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SMART SAFETY HELMET INTELLIGENT WAY TO DRIVE

[1]DR.N.L.ARAVINDA, [2]J.PRALAYA, [3]J.BHAVANI, [4]J.SHRUTHI

[1]Assistant Professor, Department of Electronics and Communication Engineering, **MALLA REDDY ENGINEERING COLLEGE FOR WOMEN,** Maisammaguda, Dhulapally Kompally, Medchal Rd, M, Secunderabad, Telangana.

[2,3,4]Student, Department of Electronics and Communication Engineering,**MALLA REDDY ENGINEERING COLLEGE FOR WOMEN,** Maisammaguda, Dhulapally Kompally, Medchal Rd, M, Secunderabad, Telangana.

ABSTRACT

Under the Indian Motor Vehicle Act of 1988, specifically Section 129, it is mandatory for motorcycle and two-wheeler riders to wear helmets while operating their vehicles. A recent survey by the World Health Organization (WHO) highlights the alarming rates of road accidents globally, particularly noting that India has one of the highest mortality rates from such incidents, with approximately 150,000 fatalities each year. This situation underscores the urgent need for a safety system aimed at protecting riders. In response, we have developed a system that verifies helmet usage and checks for alcohol consumption before allowing the motorcycle to start. If both conditions are met, the motor will ignite; otherwise, it will remain inactive. Additionally, in the event of an accident, our system can detect the occurrence and approximate location of the incident. To enhance visibility during nighttime riding, we have integrated LED strips into the helmet.

Keywords: Node MCU, Relay driver, MQ-3 sensor, FSR sensor, Vibrating sensor, Limit switches, Helmet.

I.INTRODUCTION

The rising incidence of motorcycle accidents in our country is increasingly concerning, driven largely by riders' violations of traffic regulations. Many accidents occur due to the neglect of helmet use, often without valid justification, and a lack of awareness regarding traffic safety. According to the National Crime Records Bureau, over 500 motorcycle accidents annually result from alcohol consumption or drug use. To combat these issues, we propose a Smart Safety Helmet System designed to enhance safety and awareness for motorcycle riders. Our system operates through several key processes. First, it checks if the rider is wearing a helmet using a force-sensing resistor (FSR), which detects the rider's presence. If the helmet is not worn, the vehicle will not start. The second function assesses whether the rider has consumed alcohol, utilizing an MQ-3 sensor. This sensor is capable of detecting alcohol levels in the rider's breath, preventing the vehicle from starting if the permissible limit is exceeded. The third process involves monitoring for accidents using a piezoelectric sensor, which measures vibration levels resulting from an impact. If the vibration exceeds a predefined threshold, an alert message is sent to pre-specified mobile numbers. Lastly, we have incorporated LED strips into the helmet that can signal turns and braking, enhancing

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visibility and communication with other road users during night rides.

II.EXISTING SYSTEM

In the current system, motorcycles can be started with a key, but ignition is disabled if the rider is not wearing a helmet. However, the existing setup does not lock the ignition if the rider has been drinking or in the event of an accident, although it can locate the bike. Helmets serve as essential protective gear, designed to mitigate head injuries and enhance the safety of riders. The existing framework focuses on three primary goals: ensuring rider safety, addressing modern technological needs, and reducing accident rates. The smart helmet mechanism permits vehicle ignition only when the helmet is worn. Communication between the helmet and bike is facilitated by an RF module, but this can be vulnerable to hacking or interference from other signals. If the rider is detected as being under the influence of alcohol, the ignition will be locked, and a message with the rider's location will be sent to a pre-programmed contact. In the event of an accident, the system sends a message via GSM with location data using a GPS module, though it lacks precision in pinpointing the exact accident site. Furthermore, the message delivery is not efficient.

Disadvantages:
- The current technology struggles with rider negligence and the enforcement of traffic rules by authorities.
- Many riders fail to wear helmets in areas where traffic checks are infrequent.
- Helmets are often worn only in anticipation of inspections.
- The ignition system can be bypassed, leading to potential vehicle theft.

