

# Helmetron: A Helmet-based Electronic and Monitoring Technology

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## Abstract

**Helmetron is a revolutionary system that aims to improve rider safety and enhance its features. This system is designed to prevent the vehicle from starting if the passenger is not wearing a helmet, thereby promoting helmet use and reducing the risk of accidents. In addition, the system has an accident detection feature that uses the GPS-GSM tracking system to notify people via SMS of the bike's location in the event of an accident. This enables emergency services to reach the scene of the accident quickly and provide timely assistance. The system integrates various sensors into the helmet and wirelessly sends data to a module connected to the bike's engine. The two modules (one on the helmet and the other on the bike) communicate via RF technology using a microcontroller. The smart helmet also can show directions and search for locations, and it uses a microphone and speakers for voice navigation via Google Maps. Users can use voice commands to control calls and messages, which encourages better interaction while riding.**

## 1. INTRODUCTION

Smart bikes offer new ways to improve motorcycle safety. The system is designed to prevent a fire in the vehicle if the passengers do not wear helmets and consume alcohol [1]. There is a technology that displays the rider's speed and alerts them when they exceed the speed limit [2]. The system incorporates multiple sensors into the helmet and transmits the data wirelessly to a module that is connected to the motorcycle's engine. The two modules, one mounted on the helmet and the other on the bike, communicate with each other using RF technology, while the Arduino microcontroller acts as the intermediary. [2]. This project is designed to provide users with directions and searches using voice navigation on Google Maps and free phone service. It also allows users to use commands to control calls and messages, making it easier to interact while driving. In recent years, the popularity of motorcycles has increased among middle-class people, especially young people and university students. To meet the growing demand, many motorcycle manufacturers are developing various sports bikes, making the market more competitive. India, which has approximately 37 million motorcycle owners, holds the record for the country with the most bicycle users in 2017. However, the increase in bicycle use has also led to an increasing number of accidents, causing great destruction and loss of life. The main goal of this research is to create a smart helmet that ensures the safety of passengers. In addition to helmet compatibility, the study also focuses on two important issues. The first is using a mobile phone while riding a bike, which is risky. However, there are times when it is necessary to check the phone, especially when using the

navigation system on the mobile device. Additionally, when an important call comes in, it is essential to identify the caller and decide whether to reject or answer the call by safely parking the bike on the side of the road. The issue of accidents and delayed medical attention is a significant concern, as prompt medical attention can be the difference between life and death. However, when an accident occurs in a remote location or emergency assistance is unavailable, every second becomes critical. To address this challenge, a fall detection mechanism uses the accelerometer on the bike to determine the situation in real time. The primary goal of the project is to create protective helmets that prioritize safety and enable hands-free control of smartphones. Smart helmets are equipped with various sensors that detect important factors during accidents. The project consists of two components, each using a microcontroller to enable seamless communication between the helmet and the bike via radio frequency. The purpose of this project can be summarized as follows: to create a safer cycling experience for passengers. It is essential to have a good understanding of RF transmitter and receiver circuits to implement the project effectively. With the smart helmet integrated into every bike, riders must wear it to ensure their safety, irrespective of laws and regulations. This research paper explores the development and use of smart helmet technology and highlights its potential to expedite medical intervention.

## 2. OBJECTIVE

The Smart Helmet Project aims to increase the safety of motorcycle riders by adding advanced features and technologies to helmet models. The primary goal of this project is to reduce the risks associated with traffic accidents. The objectives of the project are as follows:

1. Detection and warning: The project aims to insert sensors and communication modules into the helmets to identify the situation and send timely information to relevant persons, such as emergency services or contact persons. This goal is to shorten response times and provide timely, potentially life-saving medical assistance.
2. Promoting helmet use: The project aims to use a strategy to control helmet use. By integrating the helmet into the motorcycle's electrical outlet, the bike will not start unless the rider wears the helmet. This aim is to develop the culture of using helmets among passengers.

3. Remote monitoring and tracking: The project aims to allow remote monitoring and tracking of helmets and drivers. This mission helps respond quickly to emergencies or accidents in unpopulated areas, allowing immediate attention from authorities or stakeholders.

