International Journal of Engineering and Techniques - Volume 12 Issue 2, March-April - 2026
RESEARCH ARTICLE OPEN ACCESS

AI-BASED HELMET FOR ACCIDENT RESCUE SYSTEM

ARIVALAKAN[1], SRIVARSHAN[2], ARUN[3], ESWARAMOORTHY[4]
Mrs. Sangeetha T

1(ECE IV year, Arasu Engineering college, Kumbakonam)
2(ECE IV year, Arasu Engineering college, Kumbakonam)
3(ECE IV year, Arasu Engineering college, Kumbakonam)
4(ECE IV year, Arasu Engineering college, Kumbakonam)

Abstract: As we know India is second most populated country and has a large youth population, nowadays youth are fond of bikes and because of fashion, they neglect wearing helmet. Because of these, bike accidents are increasing day by day which causes deaths. Major deaths are due to head injuries which can be prevented by wearing a helmet. Drunk and drive cases are becoming more, which causes accidents and due to lack of negligence where an accident occurs and people are dying.

I. INTRODUCTION

This document is a template. An electronic copy can be downloaded from the conference website. For questions on paper guidelines, please contact the conference publications committee as indicated on the conference website. Information about final paper submission is available from the conference website.

OBJECTIVE

•The primary objective of the **Smart Helmet for Accident Rescue System** is to enhance rider safety by providing a real-time, automated accident detection and emergency alert mechanism. The system aims to continuously monitor critical parameters such as impact force, helmet usage, and vehicle motion to accurately detect accidents. Upon detection of a crash, the system automatically identifies the rider's location using GPS technology and sends an emergency alert with essential information to predefined contacts, emergency services, or nearby hospitals through GSM/IoT communication

METHODOLOGY

1. System Initialization

When the smart helmet is powered ON, the embedded controller (Arduino/ESP32) initializes all connected sensors, communication modules, and safety peripherals. Baseline values for motion and impact sensors are set to ensure accurate detection.

2 Helmet Usage Detection

An IR or pressure sensor verifies whether the helmet is worn by the rider. The system ensures monitoring is active only when the helmet is properly placed, preventing false accident detection.

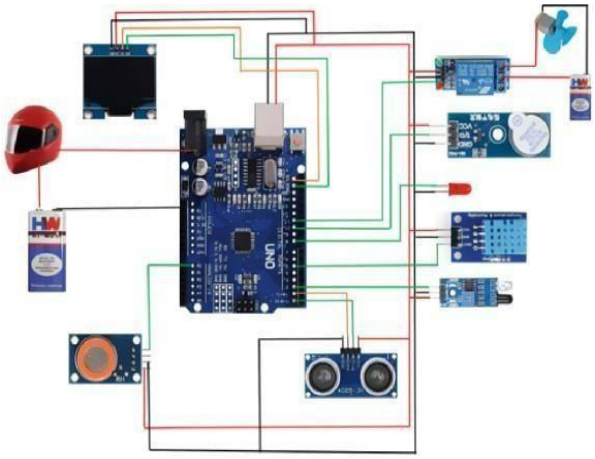
3. Continuous Accident Monitoring

Sensors such as an accelerometer, gyroscope, or vibration sensor continuously monitor sudden changes in acceleration, tilt angle, or impact force. These parameters are analysed in real time to identify abnormal conditions indicative of a collision or fall.

EXISTEMTING SYSTEM

- In the conventional accident management system, there is **no automated mechanism** to detect road accidents or alert emergency services. When an accident occurs, rescue operations rely heavily on **human intervention**, such as passersby, co-riders, or nearby residents noticing the incident and informing emergency authorities. In many cases, accidents occur in **remote or poorly monitored areas**, leading to significant delays in providing medical assistance.
- Existing helmet designs primarily focus on **passive safety**, offering protection only during impact, without any intelligent sensing or communication capability. Accident information, location details, and injury severity are not automatically captured or transmitted.

