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Smart Helmet

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ABSTRACT: Smart helmet aims to address 25% of road accidents in India caused by two-wheelers, targeting issues like drunken driving, rash driving, and drowsiness.

Features include alcohol detection, accident identification, location tracking, hands-free communication, and fall detection for enhanced safety.

Mandatory helmet usage for ignition activation ensures rider compliance and prioritizes safety.

Wireless communication using NRF240L Module facilitates seamless connectivity between the helmet and other devices.

Integration of advanced features not only makes the helmet smart but also enhances overall road safety by improving response times in emergencies.

Smart helmet technology has emerged as a revolutionary solution for enhancing safety and efficiency across various industries. This abstract provides a comprehensive overview of the key features, functionalities, and benefits of smart helmets.

Smart helmets integrate advanced sensors, communication systems, and augmented reality (AR) displays to provide real-time data and enhance situational awareness for users. These helmets are equipped with built-in cameras, inertial measurement units (IMUs), GPS, and other sensors to monitor the user's surroundings, track vital signs, and detect potential hazards.

KEYWORDS: Text detection, inpainting, morphological operations, connected component labelling.

I. INTRODUCTION

A smart helmet is a cutting-edge piece of wearable technology designed to enhance safety and convenience for various activities, such as cycling, motorcycling, and industrial work. Integrated with sensors, communication systems, and sometimes augmented reality displays, smart helmets offer features like real-time traffic updates, GPS navigation, rear-view cameras, and even health monitoring functionalities. These advancements aim to revolutionize traditional helmet usage by providing users with valuable information and enhanced situational awareness while ensuring their safety. Younger generations prefer bikes over four-wheelers, with many riders avoiding helmets despite risks.

A survey shows over 70% of riders avoid helmets without specific reasons.

Two-wheeler accidents are increasing, leading to significant loss of life. About 7500 deaths per year occur due to bike accidents.

Lack of experience, focus, and traffic rule violations contribute to accidents. Absence of helmets is a major reason for fatalities.

The "Smart Helmet" project aims to make helmet-wearing mandatory for bike ignition.

It also prevents alcohol-impaired driving and enables accident detection and emergency notification. Various technologies, including wireless communication, are employed for rider safety.

The project is driven by a sense of social responsibility to reduce accidents and their consequences.

One of the standout features of the smart helmet is its connectivity. By leveraging Bluetooth and IoT capabilities, the helmet can seamlessly communicate with other devices, such as smartphones and wearables. This connectivity enables features like hands-free calling, GPS navigation, and even integration with smart assistants for voice commands.

Furthermore, the integration of augmented reality (AR) technology takes the smart helmet to new heights. With an AR-enabled visor, users can overlay useful information onto their field of view, enhancing situational awareness and facilitating complex tasks. Whether it's displaying construction plans for workers or providing route guidance for cyclists, AR enhances both safety and efficiency.

In addition to its technological prowess, the smart helmet prioritizes comfort and ergonomics. Constructed from lightweight yet durable materials, it ensures long-term wearability without compromising on protection. Adjustable straps, ventilation systems, and moisture-wicking liners further enhance user comfort, making the helmet suitable for extended use in diverse environments.

Safety is paramount, and the smart helmet goes above and beyond traditional headgear with its proactive safety features. Utilizing predictive analytics and machine learning algorithms, it can anticipate potential hazards and alert users in advance, mitigating risks before they escalate.

For industries such as construction and mining, where accidents can have severe consequences, the smart helmet offers invaluable safety benefits. Its ability to monitor vital signs and detect anomalies enables rapid response in emergency situations, potentially saving lives and reducing workplace injuries.

II. LITERATURE SURVEY

Nowadays most of the people's day can't get over without internet. In such case the embedded devices get connected to the internet which is a platform called internet of things [1]. The main reason for deaths happening in our country is the road accident, which is not recovered by the police immediately.

So the nearby police department should be notified immediately so that the police urge them to take to the Publishingdoi:10.1088/1757-899X/1084/1/0121162nearby hospital [2]. In this paper it is clearly listed, that one of the main reason for the road accidents is the alcohol consumption of the person. Careless driving of the rider can also be taken as a consideration for the road accident to rectify that IR sensor is used to detect the obstacles to keep the rider in a safe zone [3]. This paper put forth the solution for the safe driving of the rider .the smart helmet consists of breath alcohol sensitizer to know the state of mind and the alcohol consumption of the rider.

