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Smart Helmet with Accident Detection and Prevention Technique

Jagdish Keda Bhamare[1] , Prof. Jitendra Musale[2], Prof. Chetna Upasani[3], Tejas Mukesh Gurav[4], Amol Prabhakar Janrao[5] , Amruta Shivaji Thorat[6]

[1]Software Engineering Anantrao Pawar College Of Engineering And Research Pune,India jagadishbhamare04@gmail.com
[4]Software Engineering Anantrao Pawar College OF Engineering And Research Pune, India tgurav203@gmail.com
[2]Computer Engineering Anantrao Pawar College OF Engineering And Research Pune, India jitendra.musale@abmspcoerpune.org
[5]Software Engineering Anantrao Pawar College OF Engineering And Research Pune, India 1amoljanrao108@gmail.com
[3]Computer Engineering Anantrao Pawar College OF Engineering And Research Pune, India chetna.upasani@abmspcoerpune.org
[6] Software Engineering Anantrao Pawar College OF Engineering And Research Pune, India thoratamruta9174@gmail.com

ABSTRACT

With the rise in road accidents involving motorcyclists, enhancing rider safety through technology has become a critical area of research. This paper presents an advanced version of the Smart Helmet system that integrates IoT technology with alcohol and accident detection capabilities, while adding a real-time camera sensor for video monitoring. The proposed system consists of four key components: a helmet circuit, mobile application, vehicle circuit, and camera module. The helmet incorporates alcohol detection (via MQ3 sensor), accident detection, GPS-based location tracking, and now, a camera sensor for real-time monitoring of the rider's environment. The camera captures video data, which is transmitted to the cloud and can be accessed through a mobile app in case of emergency situations or incidents. This visual data, along with GPS coordinates, provides detailed information to emergency responders. The system prevents the vehicle from starting if alcohol is detected and sends alerts in case of accidents. The inclusion of the camera sensor not only enhances accident prevention but also aids in post-accident analysis, making it a crucial addition to smart helmet technology.

Keywords: IoT, Smart Helmet, Camera Sensor, GPS, Alcohol Detection, Accident Detection, Real-Time Monitoring.

INTRODUCTION

Road accidents, particularly those involving two-wheelers, have become a critical global concern, leading to injuries and fatalities at an alarming rate. According to recent statistics, two-wheelers account for a significant share of traffic-related accidents, often due to a lack of safety measures and the inability to provide timely emergency assistance. In response, governments have implemented various laws and regulations aimed at reducing the number of accidents and ensuring road safety. However, these measures have not been entirely effective in addressing the core issues related to rider safety, especially for motorcyclists. As such, the integration of advanced technology, such as the Internet of Things (IoT), into personal protective equipment, offers a promising approach to mitigating these risks.

This paper presents an enhanced Smart Helmet system designed to improve the safety of motorcyclists by leveraging IoT technology. The system incorporates several key components, including alcohol detection, accident detection, GPS-based location tracking, and a real-time camera sensor for monitoring the rider's environment. The helmet is equipped with an MQ3 alcohol sensor, which monitors the rider's breath to detect the presence of alcohol. If alcohol is detected beyond a predefined threshold, the system prevents the ignition of the vehicle, ensuring that impaired riders are unable to operate the motorcycle. Additionally, the system features an accelerometer-based accident detection mechanism that identifies collisions or sudden impacts. In the event of an accident, the system sends an alert to emergency contacts, along with the rider's GPS location, enabling rapid response.

One of the key innovations in this system is the inclusion of a camera sensor, which provides real-time video feedback of the rider's surroundings. This feature not only enhances accident prevention by capturing live footage but also aids in post-accident analysis, offering valuable insights into the causes of accidents. The helmet is connected to a mobile application, which receives data from the helmet's sensors and provides the user with control over specific functions, such as remotely disabling the ignition or viewing real-time video footage.

The proposed Smart Helmet system represents a significant step forward in enhancing rider safety, combining multiple technologies to provide a comprehensive safety solution. By integrating IoT capabilities, real-time monitoring, and automated response mechanisms, this system aims to significantly reduce the risk of accidents and improve emergency response times, ultimately saving lives.

