

# ESP8266 Microcontroller Based Smart Helmet

Aman Harish Kodwani, Ayush Umeshrao Ardak, Prsheel Rakesh Singh, Chetan Ramesh Tidake

Department of Electronics & Telecommunication Engineering

Shri Sant Gajanan Maharaj College of Engineering, Shegaon, Maharashtra, India

**Abstract:** Road accidents involving two-wheelers are increasing rapidly due to careless driving, drunk driving, and delayed emergency response. To improve rider safety, this paper presents an IoT-based Smart Helmet System using the ESP8266 microcontroller. The proposed system integrates an MPU6050 accelerometer and gyroscope sensor for accident detection and an MQ-3 alcohol sensor for alcohol detection. The system continuously monitors the rider's condition and automatically disables the ignition when alcohol is detected above the predefined threshold. In the event of an accident, the system verifies the incident using motion analysis and sends real-time emergency alerts through the Blynk IoT platform. The proposed model is low-cost, efficient, easy to implement, and suitable for modern smart transportation systems. The system aims to reduce accident risks and improve emergency response time through automation and IoT connectivity.

**Keywords:** ESP8266, Smart Helmet, IoT, Accident Detection, Alcohol Detection, MPU6050, MQ-3 Sensor, Blynk

## I. INTRODUCTION

Road safety has become one of the major concerns in modern transportation systems. A significant number of motorcycle accidents occur due to drunk driving, rash driving, and lack of immediate medical assistance after accidents. Many fatalities can be prevented if accident information is transmitted instantly to emergency systems or responsible authorities.

To address these problems, an IoT-Based Smart Helmet System is proposed using the ESP8266 NodeMCU microcontroller. The system integrates motion sensing, alcohol detection, and IoT communication into a single smart safety device. The MPU6050 sensor is used to monitor acceleration and tilt values for accident detection, while the MQ-3 alcohol sensor detects alcohol concentration from the rider's breath. The ESP8266 processes the sensor data and communicates with the Blynk IoT platform through Wi-Fi.

If alcohol is detected above the safety limit, the system disables the ignition using the L298N motor driver. Similarly, when an accident is detected, an alert notification is transmitted through the IoT platform after verifying rider inactivity. This project enhances rider safety and reduces emergency response delay using smart embedded technology.

## II. LITERATURE REVIEW

Several researchers have worked on smart transportation and accident prevention systems using IoT and embedded technologies.

Satish Kumar et al. proposed a Vehicle Accident and Alcohol Detection System using IoT technology that could send emergency alerts during accidents and detect alcohol consumption. However, the system required multiple communication modules, increasing complexity.

Simi M. S. et al. developed a Real-Time Accident Detection and Alcohol Monitoring Smart Helmet system that improved rider safety using sensors and communication modules. Although effective, the system increased implementation cost.

Simran et al. designed an IoT-Based Vehicle Accident Detection System using motion sensors and cloud technology for accident alerting. The system focused mainly on accident detection without alcohol monitoring features.



Sontakke and Pochhi implemented a Smart Helmet Based Alcohol Detection and Auto Ignition Control System using the MQ-3 sensor for drunk driving prevention. However, their system lacked accident detection capability. The proposed system combines both accident detection and alcohol monitoring with IoT integration in a compact and cost-effective manner.

### III. OBJECTIVES

The main objectives of the proposed system are:

- To detect accidents using the MPU6050 sensor.
- To detect alcohol consumption using the MQ-3 sensor.
- To prevent drunk driving by disabling the ignition system.
- To send real-time alerts through IoT technology.
- To improve rider safety using automated monitoring systems.

