MISRIMAL NAVAJEE MUNOTH JAIN ENGINEERING COLLEGE

DEPARTMENT OF

ELECTRONICS AND COMMUNICATION ENGINEERING

MINI PROJECT REPORT ON

SMART HELMET

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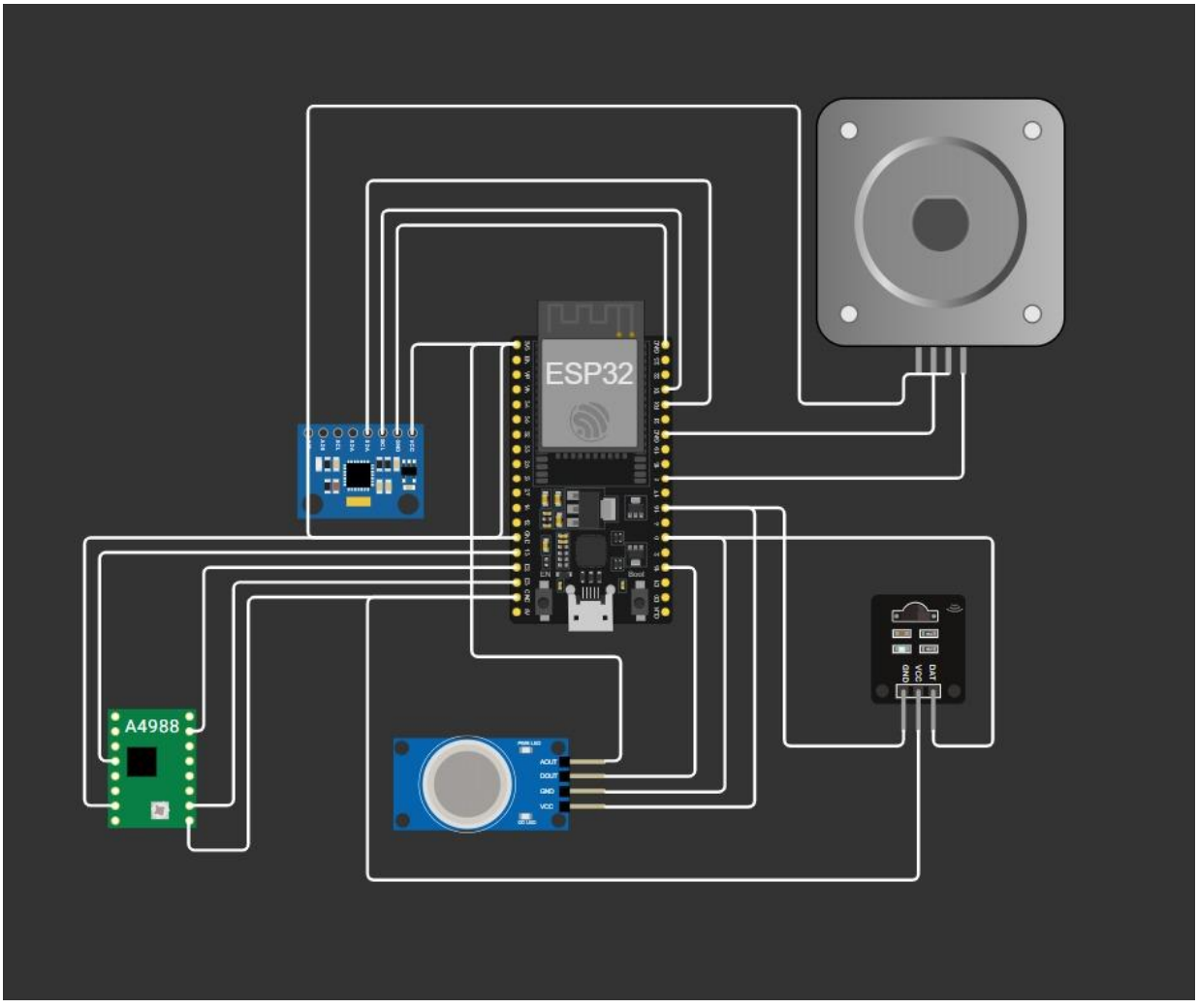
➢ OBJECTIVE

The main objective of this project is to develop a Smart Helmet that enhances rider safety by ensuring the helmet is worn before riding and detecting accidents in real time. This is achieved using an IR sensor, MPU6050 accelerometer, ESP32, and Blynk IoT to monitor helmet status, detect accidents, and send instant notifications.