LITERATURE REVIEW

This literature survey explores several innovative systems designed to enhance motorcycle safety through the integration of various sensors and technologies. [1]Jesudoos A et al. developed a comprehensive method that utilizes infrared, vibration, and gas sensors to measure alcohol levels in a rider's breath. This data is used to determine the amount of alcohol ingested. The vehicle's control system is managed using Micro-Electro-Mechanical Systems (MEMS). Additionally, a vibration sensor detects accidents, while a load checker monitors the vehicle's weight. All sensors are connected to a PIC microcontroller. If alcohol is detected, the gas sensor provides an indication on an LED display. In the event of an accident, the vibration sensor relays information to emergency services via GPS.[2]M. Kabilan et al. proposed a safety system that integrates a helmet equipped with a vibration sensor. If the vibration frequency exceeds a specific threshold, a message is sent to emergency responders through GPS. This system aims to improve accident detection and could potentially save lives.[3]Kimaya Bholaram Mhatreet al. designed a system that combines a helmet with a motorcycle. This setup includes infrared sensors, an MQS alcohol sensor, a vibration sensor, a GSM module, a GPS module, and an intercom system. If the rider's alcohol level surpasses a certain threshold, the motorcycle will not start. If an accident occurs and the vibration sensor indicates a significant impact, an alert is sent to a registered phone number. This technology is cost-effective and enhances the security of motorcyclists.[4] Sayan Tapadar created a prototype that employs an Internet of Things (IoT) module along with various sensors to monitor alcohol consumption and assess accident conditions. The system utilizes a Support Vector Machine to predict, through real-time simulations, whether sensor readings indicate an accident. The results demonstrate high accuracy and reliability in detection [5] Sayan Tapadar et al. (2018): In their study, the authors introduced a Bluetooth-enabled smart helmet designed to enhance rider safety. The helmet incorporates an alcohol detection system that prevents the motorcycle from starting if alcohol is detected in the rider's breath. Additionally, it features an accident detection mechanism that sends immediate notifications to emergency contacts upon detecting a crash.[6] Syed Umaid Ahmed and Riaz Uddin (2020): developed an IoT-based smart helmet equipped with various sensors to detect accidents. Upon detecting an accident, the system sends real-time alerts to predefined emergency contacts, including the location of the incident, thus facilitating prompt medical assistance. [7] Shouvik Chakraborty, Sachidananda Sen explained about an increasing number of accidents of Vehicles has led to the study and design of Active safety systems in modern automobiles. For the purpose, a number of sensors for the measurement of Vehicle yaw, wheel velocities and acceleration are deployed. However, some key parameters like slip angle and frictional forces are hard to be determined using sensors and also cost prohibitive. Estimation of friction coefficient and frictional forces has been of wide importance for the design of Active safety systems as the information is required for the design of efficient control system. Besides, the system being highly nonlinear in nature, linearized estimation technique may lead to high approximation errors. This paper presents an unscented Kalman Filter based estimation algorithm for a specific nonlinear tire model for the estimation of friction coefficient and lateral and longitudinal frictional forces. [8]. Hussain A.Attia1, Shereen Ismail enhanced electronic safety system design with simulation results for teenagers and older drivers is presented in this paper. Because of their physiological characteristics that lead to multiple driving errors, which need monitoring to avoid their recurrence. Comparing to the initial design, the presented safety system in this study considers additional two parameters; the number of driving errors and the errors duration. Based on these two parameters, the total number of recorded driving errors (lower/higher than the low/high front distance limits respectively) will be considered. If this number exceeds a certain limit of error then a suitable response will be taken as a safety reaction. Simulation results are demonstrating the recognition capability among the three cases of driving conditions, which are safe front distance, short front distance alarm, and long front distance alarm. In addition, the results are reflecting the highly effectiveness of the system in term of response and promising the possibility of obtaining high performance system in the fields of driving safety.[9] Armstrong Aboah et al. (2023): This research focused on developing a real-time helmet violation detection system utilizing advanced deep learning models, specifically YOLOv8. The system is designed to improve traffic surveillance by accurately identifying riders who are not wearing helmets, thereby aiding in the enforcement of safety regulations and reducing head injury incidents.[10]. Mallikarjuna Gowda C P, Raju Hajare talk about the proposed system aims at developing and designing a suitable system for automobile purposes using Zigbee protocols. The main problems faced in the existing system are inaccuracies in the calculation of speed, distance measurement, and slow response time, etc. The proposed system solves many of the problems faced by the existing systems by using a GPS module instead of the conventional speedometer and also uses sensors which are reliable in areas where human intervention is either unintended or where it puts life to risk. The problems of traffic congestion in urban arterials are increasing day by day and it is very difficult to handle it during emergencies. So we are developing a communication unit within the system to interact with other vehicles in order to clear the lanes. This system aims at communicating with the vehicle in its surrounding with the help of its location (i.e., using the latitude and longitude) to indicate their proximity. When these vehicles are very close in proximity the drivers are cautioned with the help of a message. In this way the drivers can communicate with each other and act according to the situation.