### IV. SYSTEM REQUIREMENTS

Hardware Components:

Sr. No.	Component	Function
1	ESP8266 NodeMCU	Main controller and Wi-Fi communication
2	MPU6050 Sensor	Accident and tilt detection
3	MQ-3 Alcohol Sensor	Alcohol detection
4	L298N Motor Driver	Ignition control
5	NeoPixel LED	Visual indication
6	Buzzer	Audio alert
7	DC Motor	Engine representation
8	Lithium Battery	Power supply
9	Boost Converter	Voltage regulation

### B. Software Requirements:

- Arduino IDE
- Embedded C Programming
- Blynk IoT Platform

### V. SYSTEM ARCHITECTURE

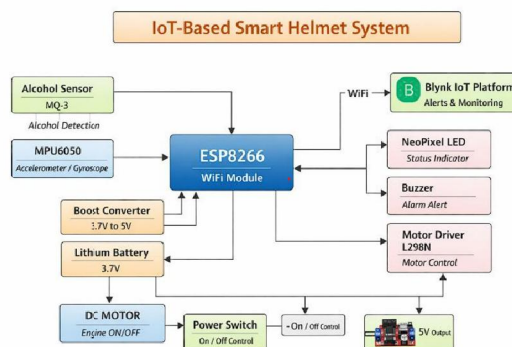


Fig. 1. Block Diagram of ESP8266 Based Smart Helmet System



The proposed smart helmet system consists of an ESP8266 microcontroller connected with the MPU6050 motion sensor, MQ-3 alcohol sensor, L298N motor driver, NeoPixel LED, and buzzer. The ESP8266 acts as the central processing and communication unit. Sensor data is continuously processed, and alerts are sent to the Blynk cloud platform through Wi-Fi connectivity.

The MQ-3 sensor detects alcohol concentration, while the MPU6050 measures acceleration and tilt angles for accident identification. The L298N module controls the ignition system by enabling or disabling motor operation based on safety conditions.

## VI. WORKING PRINCIPLE

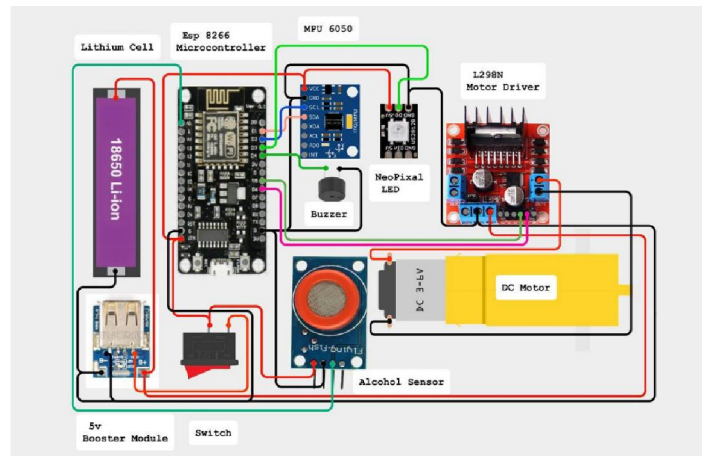


Fig. 1. Circuit Diagram of Proposed Smart Helmet System

### A. System Initialization:

When the system is powered ON, the ESP8266 initializes all connected modules and establishes Wi-Fi communication with the Blynk IoT platform. The sensors are calibrated, and the ignition system remains active under normal conditions.

### B. Alcohol Detection System:

The MQ-3 sensor continuously monitors the rider's breath for alcohol concentration. If the detected value exceeds the predefined threshold:

The ignition system is disabled using the L298N motor driver.

The NeoPixel LED glows RED.

An alert notification is sent to the Blynk IoT platform.

This prevents vehicle operation under unsafe conditions.

### C. Accident Detection System:

The MPU6050 sensor continuously monitors acceleration and tilt values. If abnormal movement or sudden impact is detected:

The system starts a 5-second verification timer.

Motion is rechecked to avoid false alarms.

If no movement is detected after verification, the accident is confirmed.

Emergency notifications are sent through the IoT cloud platform.

The buzzer and LED indications are activated during emergency conditions.



