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# LITERATURE REVIEW ON SMART RIDE HELMET

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**Abstract:** In this literature paper we aim to review about all the attempts made to bring smart helmet in the market; their success and various attempts. The paper also speaks about the various technologies involved till date in bringing smart helmets to the market. Many helmets aim to give speeding alert, and helps the user not to violate the traffic rules and also to reduce the accident rates in the society.

**Keywords:** Raspberry Pi, Heart-beat sensor, microcontroller.

## I. INTRODUCTION

It is a well-known fact that young generation prefers bikes and motorcycle over four-wheeler. The riders avoid wearing helmet without any specific reason. Moreover, over speeding and drink and drive have become common issues. Due to the lack of experience or focus and violation of traffic rules, which leads to accidents. So, with the help of technology we made sure that traffic rules are followed, problems mentioned above are avoided and their effects are minimized. The idea of developing this work comes from our social responsibility towards society. In many accidents that occur, there is a huge loss of life. Many people die on roads every year that occur due to bike accidents. There are various reasons for accidents such as not having adequate ability to drive, defective two wheelers, rash driving, drink and drive, etc. But the main reason was the absence of helmet on the person which leads to immediate death due to brain damage. Therefore, it is important that there should be a facility to minimize the after effects of these accidents. However, the main goal of our work is to make it mandatory for the rider to wear a helmet during the ride, to prevent drink and drive scenario and over speeding or rash riding by motorcyclists and also provide proper medical attention when met with accident by alerting the concerned person which will provide solutions to other major issues for accidents.

## II. OBJECTIVE

The main objective of this helmet is to detect the over speeding and send the alert to their guardians. This smart ride helmet also aims at detecting if the rider is sleepy and wakes him up to prevent accidents. The helmets will have a in built module to connect with other helmets for easier communication.

## III. LITERATURE REVIEW

**In [1].** The International Research Journal of Engineering and Technology (IRJET) has published a paper on the development of a smart helmet for safety and accident detection using IoT. The authors argue that road accidents are increasing in India due to negligence, such as not wearing a helmet, drinking and driving, and over speeding. These accidents often lead to death or severe injuries due to lack of medical treatment. The authors propose a system that ensures the safety of bikers by making it mandatory to wear a helmet during rides, preventing head injuries, drink and drive scenarios, over speeding, and rash riding. They also provide proper medical attention when an accident occurs by notifying the concerned person with location details. The main objective of this system is to design a helmet that provides safety to motorcyclists and prevents drink and drive scenarios. It detects accidents and alerts the guardian about the accident and prevents over speeding. An android application is developed to monitor the motorcyclist and send alert SMS. The proposed system includes functions such as not allowing the rider to start the vehicle if they are not wearing the helmet, detecting alcohol consumption, alerting the rider when the speed exceeds a limited value, and fingerprint authorization. The system also uses a microcontroller to detect alcohol consumption and provide alerts when the rider's speed exceeds a certain limit.

**In [2].** the author proposes that the main cause of death in two-wheeler drivers is over-speeding, drunken driving, and careless driving. To address these issues, a low-cost intelligent helmet is being developed to identify alcohol consumption and prevent road accidents. The helmet uses advanced features like alcohol detection, accident identification, location

 

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tracking, and fall detection. It is compulsory to wear a helmet, and the ignition switch cannot be turned on without one. If a rider is drunk or an accident occurs, the ignition switch is locked, and a message is sent to their registered number with their current location. Bluetooth is also used for calling while driving. The project uses advanced features like alcohol detection, accident identification, location tracking, and hands-free operation. The project also provides a feature to receive calls while driving using Bluetooth. The main disadvantage of this project is the lack of a display device for showing the current status and the high cost of the helmet. The project aims to improve the safety of bikers by utilizing advanced features like alcohol detection, accident identification, location tracking, and Bluetooth.

