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Wireless Helmet for Smart Bike

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ABSTRACT

Road accidents involving two-wheelers are increasing rapidly due to negligence such as not wearing helmets and driving under the influence of alcohol. To address these safety issues, this project proposes a Wireless Smart Helmet for Smart Bike that enhances rider safety through accident prevention and real-time monitoring. The system ensures that the motorcycle engine can start only when the rider is wearing the helmet, thereby enforcing helmet usage. Helmet detection is achieved using sensors embedded inside the helmet, and the status is transmitted wirelessly to the bike unit using RF communication.

The proposed system also integrates an alcohol detection sensor to prevent bike ignition if alcohol consumption exceeds a permissible limit. In case of an accident, the system automatically detects sudden impacts and sends an emergency alert message along with the rider's location using GSM and GPS modules. A microcontroller (ATmega328) is used to process sensor data and control the ignition system through a relay mechanism.

The developed system is cost-effective, reliable, and suitable for real-time implementation in two-wheelers. By enforcing helmet usage, preventing drunk driving, and enabling quick emergency response, the proposed smart helmet system significantly improves road safety and reduces the risk of fatal accidents.

Keywords- (wireless Smart Helmet, Two- Wheeler Safety, Helmet Detection, Alcohol Detection, Accident Detection, GSM-GPS Emergency Alert)

INTRODUCTION

Two-wheelers are one of the most commonly used modes of transportation due to their low cost, fuel efficiency, and ease of mobility. However, they are also highly vulnerable to road accidents, which often result in serious injuries or fatalities. A major reason for such accidents is the lack of safety measures such as not wearing a helmet, driving under the influence of alcohol, and delayed medical assistance after an accident. Although helmet usage is legally mandatory, many riders ignore this rule, leading to an increased risk of head injuries.

With the advancement of embedded systems and wireless communication technologies, smart safety solutions can be developed to address these issues effectively. This project presents a Wireless Smart Helmet for Smart Bike, designed to enhance rider safety by enforcing helmet usage and preventing unsafe riding conditions. The proposed system ensures that the motorcycle engine can start only when the rider is wearing the helmet properly. This is achieved using sensors embedded inside the helmet and wireless communication between the helmet unit and the bike unit.

In addition to helmet detection, the system also incorporates an alcohol detection mechanism to prevent drunk driving. If alcohol consumption exceeds the permissible limit, the ignition system of the bike remains disabled. Furthermore, the system includes accident detection and real-time location tracking using GSM and GPS modules. In the event of an accident, an emergency alert message containing the location details is automatically sent to predefined contacts for immediate assistance.

The proposed smart helmet system is controlled using a microcontroller (ATmega328), which processes sensor data and controls the ignition system through a relay. The system is designed to be compact, cost-effective, and reliable, making it suitable for practical implementation in two-wheelers. By integrating multiple safety features into a single system, this project aims to reduce accident risks, save lives, and contribute to the development of intelligent transportation systems.

LITERATURE SURVEY

Several studies have been conducted on smart helmet systems to improve rider safety. Existing research focuses on helmet detection, alcohol sensing, and accident monitoring using embedded systems. Some researchers have proposed wired helmet detection systems, but these are inconvenient and unsafe during riding. Wireless communication-based systems using RF or Bluetooth have proven to be more practical and reliable.

Other studies have explored the use of GSM and GPS modules for accident alert systems. These systems automatically send emergency messages when an accident is detected, reducing response time and saving lives. However, many existing systems lack integration of all safety features into a single platform. This project overcomes these limitations by combining helmet detection, alcohol sensing, ignition control, and emergency alerting into one compact and cost-effective system.

SYSTEM OVERVIEW

The proposed system is divided into two main units:

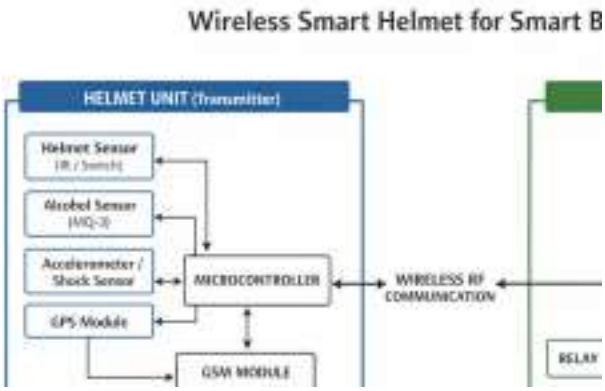
- Helmet Unit (Transmitter)
- Bike Unit (Receiver)
- The helmet unit detects helmet usage, alcohol presence, and accident occurrence. The bike unit receives this information wirelessly and controls the ignition system accordingly. The microcontroller ats as the central processing unit for decision-making and control.
- Helmet Unit Description:
- The helmet unit consists of sensors, a
- microcontroller, and wireless communication modules. An IR sensor or switch is used to detect whether the helmet is worn properly. An alcohol sensor (MQ-3) detects alcohol vapours from the rider's breath. An accelerometer or shock sensor detects sudden impacts indicating an accident. The processed data is transmitted wirelessly to the bike unit using an RF transmitter. In case of an accident, GSM and GPS modules are activated to send an emergency alert with location details.
- Bike Unit Description:
- The bike unit receives signals from the helmet unit through an RF receiver. A microcontroller processes the received data and controls the ignition system using a relay. If the helmet is not worn or alcohol is detected, the relay remains OFF,
- preventing the bike from starting. Only when all safety conditions are satisfied does the relay turn ON, allowing ignition.

HARDWARE COMPONENTS USED

- ATmega328 Microcontroller:
- Acts as the main control unit of the system. It receives input signals from sensors, processes the data, and controls RF communication, relay operation, and GSM-GPS modules.
- Helmet Detection Sensor (IR sensor):
- Used to detect whether the rider is wearing the helmet properly. If the helmet is not worn, the sensor output disables the bike ignition.
- Alcohol Sensor (MQ-3):
- Detects alcohol vapours from the rider's breath. When alcohol concentration exceeds a preset limit, the ignition system is automatically disabled to prevent drunk driving.
- RF Transmitter and Receiver:
- Provides wireless communication between the helmet unit and the bike unit. It transmits helmet status and safety signals without using physical wires.
- Relay Module:
- Controls the bike ignition system. The relay allows the engine to start only when all safety conditions such as helmet wearing and alcohol free status are satisfied.
- Shock Sensor:
- Detects sudden impact or vibration during an accident. It helps in automatic accident detection and triggers emergency alert systems.
- GSM Module:
- Used to send SMS alerts during emergency situations. It sends accident notifications to predefined contact numbers.
- GPS Module:
- Provides real-time location information in the form of latitude and longitude. This data is sent through GSM during accident alerts.
- LCD Display:
- Displays system status such as helmet detection, alcohol detection, and emergency alerts.

- Buzzer and LED indicators:
- Provide audio and visual alerts during unsafe conditions like alcohol detection or accident occurrence.
- Power Supply Unit:
- Supplies regulated supply to all components. It ensures stable and reliable operation of the system.
- Battery:
- Provides portable power to the helmet and bike unit electronics.
- V. SOFTWARE DESIGN
- Arduino IDE is used for programming
- Embedded C language is implemented
- Sensor interfacing and serial communication GSM-GPS data handling

BLOCK DIAGRAM



COMPARISON WITH CONVENTIONAL SYSTEM
ADVANTAGES

- Ensures that the bike cannot start unless the rider wears the helmet properly.
- Prevents drunk driving using alcohol detection sensor.
- Automatically detects accidents without human intervention.
- Improves overall rider safety.
- Can be implemented on existing two wheelers.
- Encourages responsible riding behaviour.
- Reduces fatal head injuries and road deaths.

LIMITATIONS

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- Initial installation cost is higher than conventional systems.
- Requires periodic maintenance and testing.
- System performance depends on battery power availability.

CONCLUSIONS

The Wireless Smart Helmet for Smart Bike enhances rider safety by enforcing helmet use, preventing drunk driving, and enabling rapid accident response. Using helmet and alcohol sensors, accelerometer-based accident detection, and GSM/GPS modules, the system ensures the bike starts only when safe and sends real-time alerts during emergencies. Its wireless, microcontroller-based design is reliable, compact, and user-friendly. While dependent on battery, range, and network, the system is a cost-effective, scalable solution that reduces accidents and can be further developed for advanced Parameter Conventional Two-Wheeler System Proposed Wireless Smart Helmet System smart vehicle safety applications.

REFERENCES

1. Sobhana et al., “Smart Helmet for Safe Ride,” IJERT. Helmet Usage Enforcement Depend on rider awareness
2. Automatically enforced
3. A. kurs et al., “Wireless Power Transfer and Safety Bike Start without Helmet Possible Not possible Systems,” IEEE.
4. IJRASET, “Implementation of Smart Helmet Based on IoT”.
5. ResearchGate, “Smart Helmet for Accident Detection and Safety”.

6. IEEE Transactions on Intelligent Transportation Systems.

Cost Effectiveness Low initial cost slightly higher but safer

Reliability	Depends on Human action	Technology driven reliability