AMRITA VISHWA VIDYAPEETHAM

SMART HELMET WITH SAFETY FEATURES

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INTRODUCTION

Imagine cruising down the highway with complete peace of mind, where your helmet isn't just protective gear but an intelligent guardian watching over you. Every year, thousands of lives are lost on our roads—not because safety technology doesn't exist, but because it hasn't been integrated effectively. Today, we present our Smart Helmet with Safety Features, a revolutionary system that transforms conventional motorcycle safety by ensuring helmet compliance, preventing drunk driving, and providing immediate emergency response when accidents occur. Our solution doesn't just protect riders—it actively creates a new standard for road safety where every journey ends as safely as it began.

RECAP OF PROJECT OBJECTIVES

- Ensuring mandatory helmet usage before vehicle ignition.
- Detecting alcohol levels and preventing drunk driving.
- Real-time accident detection and emergency alerts.
- GPS-based location tracking for rapid assistance.
- Enhancing road safety through smart technology.

PROBLEM STATEMENTS

The need for Smart Helmet

Road accidents claim thousands of lives every year, with many fatalities resulting from the absence of proper safety measures. Despite regulations, helmet non-compliance, reckless driving, and delayed medical assistance continue to be major concerns.

Critical Challenges:

- Neglect of Helmet Safety – Many riders choose convenience over safety, increasing their risk of fatal injuries.
- Driving Under the Influence – Alcohol-related accidents remain a significant cause of road fatalities.
- Slow Emergency Response – The delay in receiving medical attention often worsens accident outcomes.

A Smart Helmet offers a proactive solution by ensuring riders wear helmets, detecting intoxication, and enabling immediate emergency alerts, ultimately saving lives.

OVERVIEW OF THE SMART HELMET SYSTEM

- **Helmet Unit** (Worn by the rider)
- **Bike Unit** (Mounted on the motorcycle or a simulated gear motor)

These units communicate wirelessly using an RF Transmitter & Receiver. The helmet unit monitors safety conditions and controls the bike ignition through the bike unit.

BLOCK DIAGRAM

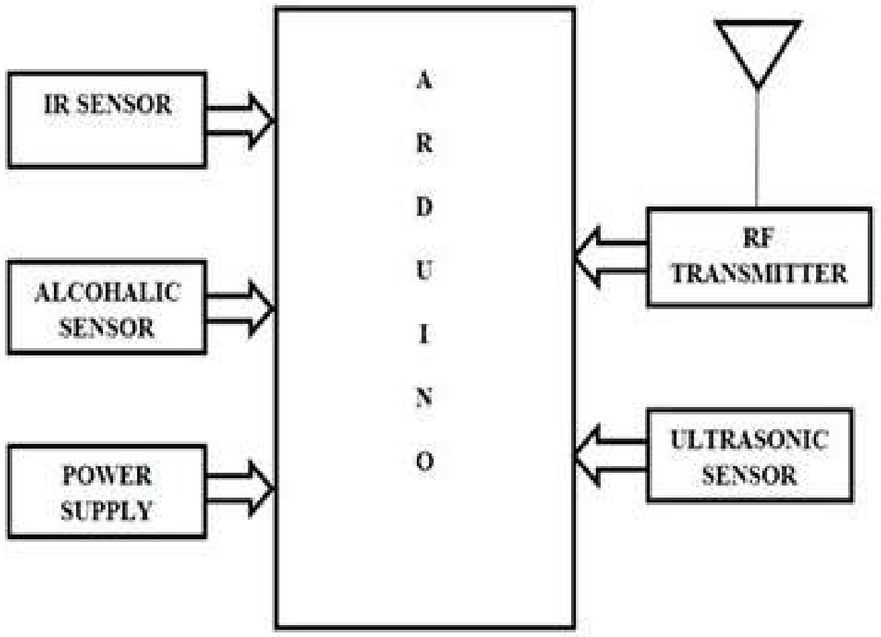


Fig.9 Transmitting part (Helmet Unit)