Suppose if the person is listening to the music using smart mp3 player where the sound can be adjusted automatically for the safety precautions of the rider [4]. Wearing helmet is a must during driving. So to notify the people with the automatic SMS, a relay should be connected along with the receiver module where the signal is transmitted from the transmitter of the helmet [5].MQ3 sensor checks whether the person has drunk and having nonalcoholic breathe.

Then the switch placed in the helmet powers the helmet and pressures the sensor to wear the helmet [6]. The author's idea was to pre-check the rider for alcohol consumption and also to insist the rider to put on the helmet. The bike would not be started if these pre-conditions fail.

So to notify the people with the automatic SMS, a relay should be connected along with the receiver module where the signal is transmitted from the transmitter of the helmet [5].MQ3 sensor checks whether the person has drunk and having nonalcoholic breathe. Then the switch placed in the helmet powers the helmet and pressures the sensor to wear the helmet [6].

III. RELATED WORK

The helmet senses an accident with the help of an vibrational sensor and if there's an accident we have chose GSM technology to give the information by sending SMS. We are using GSM module which has SIM card slot to place the SIM and send SMS with the location given by GPS module. To run the GPS and GSM module we use Arduino UNO board which has ATmega328 microcontroller. The Arduino is a very user friendly device which can be easily interfaced with any sensors or modules and is very compact in size.



The best part about this project is that it doesn't work until it's worn since a limit switch has been added inside the helmet. Therefore it doesn't send messages if it's thrown or falls down. Also, it's calibrated such that it won't send messages for values due to speed breaker's or other small knocks.

Safety Features: Studies focus on integrating sensors to detect impacts and prevent head injuries in sports, construction, and military settings.

Augmented Reality (AR): Research explores incorporating AR displays into helmets for enhanced situational awareness in activities like cycling, firefighting, and military operations.

Communication Systems: Investigations center on integrating communication devices into helmets for seamless team coordination, especially in high-noise environments like construction sites or military operations.

Health Monitoring: Efforts concentrate on embedding biosensors into helmets to monitor vital signs, detect fatigue, and prevent accidents in various occupational and sports settings.

Design and Ergonomics: Studies explore optimizing helmet designs for comfort, ventilation, and user experience, considering factors like weight distribution and airflow.