**In [3].** The research paper discusses the development of a smart helmet equipped with a MQ3 gas sensor to address road accidents and drunken driving. The helmet serves as a protective headgear for riders, enhancing the safety of bike driving. Its main purpose is to ensure the rider's safety by implementing advanced features such as alcohol detection. This transforms the helmet into a smart device, contributing to the concept of a smart bike.The mandatory requirement of wearing the helmet is enforced by integrating it with the bike's ignition system. Without wearing the helmet, the ignition switch cannot be turned on. Additionally, an RF module is utilized as a wireless communication link between the helmet's transmitter and the bike's receiver. If the rider is found to be under the influence of alcohol, the ignition is automatically locked, and a message containing the rider's current location is sent to a registered number.The implementation of the smart helmet involves the utilization of an RF transmitter, RF receiver, Encoder, and Decoder IC. The bike will not start if the rider is not wearing the helmet, and it will also be immobilized if the rider consumes alcohol.In conclusion, the research aims to develop a smart helmet that prioritizes rider safety by integrating advanced features such as alcohol detection and integrating it with the bike's ignition system. This will contribute to the overall goal of enhancing safety and reducing accidents among two-wheeler riders.

**In [4].** The study by S Sobhana et al. focuses on thr development of a smart helmet for two-wheelers in India, which aims to protect them from accidents and indicate accident-prone areas. The helmet uses various sensors to detect alcohol consumption, infrared sensors to check a rider's helmet, and vibration detectors to indicate the harsh hitting of the helmet during an accident. GPS is used to identify the location of the accident spot and sends messages to nearby police stations and hospitals through GSM. The smart helmet is designed to ensure the safety of two-wheelers, as it prevents the vehicle's ignition from starting without the helmet. Helmets have become compulsory in accordance with the Motor Vehicles Act, which requires all passengers to wear protective headgear. The main reason for the rising fatality rate in accidents is the delay and lack of proper treatment in time, with no immediate response from society to inform the police and hospital. The smart helmet also helps the traffic police and follows government regulations, making it completely safe for use by two-wheeler riders.The internet of things has become a crucial part of our lives, with embedded devices connected to the internet. One of the main reasons for road accidents is alcohol consumption, which can lead to fatalities. To prevent these accidents, IR sensors are used to detect obstacles and keep the rider in a safe zone. A smart helmet consists of breath alcohol sensitizers that monitor the rider's state of mind and alcohol consumption.A relay is connected to the receiver module, and the signal is transmitted from the transmitter of the helmet. The MQ3 sensor checks whether the rider has drunk and nonalcoholic breath, and the switch placed in the helmet powers the helmet and pressures the sensor to wear the helmet. The bike will not start if these pre-conditions fail. If the person meets an accident with the help of GPS and GSM modules, messages will be sent to family members and nearby hospitals.The project uses various sensors integrated together to prevent accidents and ensure the safety of the rider. These sensors include IR sensors, ultrasonic sensors, vibration sensors, gyroscope sensors, alcohol sensors, and nodemcu. IR sensors check if the person has head coverings and alert them to wear the helmet. Ultrasonic sensors indicate if any vehicle is near the vehicle, while alcohol sensors detect the driver's alcohol consumption status. Gyroscope sensors take care of the person during and after the accident, and vibration sensors detect the accident. GPS guides the rescue team to locate the accident spot, allowing immediate prevention.

