the device for optimal performance.

1. Unit Testing

Each component was tested individually to verify its correct operation. This phase was essential for detecting and addressing issues before integrating the system. The following modules were tested:

- **Touch Sensors:** Ensured the device activated and deactivated correctly upon user interaction, mimicking real-world emergency scenarios.
- **GPS Module:** Verified the accuracy and reliability of location tracking, ensuring that the module consistently reported correct positions in various environments.
- **Camera and Microphone Modules:** Assessed the clarity and quality of video and audio recordings to ensure they were sufficient for evidence collection in emergencies.
- **Gyroscope Modules:** Evaluated the device's ability to detect falls and sudden movements, confirming prompt activation of safety features when abnormal motion was sensed.
- **Buzzer and Vibration Motor:** Tested the responsiveness and effectiveness of the buzzer and vibration motor in alerting users and those nearby to potential dangers.

2. Integration Testing

Once the individual components passed unit testing, they were integrated, and their interactions were tested to ensure smooth collaboration between modules. This phase was crucial for verifying system-wide functionality:

- **GPS and SMS Alerts:** Tested the synchronization between real-time location tracking and the sending of emergency SMS alerts. Ensured accurate GPS coordinates were sent without delay.
- **Camera Activation and Light Sensor:** Verified that the camera was automatically activated in low-light conditions or during an emergency and captured high-quality visual data.
- **Data Upload:** Checked the consistency of data uploads, including video, audio, and sensor data, to Microsoft Azure for secure cloud storage and analysis.

3. System Testing

The entire system was tested holistically to confirm that it met all project requirements. This involved subjecting the device to real-world scenarios and evaluating its performance in different conditions:

- **Simulated Emergency Scenarios:** Various situations such as falls, harassment, and dark environments were simulated to assess the device's responsiveness and reliability.
- **Emergency Alert and Recording:** The full emergency alert system was tested to ensure that alerts, GPS data, and recorded media (audio and video) were transmitted securely to predefined contacts in real-time.
- **Data Security and Cloud Storage:** Ensured that all sensitive data, including location, audio, and video recordings, were transmitted and stored securely in the Microsoft Azure cloud environment, with no data loss or breach.

4. User Acceptance Testing

End-user testing was conducted with actual users (women and children) to ensure the device was not only functional but also practical and user-friendly. This phase focused on evaluating usability:

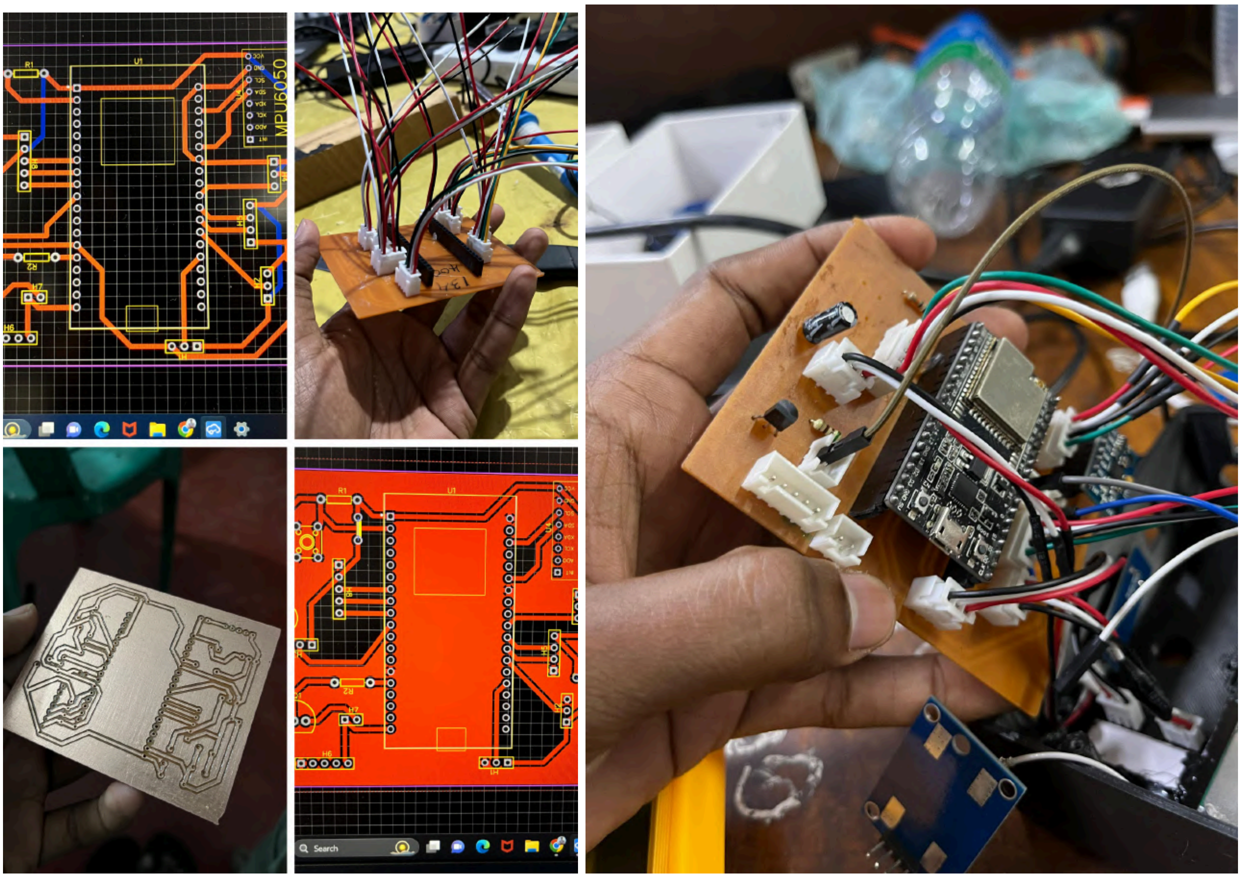
- **Ease of Use:** Users tested the interface and provided feedback on how intuitive and simple the device was to operate in emergency situations.
- **Feedback and Adjustments:** Based on the feedback, minor adjustments were made to improve the interface, responsiveness, and overall user experience.

Testing Tools and Environment

To ensure comprehensive testing, the following tools and environments were utilized:

- **Development Boards and Sensors:** ESP32-WROOM-32D, ESP32 CAM, TTP223, accelerometers, and gyroscope sensors were used to construct and test the system.
- **Software Tools:** The Arduino IDE was used for firmware development, while Microsoft Azure provided cloud storage and data management.
- **Simulated Environment:** Controlled conditions were created to simulate emergencies such as sudden falls, low-light areas, and instances of harassment to evaluate the device's real-time response.

By following this structured testing and implementation approach, the "Alert Way Guardian" device was thoroughly evaluated and optimized to ensure it was reliable, effective, and user-friendly. The testing process played a key role in validating the device's capacity to enhance the safety and security of women and children, while also ensuring it operated seamlessly in real-world conditions.