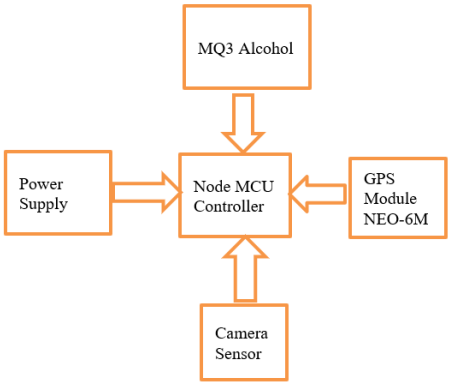
III METHODOLOGY

System Architecture

I] ESP8266 : The ESP8266 is a versatile Wi-Fi module commonly used in Internet of Things (IoT) projects. It features 128 KB of RAM and 4 MB of flash memory, providing sufficient storage for data and programming. Notably, the ESP8266 supports a Deep Sleep mode, which enhances energy efficiency. Its built-in Wi-Fi capabilities and high processing power make it an excellent choice for a wide range of IoT applications.

II] GPS Module: The GPS module, specifically the NEO-6M model, is engineered to deliver highly accurate positional data. It is equipped with a UART TTL connector and features a robust active GPS antenna measuring 25 x 25 mm, which employs advanced technology for optimal performance. To facilitate a quicker acquisition of a GPS lock, the module includes a built-in battery. This updated GPS module is compatible with the Arduino pilot Mega v2 platform, providing precise position information that significantly enhances the performance of Arduino pilot and other multirotor control systems.

III] MQ3 Sensor: The MQ3 gas sensor is specifically designed to be resistant to gasoline, vapor disturbances, and smoke, while exhibiting a high sensitivity to alcohol. It produces an analog resistive output that varies according to the concentration of alcohol present in the environment. As the concentration of alcohol gas increases, the sensor's conductivity rises accordingly. The internal resistance of the sensor changes based on whether alcohol is detected, allowing for accurate measurement of alcohol levels.



IV] CAM Sensor: CAM sensors often incorporate advanced features such as autofocus, image stabilization, and enhanced low-light performance, making them essential for capturing high-quality images in diverse conditions. The development of CAM sensors continues to evolve, with ongoing improvements in technology leading to better image quality, faster processing speeds, and increased versatility in applications.

V] Battery Power Supply: The effectiveness of a battery power supply is influenced by factors such as capacity (measured in ampere-hours, Ah), voltage, and discharge rate. Advances in battery technology continue to enhance energy efficiency, reduce weight, and increase the longevity of batteries, thereby supporting the growing demand for reliable and sustainable power sources in various sectors.

IV Existing System:

Currently, motorcycle helmets primarily serve as protective gear to reduce head injuries during accidents, but they do not offer any additional features to assist riders or improve safety beyond basic physical protection. The existing systems and technologies in helmets are limited to:

• Standard Helmet Design: Traditional helmets provide basic impact protection but lack advanced safety features like accident detection or real-time monitoring.