**In [5].** The increasing frequency of two-wheeler accidents, particularly due to non-compliance with helmet-wearing regulations, necessitates proactive safety measures. Despite government mandates, public adherence to helmet usage remains low, necessitating innovative solutions. This project aims to address this gap by developing a system that ensures helmet compliance and enhances rider safety before accidents occur. Unlike existing initiatives that focus on post-accident responses, this project prioritizes prevention by leveraging technology to enforce helmet wearing, thus mitigating the risk of severe injuries. By integrating real-time monitoring and communication capabilities, the system aims to foster a culture of proactive safety consciousness among riders, ultimately saving lives and reducing the burden of road accidents on society.Numerous factors contribute to the alarming prevalence of two-wheeler accidents, including non-compliance with helmet-wearing regulations, the consumption of alcohol, reckless driving behaviors, and a disregard for established road rules. Recognizing the urgent need for innovative solutions, the Smart Helmet system is introduced as a comprehensive safet y and security mechanism designed to revolutionize the landscape of two-wheeler safety. The system aims to detect accidents promptly, provide real-time assistance and support to riders, thereby minimizing the likelihood of severe injuries and fatalities. By leveraging advanced sensors, communication technologies, and intelligent

 

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algorithms, the Smart Helmet system empowers riders with a robust layer of protection, enhancing their safety on the roads. The study aims to investigate methods for preventing "Drunk and Drive" incidents, automatic bike side stand removal, and controlling vehicle speed to prevent severe accidents. It also explores the development of an intelligent safety helmet and the design of a system that alerts family members or friends about accidents. Several literature studies have been conducted to evaluate the effectiveness of these technologies in reducing head injuries among two-wheeler riders. Smith et al.'s 2020 study found a significant decrease in head injuries among riders who used intelligent safety helmets. Johnson et al.'s 2018 study reviewed automated speed control systems, focusing on adaptive cruise control and automatic braking systems. Patel et al.'s 2019 study highlighted the impact of GSM-based emergency notification systems on timely medical assistance for accident victims. Lee et al.'s systematic review examined mechanisms for automatic side stand removal on motorcycles, identifying promising approaches like sensor-based systems and mechanical locks. Garcia et al.'s 2021 meta-analysis assessed the effectiveness of drunk driving prevention measures, analyzing data on interventions such as sobriety checkpoints, ignition interlock devices, and public awareness campaigns.The proposed system integrates a helmet unit and a bike unit to enhance rider safety and ensure compliance with essential road safety measures. The helmet unit uses an IR sensor to detect helmet wear, while the bike unit checks for signs of intoxication.

**In [6].** This study presents a smart helmet with IoT capabilities, prioritizing safety in riding and mining sectors. The helmet features advanced sensors that detect imminent dangers, such as collisions for riders and hazardous conditions for miners. Its IoT connectivity enables real-time alerts and communication, fostering swift responses during emergencies. For riders, the helmet monitors speed and surroundings, providing heads-up displays for navigation without distractions. It seamlessly integrates with mobile devices, enabling hands-free communication and enhancing situational awareness. In mining environments, the helmet detects gases and structural risks, ensuring proactive measures for worker safety. IoT connectivity enables instantaneous communication among workers and central systems, fostering swift responses to hazards.The Internet of Things (IoT) has revolutionized safety equipment, particularly in riding and mining environments. These innovative devices offer real-time monitoring, proactive hazard detection, and swift communication, ensuring safety protocols for riders and miners. IoT-enabled smart helmets play a pivotal role in fostering safety and security in both riding and mining contexts.Several smart helmets have been developed to address various safety concerns. One system mandates helmet use for bike riders, incorporating alcohol sensors and accident alert systems to prevent drunk riding. LED strips enhance visibility, while bioelectric sensors provide real-time monitoring, hands-free bike control via voice commands, and simplified security. AI-driven self-driving bikes are also being explored, but further technological advancements are required for full-scale implementation. Another smart helmet uses IoT technology for accident prevention, linking ignition to helmet wear and employing sensors for alcohol and fall detection. RF communication facilitates real-time alerts during accidents, emphasizing helmet compliance and aiding in swift medical aid. The helmet prioritizes rider safety by integrating various sensors for precise accident detection and alcohol level measurement. Another smart helmet uses facial recognition and pressure sensors to ensure helmet use in India. It uses algorithms like Haar Cascade and contour tracing for facial recognition and Canny Edge Detection for edge highlighting. The system's efficiency in verifying helmet usage and detecting accidents significantly enhances two-wheeler safety. Another smart helmet uses cloud computing technology to detect harmful gases in mines, providing real-time data and improving communication for safer mining operations. An intelligent helmet based on web communication and IoT technology for safe driving addresses the trend of riders skipping helmets by monitoring vehicle ignition and testing alcohol levels. In conclusion, IoT-enabled smart helmets play a crucial role in enhancing safety in various sectors, including riding and mining. Future developments will focus on AI-driven self-driving bikes, smart helmets, and other safety technologies to improve safety in various industries.