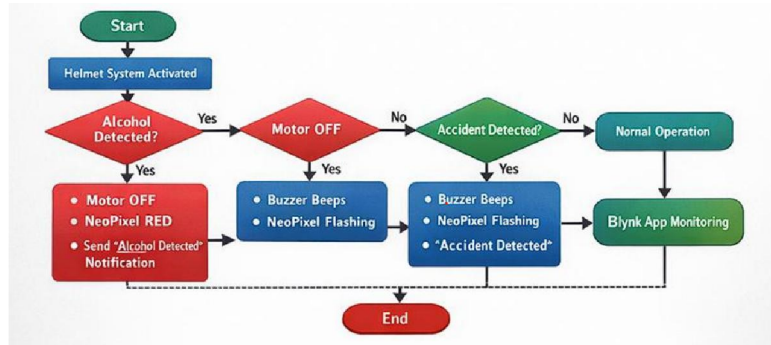


Fig. 3. Working Flowchart of Smart Helmet System

**D. IoT Alerting:**

The ESP8266 sends real-time alerts to the Blynk IoT platform for:

Alcohol detection

Accident detection

System monitoring

This enables remote monitoring and faster emergency response.

**VII. FUNCTIONAL TABLE**

Function	Input	Processing	Output
Alcohol Detection	MQ-3 Sensor	Threshold Comparison	Ignition OFF + Alert
Accident Detection	MPU6050	Tilt & Impact Analysis	Alert Notification
Motor Control	ESP8266	Logic Control	Motor ON/OFF
IoT Communication	Wi-Fi	Data Transfer	Blynk Notification

**VIII. ADVANTAGES**

The proposed system provides several advantages:

- Prevents drunk driving
- Detects accidents automatically
- Sends instant IoT alerts
- Low-cost implementation
- Easy to operate and maintain
- Improves emergency response time

The proposed system can be used in:

- Motorcycles and two-wheelers
- Smart transportation systems
- Road safety monitoring
- IoT-based vehicle monitoring systems
- Fleet management applications

**X. LIMITATIONS**

Despite several advantages, the system has some limitations:

- Alcohol sensor readings may vary with environmental conditions.
- Continuous internet connectivity is required for IoT features.



- Improper sensor calibration may generate false accident alerts.
- GPS location tracking is not included in the current model.

### **XI. FUTURE SCOPE**

The proposed system can be enhanced further by integrating:

- GPS module for live location tracking
- GSM module for SMS emergency alerts
- Mobile application support
- AI-based accident detection
- Smart helmet locking mechanism
- Automatic ambulance notification system

### **XII. CONCLUSION**

The ESP8266 Microcontroller Based Smart Helmet System successfully demonstrates the integration of embedded systems and IoT technology for improving rider safety. The system effectively detects alcohol consumption and accidents in real time while providing immediate alerts through the Blynk IoT platform. The automatic ignition control mechanism helps prevent drunk driving, while the accident detection system improves emergency response efficiency. The proposed model is cost-effective, reliable, and suitable for practical implementation in modern transportation systems. This project highlights the importance of smart safety technologies and provides a strong foundation for future advancements in intelligent transportation and IoT-based safety systems.

### **REFERENCES**

- [1]. Satish Kumar, G. A. E., Swetha Priyanka, J., and Sai Deepthi, A., "Vehicle Accident and Alcohol Detection System Using IoT Platform," *Indian Journal of Science and Technology*, 2022.
- [2]. Simi M. S., Vaishnavi A. S., Saira Bhanu R. S., Diya S., and Liyana Shibu, "Real-Time Accident Detection and Alcohol Monitoring Using Smart Helmet," *International Journal of Engineering Research & Technology (IJERT)*, 2025.
- [3]. Simran, Priya Sinha, and J. Selvin Paul Peter, "IoT Based Vehicle Accident Detection System," *International Journal of Health Sciences*, 2022.
- [4]. Afsha Akkalkot, Srujan Garde, Kishori Patil, Janhavi Asware, and Kapaleshwar Patil, "Smart Accident Detection, Prevention and Reporting Using Arduino," *International Journal of Scientific Research in Science and Technology*, 2023.