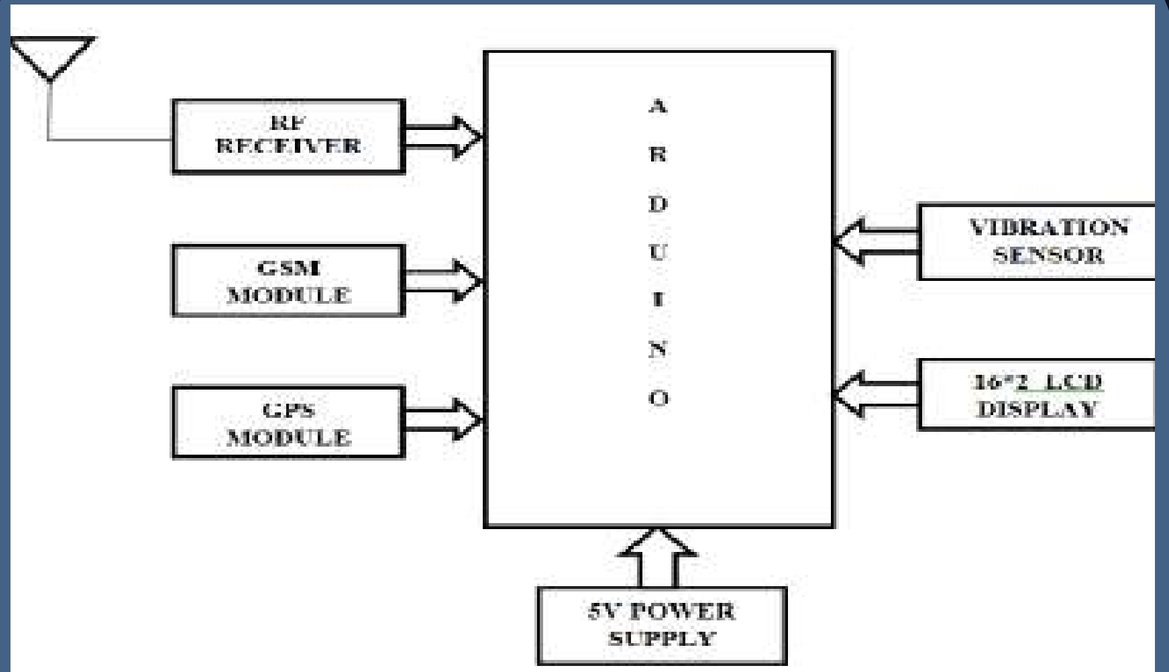
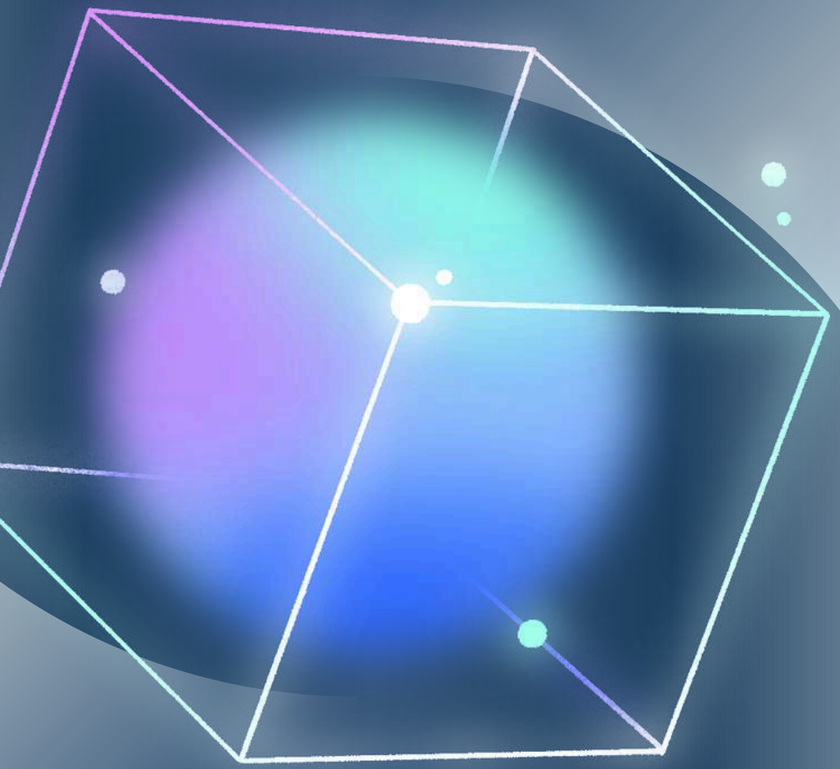


