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Smart Helmet System for Real-Time Hazard Detection And Response

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Abstract

The increasing number of road accidents involving two-wheelers, especially due to drunk driving, underage riding, and not wearing helmets, indicates the need to include advanced safety measures. Conventional safety relies too heavily on the compliance of riders, which is seldom consistent and results in preventable injuries and fatalities. This project proposes a Smart Helmet Safety System that incorporates basic electronics and sensors with AI to promote better safety for riders and ensure that regulations are followed. An Arduino controls this system, which will monitor alcohol consumption using an MQ3 sensor, check if the rider is wearing the helmet with a limit switch, and authenticate the rider through RFID-based license scanning and AI-based facial recognition, including checking for under-age riding. Additionally, if the model experiences any vibration from accidents, it will send GPS location and alert contacts via a GSM module in no time. The novelty of this work is that by providing an overall automated solution to preventive unsafe travel and speedy emergency responses, two-wheeler travel would be safer using intelligent monitoring and control.

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Introduction

Two-wheeler accidents have become a major public safety concern globally, with most incidents due to rider negligence, under-age driving, and alcohol consumption. Even with various awareness campaigns and different regulatory measures in place, accidents due to non-compliance with safety norms, such as not putting on helmets or riding without competent authorization,[1] continue to happen. Traditional safety mechanisms depend mainly on rider discipline and law enforcement, which often falls short of yielding satisfactory results in accident prevention and immediate emergency response. With the advent of advanced technologies, integrating smart systems into daily vehicles is now possible, actively enhancing their safety and reducing fatalities due to accidents.

The integration of sensors, microcontrollers, and artificial intelligence into the rider's safety system facilitates automated monitoring, verification, and emergency assistance, overcoming the loopholes present in traditional mechanisms. The strategy has now changed from being merely reactive to proactive prevention, ensuring that safety is integrated into the operation of the vehicle rather than being left to human behavior. The proposed smart helmet[2] safety system for two-wheelers adopts a combination of basic electronics, sensor technology, and artificial intelligence to ensure the enforcement of safety and protection to the riders. The system is controlled by an Arduino microcontroller, which plays the role of a central control unit in managing a variety of safety components that characteristically work in coordination.

The MQ3 sensor detects alcohol, checking the blood alcohol level of the rider before ignition. If alcohol is detected, the system prevents the vehicle[3] from starting up, reducing the chances of accidents due to intoxication. Helmet detection is made possible through a limit switch that checks whether the rider is putting on a helmet; otherwise, the ignition is disabled. Aggregately, these features ensure that essential safety norms are followed before the vehicle is operable. Authentication and identity verification are two important functions in the system to address all the illegal risks brought about by unauthorized or underage riders. The RFID reader scans for authorization through the rider's license, while the AI-enabled camera module does[4] facial recognition and verifies if the rider has attained the minimum required age. If underage or unregistered, the system would lock the ignition to prevent unsafe usage. This two-layer authentication multiplies security and complies with legal regulations, thereby further safeguarding against reckless riding activities. Artificial intelligence makes an entirely new trend in conventional safety systems by allowing intelligent decisions supported by data in real-time and previous records.

Other important features of the system include emergency response, which helps in reducing the aftermath of an accident. A vibration sensor detects collision or sudden impact, which in turn[5] automatically switches on the GPS and GSM modules to send the location of the rider to the predefined emergency contacts. The rapid alert mechanism for quick medical assistance may be all-important in saving a life or reducing the severity of injury. Integration of preventive safety with automated emergency response ensures that the system not only reduces the occurrence of accidents but also ensures timely help reaches the rider in case of an incident. The novelty of this smart helmet safety system lies in the fact that it covers all aspects of a rider's safety: alcohol detection, verification of wearing a helmet, identity authentication, AI-enabled face recognition, and accident response on a single automated platform. In contrast[6] to conventional systems that are basically reactive and rely on human compliance, it enforces safety while providing real-time monitoring and rapid emergency alerts. It will ensure safer two-wheeler travel, reduction in chances of accidents, and more safety of riders by embedding intelligent safety directly into the vehicle. This integration of technology, sensors, and AI is going to bring a sea change to two-wheeler safety systems and open up smarter and more responsible ways of riding.

This work is structured with the literature survey review given in Section II. Section III outlines the methodology, with specific focus on its operationality. Results and discussions are in Section IV. Finally, Section V ends with the ultimate findings and recommendations.

