IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

SMART HELMET FOR ROAD ACCIDENT DETECTION

Ramanagouda B. Biradar[1], Rohan Gundu Ghadi[2], Shrihari M. Khavari[3], Vikrant V. Taladappanavar[4], Ashwini Garaddi[5]

1,2,3,4 Students of Dept of ECE, KLS VDIT, Haliyal

5, Assistant Professor of Dept of ECE, KLS VDIT, Haliyal

Abstract: Motorcycle riders account for a major portion of road accident casualties in India, often due to improper helmet use and delay in obtaining assistance after a crash.In this work, a Smart Helmet prototype is designed that combines multiple sensing modules to improve rider safety.The IR sensor ensures that ignition is permitted only when the helmet is worn properly, while an MQ-3 gas sensor monitors the rider's breath to restrict vehicle operation during alcohol influence.Additionally, an impact detection sensor identifies sudden shocks that may indicate a collision, upon which the system retrieves location details through a GPS unit and sends an automatic alert message via GSM to designated contacts.The complete setup aims to encourage safer riding practices and enable rapid emergency communication without human intervention.Overall, the proposed mechanism offers a practical and economical enhancement for two-wheeler safety through real-time monitoring and accident response automation.

Keywords: Smart Helmet, Rider Safety System, Accident Alerting, Alcohol Restriction

I. INTRODUCTION

. In India, two-wheelers are among the most widely used modes of transportation, which unfortunately exposes riders to a higher risk of severe injuries during crashes.Although laws exist to make wearing helmets compulsory, real-world compliance is still low, and drunk driving remains one of the primary causes of road tragedies.To counter such unsafe practices, technological solutions that enforce protective behavior and support immediate help during emergencies have become essential.A smart helmet system uses sensing and wireless communication to continuously supervise rider conditions and uphold safety rules.The system developed in this project detects proper helmet usage, measures alcohol content, and identifies accident impacts while exchanging information with a bike-mounted unit.Through this combined safety enforcement and automated alert functionality, the model is intended to reduce preventable harm and accelerate rescue response times

II. LITERATURE SURVEY

Safety solutions for motorcyclists have attracted wide research interest, especially in designs that automatically monitor rider behaviour and riding conditions. Many previous developments demonstrated that integrating sensors with communication modules can support accident avoidance and speed up emergency help.

Some researchers designed systems that verify helmet usage using detection sensors placed inside the helmet. They proposed that restricting the ignition when the helmet is not worn encourages responsible riding and reduces critical head injuries. Other studies focused on alcohol-sensing helmets, showing that real-time breath monitoring can prevent riders from operating a motorcycle under unsafe conditions.

Additional work examined solutions for immediate accident response. By embedding shock-detection sensors in the helmet and pairing them with GPS and GSM communication, these systems are capable of identifying collision events and delivering the location instantly to emergency contacts. Research findings collectively indicate that merging these safety features into a single smart helmet can create a proactive protection system that reduces loss of life during road accidents

III. RESEARCH METHODOLGY

- . The system begins by confirming that the rider is wearing the helmet, which is sensed using an Infrared module placed inside the helmet lining. When appropriate reflection from the IR source is detected, the signal confirms correct helmet usage. If this condition fails, the system prevents ignition and restricts vehicle movement until the helmet is worn.
-
- To address drunk-driving risks, the MQ-3 breath sensor continuously evaluates alcohol presence in the exhaled air. The measured value is compared against a predefined safety threshold inside the Arduino controller. If the value exceeds the limit, the vehicle ignition remains disabled and the rider is alerted regarding unsafe behavior.
-
- All safety inputs from the helmet — including wearing status and alcohol readings — are sent wirelessly to the motorcycle unit through Bluetooth communication. This ensures a live connection between the safety hardware mounted on the helmet and the bike electronics.
- Along with helmet detection and alcohol analysis, the system uses a force/impact sensor to register any sudden hit or shock that may indicate a possible crash. This sensor generates immediate alerts whenever abnormal pressure is detected, and the Arduino evaluates this information to determine whether an accident has taken place.
-
- If an accident is confirmed, the GPS module is activated to gather the present location of the rider. The obtained coordinates (latitude and longitude) help in pinpointing the crash site accurately. Right after this, the GSM module automatically sends an alert SMS to predefined contacts carrying both the warning and location details. This helps families or emergency support teams to react quickly.