**In [7].** The Internet of Things (IoT) is a concept that aims to utilize continuously connected internet connectivity, including data sharing and remote control. One use of IoT is for security purposes, such as for safety riding, such as a Smart Helmet. The emergence of cases of motorbike theft and robbery requires vehicle owners to be more careful and increase their vigilance.Much has been done to prevent motorbike theft and robbery, such as using multiple locks and installing alarms on vehicles. However, some of these methods cannot completely overcome the rampant theft and robbery that is currently occurring. Additionally, awareness among motorcyclists regarding the use of helmets is currently very minimal, which can have a fatal impact if the rider is involved in a high-profile accident without wearing a helmet.This thesis proposes a solution by developing a smart helmet that provides facilities and equipment to anticipate crime while driving. The helmet will send a message if a robbery occurs and immediately send the driver's position. It is integrated with the motorbike engine so the engine will stop if it is far from the helmet and the motorbike will not start if the helmet is not used.This research uses unstructured interviews with motorbike riders to gather data. The researchers also conducted a literature study on topics such as transmitters, receivers, GSM modules, and GPS modules. Black box testing was used to test the functional specifications of the device. The system design focuses on Smart Helmets for IoT-based Motorcycle Security, which automatically turns off when 110 meters away from the user and sends an SMS notification. The prototype method is used for developing a redeveloped device, starting with user needs and creating a quick design that is re-evaluated before production. The prototype process involves five stages, including a quick plan,

 

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modeling, and quick design. The system uses transmitter and receiver modules as input from the microcontroller, with an Arduino in standby to turn off the relay when not connected.

**In [8].** The paper discusses an intelligent helmet system using IoT and Raspberry Pi to reduce the risk of head injuries in motorcycle accidents. The system connects the helmet and ignition switch electronically, with the helmet equipped with a sensor that can sense if the rider is wearing a helmet. The helmet and bike are connected to a wireless system, and when the rider removes the helmet, a signal is sent to the ignition and switched off, and vice versa. This system is designed to mitigate the cause of head injuries in accidents, as most deaths occur in two-wheeler vehicles. Previous research has addressed smart helmet systems using Bluetooth, accident detection, and alcohol consumption using sensors like impact, accelerometer, flex, and breath analyzer. The paper also proposes a smart helmet system that ensures the bike starts only if the rider wears a helmet.The proposed system uses a low-cost and effective RF transponder, consisting of a transmitter and receiver. The transmitter is placed in the helmet, while the receiver is placed in the vehicle. When the emergency vehicle approaches the transmitter, a code is sent. A microcontroller is coded for both transmitting and receiving parts, and the system is divided into two units: the helmet and the bike. The helmet unit has a force sensing resistor and alcohol sensor, solar panels mounted on the upper side, a battery, regular circuits, a secondary controller, and RF transmitter circuit. The antenna is located outside the helmet. The system starts with initializing all ports, then detects accidents using an accelerometer. It then listens to the RF module continuously for data and interprets it. The helmet is equipped with an RF Tx module that can be triggered using a small switch. The Raspberry Pi is an ultra-cheap minicomputer with a single core CPU, GPU, and 512 MB of SD-RAM. It consumes less power and has two cache memory levels for recent programs and an ALU for instructions. The RF module operates the system by sending a code to the vehicle when the transmitter part lands at the range.

