International Journal of Innovative Research in Computer Science and Technology (IJIRCST)
ISSN(Online): 2347-5552, Volume-12, Issue-3, May 2024
https://doi.org/10.55524/ijircst.2024.12.3.7
Article ID IRP-1513, Pages 32-37
www.ijircst.org

Smart Helmet Implementation using GSM Module

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Received 2 April 2024; Revised 16 April 2024; Accepted 29 April 2024

ABSTRACT- India is the second most populous country in the world, and it has a lot of young people. These days, young people like riding bikes, but because it's cool, they don't wear helmets. Because of these things, there are more and more bike crashes every day, which kill people. Head accidents kill a lot of people, but you can avoid them by wearing a helmet. More and more people are getting caught driving while drunk, which leads to crashes and deaths because of carelessness. These events led us to create a smart helmet using the Internet of Things(IoT) to lower the risk of accidents and deaths. The helmet has the following features: the bike will only start if the rider wears a helmet; if the rider is too drunk, the ignition will be turned off automatically; and if an accident happens, a GSM modem will send a message to the registered contact number using a SIM card.

KEYWORDS- Internet of Things, GSM Modem, Ignition, Smart Helmet, Accelerometer Sensor, Alcohol Sensor.

I. INTRODUCTION

A. Review Stage

- Functionality: Verify that the smart helmet's fundamental features operate as intended. This contains functions like GPS tracking, impact detection, and GSM module communication.
  Determine the accuracy of the impact detection system by testing it. It should have the capacity to accurately identify impacts and sound an alert in the event of a collision or accident.
- GPS Tracking: Confirm that the helmet wearer's location is accurately tracked by the GPS tracking capability. For the purpose of giving emergency personnel real-time location information, this is essential.
- GSM Module Communication: Check the GSM module's communication capability. Make sure it can effectively notify, alert, or update the location of specified contacts or emergency services.

B. Final Stage

Verify the correct integration of all hardware parts into the helmet, such as the impact sensors, GPS module, GSM module, microcontroller, and power supply.

- Software Development: Make certain that the helmet's firmware and software have been thoroughly created and tested. This entails setting up the microcontroller to manage sensor inputs, GSM module connectivity, GPS tracking, and alert triggering.
- Assessing and Adjusting: To ensure the smart helmet is working, thoroughly test it in a variety of situations. Adjust sensor calibrations for precise impact detection and guarantee dependable GPS tracking.
- Emergency Response System: In the event of an accident or emergency, test the system to make sure it can send messages or alerts to the designated contacts or emergency services.

II. PROPOSED SYSTEM

- If With the use of internet of things (IoT) technology, we are creating a smart helmet that will protect bike riders. By preventing motorcycle accidents on the roads, The rider's helmet is detected by the system, and only then will the vehicle start if the rider is wearing one [1][2].
- It recognizes the amount of alcohol the rider has consumed; if the rider has consumed too much, the bike engine will not start.
- It identifies accidents and notifies the registered contact with a location when an accident occurs[3][4][5].

We are utilizing the most recent technology to ensure the cyclist's safety. Internet of Things (IoT) technology offers sophisticated methods for warning riders and making sure they abide by the laws. Helmets are the most fundamental form of protection for riders of two wheels and are required for all users of motorbikes and bicycles. However, it does not guarantee the rider's safety, and the rider will disregard traffic laws. Now a days more people driving motorcycles where they consume lot of alcohol because of that the rider may get injured or in some cases death also[11]. By using IOT we create a safety helmet that didn’t allow rider to start the vehicle while the rider drunken. majority of individuals wear regular helmets only to avoid giving the traffic police trouble; yet, these helmets do not guarantee the driver's safety.

III. SYSTEM DESIGN

This portion includes an RF transmitter, microcontroller, accelerometer, switch, and alcohol sensor all are connected to ARDUINO shown in Figure 1. The toggle determines if a biker is wearing a helmet, and an alcohol sensor determines if the rider is drunk or not. An RF transmitter then sends the signal to the bike section.

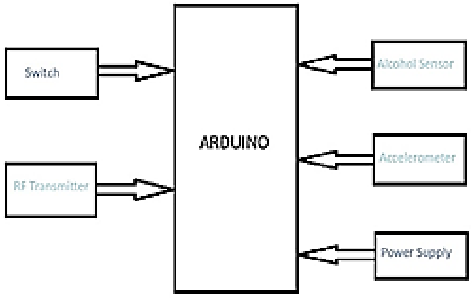

Figure 1: Block Diagram of Helmet Module

Description of the main components:

- Alcohol Sensor

Figure 2: Sensor for alcohol (MQ-3)

In the above figure 2, it determines, When a drunk individual breath close to an alcohol sensor, which measures the amount of alcohol in the air, it reveals the alcohol gas in the breath and produces an output based on the amount of alcohol in the breath. It is positioned within the helmet so that it can quickly detect the wearer's breath.

