e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
( Peer-Reviewed, Open Access, Fully Refereed International Journal )
Volume:06/Issue:11/November-2024 Impact Factor- 8.187 www.irjmets.com

# SMART SAFE HELMET FOR BIKE ACTIVATION

**Ms. Vedika Date*1, Ms. Rutuja Shinde*2, Ms. Aishwarya Pawar*3, Mr. Ranjeet Salunkhe*4**

*1,2,3,4Departmnet Of Artificial Intelligence And Data Science PVG's College Of Engineering Shrikrushna S. Dhamankar Institute Of Management, Nashik, India.

DOI: https://www.doi.org/10.56726/IRJMETS63616

## ABSTRACT

This project describes the development of a smart helmet designed to improve road safety by preventing intoxicated individuals from operating motorcycles. The helmet is equipped with an MQ-3 alcohol sensor that measures the rider's blood alcohol concentration (BAC). If the BAC exceeds a predefined limit, the system communicates wirelessly with the motorcycle's ignition system, disabling the engine to prevent operation. The helmet integrates a microcontroller for processing sensor data and uses Bluetooth technology for communication. The proposed solution is low-cost, easy to implement, and has the potential to significantly reduce accidents caused by drunk driving. This paper outlines the design, hardware integration, and testing of the system, along with its potential societal impact.

**Keywords:** Alcohol Sensor, Road Safety, Drunk Driving Prevention, MQ3 Sensor, Microcontroller, Bluetooth Communication.

## I. INTRODUCTION

Motorcycle riding is an exhilarating activity enjoyed by millions worldwide, offering both freedom and convenience. However, it is accompanied by a significant risk of accidents, with statistics indicating that motorcyclists are disproportionately affected by road fatalities. According to the World Health Organization (WHO), approximately 1.3 million people die in road traffic accidents each year, and motorcyclists are at a higher risk, especially when riding under the influence of alcohol. The interplay between alcohol consumption and riding ability is well-documented, as alcohol impairs cognitive functions, reaction times, and overall judgment, leading to an increased likelihood of accidents.

Despite strict laws against drunk driving, enforcement can be challenging, particularly for motorcyclists. Conventional measures, such as breathalyzer tests conducted by law enforcement, often occur after an accident has taken place, rather than as a preventive measure. This gap in proactive safety measures presents a pressing need for innovative solutions to help mitigate the risks associated with alcohol-impaired riding. To address this critical issue, this project presents the development of a smart helmet equipped with an alcohol detection sensor. The smart helmet serves as a personal safety device designed to ensure that riders are sober before starting their motorcycle. This project integrates an MQ-3 alcohol sensor capable of detecting blood alcohol concentration (BAC) through breath analysis. By continuously monitoring the rider's BAC, the helmet can provide immediate feedback and intervention.

If the sensor detects an alcohol level that exceeds a predefined limit, it communicates wirelessly with the motorcycle's ignition system to prevent the engine from starting. The design of the smart helmet is not merely about technology; it encompasses user experience and safety. By integrating the alcohol detection system into an everyday safety device, the project aims to create a seamless interaction for the rider. The system is designed to be unobtrusive, ensuring that safety measures do not interfere with the riding experience. Additionally, the helmet is equipped with Bluetooth technology to facilitate communication between the helmet and the motorcycle, allowing for real-time decision-making and responsiveness. In addition to the immediate benefits of preventing drunk driving, the smart helmet represents a broader vision of utilizing technology to enhance road safety This project embodies the potential for integrating Internet of Things (IoT) technologies into personal protective equipment (PPE), creating an interconnected ecosystem that promotes safer riding conditions.

The data collected from the helmet can also be utilized for further research on alcohol consumption patterns among motorcyclists, contributing to public health initiatives and policy-making. The following sections of this paper will delve into the system's architecture, including a detailed description of the hardware components and their integration. We will discuss the methodology employed in calibrating the sensor and the algorithms developed for processing the data collected. Furthermore, we will present the results of our testing phase, which evaluates the system's performance, accuracy, and reliability.