III.LITERATURE SURVEY

Sudarshan Raj and Manjesh N propose a Smart Helmet utilizing GSM and GPS technologies for accident detection and reporting [1]. Abhinav Anand discusses the use of an alcohol sensor designed to measure breath alcohol levels [2]. Mohd Khairul focuses on smart helmets equipped with sensors for accident prevention, incorporating GSM and GPS for rider location [3][4]. A. Bhargav Aditya and K. Bharath explore smart helmet technologies, highlighting the need for compliance with safety regulations, yet acknowledging the persistent violations by riders [5]. Various countries have laws mandating helmet use and prohibiting riding under the influence of alcohol, but compliance remains an issue [6][7]. Intelligent safety helmets integrate systems that verify helmet usage and alcohol consumption, disabling the ignition system if either condition is unmet [8][9]. The design of intelligent helmets aims to enhance accident prevention and theft deterrence [10][11].

IV.PROPOSED SYSTEM

The proposed system outlines the implementation of a smart helmet, detailing its components and functionality. Key components include FSR (Force Sensing Resistor), MQ-3 sensor, vibrating sensors, LED strips, NodeMCU, a 4-channel relay, and cloud integration. The FSR detects whether the rider is wearing the helmet, preventing the motor from starting if it is not. The MQ-3 sensor measures alcohol levels; if the rider’s breath exceeds 0.04 mg/l, the bike will not start. Both conditions must be satisfied for the ignition to function. The vibrating sensor detects impacts from

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accidents by measuring vibration frequencies. If vibrations exceed a certain threshold, an accident is flagged, and location data is sent to a cloud platform (e.g., Ubidots), which then relays coordinates to emergency contacts. LED strips indicate the bike's direction and braking, enhancing visibility during nighttime riding.

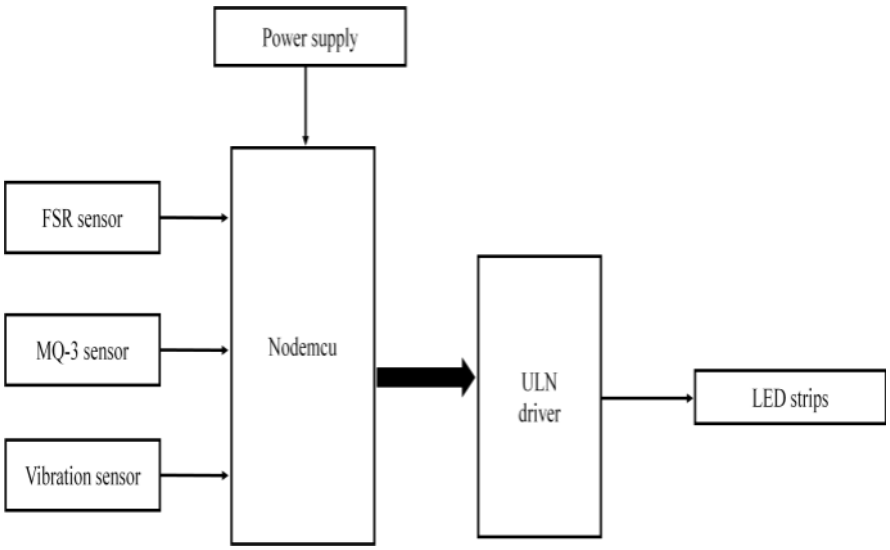
Advantages:
- The smart helmet controls vehicle ignition, improving safety.
- The MQ-3 sensor effectively determines alcohol consumption levels.
- LED strips provide critical visibility for night riding.
- The vibrating sensor aids in fall detection and accident reporting.
- The system facilitates location tracking of the bike and rider after an accident.

V.SYSTEM DESIGN

The system is designed around two main modules: the user module and the admin module. The user module serves as an interactive interface between the helmet unit and the rider, while the admin module is responsible for receiving and responding to alerts from the helmet unit.

