Smart Helmet for Alcohol Detection to Avoid Accidents In Bike Riders Using Iot

Manchikalapati Subrahmanyam[1], M.Vinay kumar[2], L.Hemanth Koushik[3]
[1,2,3]*Department of Artificial intelligenc and Data science Dhanalakshmi Srinivasan University (DSU) Trichy*

***Abstract*—The "Smart Helmet for Alcohol Detection and Accident Prevention Using IoT" project provides innovative safety features to motorcyclists by integrating Internet of Things (IoT) technology with real-time monitoring and prevention features. The helmet includes a Breathalyzer sensor to monitor alcohol intake, making the motorcycle unstart able if the alcohol concentration in the rider's blood is above the legal limit. In addition, the use of accelerometers and GPS mapping allows accidents to be detected by the identification of instantaneous crashes or collisions, which automatically sends emergency messages with the location of the rider in real time. The system uses IoT-based communication to immediately alert emergency services and authorized contacts, shortening accident response times by a considerable margin. By preventing cases of drunk driving and optimizing emergency responses, the smart helmet acts as an active safety device to reduce road fatalities and enhance the overall safety of motorcycles. Development in the future can focus on improving sensor precision, integrating health monitoring features, and broadening applications to further enhance the safety of riders.**

***Index Terms*—Smart Helmet, Alcohol Detection, IoT, Road Safety, Accident Prevention, GPS Tracking, Emergency Response, Motorcycle Safety, Breathalyzer, Rider Awareness.**

I. INTRODUCTION

Road accidents rank high among the leading causes of injury and death around the globe, and the victims include especially the motorcyclists. The motorcycle provides lesser protection as compared to a car and thus leaves riders open in case of accidents. The reasons behind most of these road accidents include human factors, among them speeding, distractions, and more importantly, alcohol-impaired driving.

Driving under the influence of alcohol slows reaction times, reduces coordination, and impairs judgment, greatly increasing the risk of accidents. Many motorcyclists involved in such accidents either do not wear helmets or wear helmets that do not meet the set safety standards, thereby worsening the injuries.

Technology with safety can save lives. This smart helmet has alcohol detection and internet of things integrated into the headgear. It detects not just if the rider has been alcohol intoxicated but also stops the engine from starting the bike. The other feature is an accident detector sending alerts with the location to get help fast in case of a crash.

This innovative solution addresses two primary causes of motorcycle accidents: alcohol consumption and delay of response to emergencies. It is for responsible riding and for maximum safety. This can be done by incorporating technology such as a Breathalyzer sensor, a GPS, and wireless communication so that the Smart Helmet keeps safe roads for motorcyclists and reduces fatal accidents.

II. LITERATURE SURVEY

Some studies have investigated the use of smart helmets in avoiding accidents by implementing IoT sensors. Mizan et al. [1] discussed a smart vehicle management system with the integration of drowsiness, alcohol, and overload sensors to avoid accidents. Likewise, Rahman et al. [2] discussed IoT-based smart helmet systems with the objective of accident detection and identification, highlighting the contribution of sensors such as alcohol sensors and crash sensors to enhance rider safety.

Apart from safety aspects, cost-effectiveness is also a key factor in making smart helmets affordable for

mass adoption. Divyasudha et al. [3] emphasized a low-cost IoT-based smart helmet solution for riders that incorporates features such as accident detection and real-time communication. This solution seeks to strike a balance between safety and affordability so that smart helmets can be adopted en masse.

Alcohol use is one of the main causes of accidents, especially in road transport. Chhabra et al. [4]

Smart helmets find application beyond road safety; they also provide noteworthy advantages for industrial use. Kurundkar et al. [8] focused on smart helmets worn by mine workers, in which health monitoring kits are embedded in the helmet to monitor the health and well-being of the worker and the environmental parameters. For construction, Jayasree et al. [7] investigated IoTbased smart helmets intended to increase worker safety through the monitoring of vital parameters and alerting in real time.

The HelmetGuard system, which has been discussed by Vani et al. [6], is a smart helmet based on the IoT to ensure improved safety of the rider by incorporating advanced sensors to detect accidents. It provides real-time alerts in the event of an accident and can notify emergency services in case of an accident, greatly enhancing the response time.

Suresh Vani et al. [6] and Somantri et al. [12] reported progress in integrating wireless communication and machine learning algorithms with smart helmets. These technologies facilitate real-time monitoring and decision-making to sense accidents and alert emergency services. These systems can greatly enhance road safety by lowering response times and improving overall rider awareness.