• No Alcohol Detection: Riders are responsible for ensuring they are not impaired, but there is no technology to monitor or alert if a rider is under the influence of alcohol.

• Limited Emergency Response: In the event of an accident, there is often a significant delay in emergency response due to the rider's inability to alert emergency services in time, especially in cases where the rider is unconscious or incapacitated.

• No Integration with Mobile Technology: Traditional helmets do not integrate with mobile devices or applications to provide real-time safety data or alerts to the rider or emergency contacts.

These limitations contribute to the high rate of motorcycle accidents and fatalities, as immediate help and proactive monitoring are not available**.**

V Proposed System:

The proposed system addresses these shortcomings by integrating advanced IoT technologies into the helmet. The smart helmet offers multiple features that enhance rider safety, provide real-time data, and facilitate faster emergency responses. The key components of the proposed system include:

Impact Detection and Emergency Alert System: The smart helmet integrates an ADX335 impact sensor to detect accidents and collisions. Upon detection, the helmet sends an immediate alert to emergency contacts or services, including the rider's GPS location. This enables a faster emergency response and can help save lives.

Alcohol Detection System: An MQ3 alcohol sensor is incorporated into the helmet to monitor the rider's breath for alcohol content. If the rider is impaired, the helmet sends an alert to the rider's connected mobile app, warning them not to ride. This feature discourages impaired riding and enhances road safety.

GPS Tracking and Real-Time Location Monitoring: The helmet includes a GPS module to track the rider's real-time location. In case of an accident, emergency responders can quickly locate the rider, reducing response times and improving outcomes.

Camera for Evidence Collection: A camera module records the rider's journey, capturing video footage of the surroundings and events leading up to an accident. This footage can be used as evidence in legal and insurance processes, improving the accuracy of claims and investigations.

Mobile Application Integration: The smart helmet connects to a mobile app that receives real-time alerts, including accident notifications and alcohol detection. The app also allows users to track the rider's location and configure emergency contacts, making the system user-friendly and comprehensive

VI Flow Chart:

This flowchart illustrates a smart helmet system for alcohol detection and prevention, ensuring that a motorcycle does not start if the rider has consumed alcohol. Below is a detailed explanation of each step:

Step-by-Step Explanation:

1. **Start:**

The system initializes and begins execution. This marks the beginning of the helmet's functionality.

2. **Search for Wi-Fi Network:**

The helmet searches for an available Wi-Fi network to connect to. This step ensures that the system can communicate with a remote server for real-time monitoring.

3. **Connect to Network:**

If a Wi-Fi network is found, the system connects to it. A stable network connection is required to proceed to the next step.

4. **Connect to Server Through API:**

After connecting to the internet, the helmet communicates with a remote server via an API (Application Programming Interface).The API acts as an intermediary that allows the helmet to send and receive data.

5. **Check for Alcohol Consumption:**

The helmet contains an alcohol sensor (e.g., MQ-3 sensor) that detects alcohol levels in the rider's breath .If the alcohol content is below a predefined threshold, the system allows normal operation. If the alcohol content exceeds the permissible limit, it proceeds to the next step.

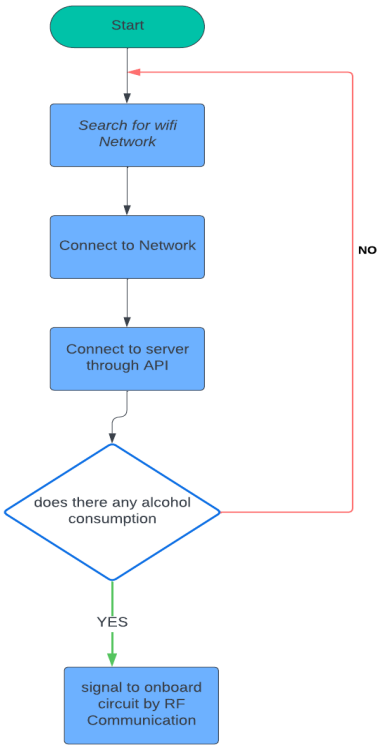
6. **Decision-Making (Yes/No Condition):**

If NO (No alcohol detected):

The system loops back to keep checking for network availability and rider's alcohol levels continuously.