MPU6050
U1
R1
R2

7.2. Total Cost and Expenditure

Component	Price(Rs.)
ESP32-Wroom-32U	1400
ESP32 CAM+Adapter	2680
INMP441 MIC	680
Ublox NEO-M8N GPS	2500
MPU 6050 Gyroscope	650
TTP223 1-Channel Touch Sensors(2)	100
Vibration Motor	300
GY-30 Light Intensity Sensor	350
YL-44 Buzzer	120
Micro USB Connector	90
Jumbo LED	75
SMA Antenna	250
JST Connectors	760
Micro USB Cable	600
Switches(2)	200
Jumper Wires	160
PCB	300
3D Printing	4050
Total	**15565**

8. Individual Contribution

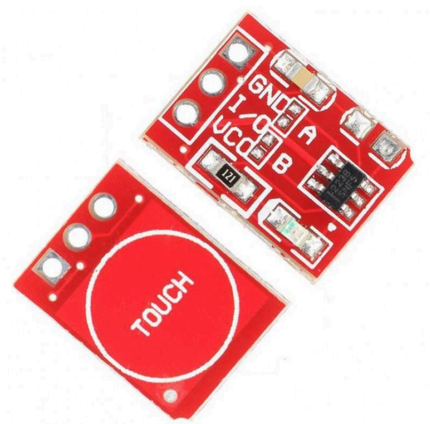
8.1. G.D.I. Gamage - 224055B

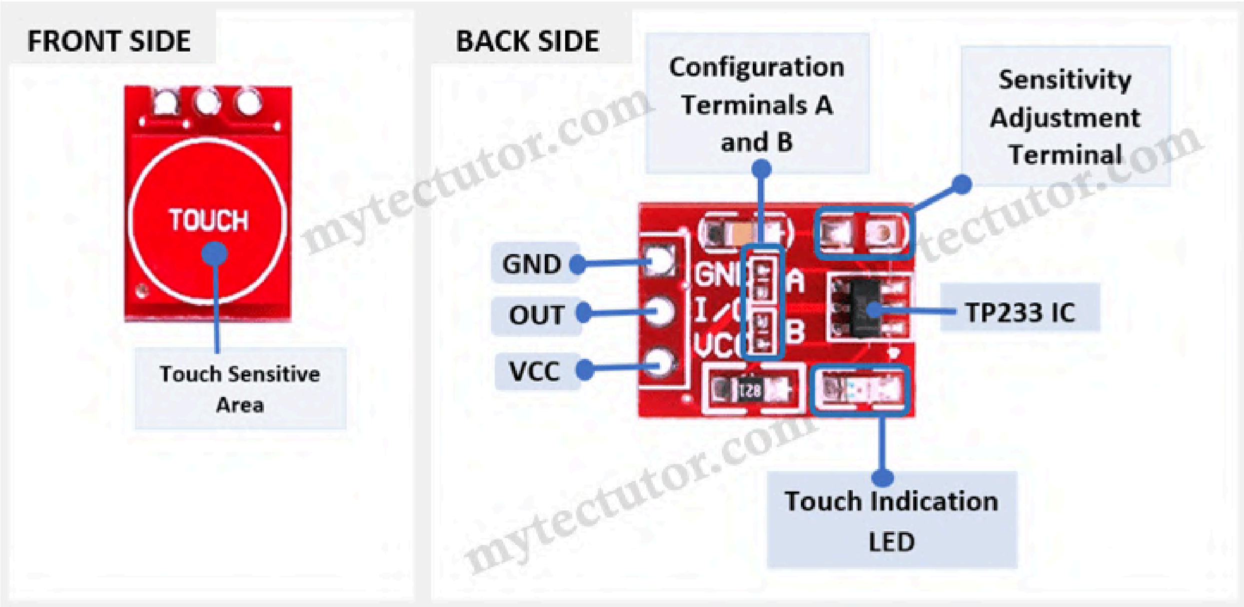
Responsibilities

- Touch Sensors:
  - Integrated dual capacitive touch sensors
  - Programmed long-press (3s) for emergency activation
  - Implemented dual-touch for emergency deactivation
- Vibration Motor:
  - Designed motor driver circuit
  - Programmed variable vibration patterns
- PCB Design:
  - Created schematic and optimized PCB layout
  - Integrated microcontroller, sensors, and power management
  - Implemented design for manufacturability (DFM)

In this project, I concentrated on the design of the custom PCB and the integration of the capacitive touch sensors, as well as on the vibration motor implementation using the ESP32 microcontroller. My contributions also included the testing and performance enhancement of these parts to achieve the optimal operation.

TTP223 1-Channel Digital Capacitive Touch Sensor



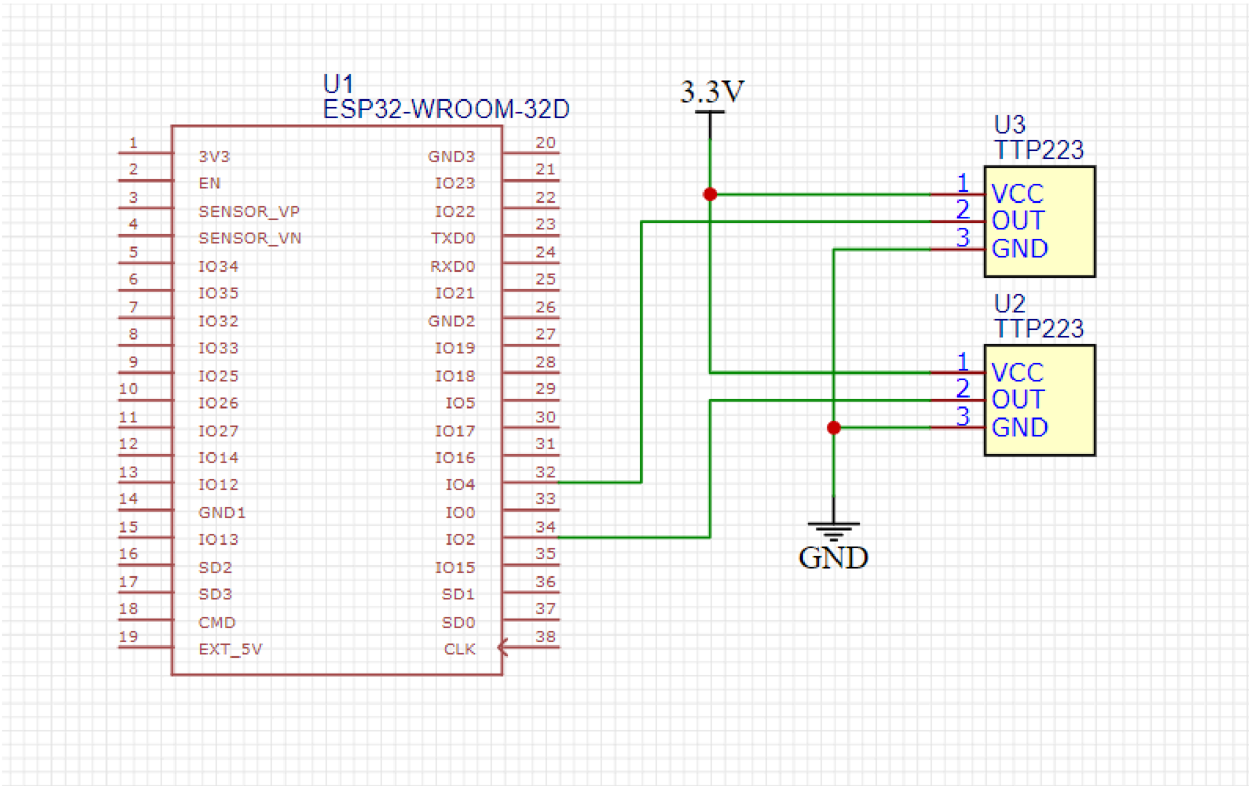


The TTP223 is a capacitive touch pad detector IC designed to replace traditional mechanical buttons with a modern touch-sensitive interface. It detects changes in capacitance when a finger approaches the pad, offering a durable, responsive touch solution without physical contact. Key features include low power consumption, a wide operating voltage range (2.0V to 5.5V), and support for various pad sizes. It also offers automatic calibration and noise suppression, ensuring accurate touch detection in different environments. The TTP223 is ideal for applications like consumer electronics, home automation, and wearable devices.