1 . Helmet Detection – The IR sensor identifies whether the rider has properly worn the helmet and sends this state to the controller.

2. Alcohol Monitoring – The MQ-3 breath sensor evaluates alcohol concentration and flags the system when the reading crosses the allowed safety limit.

3. Data Communication – The Arduino collects all helmet-side sensor outputs and sends the processed data to the vehicle module wirelessly using Bluetooth.

4. Impact Recognition – The force sensor responds to sudden strikes and alerts the controller, indicating that a crash event may have occurred.

5. Position Tracking – When a crash situation is detected, the GPS module is activated to capture the rider's current location in terms of latitude and longitude, ensuring the accident spot can be identified accurately.

6. SMS Transmission – The GSM module generates and forwards the emergency message along with GPS details to the registered contacts for immediate help.

7. Safety Control – Based on all sensor conditions, the system either enables ignition or blocks it, while also initiating emergency actions when required.

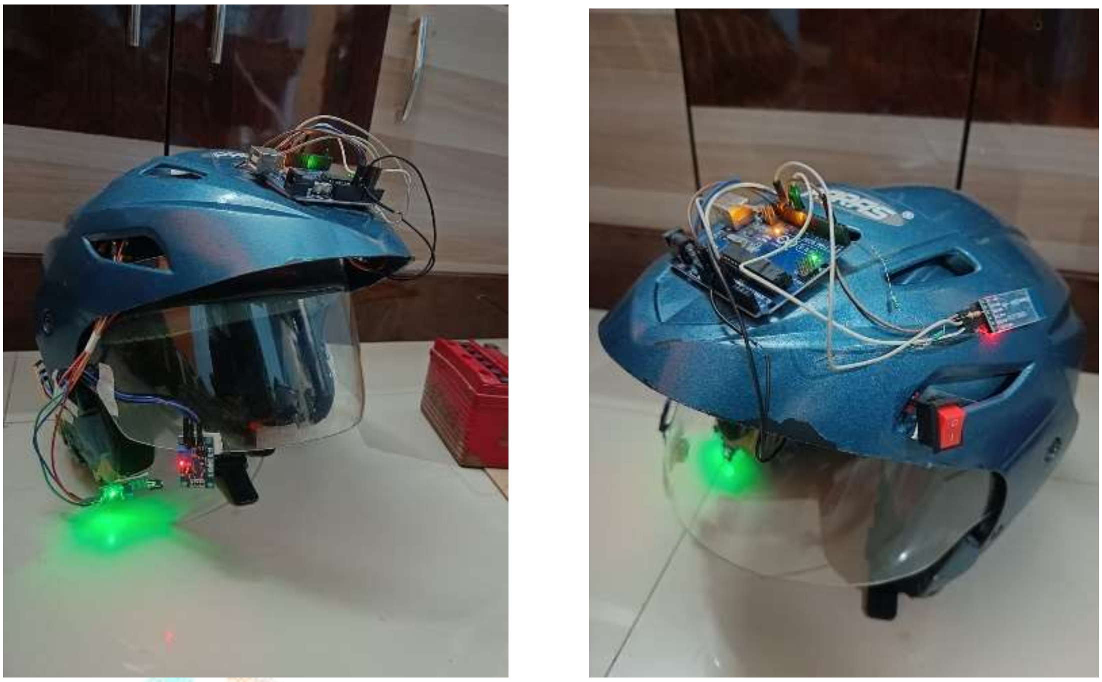

Figure 1: Transmitter Side

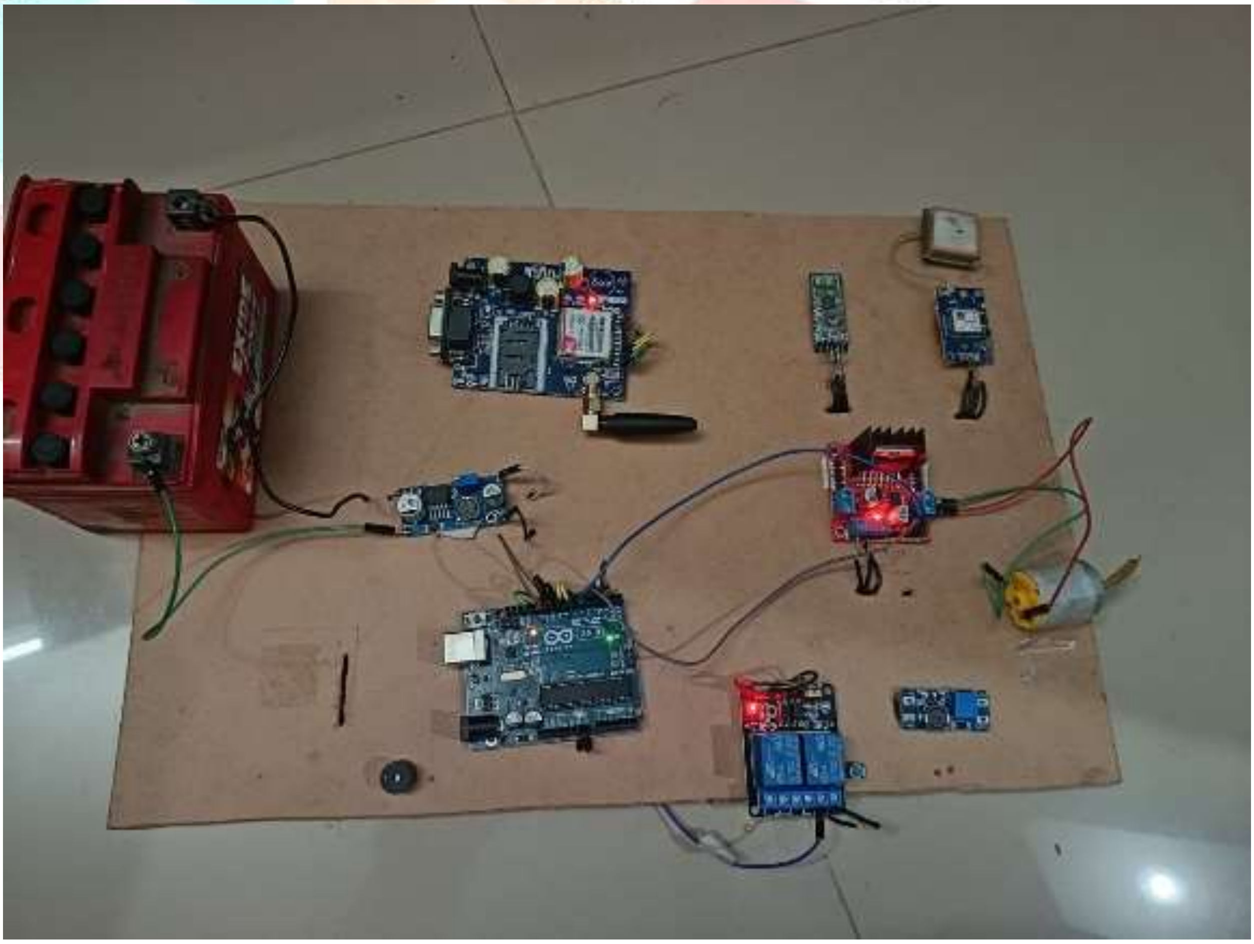

Figure 2: Processing Unit

IV. RESULT AND DISCUSSION

A series of practical tests were performed to verify how effectively each sensing module and communication unit operates within the developed system

The IR-based helmet detection module consistently differentiated between valid helmet-worn conditions and cases where the helmet was absent or loosely placed. These observations indicate strong reliability across different environmental situations, ensuring that ignition control remains accurate.