4. Communication integration: The project aims to incorporate a microphone and speaker into the helmet to enable hands-free communication with a mobile phone, including caller identification, call rejection, and text messaging capabilities.

5. Navigation assistance: The project aims to integrate Google Maps to provide the wearer with directions and navigation assistance while riding. The Smart Helmet Project aims to increase the safety of motorcycle riders by adding advanced features and technologies to helmet models. The primary goal of this project is to reduce the risks associated with traffic accidents.

### 3. NEED OF THE STUDY

Using a mobile phone while riding a bike is hazardous, but there are situations where checking the phone, like using navigation, becomes necessary. In such cases, it's vital to park the bike safely on the side of the road to manage calls without risking accidents. Smart helmet inspection is critical for enhancing the safety of two-wheeler riders. The rising number of accidents, particularly among cyclists, emphasizes the urgent need for solutions to mitigate risks and prevent fatalities. The significance of helmet use cannot be emphasized enough, as many accidents and injuries can be prevented if riders always wear helmets. However, non-compliance with helmet laws remains a prevalent issue in numerous countries. Thus, there's a necessity to develop and implement solutions that not only enforce helmet use but also enhance passenger safety. Collision detection functionality is another crucial aspect of smart helmets. Through technologies like sensors and accelerometers, smart helmets can identify impacts or falls and immediately sound an alarm while providing timely medical assistance. This feature is especially critical in remote areas where accessing medical aid promptly can be challenging. Furthermore, smart helmets can integrate communication systems like radio frequency modules or GPS to transmit vital information during emergencies. These capabilities facilitate swift assistance and tracking of the rider's location, ensuring timely intervention and pain reduction. Researchers and developers can enhance this technology by exploring new features such as fatigue detection or smartphone integration, which can provide riders with instant information and enhance overall safety. Additionally, studying smart helmets can assess their effectiveness, user acceptance, and practicality in real-world scenarios. Ultimately, research on smart helmets is indispensable for ensuring optimal safety for two-wheeler riders. By comprehending their potential, limitations, and areas for enhancement, researchers can contribute to the development of superior and more effective helmets, thereby reducing accidents, injuries, and fatalities on the road.

### 4. RESEARCH METHODOLOGY

Creating a smart helmet involves a synthesis process that combines various elements including hardware design, sensor integration, software development, and rigorous testing. The following steps outline how to create a smart helmet:

1. Analysis: Identify the specific needs and goals of the smart helmet project. This includes understanding required features such as collision detection, alcohol detection, speed control, and tracking capabilities. Determine the hardware and software required to meet these requirements.

2. Sensor Integration: Select appropriate sensors and integrate them into the helmet design. This may include sensors such as accelerometers for crashes and GPS modules for location tracking. Make sure the sensor is positioned correctly and connected to the helmet's microcontroller or unit.

3. Microcontroller programming: Create software code or program for the microcontroller that controls the functions of the smart helmet. This involves designing a microcontroller that will read sensor data, process the data, and take the necessary actions based on specified conditions.

4. Communication module integration: Integrate wireless communication modules (such as GSM or NRF modules) into the helmet design. This module enables communication between the helmet and external devices such as smartphones or electric bikes. Follow the rules and algorithms to get safe and reliable data.

5. Hardware Integration: Integrate all hardware components into the helmet, including sensors, microcontrollers, communication modules, and power supplies. Make sure the connections and connections are correct, pay attention to safety measures such as insulation and waterproofing.

6. Tests and reviews: The smart helmet has been rigorously tested to ensure its functionality and reliability. Test various situations such as accident detection, speed control, and communication capabilities to verify the effectiveness of helmet performance. Make necessary adjustments and improvements based on test results.

7. Documentation and delivery: Document the entire development process, including hardware and software, diagrams, and manuals. Ensure appropriate development and testing are done to prepare smart helmets for use. Provide users with tips and advice to use it effectively and safely.

### 5. WORKING

The RF receiver module receives the signal transmitted from the transmitter and converts the serial input into parallel outputs. It decodes the serial addresses and data received by an RF receiver into parallel data and sends them to output data pins. The process involves continuously comparing serial input data with local addresses three times. The input data code is decoded only when no errors or unmatched codes are detected. Valid transmissions are indicated by a high signal at VT pin, and then the relay turns on. A string of address and data bits is used to prevent false triggering. The RF receiver module is a crystal lock frequency receiver that maintains a constant frequency of 2.4 GHz, preventing frequency variation problems that bike parts may sense.