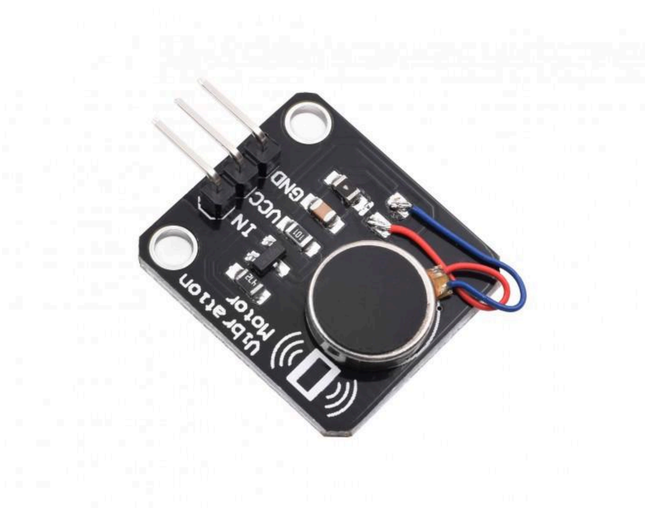
Responsibility:

My duties included the integration of two capacitive touch sensors to the PCB, pin-2 and pin-4 of the ESP32 board. I programmed them to activate emergency mode with a single long press (3 seconds) and to deactivate it with a simultaneous press of both sensors. Utilizing the ESP32’s built-in touch sensing capability, I applied a software debounce mechanism to prevent false triggers, ensuring reliable sensor operation. I also provided for a sensitivity variation option in software so that the system can be optimized based on user requirements.

Schematic Diagram



Vibration Motor Module

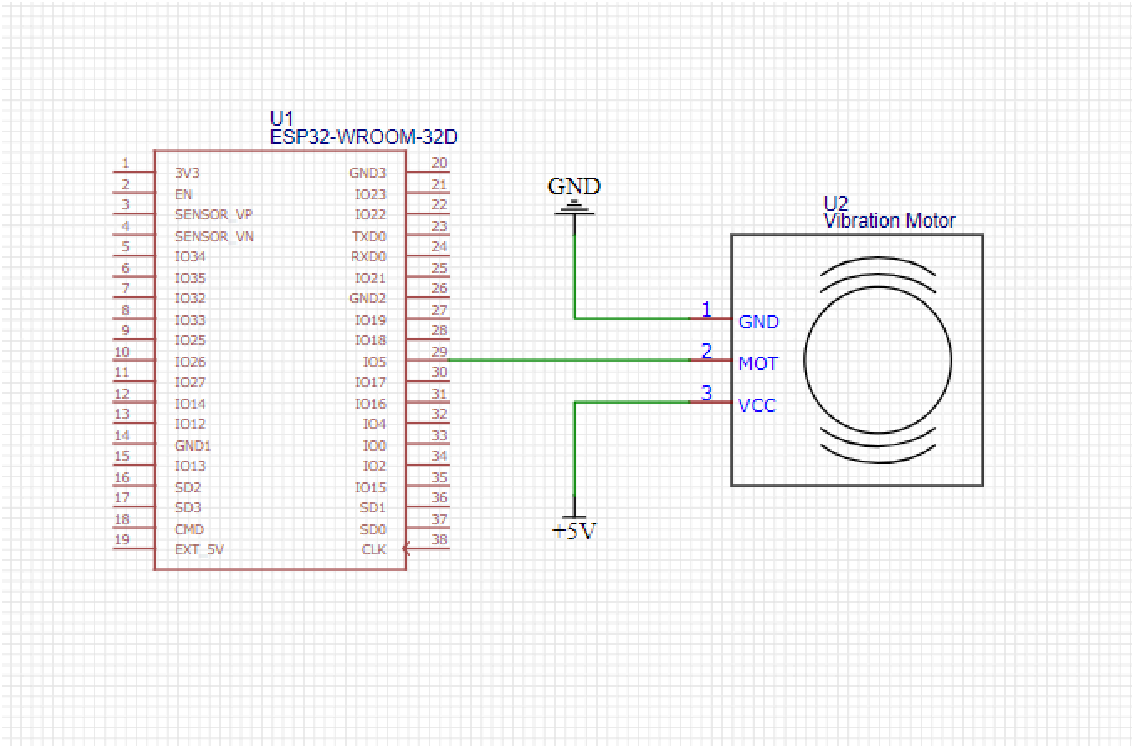


The Vibration Motor Module 5VDC PWM 1027 10x27 (MD0749) is a compact DC motor designed for precise vibration control using pulse-width modulation (PWM). Measuring 10mm in diameter and 27mm in length, it is ideal for providing haptic feedback in compact devices such as wearables, handheld gadgets, and robotics. The motor operates on a 5V power supply, making it suitable for low-power applications. It integrates seamlessly with popular microcontroller platforms like ESP32, Raspberry Pi, and Arduino, allowing for customizable vibration intensity and patterns, making it versatile for various feedback and alert applications.

Responsibility:

For the haptic feedback system, a coin-type (10 mm in diameter) vibration motor was incorporated into the design and has been schemed to be controlled by PWM on esp32 pin 5. I designed the motor to be able to vibrate at changeable levels (from 0% to 100) and without any restrictions as to how many times and for how long to vibrate and the resultant permutation of vibration patterns. By utilizing PWM, I optimized the motor's power consumption, ensuring it operates efficiently while delivering precise tactile feedback based on the user's needs.