Fig.10 Receiving Part (Bike Unit)



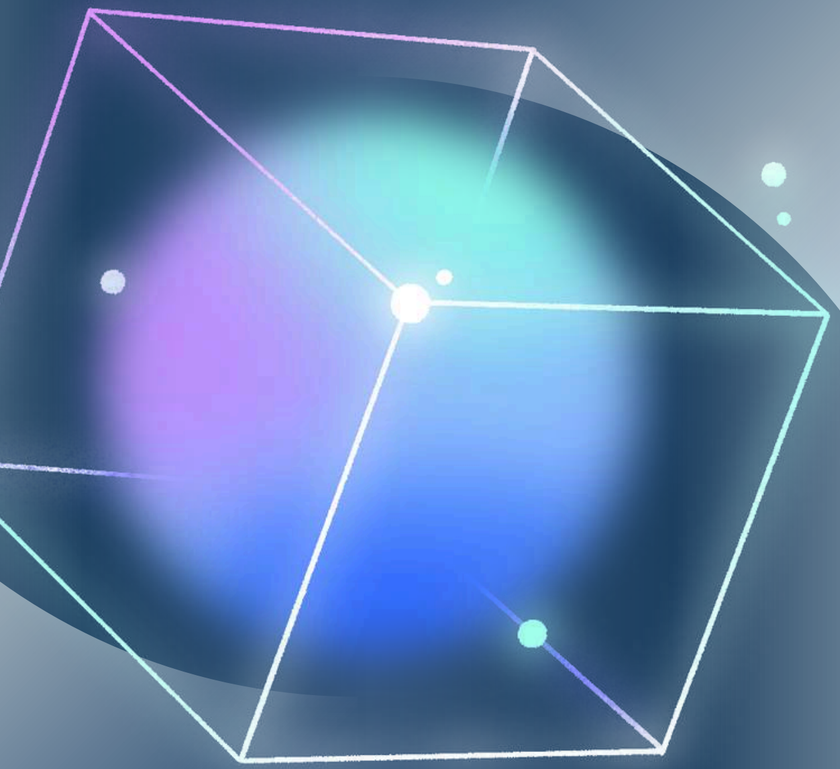
HELMET UNIT (TRANSMITTER COMPONENTS)

The Helmet Unit is an essential wearable technology designed to enhance rider safety. Worn directly by the rider, it is equipped with advanced sensors that continuously monitor key aspects such as:

- Helmet Usage: Tracks if the helmet is worn properly or if it’s been removed during a ride.
- Alcohol Levels: Measures the rider’s alcohol concentration, ensuring they meet legal safety standards before riding.
- Accident Detection: Uses impact sensors to detect collisions or sudden movements, triggering emergency alerts.
- Obstacle and Object detection: Detects other closeby objects or person driving dangerously close.

