AMRITA VISHWA VIDYAPEETHAM

SMART HELMET WITH SAFETY FEATURES

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INTRODUCTION

Since our first review, we have made significant progress in developing the Smart Helmet with Advanced Safety Features. Key advancements include hardware integration, software implementation, and initial testing. This review covers our progress, challenges faced, solutions implemented, and the next steps toward optimizing our system for real-world use. Our goal remains—to enhance rider safety through smart technology.

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 STATEMENT

The Need for a 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

This system consists of two main units:

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

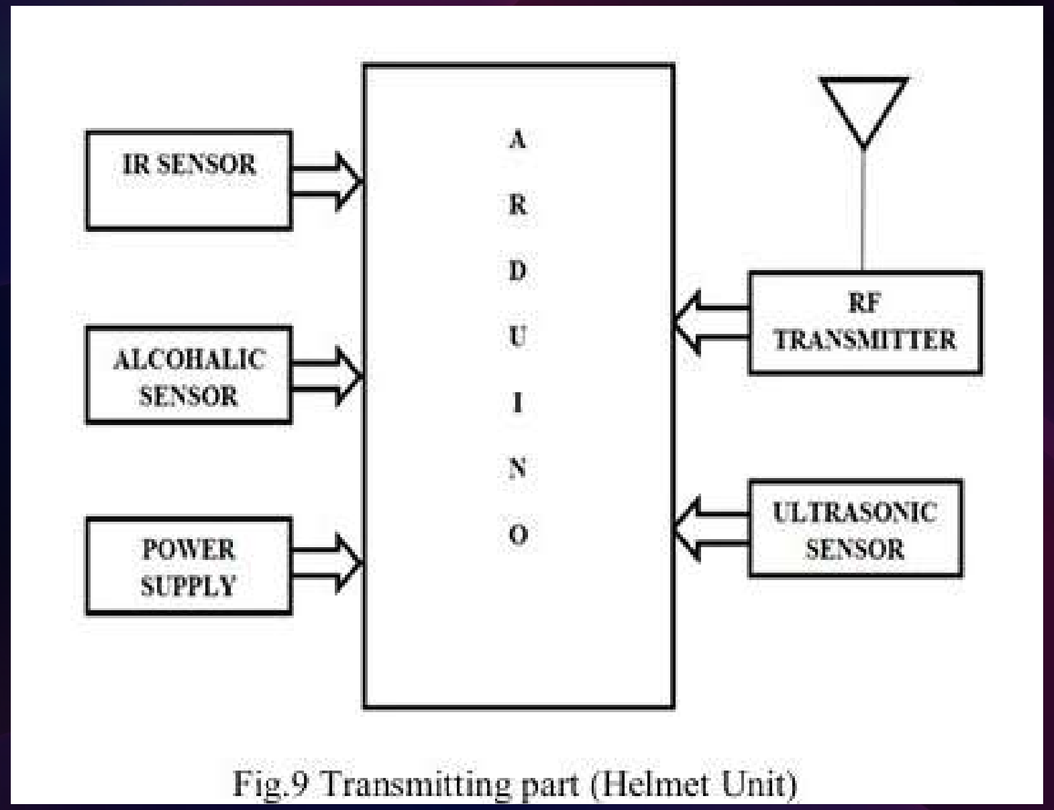


Fig.9 Transmitting part (Helmet Unit)