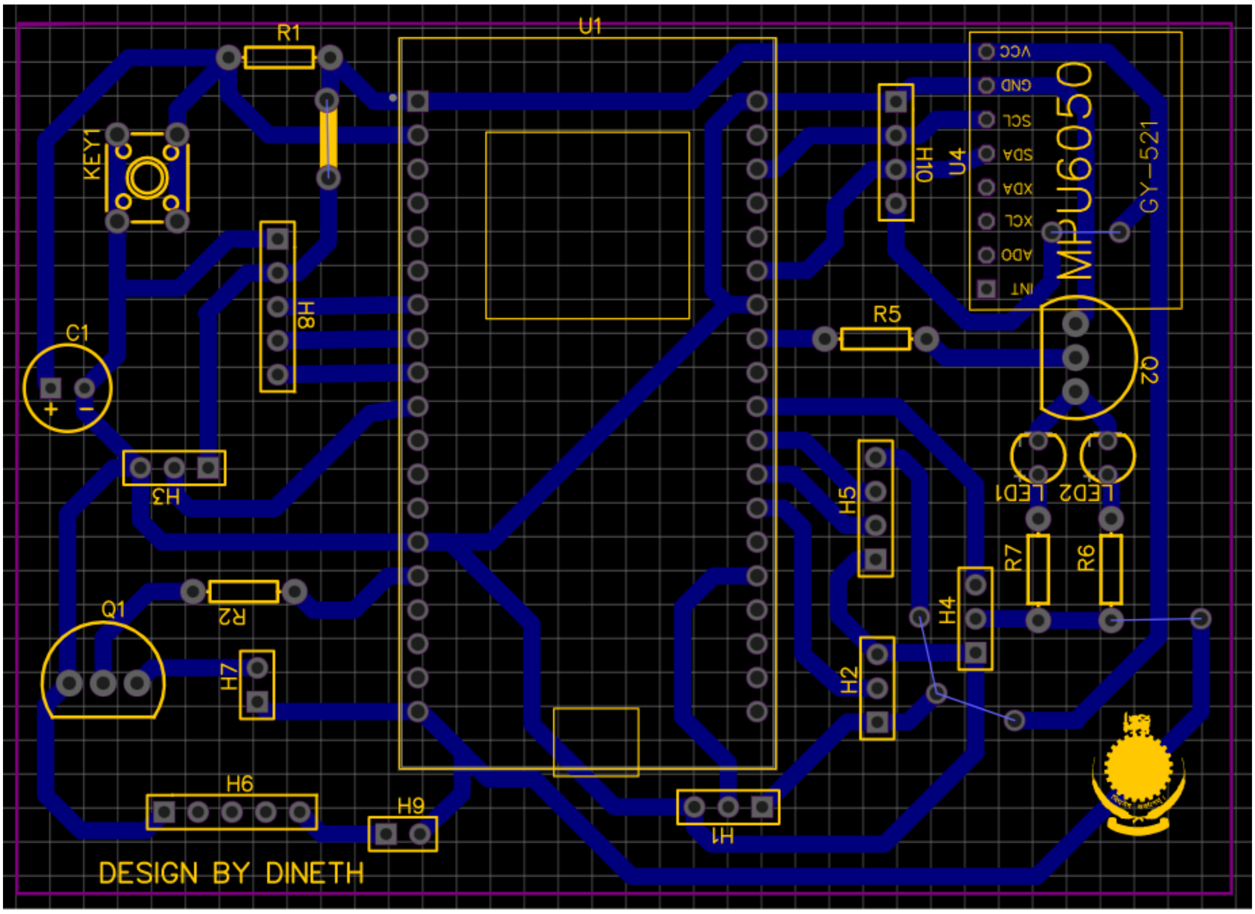
Schematic Diagram

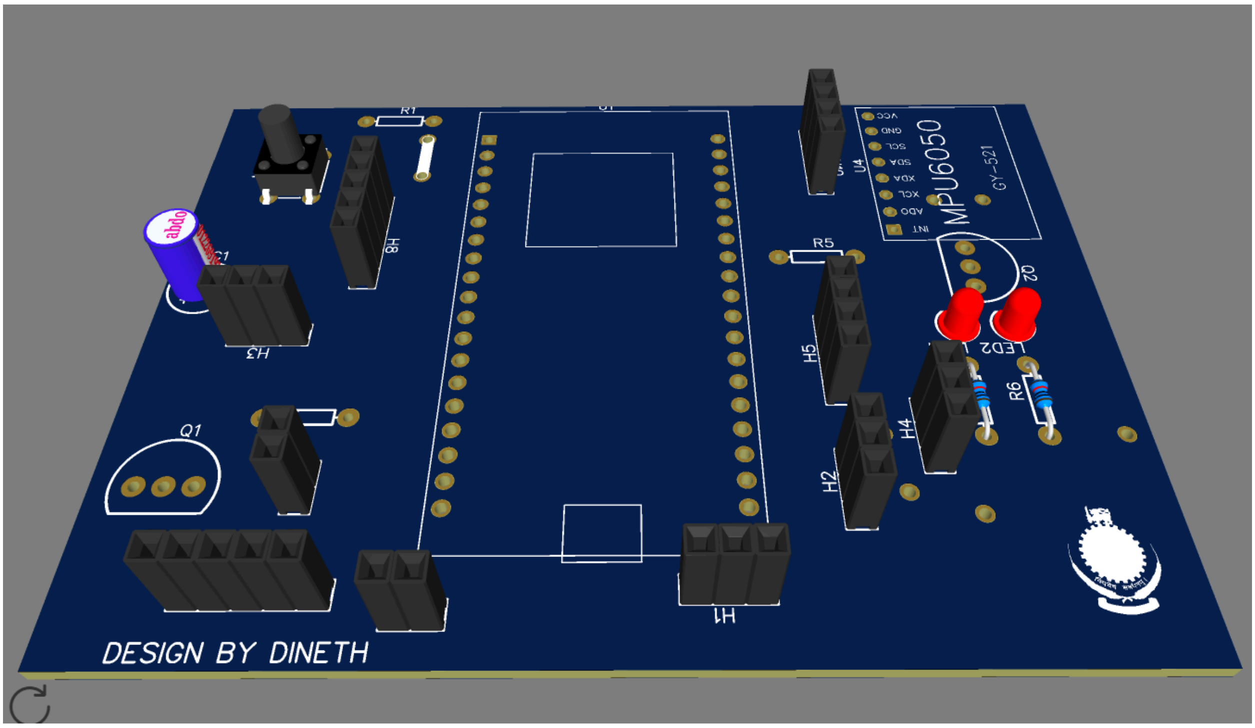


PCB Design:

As part of my contribution to the project, I designed a custom 1-layer PCB using EasyEDA that will fit essential parts of the project. I integrated the ESP32 microcontroller, all the other components, and a power management system onto this compact board. In addition, precautions were taken to optimize the placement of components within an allowable range to ensure proper heat dissipation.

I took part mainly in the integration phase, bringing together the ESP32 board, touch sensors, vibration motor, and all other components onto the PCB board. This ensured direct and efficient communication between the microcontroller and the peripherals. I also optimized the power distribution across the board, ensuring energy efficiency.