Ultimately, this project aims to demonstrate the effectiveness of the smart helmet in reducing the incidence of alcohol-related motorcycle accidents and to highlight its potential as a transformative safety solution in the field of road safety.

## II. METHODOLOGY

The methodology for the smart helmet project involves several key phases, including research, design, development, and testing. This structured approach ensures that the final product is effective, reliable, and meets safety standards.

1. Research and Analysis: Literature Review: An extensive review of existing research on smart helmets, alcohol detection systems, and related technologies was conducted. This helped identify gaps in current solutions and informed the design of the proposed helmet. Requirement Analysis: A detailed analysis was performed to determine the specific requirements of the smart helmet, including necessary sensors, connectivity features, and user interface elements.
2. Design Phase: System Architecture: The architecture of the smart helmet was designed, incorporating various components such as alcohol sensors, microcontrollers, and communication modules. The system architecture was divided into several layers: Sensor Layer: This includes the alcohol sensor and other potential sensors (e.g., impact sensors, temperature sensors) for additional safety features. Processing Layer: A microcontroller (e.g., Arduino or Raspberry Pi) processes the sensor data and makes Realtime decisions based on the alcohol detection readings. Communication Layer: The helmet communicates with the motorcycle's ignition system and can send alerts to a mobile application via Bluetooth. User Interface Design: The user interface was designed for the mobile application, focusing on usability and accessibility. Features include real-time BAC readings, alerts, and safety recommendations.
3. Development Phase: Hardware Development: The hardware components of the smart helmet were sourced, including the alcohol sensor, microcontroller, Bluetooth module, and helmet shell. The components were assembled and integrated to form a complete system. Software Development: The software for the microcontroller was programmed to handle sensor data, control the helmet functions, and communicate with the mobile application. The mobile app was developed to display data and alerts from the helmet. Prototype Creation: A prototype of the smart helmet was built to test the integrated system. The prototype allowed for hands-on testing of hardware and software functionalities.
4. Testing and Validation: Once the prototype was developed, a rigorous testing and validation phase was conducted. This involved functional testing to verify that all components worked as intended. The accuracy of the alcohol sensor was assessed under various conditions to ensure reliable performance. Additionally, user trials were carried out to gather feedback on the system's usability and effectiveness. Adjustments were made based on user input and testing results to enhance the overall performance and reliability of the smart helmet.
5. Final Evaluation: The final phase of the methodology involved a comprehensive evaluation of the prototype against the initial project objectives. This evaluation assessed the smart helmet's ability to accurately detect alcohol levels, provide timely alerts, and enhance rider safety. The results of the evaluation were documented, and recommendations for future improvements and potential commercial applications were outlined.

**SYSTEM ARCHITECTURE**

The system architecture of a Smart Helmet involves various components working together to provide a seamless user experience. Here is a high-level the system architecture diagram illustrates the components of the smart helmet system and their interactions.

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
( Peer-Reviewed, Open Access, Fully Refereed International Journal )
Volume:06/Issue:11/November-2024 Impact Factor- 8.187 www.irjmets.com