COMPONENTS AND CONNECTIONS-HELMET UNIT

COMPONENTS	PURPOSE	ARDUINO PIN	CONNECTED TO
IR Sensor (Helmet Detection)	Checks if the helmet is worn	D2	VCC → 5V, GND → GND, OUT → D2
MQ-3 Alcohol Sensor	Detects the alcohol in rider's breath	A0	VCC → 5V, GND → GND, A0 → A0
SW-420 Vibration Sensor	Detects Crash Impact	D3	VCC → 5V, GND → GND, OUT → D3
HC-SR04 Ultrasonic Sensor	Detects nearby objects and vehicle	Trig: D4 Echo: D5	VCC → 5V, GND → GND, Trig → D4, Echo → D5
Buzzer	Alerts for crash and obstacle detection	D7	VCC → 5V, GND → GND, Signal → D7
RF Transmitter (433 Mhz)	Sends helmet safety data to bike's unit	D11	VCC → 5V, GND → GND, DATA → D6



BIKE UNIT (RECIEVER COMPONENTS)

The Motorcycle Unit is a crucial component installed directly on the motorcycle to interact with the rider's Helmet Unit. It serves several vital functions:

- Data Reception: Receives real-time data from the Helmet Unit, including helmet usage, alcohol levels, and accident detection alerts.
- Ignition Control: Monitors helmet usage and alcohol detection to control vehicle ignition, preventing the motorcycle from starting if safety conditions are not met.
- Emergency Response Integration: In case of an accident, the Motorcycle Unit integrates GPS and GSM technologies to trigger emergency response protocols, including location sharing with authorities for prompt assistance.

This system ensures a seamless link between rider safety and the motorcycle's functionality, enhancing overall safety and enabling rapid emergency response if needed.

COMPONENTS AND CONNECTIONS-BIKE UNIT

Component	Arduino Pin	Power Source	Extra Components	Description
RF Receiver (DATA)	D12	5V (breadboard)	–	Receives sensor data from helmet
Relay Module (IN)	D8	5V (breadboard)	–	Turns on/off DC motor (bike)
GSM Module (TX, RX)	TX → D3, RX → D2	Li-ion Battery (3.7V) via Charger	1000µF Capacitor (across VCC & GND)	Sends SMS during crash
GPS Module (TX)	TX → D4	5V (breadboard)	100µF Capacitor	Gets latitude and longitude
Power Rails	5V & GND	Arduino + Battery Charger	Shared GND between all modules	Voltage distribution through breadboard

POWER ARCHITECTURE

- **Helmet Unit:**

Powered entirely through Arduino (USB)

- **Bike Unit:**

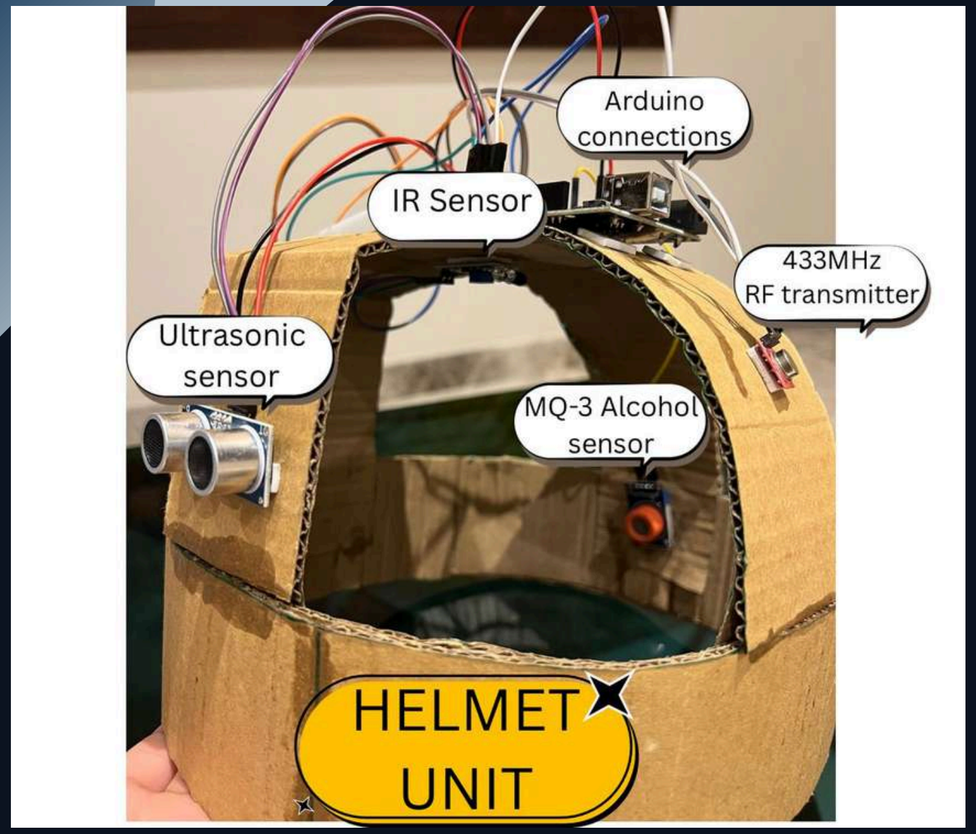
Arduino → Powered by USB
Relay & RF Receiver → 5V from Arduino
GSM Module → 3.7V Li-ion battery via battery charger module