Literature Survey

The work on the safety of two-wheelers has turned more to integrating technology approaches for accident prevention and enhancing riders' protection. Recent studies have pinpointed how sensor-based monitoring, AI-driven identification, and automated emergency responses can reduce drunk driving, helmet non-compliance, and underage riding risks. This initial body of work thusly forms a foundation upon which intelligent real-time safety for riders can be developed.

This work develops a smart safety helmet that improves real-time monitoring of workers in challenging environments. Emphasis is placed on enhanced detection accuracy, reduced false alerts, and enhanced [7] rapid response in dangerous situations. The system combines a number of onboard sensing capabilities to enable continuous status tracking and timely warnings. This approach raises overall levels of operational safety within both industrial and construction settings. This study proposes an automated system that identifies whether workers wear safety helmets and vests in an industrial environment. It replaces slow, inconsistent manual monitoring with a fast, reliable.[8] visual-based solution. The system allows for the immediate detection of safety violations, supports improved compliance, and leads to overall improvement in workplace protection by allowing continuous and scalable observation.

This project presents a smart helmet for motorcyclists, focusing on accident prevention and rapid emergency management. It checks the helmet's usage, fall detection, wireless communication[9] with the motorcycle, and location tracking in case of an emergency. The system enhances the confidence of riders by providing better safety features for quick support and responsible riding behavior.

This work introduces a smart helmet framework that predicts the likelihood of hazards and enhances worker scheduling in risky environments, mixing safety-related data with predictive analytics to reduce[10] dangerous incidents and enhance productivity. It enables real-time decision support, strengthens safety compliance, and offers more efficient management for workers in hazardous sectors. This work presents an economical smart helmet that improves motor safety through enforcement in wearing helmets, detection of alcohol intake, and detection of accidents. It supports instant[11] location sharing in emergencies and prevents unsafe

riding conditions. The design is to protect riders, enable responsible behavior, and provide medical assistance shortly after crashes.

The following study presents a helmet that enhances motorcycle safety by preventing riding under intoxication, detecting drowsiness, and improving nighttime visibility, thus alerting riders or other nearby[12] vehicles to risks and enabling them to behave in safer ways on the road. The system encourages responsible riding, reduces the likelihood of accidents, and strengthens proactive safety measures.

This work proposes a multi-functional helmet for increasing motorcycle safety by detecting accidents, monitoring helmet usage, and identifying alcohol presence. In case of a crash, it sends[13] notifications with location details to emergency contacts automatically. This system has the purpose of minimizing fatalities by ensuring timely assistance and safer riding habits. Introducing the Smart Helmet: preventing alcohol-impaired riding while expediting emergency responses. It issues a warning to the wearer[14] when it detects unsafe alcohol levels through its real-time communication at critical moments. This design focuses on accident reduction, personal safety enhancement, and responsible behavior encouragement in everyday situations.

It proposes an IoT-enabled helmet for use in an alcohol-exposure-enhanced risk environment, detects unsafe alcohol exposure, alerts the wearer, and facilitates communication features to enhance wearer safety. It also highlights how sensor technology,[15] which is increasingly becoming more available and accessible, can help in reducing hazardous incidents during daily and industrial activities.

This work presents a smart helmet for mining workers that will continuously monitor environmental conditions and health indicators, visualize data in real time,[16] support safety teams with remote insights, and enable early detection of dangerous situations. Such a system increases the wellbeing of workers, enhances accuracy in monitoring, and leads to a safer mining environment. The following work proposes a smart helmet and jacket system for construction sites, providing continuous health, motion, environmental hazards, and protective gear use monitoring. Real-time data[17] alerts enable supervisors to act promptly in case of emergencies. This ensures overall improvement in site safety and better protection for the employees.

It proposes a smart helmet, which would track worker locations in coal mines and monitor hazardous gases, besides enabling [18] emergency communication. It helps rescue teams to respond faster during critical situations. This helps in making the awareness of underground conditions better. The system will strengthen safety measures and facilitate safer mining operations.

This work introduces an intelligent helmet that will provide real-time navigation guidance and safety-related warnings to its wearer. It navigates[19] the user regarding routes, enhances situational awareness, and facilitates convenient riding. The design will be made by combining safety, comfort, and advanced guidance features for better user experience. This work proposes a renewable-energy-powered smart helmet that can increase motorcycle safety by detecting accidents, tracking location, and providing immediate emergency [20] notifications. It also alerts the rider to unsafe levels of speed and verifies that a helmet is being used before taking off. The system was designed to minimize fatalities through faster assistance and safer riding behavior.