If YES (Alcohol detected):

The system sends a signal to the onboard circuit via RF (Radio Frequency) communication, instructing it to disable the motorcycle ignition system. This prevents the rider from starting or operating the motorcycle while intoxicated.



VII Advantages of Proposed system:

The proposed IoT-integrated smart helmet offers multiple advantages in rider safety, accident prevention, and emergency response. Below are the key benefits:

1. Enhanced Accident Detection & Faster Emergency Response:

ADX335 impact sensor detects accidents and collisions immediately. Automatic alert is sent to emergency contacts and services with the rider's GPS location. Reduces response time, increasing survival chances after a crash.

2. Alcohol Detection & Prevention of Drunk Driving :

MQ3 alcohol sensor detects alcohol levels in the rider's breath. Alerts the rider and emergency contacts through a mobile app notification. Can be integrated with bike ignition control to prevent drunk riding.

3. Real-Time GPS Tracking & Location Monitoring :

GPS module provides live tracking of the rider's location.

In case of an accident, emergency responders can quickly locate the rider. Family members can monitor the rider's journey via the mobile app.

4. Proactive Safety Instead of Just Protection :

Unlike traditional helmets, which only provide physical protection, this smart helmet offers preventive measures. Stops drunk driving, enables fast accident response, and tracks the rider's location. Reduces motorcycle accident rates and fatalities.

5. Improved Insurance & Legal Benefits :

Video recording and GPS data logs serve as legal proof in case of accidents. Helps in faster insurance processing by providing accident evidence. Reduces false claims, benefiting both riders and insurance companies.

VIII Conclusion :

The development of a smart helmet equipped with an accident detection mechanism represents a significant advancement in enhancing motorcycle safety. By integrating various technologies such as sensors for detecting alcohol levels, vibrations, and GPS capabilities, this innovative helmet aims to provide real-time monitoring and rapid emergency response. The ability to detect accidents and alert emergency services not only increases the likelihood of timely assistance but also has the potential to save lives. Additionally, features that prevent operation under the influence of alcohol further promote responsible riding behavior. As the demand for safety solutions in the growing motorcycle market continues to rise, the smart helmet stands out as a promising tool for reducing accidents and improving overall rider safety. Continued research and development in this area will be essential to refine these technologies, enhance their reliability, and ensure they meet the evolving needs of users. Ultimately, the smart helmet can play a crucial role in fostering a safer riding environment for all motorcyclists. By integrating mobile applications and IoT connectivity, this system allows for seamless real-time monitoring, alerts, and user-friendly interaction, making it a practical and efficient solution for modern motorcyclists. The smart helmet is not just a protective device but a life-saving innovation that enhances road safety, reduces accident-related fatalities, and encourages responsible riding behavior. Future enhancements could include fatigue detection, speed monitoring, and AI-based predictive analytics to further improve rider safety. With continued development and widespread adoption, this smart helmet system has the potential to revolutionize motorcycle safety standards and significantly contribute to reducing road accidents worldwide.

IX REFERENCES:

[1] S. Choubey, P. William, A. B. Pawar, M. A. Jawale, K. Gupta and V. Parganiha, "Intelligent Water Level Monitoring and Water Pump Controlling System using IOT," 2022 3rd International Conference on Electronics and Sustainable Communication Systems (ICESC), 2022, pp. 423-427, doi: 10.1109/ICESC54411.2022.9885358.

[2] Pawar, A.B., Jawale, M.A., William, P., Sonawane, B.S. (2022). Efficacy of TCP/IP Over ATM Architecture Using Network Slicing in 5G Environment. In: Asokan, R., Ruiz, D.P., Baig, Z.A., Piramuthu, S. (eds) Smart Data Intelligence. Algorithms for Intelligent Systems. Springer, Singapore. https://doi.org/10.1007/978-981-19-3311-0_8

[3] P. William, A. Shrivastava, H. Chauhan, P. Nagpal, V. K. T. N and P. Singh, "Framework for Intelligent Smart City Deployment via Artificial Intelligence Software Networking," 2022 3rd International Conference on Intelligent Engineering and Management (ICIEM), 2022, pp. 455-460, doi: 10.1109/ICIEM54221.2022.9853119.