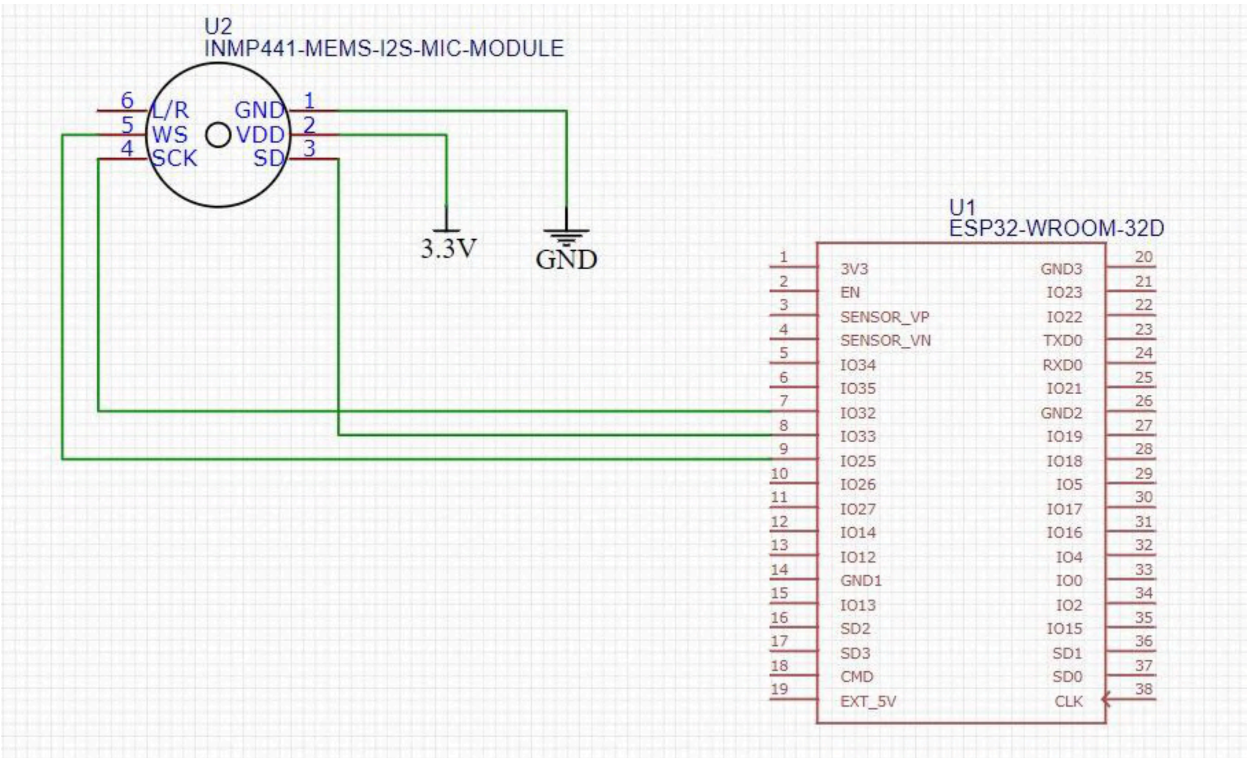

DESIGN BY DINETH
MPU6050
GY-521
R1
R5
R6
H1
H2
H3
H4
H5
H8
U4
Q1
Q2
LED2
C1
VCC
GND
SCL
SDA
XDA
XCL
AD0
INT

8.2. R.G.M.C Gamage - 224057H

Responsibilities

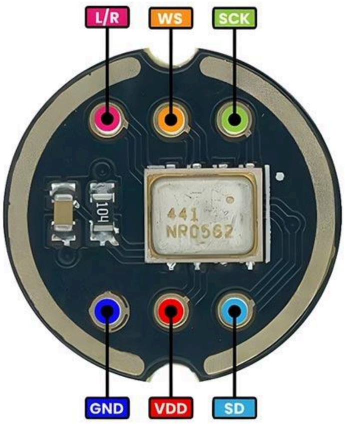
- Uploaded real-time audio files using the INMP441 microphone module to Azure Blob Storage.
- Developed a Python server to convert PCM files to MP3 and appended them into a complete audio file
- Integrated and optimized the microphone code with the full system code for efficient operation.
- Managed tasks to optimize core usage and timing for improved performance.

Schematic Diagram



INMP441 MEMES Microphone

- Digital I²S Interface with High-Precision 24-Bit Data
- High SNR of 61 dBA • High Sensitivity of -26 dBFS
- Flat Frequency Response from 60 Hz to 15 kHz
- Low Current Consumption of 1.4 mA
- High PSR of -75 dBFS
- Small 4.72 × 3.76 × 1 mm Surface-Mount Package
- Compatible with Sn/Pb and Pb-Free Solder Processes
- RoHS/WEEE Compliant



In our project, I worked extensively with the INMP441 MEMS microphone, a high-performance, low-power component with a digital I²S output. This microphone is ideal for applications that require robust audio quality, such as real-time voice transmission and audio processing. My primary responsibility involved managing audio inputs by capturing raw pulse-code modulation (PCM) data and transmitting it to a virtual machine server through a websocket connection in real-time.

Once the audio data was received on the server, I transferred it to Azure Blob Storage for user access. To ensure the efficient transmission of large audio files, I chunked the PCM data, sending it in segments for optimal websocket performance. Each chunk underwent various audio processing techniques, including filtering to remove unwanted frequencies, noise reduction to eliminate background sounds, and high-band and low-band filtering to enhance the clarity of the audio. I also methodically increased decibel levels to normalize and optimize the overall loudness of the audio.

After processing, the audio was converted into the MP3 format for enhanced efficiency in storage and streaming. Once all the audio chunks were processed and saved as MP3 files, I combined the relevant segments to form a complete audio file, which was then uploaded to Azure Blob Storage for seamless access and playback. The integration of real-time audio transmission, efficient cloud storage management, and advanced audio processing techniques ensured that the final output was optimized for both quality and performance

8.3. L.M.S.M. Lokuwella -224120V

Responsibilities:

- Video Data Capturing: Implementing a video capturing mechanism using ESP32 cam module
- Video data sharing and storing: Implementing server codes to send and store video data in a cloud storage, real time.
- Testing cam module and server codes with the full device and debugging

Video Data Capturing:
Developing Real-time Video Capture Using the ESP32 CAM Module

My role involved designing the functionality for real-time video capture using the ESP32 CAM module, integrating the OV2640 camera sensor for optimal performance. I configured the system to meet specific frame rate and resolution requirements. To enhance the video capturing process, I optimized the usage of the PSRAM, allowing the device to temporarily store multiple frames, which improved stability, especially in scenarios where low power was a concern. Furthermore, I implemented Wi-Fi connectivity to facilitate the real-time transmission of video data directly to the server.

Video Data Transfer and Storage:
Implementing Real-time Video Upload to Cloud Storage

I contributed to developing the server-side code, which handled the transmission and storage of video data captured by the ESP32 CAM. I focused on writing scripts that allowed secure and efficient communication between the device and cloud storage solutions like Azure Blob Storage or Google Drive. By optimizing the real-time upload process, I ensured that video data was immediately backed up and stored in the cloud. Additionally, I configured the server to support high-speed data transfers, ensuring the smooth handling of video data without compromising its integrity.

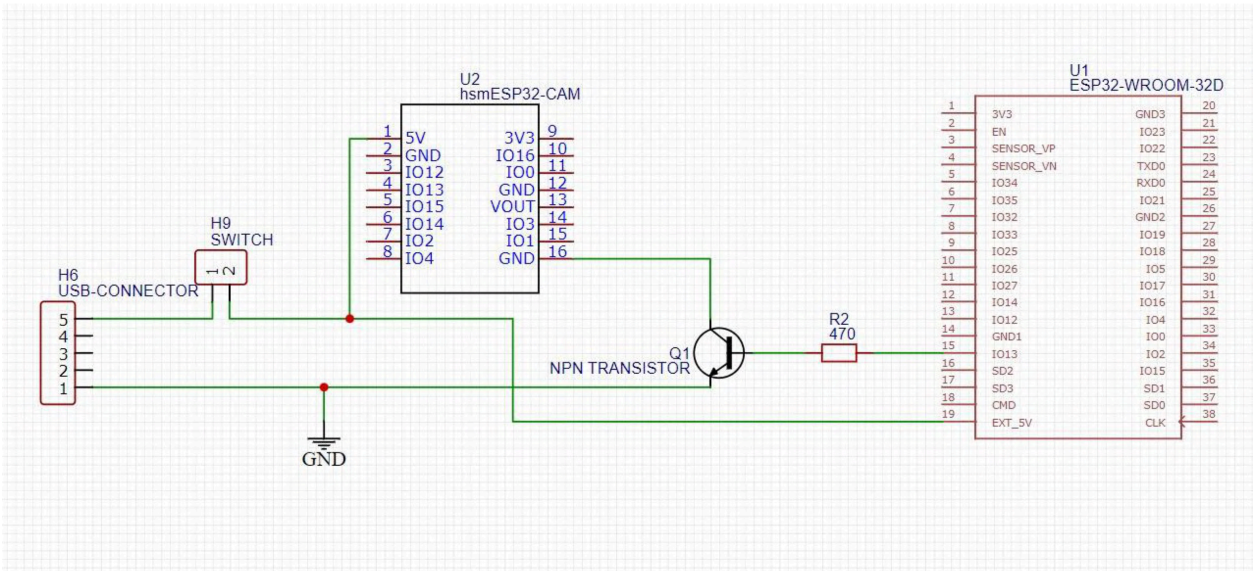
Testing and Debugging:
Ensuring System Reliability

I led the testing and debugging process for the system integration between the ESP32 CAM and the server. This involved conducting tests under varying conditions, such as fluctuating network speeds and large data loads, to evaluate the system's performance. During debugging, I identified and resolved issues like communication delays, packet loss, and memory overflow, ensuring the system could operate reliably in real-world scenarios. I made key adjustments to both the ESP32 firmware and server-side code to improve the system's overall performance and reliability.

