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Research Paper for Smart Helmet Scientific Research and Engineering Development

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Abstract:
In recent times, road accidents and cases of drunken driving have become a prevalent issue in our daily lives, particularly among two-wheeler riders. Non-compliance with wearing helmets has been identified as a primary cause behind these accidents. The use of helmets can significantly increase the chances of survival in the event of an accident. To address this issue and prevent such accidents, a smart helmet has been designed, incorporating a MQ3 gas sensor. The smart 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. Furthermore, 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. This project is undertaken with the primary objective of ensuring road safety among two-wheeler riders.

The implementation of the smart helmet involves the utilization of an RF transmitter, RF receiver, Encoder, and Decoder IC. With this system in place, 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 summary, this project focuses on the development of a smart helmet equipped with a MQ3 gas sensor. By incorporating advanced features such as alcohol detection and integrating it with the bike's ignition system, the smart helmet aims to promote road safety and reduce the incidence of accidents caused by non-compliance with helmet usage and drunken driving. The use of an RF module facilitates seamless communication between the helmet and the bike, allowing for prompt action in case of alcohol consumption. The implementation of this smart helmet system contributes to the overall goal of enhancing safety and reducing accidents among two-wheeler riders. ----------

INTRODUCTION

Street Healthcare In recent times, the popularity of motorcycles has been on the rise, particularly among middle-class individuals who find them affordable and suitable for their budgets. This trend is especially prominent among young people and college students, who are increasingly drawn to the thrill and convenience of bikes. In response to the growing demand, various motorcycle manufacturers have introduced a wide range of sports bikes, intensifying the competition in the market.

India, with approximately 37 million motorcycle owners, held the record for the highest number of two-wheeler riders in 2017. However, this surge in bike usage has led to increased traffic congestion and a corresponding rise in accidents, resulting in significant damage and loss of life. One of the leading causes of these accidents is drinking

and driving, a prevalent issue in today's fast-paced lifestyle. While many countries have implemented helmet-wearing regulations, these rules are often violated by some uncivilized individuals, jeopardizing their safety.

The primary objective of this research is to develop a smart helmet that prioritizes rider safety. In addition to addressing helmet compliance, the research aims to tackle two other critical issues: accidents and delayed medical assistance. When a rider experiences an accident, immediate access to medical help is crucial, as delays can contribute to fatalities. Unfortunately, in situations where accidents occur in unmanned areas or lack immediate assistance, every passing second becomes a matter of life and death. To combat this, a fall detection mechanism, utilizing an accelerometer placed within the bike unit, can identify accidents promptly.

The project's core aim is to create a protective system within the helmet to ensure bike rider safety. The smart helmet is equipped with various sensors responsible for detecting important factors, such as alcohol consumption and accidents. The project consists of two main units, each

employing a microcontroller, which facilitates seamless communication between the helmet unit and the bike unit through an RF module.

The objectives of this project can be summarized as follows:

Designing a circuit that significantly improves bike rider safety.

Developing a helmet that prevents alcohol consumption by the rider, thereby reducing the risk of accidents caused by impaired judgment.

Gaining a comprehensive understanding of RF transmitter and receiver circuits to effectively implement the project.

By integrating the proposed smart helmet with any bike, it becomes mandatory for the rider to wear it, ensuring their own safety regardless of legal regulations. This research paper explores the development and implementation of smart helmet technology, highlighting its potential to enhance bike rider safety, prevent accidents caused by alcohol consumption, and expedite emergency medical response.

NEED OF THE STUDY

The study of smart helmets is crucial in addressing the pressing need for improved safety measures for two-wheeler riders. With the increasing number of road accidents and fatalities, especially among motorcyclists, there is an urgent requirement for effective solutions that can mitigate risks and protect riders.

The need for the study of smart helmets arises from the fact that a significant number of accidents and injuries can be prevented if riders wear helmets consistently. Unfortunately, non-compliance with helmet-wearing regulations remains a prevalent issue in many countries. Therefore, it becomes imperative to develop and implement innovative solutions that not only enforce helmet usage but also enhance the overall safety of riders.

Smart helmets offer a comprehensive approach to rider safety by incorporating various advanced features. The inclusion of sensors for alcohol detection addresses the issue of drunken driving, which is a leading cause of accidents. By automatically preventing the bike from starting if the rider is under the influence of alcohol, smart helmets act as a deterrent and promote responsible behavior.

Accident detection capabilities are another crucial aspect of smart helmets. With sensors and technologies like accelerometers, smart helmets can detect sudden impacts or falls, allowing for immediate alerts and prompt medical assistance. This feature is especially critical in situations where the accident occurs in remote or unmanned areas, where timely medical help may be challenging to access.

Additionally, smart helmets can incorporate communication capabilities, such as RF modules or GPS systems, enabling the transmission of vital information in case of emergencies. This feature ensures that help can be dispatched promptly, and the rider's location can be tracked, enhancing the chances of timely intervention and reducing the severity of injuries.