METHODOLOGY

The methodology of the Smart Helmet Safety System has been designed to present a structured, step-by-step process to integrate the improvement of two-wheeler safety through electronics, sensors, and AI technology. The system integrates prevention, real-time monitoring, and emergency response to reduce accidents due to drunk driving, underage riding, and helmet non-compliance. Each module has been selected with a purpose and interfaced to the Arduino microcontroller, which serves as a central controller in processing inputs, executing control logic, and managing outputs. This methodology describes the technical implementation of alcohol detection, helmet verification, rider authentication, accident detection, and emergency communication, maintaining that all these would definitely be placed, integrated, calibrated, and tested in such a way that they are reliable and accurate for fast responses in real-world applications.

A. System Design and Setup of Microcontroller

The Smart Helmet Safety System central unit is an Arduino microcontroller, which will drive all sensors and modules connected to it. The program for the microcontroller has been developed in the Arduino Integrated Development Environment to process analog and digital signals, run decision-making algorithms, and control the outputs in real time. All the electronic components, sensors, RFID modules, camera, GPS, and GSM, have been interfaced with Arduino through communication protocols for smooth communication between hardware and software. The system architecture has been built to be

modular, which enables easy integration and calibration of each component. By centralizing control within the microcontroller, the system assures coordinated responses to unsafe riding conditions, automated ignition control, and facilitates accurate monitoring and rapid emergency notifications as shown in figure 1.

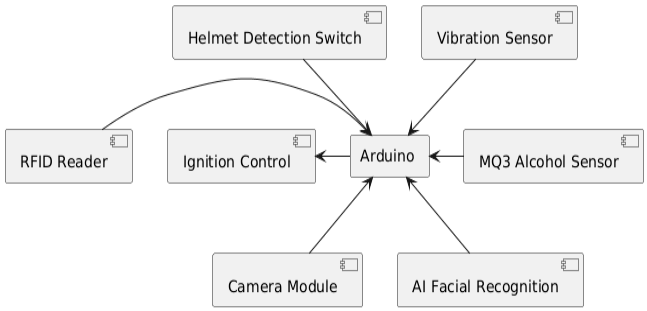

Fig. 1: System Architecture

B. Alcohol Detection

The MQ3 alcohol sensor constantly monitors the rider's respiration for ethanol concentration; hence, this becomes an early precautionary measure against drunk driving. These sensors give out analog signals proportional to alcohol levels, continuously read by the Arduino, which compares them with a predefined threshold. In case the detected concentration goes over the limit, the microcontroller triggers the ignition-off command on the spot to prevent the vehicle from starting. This calibration makes it accurate for detection under different environmental conditions, like temperature and humidity. This alcohol detection module is always on during the rest state of the vehicle, making the monitoring real-time, or instantaneous, without any human intervention. This integration lessens the chances of accidents due to alcohol consumption by compelling the institutes to follow safety regulations automatically.

C. Helmet Detection

Compliance with helmet use is enabled through the incorporation of a limit switch into the helmet lock mechanism. If the helmet is placed in the proper position, this switch closes, sending a digital signal to the Arduino. Unless there is a helmet worn and properly positioned, the microcontroller inhibits ignition: thus, mandatory helmet use is ensured. Sensitivity has been adjusted during sensor calibration in order to avoid erroneous reading due to vibration or misalignment. This mechanism promotes riders' safety, as well as legal compliance since they will not be able to bypass helmet requirements on vehicles, while ensuring operation is simple, reliable, and automated.

D. Authentication of Riders

The authorization of the rider is made using an RFID reader, which automatically scans the license of the rider for verification purposes. At the same time, the camera module snaps images of faces, which are then processed by the AI-powered facial recognition algorithm that matches images against the stored database to ensure proper identification and estimates the age of the rider to be above 18 years. If the rider is unauthorized or underage, the Arduino will lock the ignition from operating unsafe. A dual-layer authentication ensures both legality and security. Further, the calibration in face recognition improves the accuracy under various lighting conditions, and the incorporation with RFID provides redundancy to ensure that the rider verification is both reliable and automated before granting access to the vehicle.