Specific Objectives:

1. **Helmet Detection: Ensure the rider wears the helmet before starting the bike.**
2. **Accident Detection: Detect sudden impacts or falls and trigger emergency notifications.**
3. **IoT-based Alerts: Send notifications to emergency contacts through the Blynk IoT platform.**
4. **Speed Control Mechanism: Reduce motor speed if the helmet is not worn.**
5. **Real-time Monitoring: Provide real-time data logging and notifications for improved safety.**

➢ CIRCUIT DIAGRAM – EXPLANATION



The Smart Helmet system integrates multiple sensors and components to ensure safety and IoT-based monitoring. Below is a breakdown of the circuit connections and working principle.

❖ **Circuit Diagram Components**

Component	Function
ESP32	Main microcontroller, processes sensor data and connects to IoT (Blynk).
IR Sensor	Detects whether the helmet is worn.
MPU6050 (Accelerometer + Gyroscope)	Detects accident by measuring impact and tilt.
MQ-3 Alcohol Sensor	Detects alcohol level in the rider's breath.
L298N Motor Driver	Controls the DC motor speed based on helmet and alcohol detection.
DC Motor	Simulates the vehicle's engine control.
Li-ion Battery (3.7V - 12V)	Powers the circuit.
Blynk IoT (Cloud Platform)	Sends push notifications when alcohol is detected or an accident occurs.

❖ **Circuit Diagram Overview**

Connections are explained in detail below for each component.

1. **ESP32 (Main Controller)**
    - **Power Supply: The ESP32 is powered by a 3.3V or 5V supply from the Li-ion battery.**
    - **I/O Pins:**
        - **Connected to IR sensor to detect helmet status.**
        - **Connected to MPU6050 via I2C (SDA, SCL).**
        - **Connected to L298N Motor Driver for speed control.**
        - **Connected to Blynk IoT via WiFi.**

2. **IR Sensor (Helmet Detection)**

The IR sensor ensures that the helmet is worn before starting the bike.

Connections:

IR Sensor Pin	ESP32 Pin	Function
VCC	3.3V / 5V	Power Supply
GND	GND	Ground
OUT	GPIO 21	Detects helmet status (HIGH = Helmet Worn, LOW = Not Worn)

3. **MPU6050 (Accident Detection)**

The MPU6050 Accelerometer & Gyroscope detects sudden impacts and abnormal tilt angles.

Connections:

MPU6050 Pin	ESP32 Pin	Function
VCC	3.3V	Power Supply
GND	GND	Ground
SDA	GPIO 22 (SDA)	I2C Communication
SCL	GPIO 23 (SCL)	I2C Communication

4. **L298N Motor Driver (Motor Speed Control)**

The L298N module controls the DC motor speed based on the IR sensor input.

Connections:

L298N Pin	ESP32 Pin	Function
VCC	Li-ion Battery (12V)	Power Supply
GND	GND	Common Ground
IN1	GPIO 5	Motor Direction Control
IN2	GPIO 18	Motor Direction Control
ENA	GPIO 4 (PWM)	Speed Control (0-255 PWM)

5. **MQ-3 Sensor Connection with ESP32**

MQ-3 Pin	ESP32 Pin	Function
VCC	3.3V / 5V	Power Supply
GND	GND	Ground
A0 (Analog Output)	GPIO 34 (ADC1)	Reads alcohol level

6. **IoT Connectivity (Blynk IoT)**

The ESP32 sends accident alerts to the Blynk App.