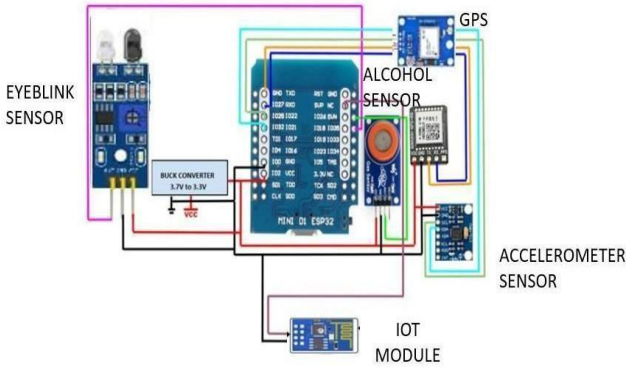
CIRCUIT DIAGRAM



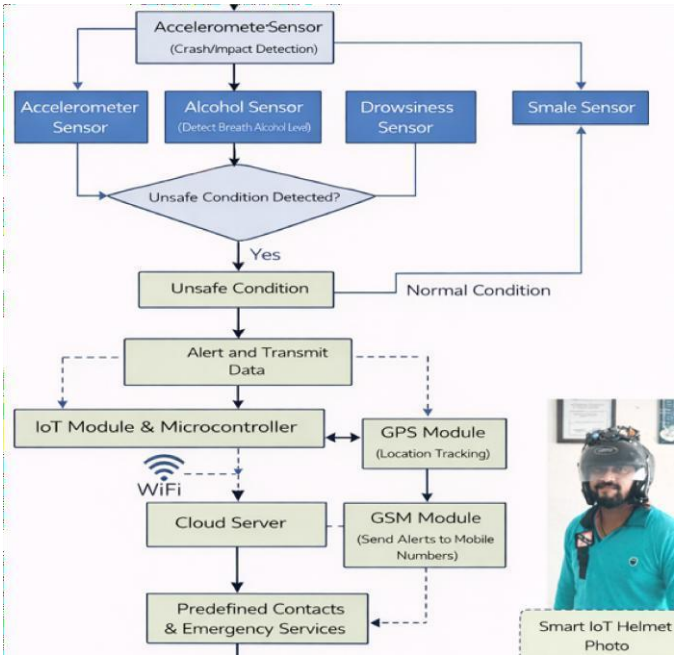
PROPOSED WORK

- The proposed Smart Helmet for Accident Rescue System is an intelligent safety solution designed to enhance rider protection by integrating multiple sensors, a microcontroller, and wireless communication modules within a helmet. As shown in the figure, all sensing, processing, and communication units are embedded directly into the helmet, making the system compact and self-contained.
- At the core of the system is a microcontroller, which continuously collects and processes data from various sensors mounted on the helmet. An accelerometer sensor is used to detect sudden impacts, abnormal acceleration, or tilt changes that may indicate a crash or fall. When the sensed values exceed predefined threshold levels, the system identifies a possible accident condition.

CIRCUIT DIAGRAM - PROPOSED



FLOWCHART



Microcontroller

Example: Arduino Uno / Arduino Nano / ESP32
Operating Voltage: 5 V (Arduino) / 3.3 V (ESP32)
Clock Speed:

- Arduino Uno: 16 MHz
- ESP32: 240 MHz

Functions:

- Reads sensor data
- Processes accident, alcohol, and drowsiness conditions
- Controls GSM and GPS modules

Accelerometer Sensor
- **Example**: ADXL345 / MPU6050

Operating Voltage: 3.3 V – 5 V
Axes: 3-Axis (X, Y, Z) Measurement Range: ±2g ±16g
- **Purpose**: Detects sudden tilt, impact, or accident

Monitors rider movement and orientation

Alcohol Sensor
- **Example**: MQ-3 Alcohol Sensor

Detection Range: 0.05 – 10 mg/L
Output Type: Analog
- **Purpose:** Detects alcohol presence in rider's breath vehicle operation under intoxication

Operating Voltage :5

Drowsiness Sensor
- **Example**: IR Eye Blink Sensor

Operating Voltage: 3.3 V – 5 V
Output Type: Digital
Detection Method: Eye closure duration
- Purpose:

Detects driver fatigue or sleepiness
Triggers alert or safety action

GSM Module
Example: SIM800 / SIM900
Operating Voltage: 3.8 V – 4.2 V
Network: GSM 850/900/1800/1900 MHz
Communication: UART (TX/RX)
- Purpose: Sends SMS alerts during accident or abnormal conditions.