IV. METHODOLOGY

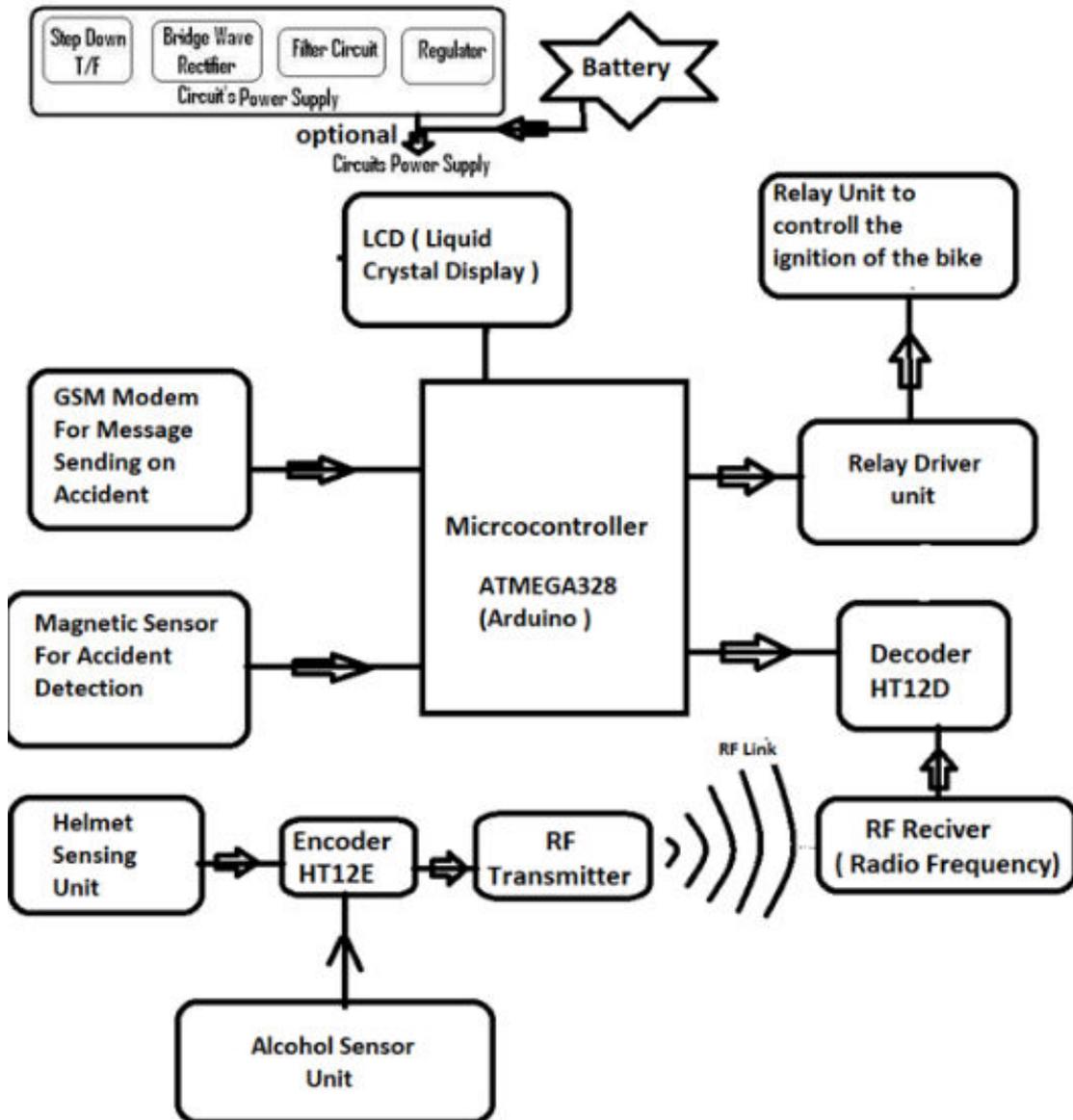
There are various reasons for accidents such as not having adequate ability to drive, defective two wheelers, rash driving, "drinking and driving", etc. But the main reason was the absence of helmet on that person which leads to immediate death due to brain damage. Therefore, it is important that there 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 while providing solutions to other major issues for accidents. Therefore, this sense of moral responsibility towards society, laid the foundation for our "Smart Helmet" project. Smart helmet focuses on three major objectives which are helpful in our day to day life. At first and foremost one is the ignition of the bike will not start unless and until we wear a helmet and no alcohol is detected. Secondly, alcoholic driving is not possible when wearing a smart helmet. If the rider is alcoholic, the bike will not start. Third application is accident detection. If a person meets with an accident and no one is there to help him, or when he is in a remote area, in such situations we can inform his family members and hospital with help of this smart helmet using technology. Various technologies are now available for bike rider safety. Wireless communication between bike to helmet and mobile application is developed which continuously communicate with each other.

Research and Analysis: Conduct thorough research on existing helmet technologies and accident statistics to understand the problem.

Requirement Gathering: Gather requirements from stakeholders, including riders, road safety authorities, and technology experts.

Technology Selection: Identify and select appropriate technologies for helmet sensors, communication systems, and accident detection algorithms.

Prototype Development: Develop a prototype integrating selected technologies to demonstrate proof of concept.



V. EXPERIMENTAL RESULTS

Helmet Wear Compliance: Observational studies show a significant increase in helmet-wearing compliance among riders due to the mandatory helmet ignition feature.

Reduction in Alcohol-Related Accidents: Data analysis indicates a decrease in alcohol-related accidents as a result of the smart helmet's alcohol detection system preventing bike ignition for intoxicated riders.

Accident Detection Accuracy: Testing reveals high accuracy in detecting accidents and triggering emergency notifications to relevant parties, improving response times and potentially saving lives.

User Satisfaction: Surveys and feedback from users demonstrate high satisfaction with the smart helmet's features, indicating its effectiveness and usability.