Setup in Blynk:

1. **Create a Blynk Project.**
2. **Add Notifications Widget to receive alerts.**
3. **Get Blynk Authentication Token.**
4. **Upload ESP32 Code with Blynk Configurations.**

➢ WORKING PRINCIPLE

1. **Helmet Detection: The IR sensor detects whether the helmet is worn.**
    - **If IR HIGH, the motor runs at full speed.**
    - **If IR LOW, the motor speed is reduced.**
2. **Accident Detection: The MPU6050 accelerometer continuously monitors the tilt and acceleration.**
    - **If a sudden impact or abnormal tilt (e.g., more than 60°) is detected, an accident is assumed.**
    - **The ESP32 then sends an emergency notification via Blynk IoT.**
3. **Motor Speed Control: The L298N motor driver regulates the DC motor speed based on the IR sensor's input.**
4. **Alcohol Detection (MQ-3 Sensor)**
    - **MQ-3 reads alcohol level from the rider's breath.**
    - **If alcohol level is HIGH, the system stops the motor and sends an IoT alert.**
5. **Notification via Blynk IoT: The ESP32 pushes real-time notifications to the Blynk mobile app, alerting emergency contacts when an accident occurs.**

➢ ABSTRACT

Two-wheeler accidents are a leading cause of serious injuries and fatalities. Many accidents are worsened by the rider's failure to wear a helmet or the lack of immediate medical assistance.

This Smart Helmet is designed to solve these problems by integrating IoT-based safety mechanisms:

- **Helmet Detection: The system ensures the helmet is worn using an IR sensor. If the helmet is not detected, the motor speed is limited.**
- **Accident Detection: The MPU6050 accelerometer monitors acceleration and tilt. If an impact or abnormal tilt is detected, an accident is assumed.**
- **IoT-based Notification: The ESP32 microcontroller sends alerts via Blynk IoT to emergency contacts in case of an accident.**
- **Motor Speed Control: The motor driver (L298N) adjusts speed based on the helmet status.**

The system is cost-effective, low power, and highly efficient in reducing road fatalities and ensuring quick emergency response.

➢ APPLICATIONS

The Smart Helmet system can be used in various applications:

1. Road Safety & Traffic Regulation

- **Ensures that riders wear helmets before starting their bikes.**
- **Helps authorities enforce helmet usage without manual intervention.**

2. Accident Prevention & Detection

- **Detects accidents instantly using MPU6050.**
- **Sends notifications to emergency contacts, reducing emergency response time.**

3. IoT-based Smart Monitoring

- **Logs accident data for analysis and research.**
- **Can be extended to include GPS tracking for location-based assistance.**

4. Industry & Commercial Use

- **Useful for delivery personnel, construction workers, and motorcycle taxis for enforcing helmet safety.**
- **Adaptable for military and security applications.**

➢ ADVANTAGES

1. Safety Enhancements

- **Helmet Enforcement: Prevents riding without a helmet.**
- **Real-time Notifications: Sends alerts via IoT.**
- **Accident Detection: Reduces emergency response time.**

2. Cost & Power Efficiency

- **Low Power Consumption: Uses ESP32's power-efficient features.**
- **Affordable Components: Cost-effective and easy to implement.**

3. IoT-based Features

- **Cloud-based Data Storage: Accident logs can be stored and analyzed.**
- **Mobile Integration: Blynk app provides instant access to notifications.**

➢ LIMITATIONS & FUTURE ENHANCEMENTS

1. Current Limitations

- **No GPS Module – Currently, location tracking is not integrated.**
- **No Emergency Calling – Only notifications are sent, not direct calls.**
- **Limited to Short Distances – Blynk notifications require an internet connection.**

2. Future Enhancements

- **GPS Integration: To send exact accident locations to emergency contacts.**
- **Emergency Calling: Automatically dial emergency numbers upon an accident.**
- **Voice Commands: Allow hands-free operation using voice control.**
- **Alcohol Detection: Integrate an MQ-3 sensor to prevent drunk driving.**
- **RFID Integration: For bike ignition control using RFID-based authentication.**

➢ CONCLUSION

The Smart Helmet with IoT is an innovative and cost-effective solution for improving motorcycle safety. By enforcing helmet usage, detecting accidents, and providing real-time alerts, this system significantly enhances rider protection.

With IoT-based notifications via Blynk, the system ensures that accidents are reported immediately, potentially saving lives. Future enhancements such as GPS tracking, emergency calling, and alcohol detection could make the system even more robust.