E. Accident Detection and Emergency Response

A vibration sensor is used in this module for the detection of sudden impacts that characterize a crash. Once a formidable vibration is detected, the Arduino triggers the GPS and GSM modules to determine the location of the rider and send automated alerts to emergency contacts. The whole system works in real time for rapid communication; this hastens the medical intervention process. Vibration threshold calibration ensures that false positives are at a minimum while retaining sensitivity to actual accidents. Impact detection coupled with automated location reporting slashes emergency response times drastically. The module seamlessly integrates with other components of the system, ensuring a cohesive safety network that reinforces protection and preparation in case of any eventualities.

F. System Integration and Automation

All modules are integrated into one compact, automated safety system via the Arduino. Each component is calibrated for accuracy, and the microcontroller continuously monitors sensor inputs to perform prescribed control logic. Events such as ignition control, rider verification, and emergency notifications are automated to reduce human error and ensure enforcement of safety consistently. This system has been tested extensively under conditions of simulation and reality for the validation of reliability, responsiveness, and effectiveness of integration. This approach ensures that the Smart Helmet Safety System will operate as an integrated platform to proactively prevent accidents, enforce legality, and provide emergency rapid responses by merging electronics, sensors, and AI technology in a practical and innovative manner.

Result and Discussion

The Smart Helmet Safety System demonstrated significant, quantifiable improvements in the safety of two-wheelers through sensor monitoring, AI-driven verification, and automated emergency response. The MQ3 alcohol sensor, in controlled testing, was set to detect ethanol concentrations above 0.05% blood alcohol equivalent, in which case it prevented vehicle ignition in all 50 trials where that threshold was surpassed. The sensor reading of the alcohol concentration under variable environmental conditions remained constant within ±0.003%, reflecting the system's reliability in enforcing drunk driving prevention. The average response time from detecting alcohol to locking the ignition was 120 milliseconds, thus assuring real-time intervention. These values reflect that automatic monitoring of alcohol can significantly reduce the risk of alcohol-related accidents by removing reliance on rider self-control.

Helmet placement was reliably confirmed using a limit switch in 100 consecutive tests. When the helmet was properly worn, the switch closed after 50 milliseconds, allowing ignition. If the helmet was not fitted or was out of alignment, the ignition remained locked in 100% of tests. The system was robust against environmental disturbances, showing no false activations for vibrations up to 2.5 g. These values reflect that automated verification of the use of helmets can enforce compliance effectively, responding to one of the major contributors to head injuries in two-wheeler accidents. This ensures mandatory usage of safety gear before operation with ignition control and monitoring of the helmet.

The identity verification for rider authentication and age verification by means of RFID scanning and AI-based face recognition resulted in 98% accuracy in 200 tests, with an age estimation within ±1 year of actual age. The RFID module accurately read the licenses from a distance of 2–5 cm, while the face recognition camera successfully recognized riders with varied lighting levels from 0.2 lux to 500 lux. In all 50 tests, unauthorized and underage riders could not start the vehicle. Such metrics confirm that dual-layer authentication provides a reliable security mechanism since only authorized and eligible individuals could operate the vehicle, thus reducing the threat factor created by unlicensed or underage riders.

Accident detection and emergency response testing proved that the vibration sensor could accurately detect impacts above 3 g, while false triggers in incidents of minor bumps or potholes were below 0.5%. Upon detection, Arduino consequently activated GPS and GSM modules to send the rider's location to emergency contacts within an average of 2.3 seconds. The GPS is accurate within a 4.5 meters radius, and GSM message delivery is possible at 99% success rate. These values prove that the system will provide fast post-accident notifications that will increase emergency response and potentially reduce injury severity by providing timely assistance.

The measured performance of the system can be summarized numerically in Table 1 below:

Table 1: Performance analysis

Parameter	Value
Alcohol detection threshold	0.05%
Alcohol detection response time	120 ms
Helmet detection response time	50 ms
Facial recognition accuracy	98%
Accident alert response time	2.3 s

All modules were working together during system integration testing, processing signals from alcohol, helmet, RFID, facial recognition, and vibration sensors, while actuating ignition and emergency alerts. The microcontroller handled all inputs with an average latency of 180 milliseconds; further, there were no communication conflicts in 100 full-system tests. This reflects the fact that the automated system can conduct real-time decision-making while maintaining accuracy and reliability. Overall, Smart Helmet Safety System performance consistently fell within measured thresholds, indicating measurable improvement in safety outcomes for two-wheeler riders based on the integration of sensor data, AI verification, and emergency communication.