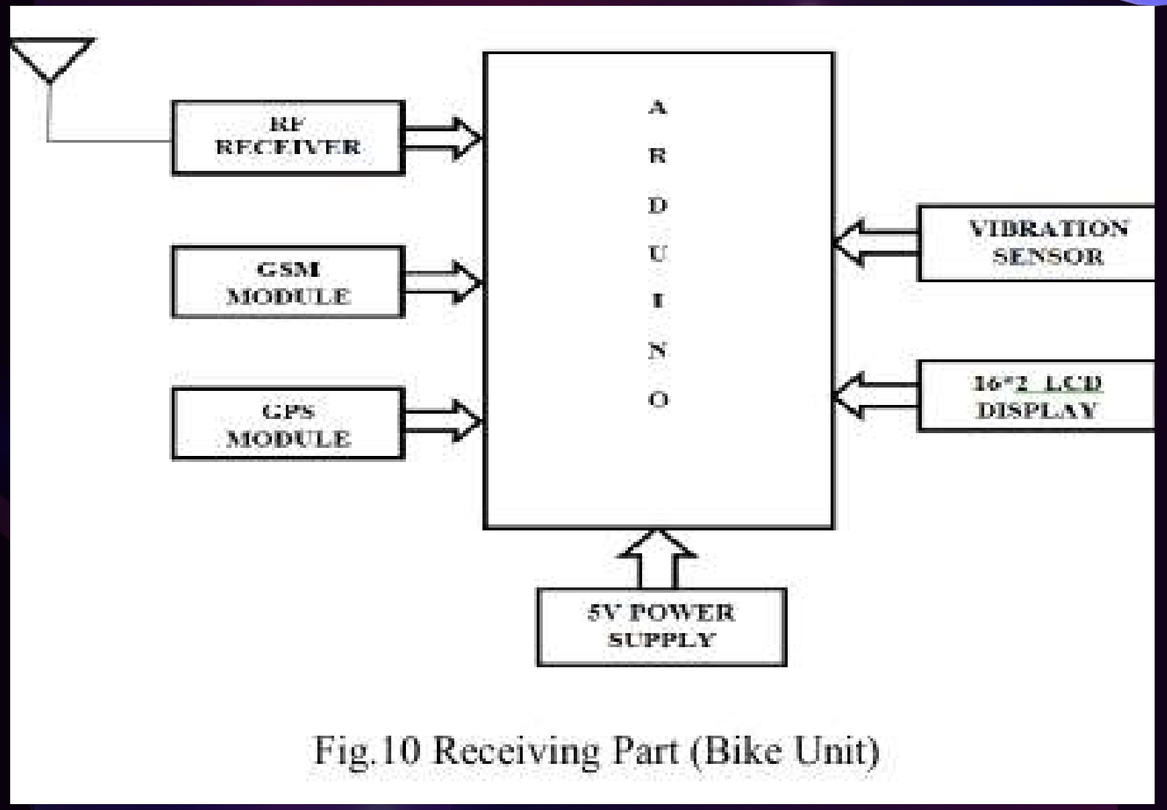
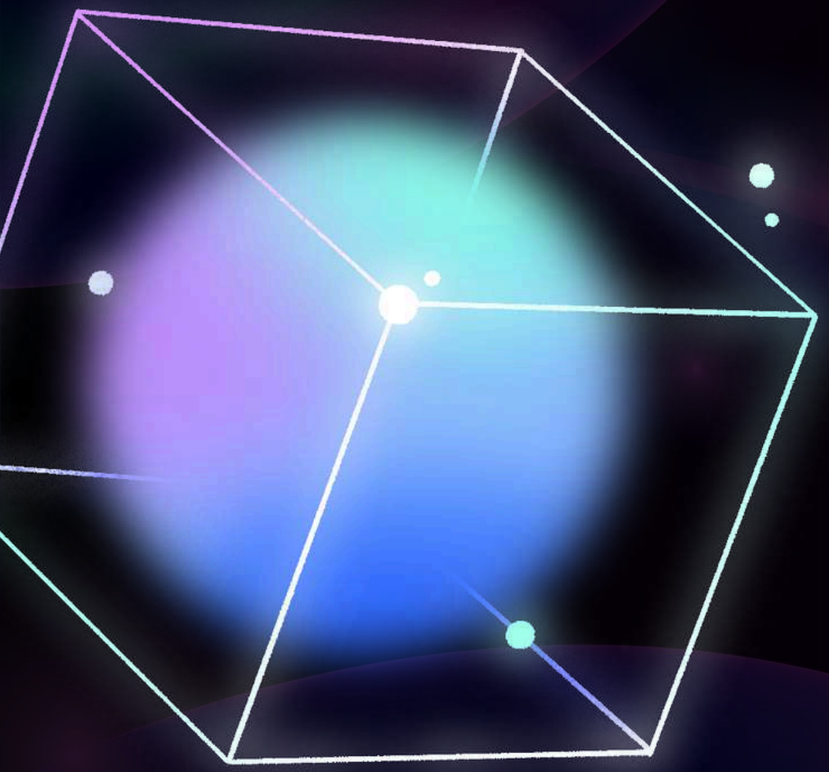


Fig.10 Receiving Part (Bike Unit)



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.