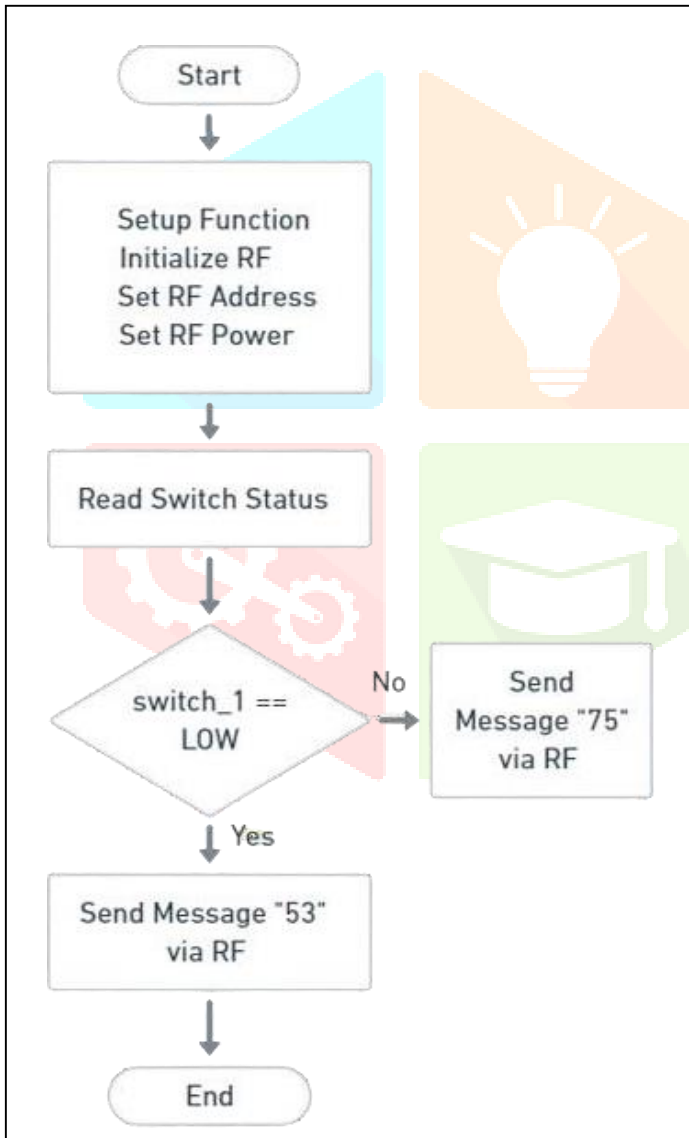


Figure 1. Flowchart of transmission

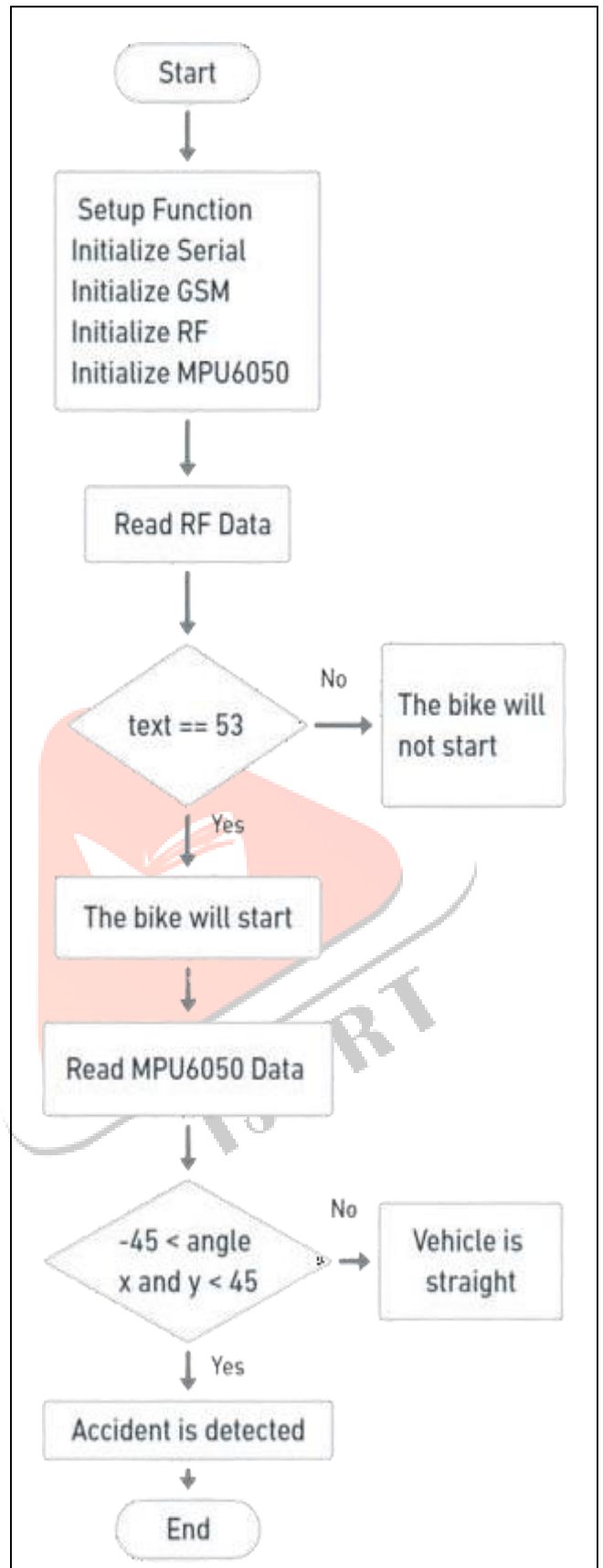


Figure 2. Flowchart of receiver

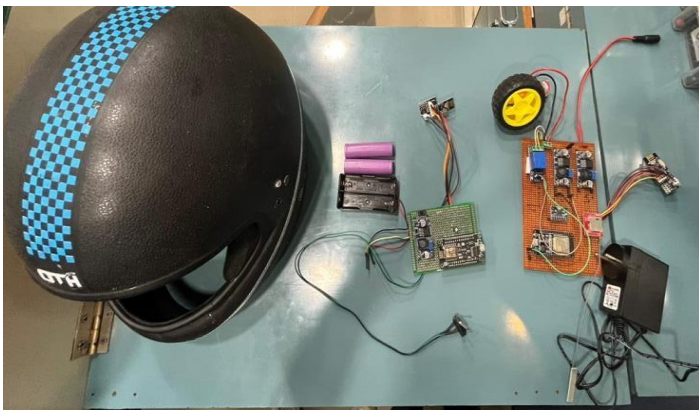


Figure 3. Hardware model of the project

If the vibration sensor detects any kind of vibration, the bike turns off and sends a message via the GSM unit, assuming that the person on the bike has fallen down. It also sends the location in that message via GPS to the number saved in that GSM unit. The helmet unit contains a speaker and microphone built inside it and is wirelessly connected to a mobile phone. The mobile can be controlled and commanded by voice. While riding the bike, when a call comes in on the mobile phone, we can receive or reject the call using only voice commands. To enable this feature, we need to make some additional settings on the mobile so that we can assist the mobile using only voice commands. We can enable permission settings on the mobile phone so that we can control it from the helmet.

## 6. CONCLUSION

The development of smart helmets has emerged as a promising way to improve the safety of two-wheelers. Smart helmets can reduce traffic accidents and their occurrence thanks to crash monitoring and communication capabilities. The main purpose of smart helmets is to ensure the safety of passengers by using the helmets that should be used. By using technologies such as radio frequency modules, the helmet can prevent the bike from starting unless the rider is wearing a helmet. This feature alone will encourage riders to be mindful of their own safety and reduce the likelihood of non-compliance with helmet regulations. It is important to know that smart helmets are not the solution to road safety. This should be done through advertising, strict enforcement of traffic laws, and development of infrastructure. As a result, smart helmets can increase road safety by using the helmet, controlling situations, and enabling communication. Continued research and development in this area will pave the way for more advanced features and ultimately provide a safer environment for two-wheeler riders.

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