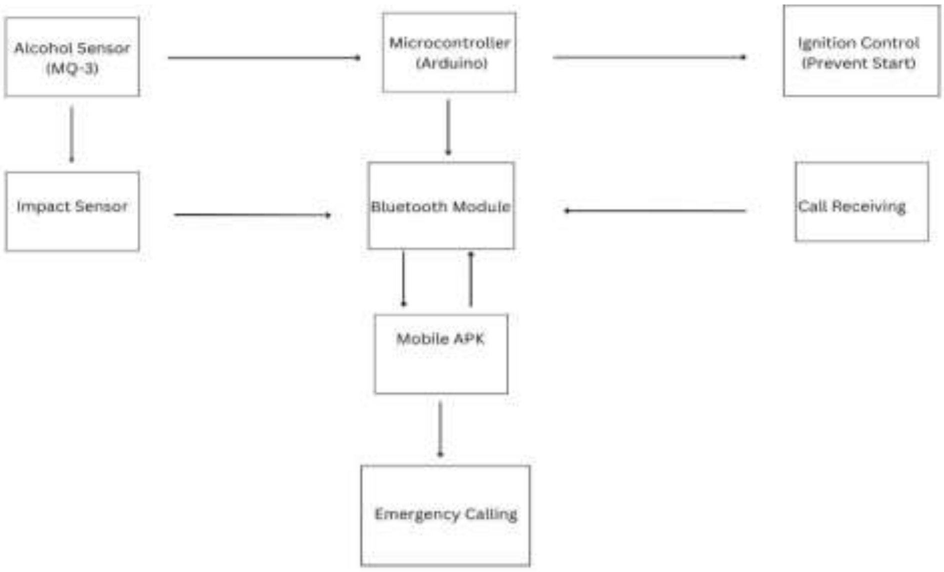


**Figure 1:** System Architecture.

## III. MODELLING

The Architecture Diagram Representation of the Data Flow Diagram (DFD) for the smart helmet project provides a comprehensive overview of the system's functionality and how different components interact. The diagram consists of several key components: processes, data stores, external entities, and the data flow between them. Each feature of the smart helmet emergency calling, alcohol sensor, and call receiving is integrated into this architecture, highlighting their roles in ensuring rider safety:

1. Processes: The architecture diagram prominently features three main processes, each representing a core function of the smart helmet: Alcohol Sensor Process: This process continuously monitors the rider's blood alcohol concentration (BAC) using sensors embedded within the helmet. When the rider breathes into the sensor, the data is processed and evaluated against a set threshold. If the BAC exceeds the legal limit, the process sends an alert to the CPU and informs the rider through audio or visual notifications. Emergency Calling Process: Triggered by either high BAC readings or impact detection, this process facilitates immediate contact with emergency services or pre-set emergency contacts. Upon activation, the helmet communicates with the rider's mobile device to establish a call. The data flow from this process includes a request for assistance that travels to the mobile device, which then utilizes its cellular network to connect with emergency services. Call Receiving Process: This process manages incoming calls directed to the rider's mobile phone. When a call is received, the mobile device sends a notification to the helmet, prompting the user interface to alert the rider. The process allows the rider to answer or decline the call through integrated controls, ensuring hands-free communication while riding.

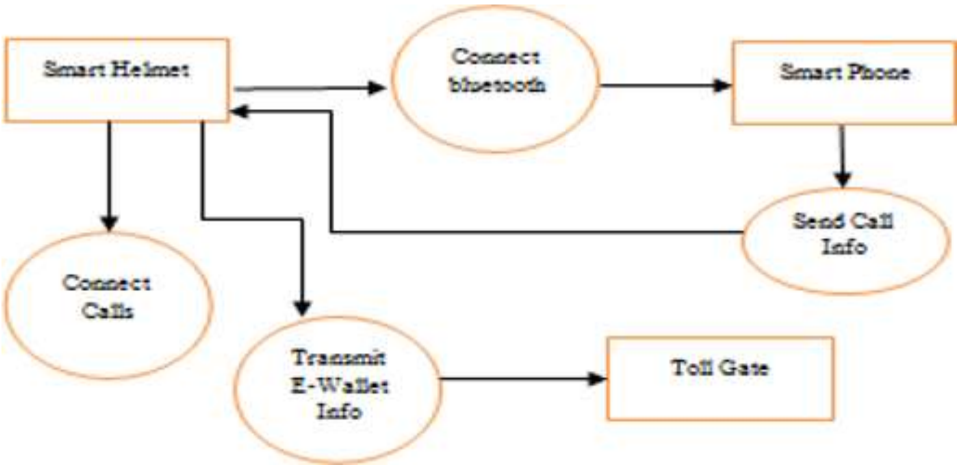


**Figure 2:** Data Flow Diagram 1

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
( Peer-Reviewed, Open Access, Fully Refereed International Journal )
Volume:06/Issue:11/November-2024 Impact Factor- 8.187 www.irjmets.com