**In [9].** The International Research Journal on Advanced Engineering Hub (IRJAEH) has published a study proposing a multi-domain smart safety helmet for rider safety and accident prevention. The helmet integrates sensors like an MQ-3 alcohol sensor and helmet detection sensors to ensure safety conditions before the motorcycle engine starts. If alcohol levels exceed a threshold, the ignition system disables, preventing intoxicated riding. Helmet detection promotes helmet use, reducing head injury risk. The scalable sensor infrastructure enables multi-domain applications beyond motorcycles, such as coal mining and firefighting. In coal mining, the helmet monitors environmental conditions and worker vital signs. In firefighting, it detects hazardous gases and monitors firefighter status. During motorcycle operation, the helmet continuously monitors critical parameters—speed, tilt, and environment—providing immediate feedback on unsafe behaviors. In accidents, the helmet's accelerometer detects impacts, activating GPS to pinpoint the location and GSM to alert emergency contacts. This smart helmet aims to enhance motorcycle safety, prevent accidents, and expedite emergency responses. The Smart Helmet system comprises two primary components: a transmitter unit housed within the helmet and a receiver unit positioned externally. The transmitter unit incorporates sensors for alcohol detection and helmet status monitoring, an ESP32 module, and utilizes the ESP Now Protocol for data transmission. The receiver unit features an ESP32 module for data reception and control, an AI Thinker A9G module for GPS and GSM capabilities, and an emergency response mechanism. This cohesive integration of components enhances motorcycle safety and facilitates rapid accident response. The multi-domain smart safety helmet is designed to improve safety across various domains and environments, focusing on motorcycle helmet functionality. It features two ESP32 modules for seamless communication between transmitter and receiver units, equipped with sensors and modules for effective monitoring. The transmitter unit has an IR sensor and MQ3 sensor, and the receiver unit includes an LCD display, MPU6050 accelerometer, and AI Thinker A9G module for real-time tracking and emergency messaging. Communication protocols are optimized for efficient data transmission.

**In [10].** The security of underground mines is crucial due to the serious issues faced by miners, such as gas explosions and lack of light. The proposed framework aims to improve mining safety by incorporating sensors and microcontrollers to enhance the safety of miners. The helmet, a crucial safety tool, can be made more secure by adding an organization to detect natural conditions around the excavator working underground. The system uses the Internet of Things (IoT) to remotely update constant qualities, allowing control stations to be more aware of the environmental conditions where the digger is working. The system also incorporates a Liquid Crystal Display (LCD) and ringer to inform colleagues about any adverse events with the excavator.The proposed system uses various sensors, including gas, humidity, temperature, and infrared sensors, with the IR sensor being used as a helmet removal sensor. The goal is to make the system fully secure and innovative by including sensors and microcontrollers. The helmet should be adjusted without changing its design, and the system should determine if a digger has sustained a serious injury and report hazardous gases.The literature survey explores various wireless communication systems based on ZigBee for monitoring humidity levels and air conditions in the mining industry. These systems can be automated through ZigBee-based wireless networks, allowing for long-distance alerting without disturbances. Safety measures can be implemented through wireless network connections, with data logging mechanisms to identify miner difficulties. An "Intelligent Mining: A Monitoring and

 

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Security System for Coal Mine Workers" based on ZigBee provides real-time, reliable, and robust monitoring, ensuring safety and stable operations. A "GSM Based Flexible Calling System" based on GSM modules, solar panels, vibration sensors, battery sensors, and fire sensors is also proposed. The system architecture uses Raspberry Pi, gas sensors, temperature sensors, buzzers, LCD, IoT, and switch. The IoT paradigm enables the integration of objects into the internet, establishing interaction between people and devices.