ESP32 CAM OV2640 2Megapixel Camera

- **Camera Sensor**: 2MP OV2640, max resolution 1600x1200 (UXGA), outputs JPEG, RGB565,YUV422.
- **ESP32 Chip**: Dual-core 32-bit LX6 microcontroller with Wi-Fi and Bluetooth.
- **Memory**: 520 KB SRAM, supports up to 4MB external PSRAM for larger images/videos.
- **Video & Image**: Captures stills and streams video at 12-15 FPS (VGA) over Wi-Fi.
- **Storage**: MicroSD card slot supports up to 4GB for local image/video storage.
- **Power Supply**: Operates at 5V, with a 3.3V option for lower power use.
- **GPIOs**: Multiple pins for connecting sensors (e.g., motion detectors, LEDs, buttons).
- **Applications**: Ideal for IoT projects like surveillance, remote monitoring, smart doorbells.

Schematic Diagram



8.4. P.G.L.I. Pallewaththa - 224143T

Responsibilities

MPU6050 Gyroscope Module

- Implement gyroscopic sensing for detecting sudden movements.
- Configure gyro ranges and filters for accurate motion detection.

YL44 Buzzer:

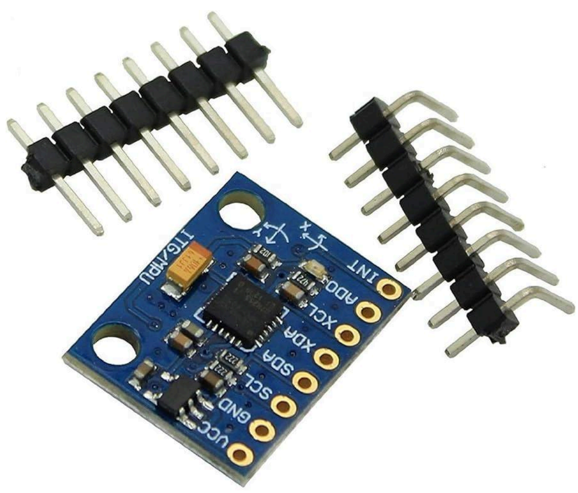
- Control buzzer activation based on emergency mode and the health mode.
- Integrate with LEDC for precise tone and frequency control.

Integration to activate and deactivate the emergency mode:

- Here, I integrated the gyroscope, buzzer, touch sensors, and vibration module according to a specific logic. The gyroscope is continuously active and monitors for sudden movements, which, when detected, trigger the emergency mode, activating both the buzzer and the vibration motor. The system is also designed to enter emergency mode if either of the touch sensors is pressed for more than three seconds. To deactivate the system, the user must touch both touch sensors simultaneously.

MPU-6050 Triple Axis Analog Accelerometer Gyroscope Module

- Model: MPU6050
- Components: Gyroscope, Accelerometer, Digital Motion Processor (DMP)
- Communication Protocol: I2C (Inter-Integrated Circuit)
- Operating Voltage: 2.375V to 3.46V
- Power Consumption:Sleep Mode: 5μA, Active Mode: 3.6mA (gyro+ accelerometer)



My primary responsibility was to integrate and implement the **gyroscope module** in the **"Alert Way Guardian"** device, which detects sudden movements or impacts, crucial for identifying dangerous situations like falls or assaults. The key contributions are summarized below:

1. Module Selection: Researched and selected the MPU-6050 Triple Axis Gyroscope for its reliability and compatibility with the microcontroller.

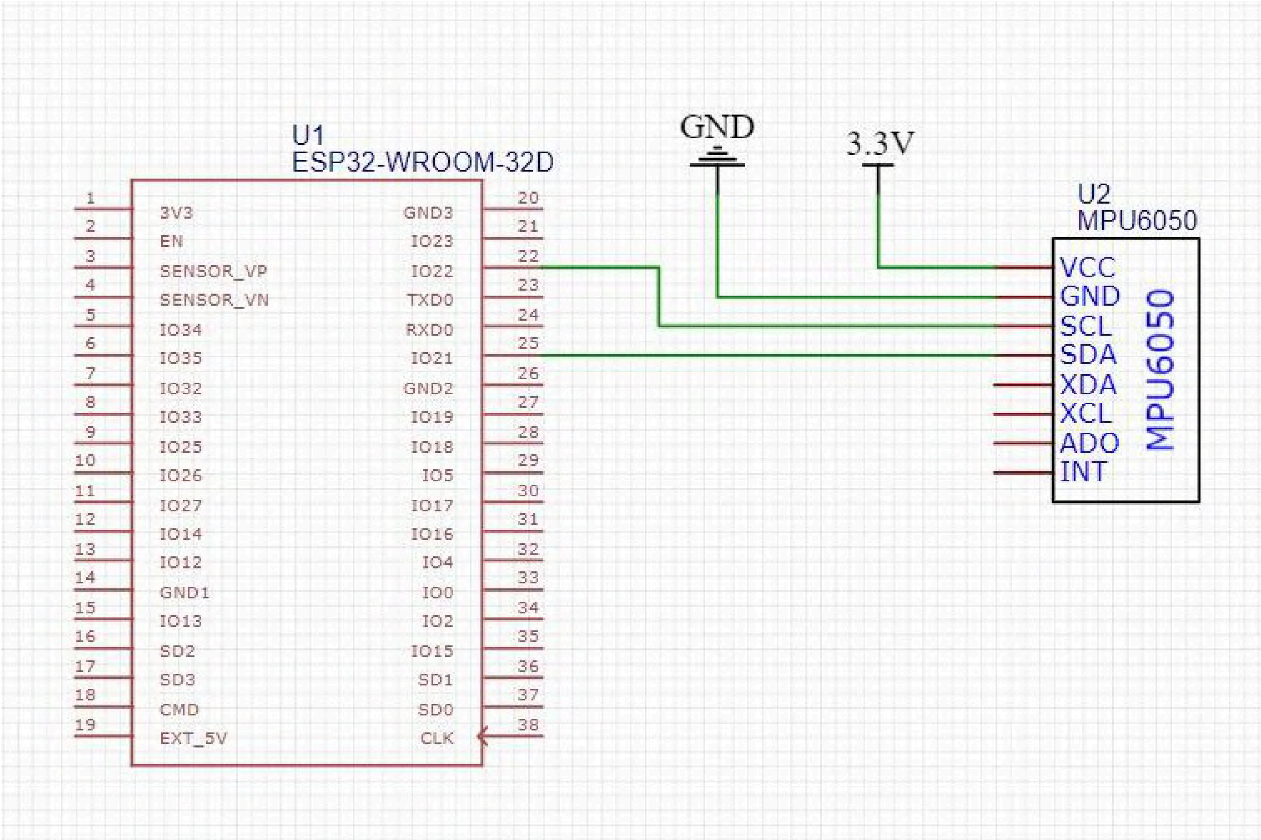
2. Integration: Integrated the gyroscope with the ESP32 microcontroller to accurately detect abnormal movements.

3. Algorithm Development: Developed and fine-tuned an algorithm to differentiate between normal and sudden movements, minimizing false positives.

4. Emergency Alert: Linked the gyroscope to the alert system, ensuring automatic notifications to contacts during emergencies.

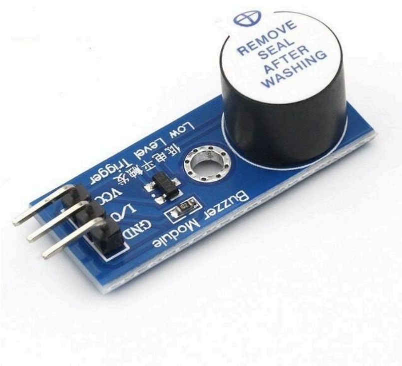
5. Testing & Calibration: Conducted extensive testing and calibration to ensure reliable detection of dangerous movements in real-world scenarios.