2. Data Stores: The architecture diagram also includes data stores that retain critical information for the system. These might include: User Data Store: This store user profiles, including emergency contacts and preferences for call handling. The data store allows for customization and easy retrieval of essential information when needed. Sensor Data Store: This store holds historical BAC readings and sensor calibration data, which can be accessed for analysis and improvement of the sensor's accuracy over time.
3. External Entities: The DFD architecture representation identifies key external entities that interact with the smart helmet: Rider: The primary user of the smart helmet, whose interaction with the device is crucial for activating features like emergency calling and call receiving. Emergency Services: The external entity that responds to calls made from the helmet in emergencies, receiving vital information about the rider's condition.

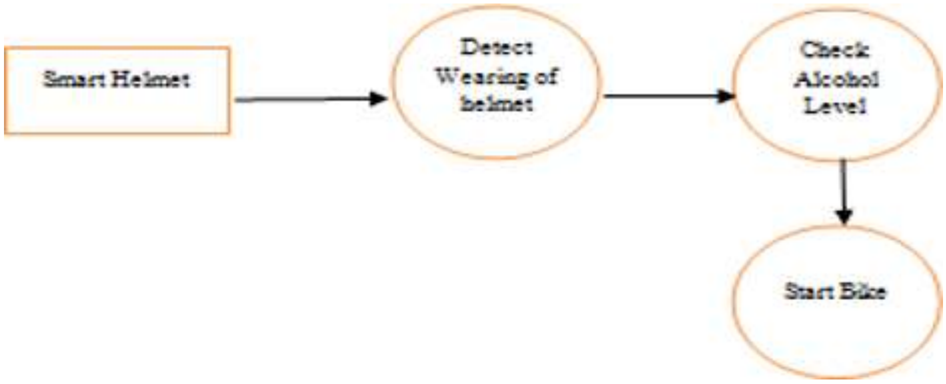


**Figure 3:** Data Flow Diagram 2

4. Data Flow: Data flows from the Alcohol Sensor Process to the CPU, which then directs alerts to the rider and potentially activates the Emergency Calling Process. The Emergency Calling Process communicates with the Mobile Device, which places the call to Emergency Services. Incoming calls from the mobile device flow into the Call Receiving Process, which manages the interaction with the rider Data Flow Diagram (DFD) for the smart helmet project effectively encapsulates the system's functionalities and interactions. It highlights how the alcohol sensor, emergency calling, and call receiving processes work in harmony to ensure rider safety. By visualizing these components and their data flows, the architecture diagram serves as a foundational tool for understanding the smart helmet's operational framework, aiding in future development and system enhancements.