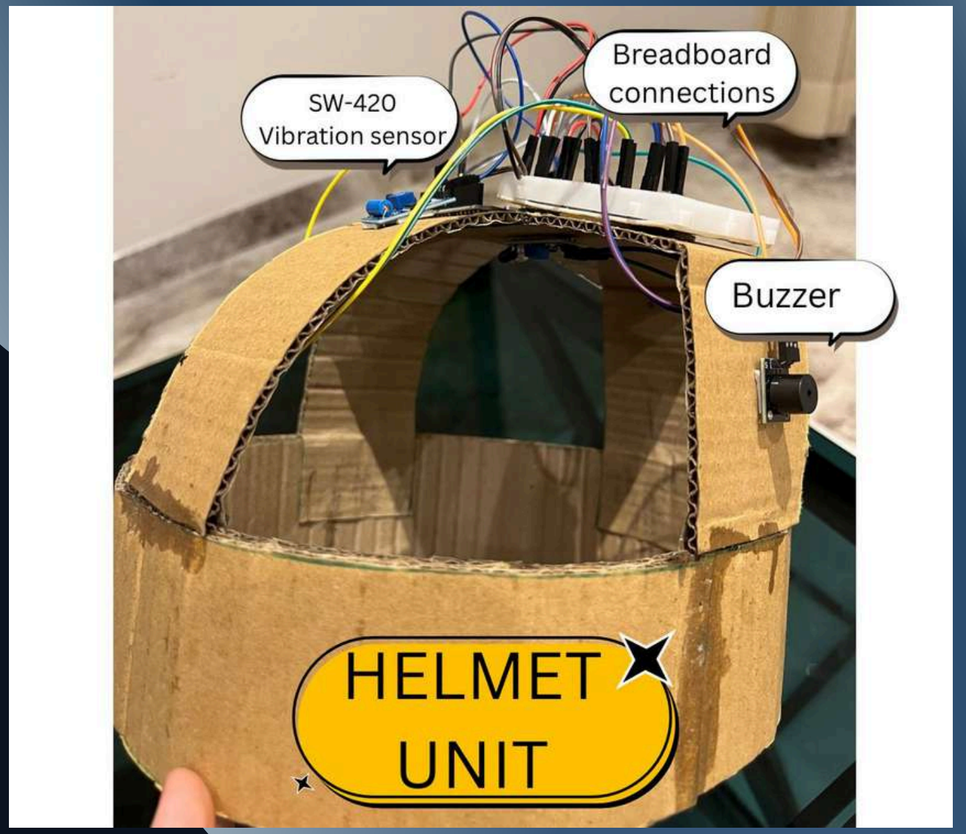
- **Capacitor Support:**

1000µF across GSM VCC & GND (for surge stability)
100µF across GPS VCC & GND