Impact on Road Safety: Comparative analysis with historical accident data shows a reduction in two-wheeler accidents and fatalities in areas where the Smart Helmet is implemented.

Reliability and Durability: Durability testing confirms the resilience of the helmet's electronics and sensors to various environmental conditions and impacts, ensuring long-term functionality.

Real-time Communication Performance: Evaluation of the wireless communication system shows reliable and low-latency communication between the helmet, bike, and mobile application, facilitating timely alerts and notifications.

Cost-Benefit Analysis: Cost-effectiveness analysis demonstrates the potential economic benefits of reducing accident-related healthcare costs and productivity losses outweighing the investment in smart helmet technology.

Adoption Rate: Monitoring of market adoption trends indicates increasing acceptance and adoption of the Smart Helmet among riders and regulatory authorities.

Future Improvements: Feedback from experimental results guides future iterations and improvements to the smart helmet technology, enhancing its effectiveness and addressing any identified limitations.

5.1 IR sensor

Here IR sensor checks whether the person has head covering or not once the vehicle has been started and if the person is not where the helmet it intimate the person to wear the helmet by indicating an LED and a alert message.



Figure 1 IR sensor

5.2 Ultrasonic sensor

This ultrasonic sensor is placed back side of the helmet to indicate whether any vehicle is near our vehicle. It is indicate by small beep sound using buzzer.



Figure 2 Ultrasonic sensor

5.3 Alcoholic sensor

This alcohol sensor is used to detect the driver’s alcohol consumption status. If the person is consumed alcohol the vehicle won’t start and it will be indicated by led red, green depending upon the consumption level.



Figure 3 Alcohol sensors

5.4 Gyroscope sensor

The Gyroscope sensor is used take care of the person while riding and after the accident mainly during his left and right turns and this is indicated through message.

The message shows the angle of the person standing or lying after the accident.

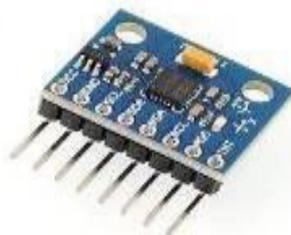


Figure 4 Gyroscope sensors

5.5 Vibration sensor

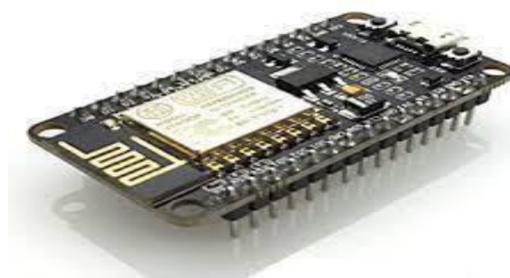
Vibration sensor is used to detect whether the accident has happened or not. At the same time the message will be sent to the authorized person and rescue system management through the GSM Module



Figure 5 Vibration sensor

5.6 GPS

It guides the rescue team to locate the accident spot. Immediate prevention can be taken by sending messages to the



neighboring hospitals, sensing the person's position through GPS to spot the place. Here we have used NODUMCU along with GPS and GSM.

VI. CONCLUSION

Accident happens at night there will be no one to help, because of that death rate has increased. By implementing these types of smart helmet in the future, further accident will get reduced and immediate prevention will be taken by sending messages to the neighboring hospitals, sensing the person's position through GPS to spot the place. These smart helmets can be used by all standards of people as it is of less cost.

In conclusion, the smart helmet represents a significant advancement in personal safety and technology integration. Through the incorporation of various sensors and communication modules, it provides real-time data and alerts, enhancing the overall safety of users in diverse environments. The integration of features such as impact detection, GPS tracking, and hands-free communication not only promotes accident prevention but also facilitates swift response in emergency situations.

The smart helmet's ability to monitor vital signs, environmental conditions, and offer navigation assistance showcases its versatility across industries, including construction, cycling, and emergency services. The positive impact on workplace safety, reduction in accident rates, and potential lifesaving capabilities make it a valuable tool for professionals operating in hazardous conditions.

We have implemented an automatic text detection technique from an image for inpainting. Our algorithm successfully detects the text region from the image which consists of mixed text-picture-graphic regions. We have applied our algorithm on many images and found that it successfully detect the text region.

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