Schematic Diagram



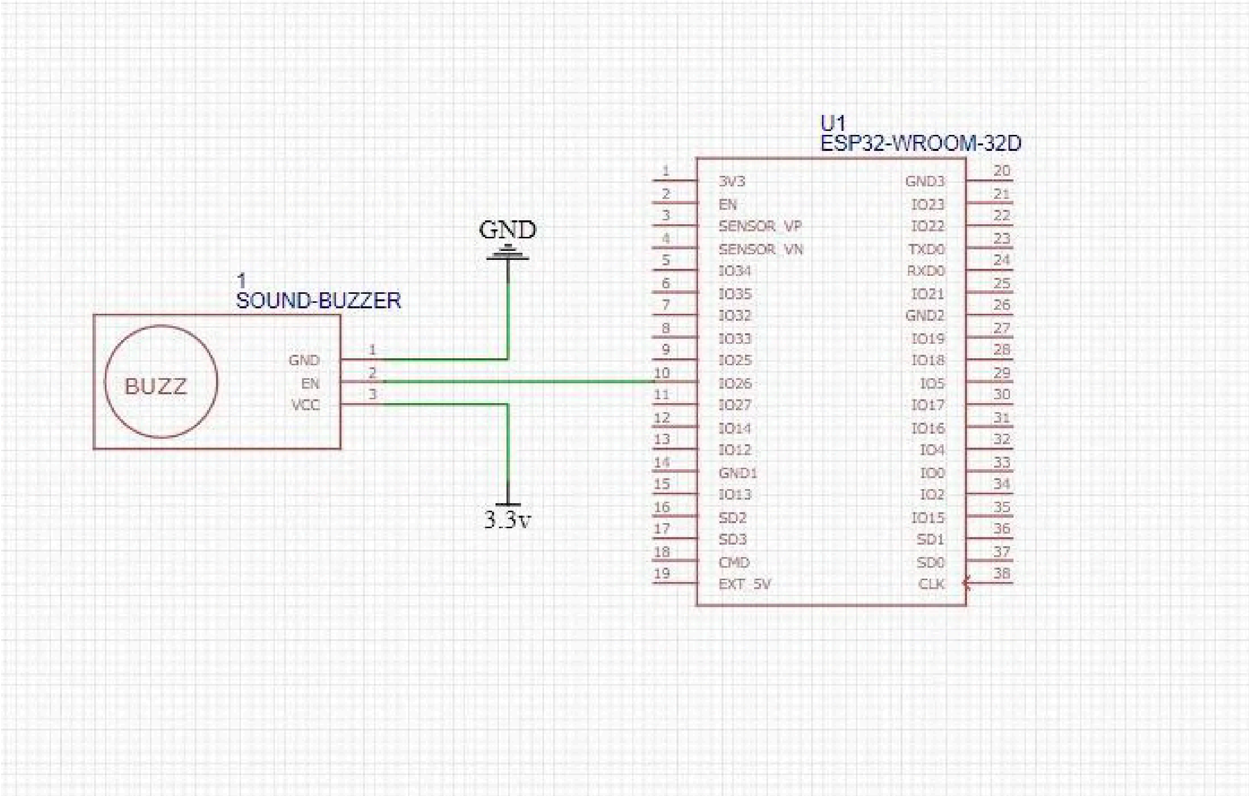
YL 44 -Buzzer Module

- Operating Voltage:Typically operates at 3-5V DC.
- Operating Current:Typically consumes around 15mA to 30mA.
- Sound Output: Produces sound with a frequency around 2300 Hz.
- Sound Pressure Level (SPL): Can vary, but commonly around 85 dB at 10 cm distance.
- Control Interface: Often controlled using PWM signals to vary the sound frequency and intensity.



I was responsible for integrating the **buzzer module** into the **"Alert Way Guardian"**. This module serves as an audible alert system that activates during emergencies. The key contributions included selecting the appropriate buzzer, ensuring its compatibility with the microcontroller, and programming it to emit a loud sound when triggered by the panic button or motion sensors. Additionally, I tested the buzzer to ensure it functions reliably, alerting nearby individuals during a crisis. This feature enhances the device’s ability to attract immediate attention in dangerous situations.

Schematic Diagram



8.5. K.G.K.R. Kariyawasam - 224259E

Responsibilities:

As a part of developing the Alertway Guardian, a safety device for women and children, I was responsible for integrating location tracking and light control functionalities. My contributions centered around utilizing the Neo-M8N GPS module and the GY-30 LIR light sensor module, ensuring that the device could reliably provide location data in emergencies and operate its lighting system efficiently.

GPS and Location Services

My first task involved programming the ESP32 microcontroller to fetch GPS coordinates using the Neo-M8N module. This was crucial for enabling the device to send accurate location data during emergencies. To enhance usability, I implemented functions that created Google Map links from the fetched coordinates, which could then be sent to a pre-designated contact.

Recognizing the potential for delays in acquiring GPS data, I developed a backup system using the Google Geolocation API. This system allowed the device to obtain location coordinates through the ESP32's IP address when the GPS module was unable to acquire proper coordinates within the specified time. I ensured that the code allowed us to define a waiting period before the backup system was triggered, optimizing the balance between speed and accuracy in location reporting.

Device activation could occur through two methods: touch sensors or a gyroscope. The touch sensors were designed for general emergencies, such as theft, while the gyroscope detected sudden accelerations or changes in angle, which we assumed indicated the user had fainted or experienced a health related emergency. Depending on the activation method, the device would send a text message with the generated Google Map link and details about the type of emergency, using the notify.lk API.

Light Control System

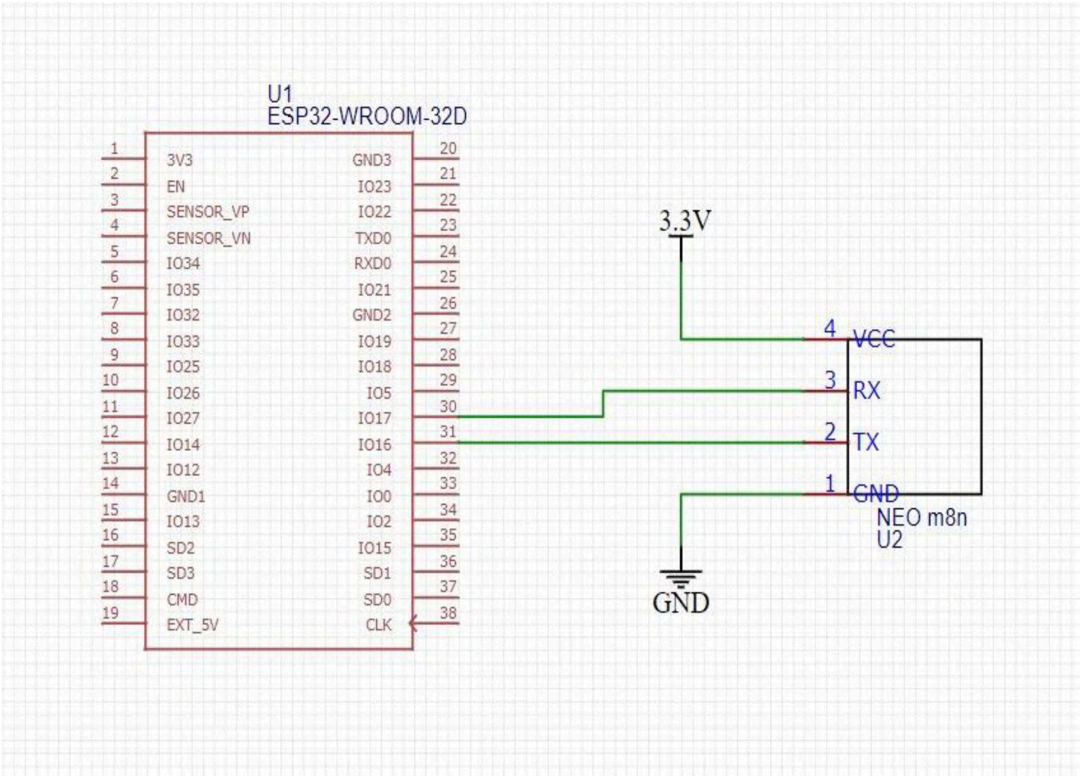
In addition to the GPS functionality, I was responsible for integrating the GY-30 LIR light sensor module into the device. This sensor monitored ambient light levels and activated jumbo LEDs if the light level dropped below a predefined lux threshold. I programmed the ESP32 to send a high signal when lighting was necessary, triggering a 2N2222A transistor to complete the circuit and power the LEDs.