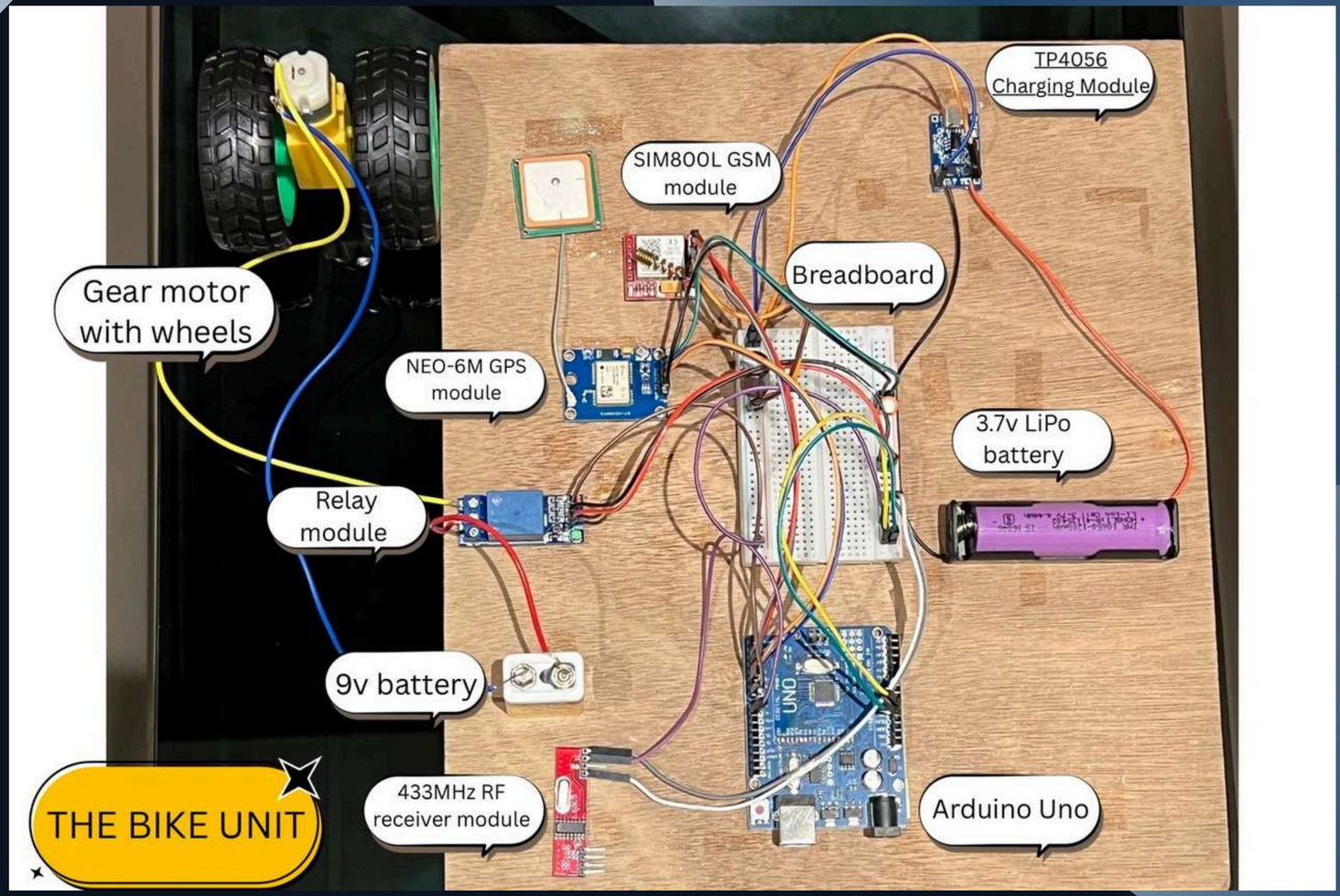
All GND lines are shared between breadboard, Arduino, GSM, and GPS to ensure proper referencing.