In addition to accident detection, smart helmets are also employed to keep an eye on the health and well-being of those who work in dangerous environments. Health monitoring sensors integrated into such helmets enable them to monitor critical vital signs like heart rate and oxygen saturation. This is especially useful for workers in conditions such as mines or construction work, where health hazards are common.

Machine learning algorithms are pivotal in enhancing the performance of smart helmets. Rathod et al. [10] investigated intelligent accident detection and alerting systems based on machine learning across IoT networks. Such systems are capable of detecting possible accidents and reacting accordingly, providing more secure and accurate safety features.

Wearable Technology and Awareness: In a Somantri et al. [12] review, the convergence of smart helmets with motorcycles was explored to provide rider awareness and safety. Such convergence enables real-time monitoring and alerts, allowing riders to remain aware of the environment and threats at all times.

III. PROPOSED SYSTEM

The main aim of this project is to develop a Smart Helmet for Alcohol Detection and Accident Prevention Using IoT. This system integrates several hardware and software components to increase motorcycle riders' safety levels. It focuses on preventing alcohol-related accidents by incorporating a Breathalyzer sensor that detects the rider's alcohol level. When alcohol is at or above the illegal level, the system restricts the ignition of a bike so that the handicapped riders cannot drive; and it also has other facilities, such as crash detecting technology with accelerometers and gyroscopes that can sense immediate impact and send out some automatic protocols for emergency response purposes.

The real-time response capabilities of the helmet are made possible by the application of IoT technology. A system with a GPS module enables proper tracking of location and a wireless communication module like Bluetooth, GSM, or Wi-Fi to alert contacts or services of an emergency. In accidents, real-time data are reported: from the location of the rider up to the stage of emergency intervention. The system does not only make connectivity possible in an emergency response but also flexible and scalable in the future for improvement.

In hardware setup, the Smart Helmet consists of a Breathalyzer sensor, microcontroller unit, accelerometer, GPS module, and a wireless communication module. In this case, MCU is used to process data coming from sensors and handle all communications between different components. This system is equipped with a rechargeable battery to provide long-lasting operation. The helmet is lightweight, ergonomic, and comfortable to wear for the rider while it contains all the necessary elements.

On the software side, the system is based on the use of embedded firmware in control of hardware ensuring that only riders who are genuinely intoxicated are prevented from starting the vehicle. This makes the

system more reliable and practical in real-world conditions.

B. Crash Detection and Emergency Response

These sensor suites allow the detection of any unusual impacts and unusual scenarios where crashing occurs. The accelerometer in Smart Helmet detects the changes in speeds or the alteration of movements, while a gyroscope measures the direction as well as orientation of the helmet during those abrupt moves and signals for the system to apply an emergency response protocol to take place. This helps in ensuring that the helmet responds promptly during critical incidents, thus reducing chances of delayed assistance. As soon as a crash is detected, the helmet uses the GPS module to determine the exact location of the rider. The GPS system will keep on sending live coordinates to the GSM or wireless communication module for transmitting an emergency alert. There is an alert to the specified emergency contacts or services, and they are availed with the rider's location among other relevant information. The GPS data allows first responders to arrive at the scene on time, thereby increasing the chances of providing timely medical assistance to the rider.

Crash detection is integrated with emergency response, thereby ensuring that help reaches the rider immediately in case of an accident. This system reduces the time between the accident and the alert sent out to emergency services, as it saves lives in urgent situations where quick intervention is key. Therefore, the Smart Helmet enhanced rider safety due to streamlined emergency response and ensured that no minute was missed in the provision of immediate assistance in the event of accidents.

C. Iot Integration and Communication

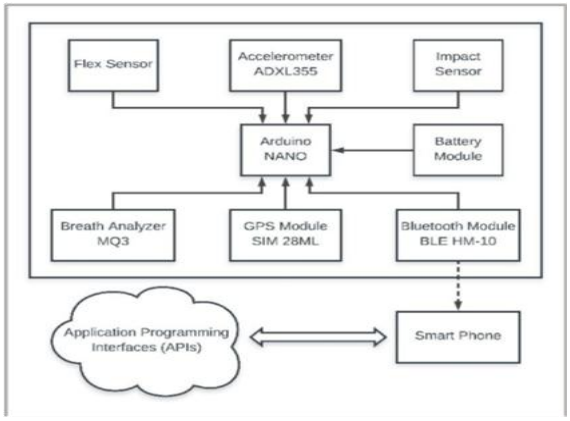

Fig 2 Architecture Diagram of Alcohol Detection

The Smart Helmet uses IoT technology to ensure efficient communication between its internal and external systems. As shown in fig 2, It does so through a wireless communication module like Bluetooth, Wi-Fi, or GSM, which connects the helmet to a mobile application or emergency services for the efficient exchange of data. The helmet is ensured to stay in touch with the rider's surroundings, allowing it to deliver vital information that can ensure safety and functionality in its entirety.