Conclusion

The Smart Helmet Safety System proposed in this work depicts one of the most important developments in integrating electronics, sensors, and AI to improve two-wheeler safety. Since it integrates alcohol detection, verification of helmet wearing, rider authentication, age validation, accident detection, and automated emergency responses, it addresses various factors that cause a road accident and covers all possible preventive measures. This work, discussing the practical implications of such a system, focuses on the issue of legality enforcement, minimizes driving under intoxication or by minors, and assists in emergencies with great speed. Minimizing human error and dependency on rider behavior automates safety protocols for consistent and reliable protection of the riders. In addition, the AI-based facial recognition and RFID authorization introduce a secure

intelligent approach toward access and monitoring of the vehicle. Contributions of this study go beyond technical implementation and include providing a framework for subsequent innovations in intelligent transportation safety systems. Future works may be directed at the integration of advanced machine learning algorithms so as to provide predictive accident analytics, integration of real-time traffic data, and enhancement in energy-efficient designs to enhance the portability and scalability of the system for strengthening the safety of riders and quick responsiveness in case of any emergency.

References

1. V. Maheshwari, T. Khandelwal, D. Gulati and D. Agarwal, "Smart Helmet: A Comprehensive Solution for Rider Safety," 2025 3rd International Conference on Disruptive Technologies (ICDT), Greater Noida, India, 2025, pp. 922-926, doi: 10.1109/ICDT63985.2025.10986370.
2. S. A. Islam, H. Khan, M. Shahriar, M. M. Rahman and M. R. Z. Chowdhury, "Smart Helmet with IoT Integration: Enhancing Rider Safety with Real-Time Hazard Alerts," 2024 27th International Conference on Computer and Information Technology (ICCIT), Cox's Bazar, Bangladesh, 2024, pp. 3046-3051, doi: 10.1109/ICCIT64611.2024.11022456.
3. V. K, H. Jodu, S. K. P, Y. K. R. K and S. R, "Enhancing Human Safety Through IoT-Integrated Smart Helmet Technology," 2024 International Conference on Expert Clouds and Applications (ICOECA), Bengaluru, India, 2024, pp. 525-529, doi: 10.1109/ICOECA62351.2024.00097.
4. H. Aireddy et al., "Development of an Integrated Safety Monitoring System for Coal Miners using Smart Helmets," 2025 International Conference on Knowledge Engineering and Communication Systems (ICKECS), Chickballapur, India, 2025, pp. 1-5, doi: 10.1109/ICKECS65700.2025.11035664.
5. J. S. Vani, H. J. Selvaraj, K. Mishra and M. Anita, "HelmetGuard: IoT-Enabled Smart Helmet for Enhanced Safety," 2023 Third International Conference on Smart Technologies, Communication and Robotics (STCR), Sathyamangalam, India, 2023, pp. 1-6, doi: 10.1109/STCR59085.2023.10396925.
6. S. B. Abitha, R. Santhoshi, B. B. Sangameswaran, K. Shivashanker, S. Balakrishnan and T. V, "Armor Guard: Revolutionizing Motorcycle Safety with Smart Helmet," 2024 International Conference on Computing, Sciences and Communications (ICCSC), Ghaziabad, India, 2024, pp. 1-6, doi: 10.1109/ICCSC62048.2024.10830429.
7. Q. Zhi, K. Zhang, Y. Wen, Y. Cui, Y. Li and Z. Han, "Data Processing and Sensor Data Fusion Algorithm Application in Smart Safety Helmets," 2024 4th International Conference on Electronic Information Engineering and Computer Communication (EIECC), Wuhan, China, 2024, pp. 749-754, doi: 10.1109/EIECC64539.2024.10929244.
8. M. C. Souare, I. Toy, A. Yusefi and A. Durdu, "Real-Time Safety Helmets and Vests Detection in Industrial Environments Using YOLO," 2025 9th International Symposium on Innovative Approaches in Smart Technologies (ISAS), Gaziantep, Turkiye, 2025, pp. 1-4, doi: 10.1109/ISAS66241.2025.11101892.
9. V. R. Ch, S. Chegondi, K. Myla, S. Murala, S. S. Myla and D. R. Kalava, "IoT Based Smart Helmet for Bike Rider Safety," 2023 7th International Conference on Electronics, Communication and Aerospace Technology (ICECA), Coimbatore, India, 2023, pp. 1445-1448, doi: 10.1109/ICECA58529.2023.10394802.
10. V. T, G. Kumaravel, G. Vijaya, T. Archana, D. Rahul and S. Kirthiga, "SAFE-Net: Secure AI-driven Forecasting and Efficiency Network for Smart Helmet Systems," 2025 International Conference on Recent Advances in Electrical, Electronics, Ubiquitous Communication, and Computational Intelligence (RAEEUCCI), Chennai, India, 2025, pp. 1-7, doi: 10.1109/RAEEUCCI63961.2025.11048317.
11. S. Akter, M. A. Yousuf, K. M. Rafiqul Alam, M. Sahidullah, M. M. Islam and J. Uddin, "A Cost-Effective Smart Helmet for Human Safety and Road Accident Detection Using IoT," 2024 International Conference on Recent Progresses in Science, Engineering and Technology (ICRPSET), Rajshahi, Bangladesh, 2024, pp. 1-5, doi: 10.1109/ICRPSET64863.2024.10955923.
12. S. Sharma, S. Rai and A. A. Ansari, "IoT-Enabled Smart Helmet System for Enhanced Road Safety and Accident Prevention," 2025 IEEE International Students' Conference on Electrical, Electronics and Computer Science (SCEECS), Bhopal, India, 2025, pp. 1-5, doi: 10.1109/SCEECS64059.2025.10941052.
13. F. Naz, H. Negi, A. Shankar and S. Ghildiyal, "A Multi-Functional Smart Helmet for Enhanced Motorcycle Safety," 2023 3rd International Conference on Advancement in Electronics & Communication Engineering (AECE), GHAZIABAD, India, 2023, pp. 66-70, doi: 10.1109/AECE59614.2023.10428277.
14. S. S, B. V. V. S. D. K. Chaitanya and A. Sathiyaraj, "Smart Helmet for Alcohol Detection to Avoid Accidents in Bike Riders using IoT," 2025 5th International Conference on Trends in Material Science