**In [11].** The "Smart Helmet" project aims to make it mandatory for bikers to wear helmets during their rides while providing solutions to other major accidents. The project uses a radio frequency module, Piezo electric buzzer, ALCHO-LOCK function, accelerometer, GSM module, fog sensor, and E-HELMET feature to ensure the helmet is worn. The main component used is a microcontroller 89S52, with the main idea derived from previous projects. The project aims to minimize the after effects of accidents and make helmets mandatory for riders. The technology used is RoHS compliant and suitable for long-term use. The project also incorporates a fog sensor for increased visibility in fog or smog.

The helmet unit consists of an alcohol sensor, fog sensor, GSM module, LCD display, microcontroller ATMega328-PU, accelerometer for accident detection, and RF module. The sensors provide analog output, which is encoded in binary signals via a RF transmitter. The bike unit consists of a receiving part, decoder, microcontroller, LED, and DC motor. The system ensures safety and security by matching the encoder and decoder, and controls the DC motor.

**In [12].** The study presents an IoT-based smart helmet designed for real-time monitoring of underground miners' health hazards. The helmet consists of ambient and flexible body sensors connected wirelessly to the cloud via the LoRaWAN protocol. The helmet's effectiveness and performance were tested and analyzed. The smart helmet aims to mitigate the number of injuries and casualties in underground mines by monitoring health hazards and sending a control signal to the server when a hazardous condition is identified. The flexible sensors measure sweat pH and temperature levels, which correlate with fatigue levels. The smart helmet alerts the control room when hazardous conditions are identified, allowing miners to be rescued immediately.The proposed system consists of two main units: one mounted on a miner's helmet, which uses ambient sensors and a LoRa32 SX1276 module integrated with the ESP32 microcontroller, and the other with flexible temperature and pH sensors attached to the helmet strap. The data collected is sent to the server via a LoRa transceiver chip and stored in the cloud for future event prediction. The system also includes a CO and Methane gas sensor, a temperature and humidity sensor, and sweat pH and temperature sensors.

| Sl. No | Technologies used | Results |
|---|---|---|
| [1] | IoT, Microcontroller | Enhance rider safety by alcohol detection |
| [2] | Location tracking | Features like location tracking and handsfree calling |
| [3] | Gas sensor | Detects alcohol and locks bike’s ignition |
| [4] | GPS, Sensors | Prevents accidents , speeding limit |
| [5] | IR, alcohol, GSM sensors | detecting intoxication, and providing real-time assistance in case of accidents. |
| [6] | IoT, Cloud Computing | detecting imminent dangers, enabling real-time alerts and communication, and fostering swift responses during emergencies. |
| [7] | cloud computing, Bio- electric sensors | integrates GPS, GSM, and microcontrollers to prevent theft, robbery, and accidents, while also ensuring helmet usage. |
| [8] | RF, Raspberry Pi | prevent motorcycle accidents by ensuring riders wear helmets and detecting accidents, alcohol consumption, and emergency situations. |
| [9] | ESP , GPS, GSM | prevent accidents, and expedite emergency responses, with scalable applications in coal mining and firefighting. |
| [10] | IoT Sensors, ESP | incorporating IoT, sensors, and microcontrollers into a smart helmet, detecting environmental conditions, hazardous gases, and injuries, and alerting control stations and colleagues. |
| [11] | RF,GSM and DC Motor | to ensure helmet usage, detect accidents, and prevent drunk driving, while also enhancing visibility in foggy conditions. |
| [12] | LoRaWAN protocol, Cloud Computing | designed for real-time monitoring of underground miners' health hazards, using ambient and flexible body sensors, LoRaWAN protocol, and cloud storage to mitigate injuries and casualties by detecting hazardous conditions and alerting the control room. |

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## IV. CONCLUSION

The literature review on smart ride helmets reveals that integrating IoT, sensors, and microcontrollers can significantly enhance motorcycle safety by detecting alcohol consumption, enforcing helmet usage, preventing accidents, and providing real-time emergency responses. These innovative helmets have the potential to reduce fatalities and injuries, while also promoting a safer riding culture.

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