COMPONENTS & THEIR 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	D6	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:

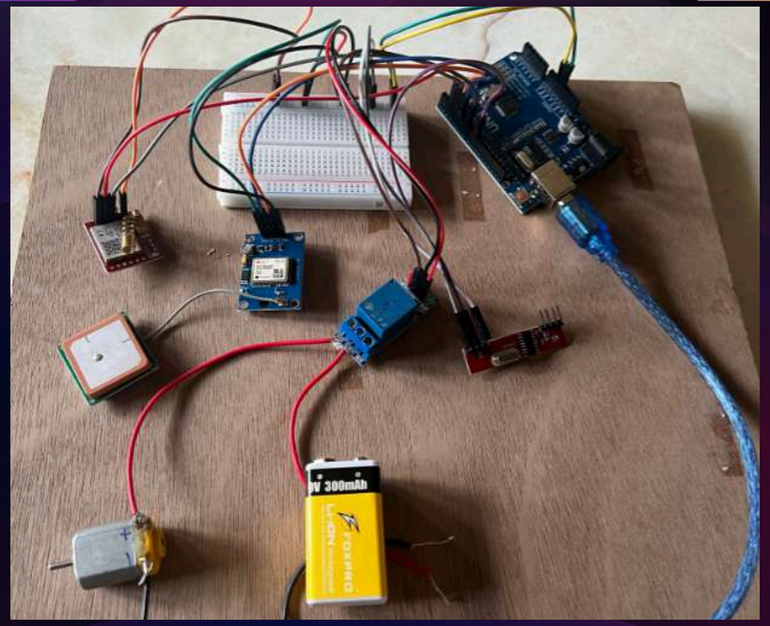
- Data Reception: Receives real-time data from the Helmet Unit, including helmet usage, alcohol levels, and accident detection alerts.
- Ignition Control: Monitors helmet usage and alcohol detection to control vehicle ignition, preventing the motorcycle from starting if safety conditions are not met.
- 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.

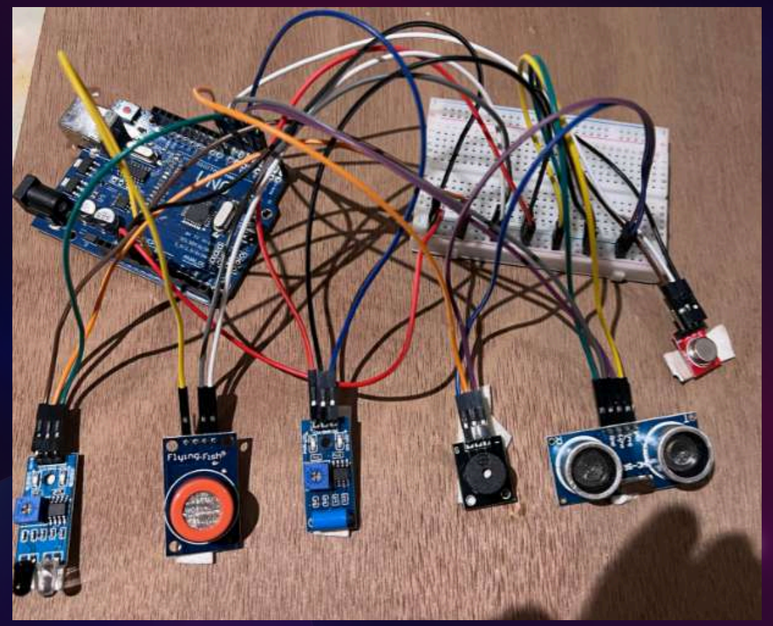
COMPONENTS & THEIR CONNECTIONS - BIKE UNIT

Component	Purpose	Arduino Pin	Connected To
RF Receiver (433 MHz)	Receives data from helmet unit	D9	VCC → 5V, GND → GND, DATA → D9
Relay Module	Controls DC motor (bike ignition)	D7	VCC → 5V, GND → GND, IN → D7
DC Motor (Bike Engine Simulation)	Turns ON/OFF based on safety conditions	Connected to Relay Module	NO → DC Motor +, COM → 12V Battery +, DC Motor - → Battery -
GSM Module (SIM800L)	Sends emergency SMS alerts	D2 (RX), D3 (TX)	VCC → 5V, GND → GND, TX → D2, RX → D3
GPS Module (NEO-6M)	Provides real-time location tracking	D4 (RX), D5 (TX)	VCC → 5V, GND → GND, TX → D4, RX → D5

HARDWARE IMPLEMENTATION



BIKE UNIT



HELMET UNIT

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.

IMPLEMENTATIONS SO FAR

- Helmet Unit and Bike Unit are successfully connected via RF Communication.
- All sensors in the helmet unit are tested and working individually.
- Buzzer is correctly responding to crash and obstacle detection.
- RF transmitter is sending data from the helmet unit to the bike unit.
- Bike unit successfully processes RF signals to control the DC motor.
- DC motor is wired with a relay and ready for bike simulation.

NEXT STEPS & COMMITMENTS

- Affix all components securely inside the helmet for a final prototype.
- Cover the DC motor with a toy for demonstration as a bike unit.
- Ensure stable power distribution for all components.
- Test full system integration with GPS and GSM modules for emergency alerts.

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!