By studying smart helmets, researchers and developers can further refine and improve these technologies. There is a need to explore new features, such as fatigue detection or integration with smartphone applications, to provide riders with real-time feedback and enhance their overall safety. Moreover, studying smart helmets allows for the evaluation of their effectiveness, user acceptance, and practical implementation in real-world scenarios.

Ultimately, the study of smart helmets is essential to address the need for comprehensive and advanced safety solutions for two-wheeler riders. By understanding their potential, limitations, and areas for improvement, researchers can contribute to the development of smarter, more effective helmets that can significantly reduce accidents, injuries, and fatalities on the roads.

RESEARCHMETHODOLOGY

The methodology for developing a smart helmet involves a systematic approach that combines hardware design, sensor integration, software development, and testing. The following steps outline the methodology for creating a smart helmet:

1.Requirement Analysis: Identify the specific requirements and objectives of the smart helmet project. This involves understanding the desired features such as accident detection, alcohol detection, speed control, and tracking capabilities. Determine the hardware and software components needed to fulfill these requirements.

2.Sensor Integration: Select and integrate the necessary sensors into the helmet design. This may include sensors such as accelerometers for accident detection, gas sensors for alcohol detection, and GPS modules for location tracking. Ensure proper sensor placement and connection to the helmet's microcontroller or processing unit.

3.Microcontroller Programming: Develop the software code or program for the microcontroller that controls the smart helmet's functionalities. This involves programming the microcontroller to read sensor data, process it, and trigger appropriate actions based on predefined conditions. For example, activating an alarm in the event of an accident or sending notifications in case of alcohol detection.

4.Communication Module Integration: Incorporate wireless communication modules, such as GSM or RF modules, into the helmet design. These modules enable communication between the helmet and external devices, such as a smartphone or a bike's ignition system. Implement protocols and algorithms for secure and reliable data transmission.

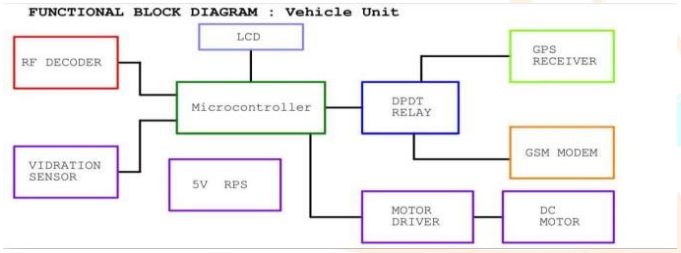
5.Hardware Integration: Integrate all the hardware components, including sensors, microcontroller, communication modules, and power supply, into the helmet. Ensure proper wiring and connections, taking care of safety considerations such as insulation and waterproofing.

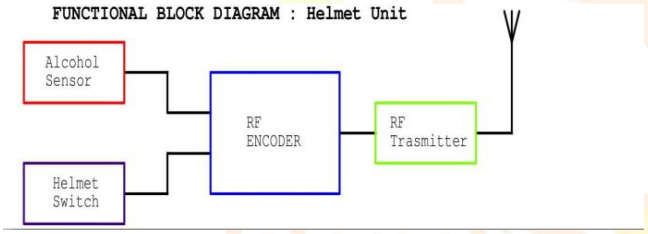
6.User Interface Design: Develop a user interface for the smart helmet, which may include an LCD display or LED indicators to provide feedback and information to the rider. Design an intuitive user interface that allows for easy interaction and understanding of the helmet's status and alerts.

7.Testing and Validation: Conduct rigorous testing of the smart helmet to ensure its functionality and reliability. Test various scenarios, such as accident detection, alcohol detection, speed control, and communication capabilities, to verify the effectiveness of the helmet's features. Make

necessary adjustments and refinements based on the test results.

8.Documentation and Deployment: Document the entire development process, including hardware and software designs, wiring diagrams, and user manuals. Prepare the smart helmet for deployment by ensuring proper installation and calibration. Provide user instructions and guidelines for effective and safe usage.





OBJECTIVES

The objective of the smart helmet project is to enhance the safety of motorcycle riders by introducing advanced features and technologies into the traditional helmet design. The primary goal is to mitigate the risks associated with road accidents and promote responsible riding practices. The project aims to achieve the following objectives:

Accident Detection and Reporting: Implement sensors and communication modules in the helmet to detect accidents and promptly relay the information to relevant parties, such as emergency services or registered contacts. This objective seeks to reduce response time and ensure timely medical assistance, potentially saving lives.

Alcohol Detection: Integrate alcohol detection sensors into the helmet to detect whether the rider is under the influence of alcohol. If alcohol consumption is detected, the helmet triggers safety measures such as immobilizing the bike or notifying the rider's contacts about their condition. This objective aims to discourage and prevent drunken driving, a major cause of accidents.