Integration and Power Management

I also took charge of integrating both the GPS and light sensor modules into the main program. This involved coding the logic for the activateEmergency and deactivateEmergency functions, ensuring that each module responded appropriately to the device’s activation. To enhance power efficiency, I introduced a transistor system that only powered the OV2640 camera module when the device was actively in use, helping to conserve battery life.

Overall, my contributions were focused on ensuring the device’s ability to provide timely and accurate location data, as well as effective lighting, while maintaining power efficiency.

Neo M8N GPS Module (Model: GY-GPS6MV2)

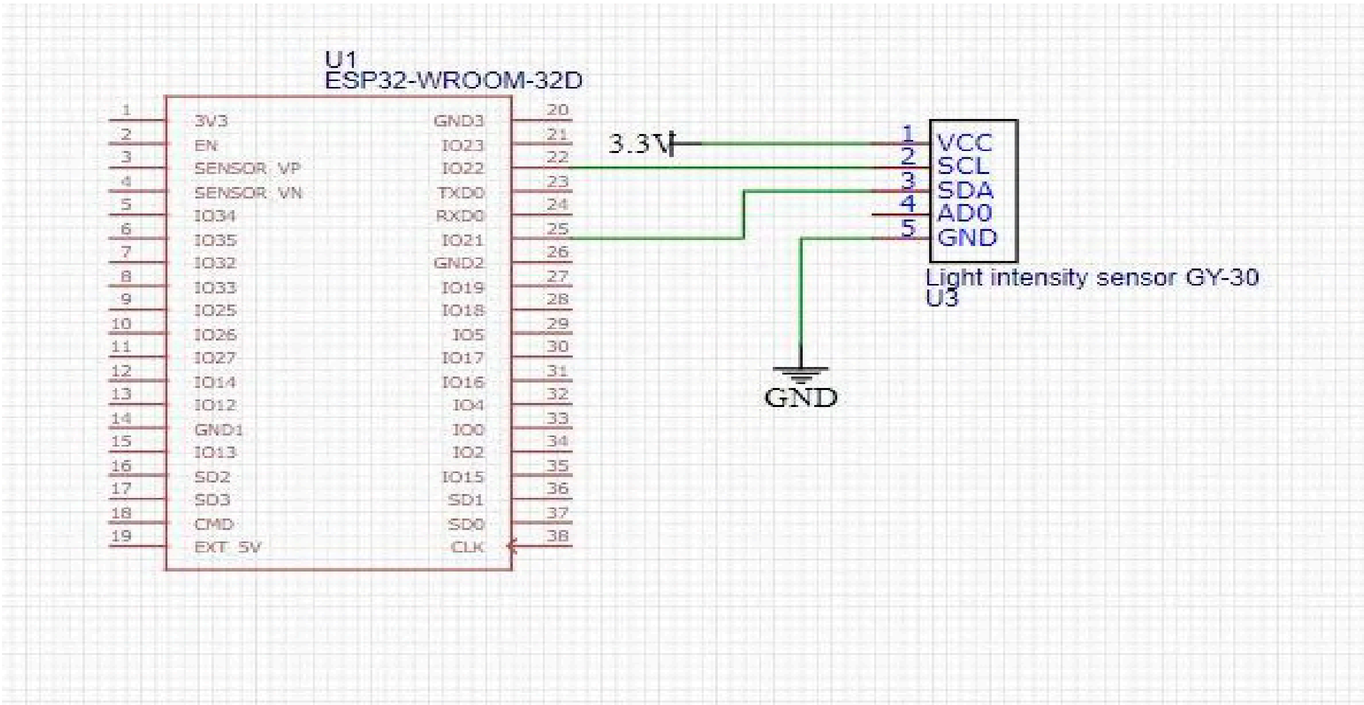


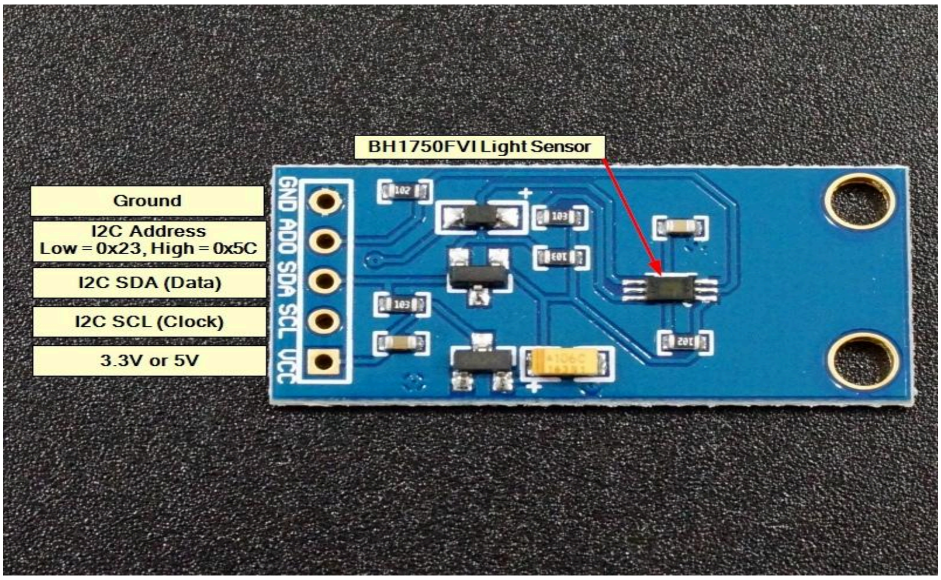
The Neo M8N is a high-performance GPS module developed by u-blox to get precise positioning.

- Concurrent reception of up to 3 GNSS (GPS, Galileo, GLONASS, BeiDou)
- Position accuracy of 2.5m Probable Circular Error
- Cold starts in less than 26 seconds
- Operating voltage range of 2.7V to 3.6V
- Approximately 25-30 mA at 3.0V Active mode
- Low power consumption
- UART1 Interface

GY-30 BH1750 Light Sensor Module

Schematic Diagram





The GY-30 is a module based on the BH1750 digital light sensor. It provides precise measurements of ambient light levels.

- 16-bit built-in Analog to Digital converter
- Wide range and high resolution (1 - 65535 lux)
- Low temperature dependency
- I2C interface for easy integration with microcontrollers
- Current consumption typically around 7mA when active
- Low power consumption (typically 120µA) in low-power mode
- Supply voltage range: 3.3V to 5V
- High accuracy: ±20% in various light conditions

9. References

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2. https://www.youtube.com/watch?v=qq2FRv0lCPw
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10. https://learn.microsoft.com/en-us/azure/storage/blobs/