Similarly, the MQ-3 alcohol sensor demonstrated high sensitivity in recognizing variations in breath alcohol content. Even slight increases above the threshold were identified, allowing the system to intervene before unsafe driving could occur.

During controlled impact trials, the force sensor responded immediately to abrupt mechanical shocks, enabling the controller to recognize accident conditions without delay. This responsiveness is crucial for timely activation of alert mechanisms.

The Bluetooth communication link between the helmet and bike unit operated smoothly within its designated wireless range. Safety-related data such as wearing status, alcohol levels, and impact alerts were transmitted with negligible delay, supporting uninterrupted system monitoring.

Evaluation of the GPS module showed that location coordinates were obtained promptly and with satisfactory accuracy. This ensures that emergency alerts contain precise geographical information, which is vital for quick assistance.

The GSM module further enhanced system reliability by successfully delivering automated SMS alerts containing accident notifications and GPS coordinates. Although message delivery time occasionally varied depending on network strength, timely communication was achieved in all tested scenarios.

Overall, the integration of sensing, safety control, and communication elements validated that the prototype is capable of performing effectively under real operating conditions and can significantly improve emergency responsiveness and rider safety

V. CONCLUSION

The developed smart helmet prototype demonstrates a comprehensive solution for enhancing the safety of two-wheeler riders. By jointly implementing helmet-wear verification, alcohol control, accident detection, and automated emergency messaging, the system provides proactive monitoring throughout the ride.Experimental observations confirmed that the IR sensor reliably validated helmet usage while the MQ-3 sensor precisely identified alcohol presence, ensuring that ignition is permitted only under safe conditions. Additionally, the force sensor effectively recognized impact events, enabling rapid initiation of emergency procedures.

Incorporating GPS and GSM communication strengthened the overall design by ensuring accurate location tracking and quick dissemination of alert messages to emergency contacts.

These results confirm that the system has practical potential as an assistive safety tool for riders and as an embedded solution to reduce accidental fatalities through timely response.

Future enhancements may include direct integration with the vehicle's ECU, cloud-based monitoring, and advanced sensing mechanisms to further improve detection accuracy and overall system robustness.

REFERENCES

[1]Evans, D. (2011). Insights into the Internet of Things and its impact on interconnected digital environments. Cisco Press.

[2] William, J., Padwal, K., Samuel, N., Bawkar, A., & Rukhande, S. (2016). "Design of an Intelligent Helmet for Rider Safety." International Journal of Scientific & Engineering Research, 7(3), 591–594.

[3] Jadhawar, M., Kandepalli, G., Kohade, A., & Komati, R. (2016). A smart helmet-based protection approach designed with an ATmega microcontroller platform. International Journal of Research in Engineering and Technology, 9(3), 491–494.

[4] Kavianand, G., & Padmapriya, N. (2015). A protective helmet concept featuring alcohol-sensing and neural-signal monitoring technologies to enhance rider safety. International Journal for Research in Applied Science & Engineering Technology, 3(3), 391–394.

[5] Vijay, A., Singh, A., Singh, B. V., Yadav, A., Varghese, B., & Vijay, A. (2015). Advanced helmet architecture with integrated accident prevention mechanisms employing intelligent electronic modules. International Journal of Advanced Technology and Engineering Exploration, 2(6), 44□50.

[6] Srikrishnan, A., & Sudhaman, K. (2016). "Alcohol Detection Mechanisms in Intelligent Helmet Systems." International Journal of Computer Technology and Applications, 9(4), 1933–1939.

[7] Manjesh, N., & Raj, S. (2014). "Implementation of International Journal of Emerging Engineering Research, 2GSM and GPS-Based Accident Detection and Reporting Helmet." (4), 122–127.