The IoT connectivity allows the helmet to share data with the rider. For instance, the real-time data from the alcohol level, location, or crash alert can be communicated to the rider's mobile application or to emergency contacts when the rider's alcohol levels have exceeded the legal limit. Similarly, in case of an accident, the crash detection system of the helmet sends the GPS coordinates of the rider to the emergency responders so that help can reach them quickly. This feature gives the rider and their family more security, knowing that help is just a call away if needed.

The system ensures that sensitive information is kept secure by employing encryption protocols for data transmission. This means that any data going out of the helmet to outer systems, like location or alcohol levels, is protected from unauthorized access. The Smart Helmet therefore employs IoTbased communication both in enhancing the rider's safety and additional features that entail remote monitoring to help monitor the status of the helmet and keep the user updated with notifications to ascertain real-time functioning of the helmet. This IoT integration significantly contributes added value towards enhancing the helmet's capabilities and user experience.

D. Hardware Components and Configuration

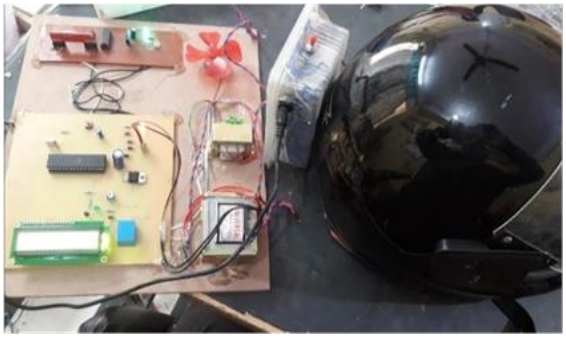

Fig 3 Hardware components and connective of Alcohol Detection Helmet

The hardware setup of the Smart Helmet given in fig 3, is chosen with utmost care so that it works in line with the project aims: that is, enhancing rider safety. The heart of the system is the Breathalyzer sensor, which detects alcohol levels in the rider's breath. This sensor integrates into the helmet to allow for continuous monitoring of a rider's alcohol concentration. The motorcycle system would not let the motorcycle start if the alcohol level is over the legal limit, hence meaning impaired riders cannot drive the motorcycle.

The helmet houses a Microcontroller Unit that serves as the brain of the system. The MCU controls all the data coming from all sensors. The accelerometer and gyroscope will manage to detect the crash or sudden impacts in this regard. These sensors in coordination identify the most significant variations in motion and send crash response signals whenever a collision has occurred. The module also contains GPS for Realtime location tracking to be sent along with the location in case of a crash to emergency services.

The GSM/wireless module enables data transmission to external devices such as mobile application or to emergency services. The information will be critical, such as alcohol levels, crash alerts, and GPS coordinates, all transmitted in real time. It is also powered by a rechargeable lithium-ion battery, providing long-term usage with minimal need for frequent recharging. All of these components are housed in a lightweight ergonomic helmet design, ensuring the comfort of the rider without sacrificing any aspect of safety or usability.

E. Software Implementation

The software system of the Smart Helmet is intended to integrate several components such as embedded firmware, alcohol detection algorithms, and communication protocols. The Embedded Firmware is responsible for the control of the hardware components of the helmet, which

IV. OUTPUT

The Smart Helmet system has an LCD display that provides vital information to the rider, for example, if the helmet is worn correctly or if the motorcycle can start. This feature would enhance the experience of the user with immediate feedback as well as enforcing safety protocols.

In case the helmet is not worn, the display will show a warning message that says , meaning that the motorcycle cannot be started unless the helmet is fitted properly which is shown in fig 5. Similarly, the system integrates with the alcohol detection mechanism to display a message if the rider's breath alcohol concentration exceeds the permissible limit, further preventing the ignition of the motorcycle.

Fig 5 LCD Output of Alcohol Detection System

This LCD interface ensures the rider is well informed of the system status which makes riding safe while making interaction with the advanced features of this helmet very easy.

V. CONCLUSION

This system is a significant innovation in motorcycle safety with a Breathalyzer sensor that helps to prevent drunk driving, and crash sensors that help to send instant emergency notifications. The application of IoT technology facilitates the utilization of real-time information to send, improving reaction to accidents and fostering safety for riders. Even with its success, there are certain issues that need to be addressed, such as sensor precision, network stability, and data security. Future versions can potentially enhance detection rates, add features like drowsiness detection, and utilize 5G technology for faster communication. All these issues being addressed will further increase the dependability of the system, hence making it an even safer gadget for motorcyclists globally.

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