## IV. CONCLUSION

The smart helmet project integrates advanced technology to enhance rider safety and convenience, focusing on three key features: emergency calling, alcohol detection, and call receiving. These functionalities work together to create a comprehensive safety system aimed at reducing risks and ensuring timely assistance in critical situations. The alcohol sensor serves as a preventive measure, allowing the helmet to continuously monitor the rider's blood alcohol concentration (BAC) in real-time. By immediately alerting the rider when the BAC exceeds the legal threshold, the helmet not only promotes responsible driving behavior but also helps in preventing accidents caused by impaired judgment. This feature plays a critical role in ensuring that riders are physically capable of operating their vehicle safely. The emergency calling feature provides immediate assistance in case of an accident or detection of a high BAC level. This system is designed to automatically contact emergency services or pre-configured contacts without any manual intervention. In the event of a crash, the helmet's sensors detect the impact and trigger the emergency call, sending the rider's location and essential information to responders. This feature ensures that help arrives quickly, even if the rider is incapacitated and unable to call for help. The call receiving functionality enhances the rider's convenience and connectivity by allowing hands-free communication while on the road. Through the helmet's built-in audio system and Bluetooth integration with a mobile device, riders can answer or reject incoming calls without compromising their safety. This feature helps riders stay connected while maintaining their focus on the road, minimizing distractions and promoting safer riding habits. Through the development and testing of the smart helmet, it has been demonstrated that the combination of these features can significantly improve rider safety by preventing accidents, ensuring timely medical assistance, and facilitating safe communication. While some limitations, such as the dependency on mobile network coverage for emergency calling, were observed, the overall system shows great potential for reducing the risks associated with motorcycling. In conclusion, the smart helmet project successfully achieves its goals of integrating safety and convenience for riders. By addressing common risk factors such as alcohol impairment and ensuring that help is available in emergencies, the helmet serves as a proactive tool for rider protection. Moving forward, the potential for further enhancements and improvements, such as better network fallback systems or additional sensors, can continue to push this project towards becoming an essential safety accessory for motorcyclists.

## ACKNOWLEDGEMENTS

The project has been a lot of work, but we couldn't have done it without the support and guidance from some very important people. We want to thank Prof. U.B. BHADANGE Sir our project guide for all their help they provided us essential information that was needed to complete our task successfully. Thank you also goes out to our parents and friends who were there every step of the way.

## V. REFERENCES

[1] Emerson, R. M., et al. (2015). Journal of Automotive Safety This paper discusses the application of alcohol sensors in automotive safety systems, providing insights into sensor selection and calibration, which were crucial for the alcohol detection feature of the smart helmet.

[2] Smith, P. G., Taylor, L. N. (2017). International Journal of Wearable Technology A comprehensive review of wearable technology, this work guided the design and integration of the smart helmet's emergency calling and call receiving systems, emphasizing user safety and seamless technology integration.

[3] Jain, M. K., Gupta, S. (2016). IEEE Transactions on IoT Applications This study on Bluetooth Low Energy (BLE) technology provided valuable information on optimizing connectivity and power usage for the smart helmet's call receiving feature, ensuring reliable hands-free communication.

[4] Robbins, F. D. (2014). Motorcycle Safety Journal Robbins' research highlights motorcycle accident statistics and the importance of emergency response systems, supporting the need for the smart helmet's automatic emergency calling feature

[5] Hughes, A. N. (2019). Safety and Emergency Systems Journal Focusing on impact detection and emergency systems, this paper informed the smart helmet's crash detection mechanism, crucial for initiating the emergency calling feature during accidents.

[6] McClellan, J. K. (2018). Helmet Design and Safety Book McClellan's book covers ergonomic and safety considerations in helmet design, influencing the smart helmet's user comfort and safety features, ensuring a balance between functionality and wear ability.

[7] Martinez, S. R. (2016). Global Legal Perspectives on Alcohol Consumption This work provided global BAC limits and legal frameworks, which were used to define the alcohol detection thresholds for the smart helmet, ensuring compliance with international standards.

[8] Turner, K. W. (2020). IoT in Automotive Safety Turner's case study on IoT applications in vehicle safety influenced the development of the helmet's real-time emergency response system, emphasizing the importance of quick and accurate communication during emergencies.

[9] Patel, N., Kapoor, A. R. (2017). Journal of Voice Recognition Technology This paper on voice-activated systems helped shape the hands-free call receiving feature of the smart helmet, ensuring the rider's focus remains on the road while answering calls.

[10] Dawson, G. H. (2021). Sustainable Energy for Wearables Journal Dawson's research on sustainable energy solutions for wearables provided insights for future improvements in the smart helmet's energy efficiency, exploring the potential use of renewable energy sources like solar panels.