REFERENCES

[1]. S Sobhana et al 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1084 012116

[2]. J Joy Mathavan et al 2022 IOP Conf. Ser.: Mater. Sci. Eng. 1258 012051

[3]. Shravya Kesrvani, et al. "Smart Helmet for safe driving" E3S Web of Conferences · (January2019).87:01023

- Communicates emergency notifications

GPS Module
- Example: NEO-6M GPS

Operating Voltage: 3.3 V – 5 V
Position Accuracy: ~2.5 m
Update Rate: 1 Hz
Purpose: Provides real-time location of the rider
Sends latitude and longitude via GSM

Power Supply
- Type: Li-ion / Li-Po
- Battery Voltage: 7.4 V / 5 V

regulated Capacity: 1000mAh – 3000mAh
Supporting Components:
Voltage regulator (7805 / Buck converter)
Protection circuit Purpose:
Supplies stable power to all modules
Ensures uninterrupted system operation

Helmet (Physical Housing)
- Material: ABS / Fiber-reinforced plastic

Function:
- Holds all electronics safely
- Protects rider and embedded components

ADVANTAGES
- Economical.
- Easy way of tracking.
- Easy-Friendly Circuits.

[4]. Gupta, Rakesh, et al. "Design and Development of a Smart Helmet for Accident Detection. "International Journal of Engineering and Advanced Technology 9.4 (2020): 2635-2642

[5]. Chen, Wei, et al. "Intelligent Helmet for Motorcycle Riders: A Review." Applied Sciences11.5(2021): 2389.

[6]. Wang, Hong sheng, et al. "Development of a Smart Helmet for Motorcycle Safety." International Journal of Automation and Smart Technology 11.3 (2021): 121-130.

[7]. Li, Wei, et al. "Real-Time Monitoring System for Motorcycle Safety Based on Internet of Things. “Sensors 20.19 (2020): 5363

[8]. Song, Wei, et al. "Design and Implementation of a Smart Helmet for Enhanced Safety and Communication." IET Intelligent Transport Systems 15.7 (2021): 956-963.

Conclusion

•The smart AI-based helmet integrates IoT technology with intelligent sensors such as an accelerometer, alcohol sensor, drowsiness sensor, GPS, and GSM, all controlled by a microcontroller, to ensure enhanced rider safety and real-time monitoring. By continuously collecting and analysing sensor data, the system can intelligently detect accidents, alcohol consumption, and rider drowsiness, thereby preventing unsafe riding conditions. Through IoT connectivity, critical data and alerts are transmitted in real time to cloud platforms or authorized users, enabling remote monitoring and faster emergency response. The AI-assisted decision making improves accuracy in identifying hazardous situations, while GPS and GSM provide precise location tracking and instant alert communication. Overall, this smart AI-based IoT helmet offers a reliable, proactive, and efficient solution for accident prevention and emergency management, contributing significantly to safer and smarter transportation systems.

Applications

1. Motorcycle Safety: The smart helmet can be used by motorcyclists to alert emergency services in case of an accident.
2. Industrial Safety: The smart helmet can be used in industrial settings, such as construction sites, to monitor workers' safety and alert emergency services in case of an accident.
3. Sports Safety: The smart helmet can be used in high-impact sports, such as football, hockey, and cycling, to monitor athletes' safety and alert medical staff in case of a concussion or other injury.
4. Emergency Response: The smart helmet can be used by emergency responders, such as firefighters and paramedics, to monitor their safety and alert their team in case of an emergency.
5. Search and Rescue: The smart helmet can be used in search and rescue operations to locate missing people and alert emergency servicesS