A. Helmet Unit

The helmet unit consists of an FSR, MQ-3 sensor, vibrating sensor, NodeMCU, relay driver, and LED strips. These sensors continuously monitor the rider's conditions and communicate data to the bike unit via the NodeMCU. The LED strips provide visual signals for direction and braking, while the relay driver manages power distribution to the LED components.



B. Bike Unit

The bike unit (see Figure 2) is composed of several key components, including switches S1, S2, and S3, a NodeMCU, a relay driver, a motor, and cloud integration. The switches S1, S2, and S3 are designated for controlling the LED strips in the helmet unit, providing visual signals for direction and alerts. The

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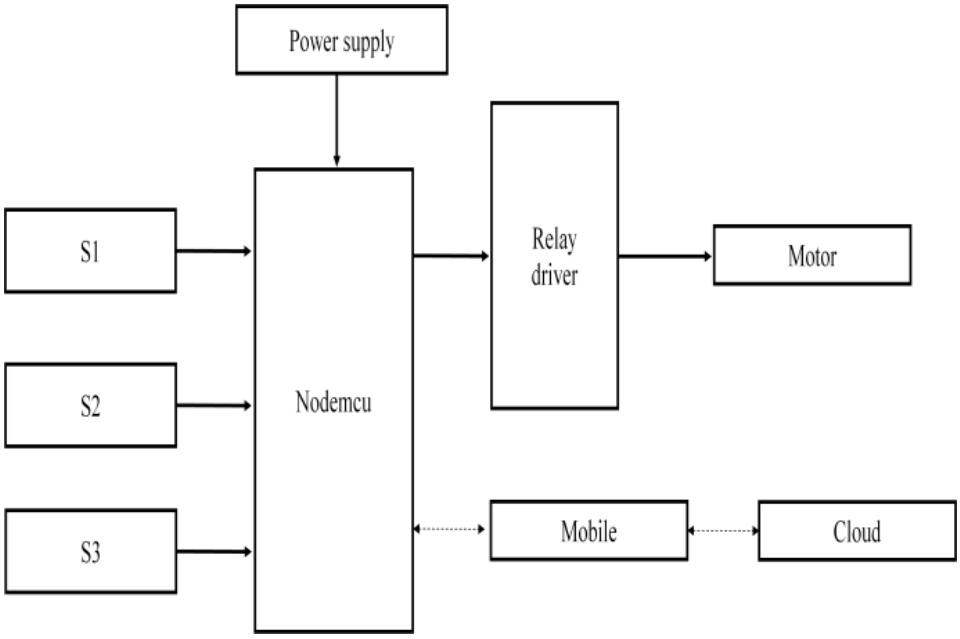
relay driver manages the motor's operation, activated by commands from the NodeMCU. When the helmet unit detects an accident, it communicates this information to the bike unit. In response, the bike unit transmits relevant data to the cloud, ensuring that emergency messages are sent to designated mobile numbers. This system facilitates rapid communication and enhances the rider's safety in emergency situations.



VI. CONCLUSION AND FUTURE WORK

The smart safety helmet system offers an innovative solution for enhancing rider safety by addressing key issues such as helmet usage and alcohol consumption. By ensuring that the bike can only be started when the helmet is worn and the rider is sober, the system significantly reduces the likelihood of accidents. This user-friendly approach not only promotes adherence to traffic regulations but also makes safety accessible and affordable. The helmet's functionality, combined with LED indicators, contributes to improved visibility and awareness during nighttime riding, thus further decreasing accident rates.

VII.FUTURE ENHANCEMENTS

Looking ahead, there are several potential improvements for this system. Future developments could include features for calculating speed and distance prior to an accident, as well as navigation assistance via the helmet. Additional functionalities may involve controlling acceleration, braking, and headlight operations directly from the helmet. Displaying speedometer values within the helmet could also enhance safety. Furthermore, incorporating a digital signage system for messages could improve communication between riders and other road users. These enhancements aim to increase the system's effectiveness in accident prevention and overall bike automation, thereby contributing to a safer riding environment.

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