[4] S. L. Bhoi, S. Shantilal Salve, D. V. Kumar, D. B. Pardeshi and P. William, "Deployment of Slow power Hybrid Electric Vehicle based on Combustion Engine," 2022 3rd International Conference on Electronics and Sustainable Communication Systems (ICESC), 2022, pp. 231-235, doi: 10.1109/ICESC54411.2022.9885402.

[5] A. B. Bornare, S. B. Naikwadi, D. B. Pardeshi and P. William, "Preventive Measures to Secure Arc Fault using Active and Passive Protection," 2022 International Conference on Electronics and Renewable Systems (ICEARS), 2022, pp. 934-938, doi: 10.1109/ICEARS53579.2022.9751968.

[6] R. S. Charran and R. K. Dubey, "Two- Wheeler Vehicle Traffic Violations Detection and Automated Ticketing for Indian Road Scenario," in IEEE Transactions on Intelligent Transportation Systems, vol. 23, no. 11, pp. 22002-22007, Nov. 2022, doi:10.1109/TITS.2022.3186679

[7] S. S. Gondkar, P. William and D. B. Pardeshi, "Design of a Novel IoT Framework for Home Automation using Google Assistant," 2022 6th International Conference on Intelligent Computing and Control Systems (ICICCS), 2022, pp. 451-454, doi: 10.1109/ICICCS53718.2022.9788284.

[8] D. S. Navare, Y. R. Kapde, S. Maurya, D. B. Pardeshi and P. William, "Robotic Bomb Detection and Disposal: Application using Arduino," 2022 7th International Conference on Communication and Electronics Systems (ICCES), 2022, pp. 479- 483, doi: 10.1109/ICCES54183.2022.9836011.

[9] Rawat, R., Rimal, Y. N., William, P., Dahima, S., Gupta, S., & Sankaran, K. S. (2022). Malware Threat Affecting Financial Organization Analysis Using Machine Learning Approach. International Journal of Information Technology and Web Engineering (IJITWE), 17(1), 1-20. http://doi.org/10.4018/IJITWE.304051

[10] D. S. Navare, Y. R. Kapde, S. Maurya, D. B. Pardeshi and P. William, "Robotic Bomb Detection and Disposal: Application using Arduino," 2022 7th International Conference on Communication and Electronics Systems (ICCES), 2022, pp. 479- 483, doi: 10.1109/ICCES54183.2022.9836011.

[11] A. Wakchaure, P. Kanawade, M. A. Jawale, P. William and A. B. Pawar, "Face Mask Detection in Realtime Environment using Machine Learning based Google Cloud," 2022 International Conference on Applied Artificial Intelligence and Computing (ICAAIC), 2022, pp. 557-561, doi: 10.1109/ICAAIC53929.2022.9793201.

[12] A. A. Batt, R. Ahmad Bhat, D. B. Pardeshi, P. William, S. S. Gondkar and H. Singh Matharu, "Design and Optimization of Solar using MPPT Algorithm in Electric Vehicle," 2022 6th International Conference on Intelligent Computing and Control Systems (ICICCS), 2022, pp. 226-230, doi: 10.1109/ICICCS53718.2022.9787988

[13] R. B. Ghoderao, S. Raosaheb Balwe, P. S. Chobe, D. B. Pardeshi and P. William, "Smart Charging Station for Electric Vehicle with Different Topologies," 2022 6th International Conference on Intelligent Computing and Control Systems (ICICCS), 2022, pp. 243-246, doi: 10.1109/ICICCS53718.2022.9788143.

[14] Thamba Meshach W., Hemajothi S., E A M.A.,(2022),"Smart Affect Recognition System for Real-Time Biometric Surveillance Using Hybrid Features and Multilayered Binary Structured Support Vector Machine",Computer Journal,Vol.65,no.4,pp.897- 917.doi:10.1093/comjnl/bxaa125