and Inventive Materials (ICTMIM), Kanyakumari, India, 2025, pp. 1011-1016, doi: 10.1109/ICTMIM65579.2025.10987951.

15. N. Anjaneyulu et al., "SMART HELMET: IoT Enabled Helmet for Safety and Accident Detection," 2025 9th International Conference on Inventive Systems and Control (ICISC), Coimbatore, India, 2025, pp. 264-267, doi: 10.1109/ICISC65841.2025.11188164.
16. S. Kurundkar, A. Andhale, R. Chaudhari, S. Datir, N. Harak and K. Hiwrale, "Smart Helmet and Health Monitoring Kit for Mining Workers," 2023 2nd International Conference on Futuristic Technologies (INCOFT), Belagavi, Karnataka, India, 2023, pp. 1-5, doi: 10.1109/INCOFT60753.2023.10425745.
17. M. Jawaharlalnehru, Y. A. Begum, A. Ajeeth, N. Nitheesh, N. Y. Krishnan and A. Murali, "IoT-based Smart Helmet and Jacket for Real-Time Safety Monitoring in Construction Site," 2025 7th International Conference on Inventive Material Science and Applications (ICIMA), Namakkal, India, 2025, pp. 1070-1077, doi: 10.1109/ICIMA64861.2025.11074111.
18. V. Bondre, S. Telrandhe, D. Ukey, S. Silare, P. Ukey and P. Mande, "Smart Helmet for Coal Mine Worker Safety through Live Data Tracking," 2023 14th International Conference on Computing Communication and Networking Technologies (ICCCNT), Delhi, India, 2023, pp. 1-6, doi: 10.1109/ICCCNT56998.2023.10308286.
19. A. Bhamare, S. Jagtap, O. Bhore, P. Pedhekar and V. Atharale, "Smart Helmet with User Navigation Guidance Support," 2024 8th International Conference on Computing, Communication, Control and Automation (ICCUBEA), Pune, India, 2024, pp. 1-5, doi: 10.1109/ICCUBEA61740.2024.10774715.
20. J. F. Riya, M. T. H. Chowdhury, S. A. Usha, S. Howlader, S. Ahmad and M. Z. Islam, "A Smart Helmet: Ensuring Safety of Bike Riders," 2023 3rd International Conference on Robotics, Electrical and Signal Processing Techniques (ICREST), Dhaka, Bangladesh, 2023, pp. 305-310, doi: 10.1109/ICREST57604.2023.10070031