HARDWARE IMPLEMENTATION

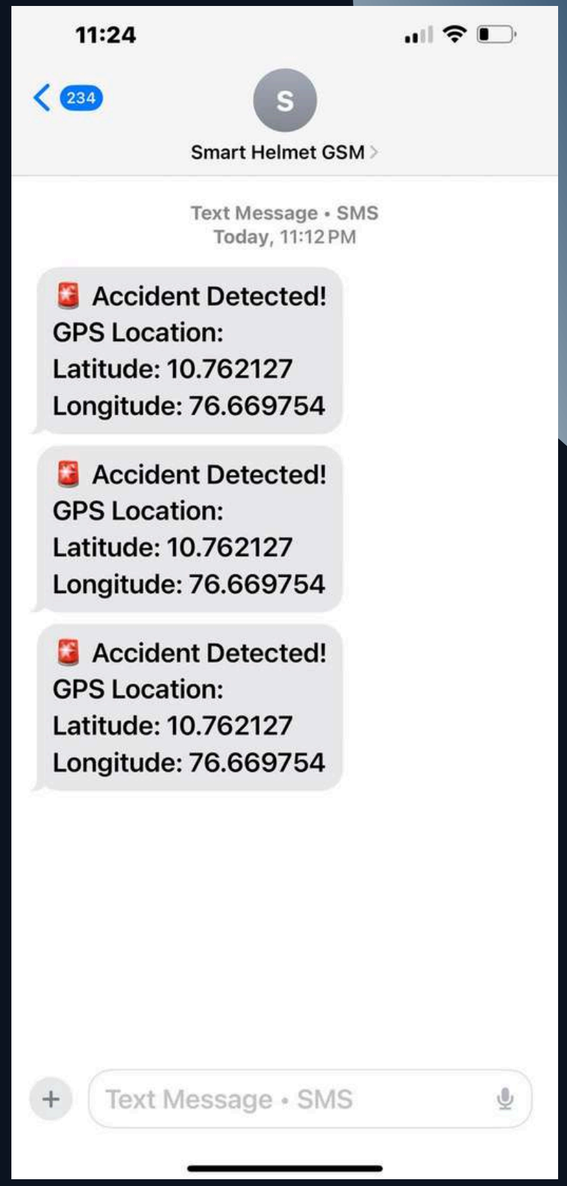




HARDWARE IMPLEMENTATION



SMS EXAMPLE TESTING



SAFETY FEATURES WORKFLOW

1. Helmet Wearing Enforcement

- An IR sensor inside the helmet detects if the rider is wearing it, Otherwise the bike will not start.
- If the helmet is removed while riding, an alert system (buzzer/vibration) warns the rider.
- Helps enforce continuous helmet usage and prevents risky riding behaviour.

2. Alcohol Detection System

- The MQ-3 alcohol sensor measures the rider's breath alcohol level
- If the system detects alcohol, the ignition is stopped.
- Helps prevent drunk driving and potential accidents due to intoxication.

3. Accident Detection Protocol

- A vibration sensor detects sudden impacts or crashes.
- If the impact exceeds a predefined threshold, the system assumes an accident has occurred.
- Once an accident is detected, the system automatically triggers an emergency alert via the GSM module.
- An SOS message is sent to emergency contacts and local medical services.
- The GPS module provides the precise accident location in real time.
- Helps emergency responders reach the accident site quickly, improving the chances of saving lives.

FUTURE SCOPE

- Web Integration: Connect helmet system with UID website for real-time monitoring of alcohol levels, crash incidents, and emergency alerts
- User Customization: Enable users to input emergency contact numbers directly through the website interface
- Mobile App Development: Create companion app for riders with user dashboard and alert settings
- Advanced Sensors: Add fatigue detection, drug detection and vital signs monitoring for comprehensive rider safety
- Environmental Monitoring: Include air quality sensors to alert riders of hazardous conditions

CONCLUSION

This project demonstrates a significant step forward in enhancing road safety through innovative technology. By integrating smart helmet features such as mandatory helmet detection, alcohol sensing, and real-time accident alerts, the system not only ensures rider protection but also promotes responsible driving behavior. The innovation lies in its seamless integration of sensor data, wireless communication, and automated emergency response, making it a scalable solution for broader applications in traffic safety management. With its potential to reduce road accidents and improve emergency response times, the smart helmet project promises considerable societal benefits and lays the groundwork for future advancements in intelligent transportation systems.

THANK YOU!