Speed Control and Warning: Utilize sensors to monitor the speed of the motorcycle and provide warnings to the rider when they exceed predefined speed limits, especially in areas with higher risks, such as school zones or hospitals. By promoting speed control, this objective seeks to reduce the likelihood of accidents and ensure compliance with speed regulations.

Compulsory Helmet Usage: Implement mechanisms that enforce the mandatory use of helmets. By integrating the helmet with the motorcycle's ignition system, the bike will not start unless the rider is wearing the helmet. This objective aims to instill a culture of helmet usage among riders.

Remote Monitoring and Tracking: Enable remote monitoring and tracking of the helmet and the rider's location. This objective allows for real-time monitoring by authorities or concerned individuals, facilitating quick response in case of emergencies or accidents in unmanned areas.

Working:

When biker wears the helmet, the switch on belt is pressed and a signal is generated. At the same time, through the mq3 gas sensor it is checked that whether the biker is consuming alcohol or not. If the biker has consumed alcohol, then the bike never turns on. But if he doesn't consume alcohol, then a combination of these signals is passed to the microcontroller.

Now in response of the combination of these signals, Encoder IC (HT12E) receives parallel data in the form of address bits and control bits. The control signals from remote switches along with 8 address bits constitute a set of 12 parallel signals. The encoder HT12E encodes these parallel signals into serial bits. Transmission is enabled by providing ground to pin14 which is active low. The control signals are given at pins 10-13 of HT12E.

The RF receiver module receives the signal transmitted from the transmitting unit. It consists of 8 pins namely three ground pins, two vcc pins, two pins for data o/p (One for digital data and another for linear data) and the ant pin (receiving I/p).

In simple terms, HT12D converts the serial input into parallel outputs. It decodes the serial addresses and data received by, say, an RF receiver, into parallel data and sends them to output data pins. The serial input data is compared with the local addresses three times continuously.

The input data code is decoded when no error or unmatched codes are found. Valid transmissions in indicated by a high signal at VT pin and then relay goes on. A string of address and data bit is used to prevent from false triggering.

RF receiver module is crystal lock frequency receiver which maintain a constant frequency i.e., 434 MHZ due to this variation problem in frequency to be sensed by the receiver can be negotiate.

So then according to conditions helmet part gets on (person is not drunk and belt's switch is pressed as sign of wearing helmet) then it gives all positive signals to bike's part then bike turns on as helmet's conditions fulfilled if vibration sensor detects any kind of vibration, then bike turns off and send message via GSM unit by supposing that person on bike was fallen down and also send location in that message via GPS.

It sends message on that number which is saved in that GSM unit. So, like this this system works.

Diagram 1

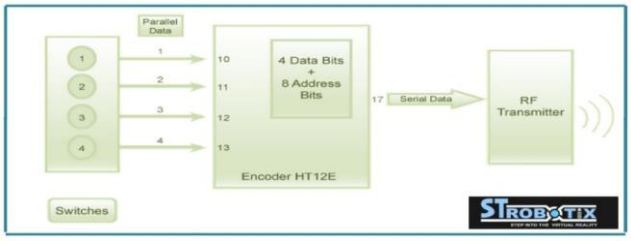


Diagram 2

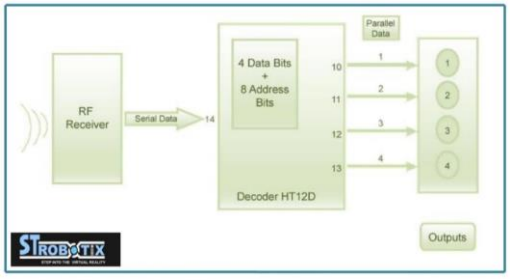


Diagram 3

Conclusion

The In conclusion, the development of smart helmets has emerged as a promising solution to enhance the safety of two-wheeler riders. Through the integration of advanced features such as alcohol detection, accident detection, and communication capabilities, smart helmets have the potential to significantly reduce road accidents and mitigate their consequences.

The primary objective of a smart helmet is to ensure the rider's safety by making the use of a helmet compulsory. By employing technologies like RF modules, the helmet can prevent the bike from starting unless the rider is wearing the helmet. This feature alone can encourage riders to prioritize their safety and reduce the instances of non-compliance with helmet-wearing regulations.

It is crucial to recognize that smart helmets are not a standalone solution to road safety. They should be complemented by awareness campaigns, stringent enforcement of traffic rules, and infrastructure improvements.

In conclusion, smart helmets hold immense potential to improve road safety by enforcing helmet usage, detecting alcohol consumption, detecting accidents, and enabling communication capabilities. Continued research and development in this field will pave the way for even more advanced features, ultimately contributing to a safer and more secure riding environment for two-wheeler riders.

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