- The Accelerometer

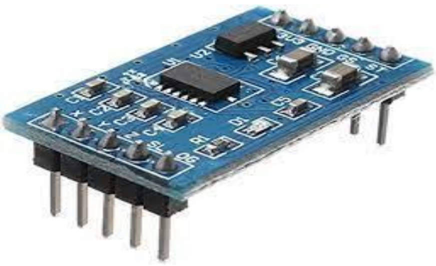

Figure 3: MMA7361 Accelerometer

In the above figure 3 MMA7361 Accelerometer is used as, the acceleration forces, which might be either static or dynamic, are measured by this electromechanical apparatus. An accelerometer is used to measure the vibration of the material and is useful in determining the probability of accidents as well as the rider's head inclination and helmet position.

- RF Transmitter

Figure 4: RF transmitter (434-Mhz)

RF Transmitter Figure 4 has Transmitter and receiver parts operating at 434 MHz are called RF modules from Figure 4. The gadget that transmits data wirelessly is called an RF transmitter. Through an antenna attached to the transmitter's fourth pin, serial data is transmitted to the recipient. Through radio frequency waves, it sends the helmet data to the bike receiver, where a microcontroller processes the information, it receives.

- Switch

Figure 5: Switch (ON/OFF button)

Figure 5 is an electrical mechanism that turns a gadget on or off and controls the flow of electricity by switching the current between conductors. This switch is positioned within the helmet's top and is released when the rider removes the helmet. It is pressed when the helmet is on. The bike's ignition key will be ON or OFF depending on the switch's status.

- Arduino

Figure 6: Arduino UNO

Arduino UNO board in figure 6 is used to connect all the other devices. The open-source platform Arduino is used to create electronic creations. It is made up of a software tool and a hardware circuit. The software is used to write the code and upload it via a cable into the actual board. The Arduino IDE is one of the SIMplest ways to write code, although it uses a SIMplified version of C++. Arduino is able to communicate with sensors, motors, the internet, smartphones, and televisions. Although Arduino offers many other boards, one of the most well-known is the UNO.

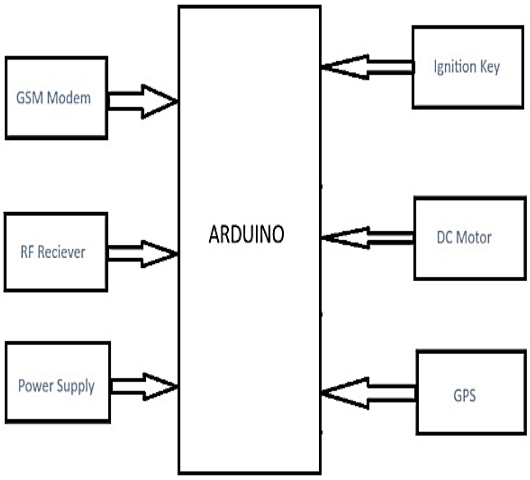

Figure 7: Bike Module Block Diagram

In figure 7, the RF receiver, microcontroller, ignition key, GPS LCD, GSM modem, and decoder are all included in this section. The signal is obtained from the helmet area by the RF receiver, which then uses a decoder to decode it. The relay will immediately turn off the ignition if the person is too intoxicated, and a GSM modem will be used to send out a message in the event of an accident.

A. GSM Modem

Fig 8: GSM Modem (SIM 900)

Figure 8 is used to A SIM can be used with a mobile device to send and receive messages from registered numbers; it just has to be put into the modem's SIM card slot.

B. RF Receiver

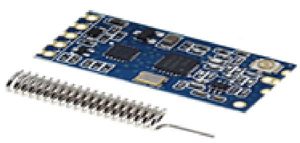

Figure 9: RF receiver (434-mhz)

Figure 9 (Radio-Frequency receiver) is an electronic device that helps to establish wireless communication between two other electronic devices. Electromagnetic radiation in the form of radio waves is used for transmission. In this process, the vehicle module (receiver) receives the output data from the helmet module (transmitter), and wireless technology is used throughout the process.

C. GPS Tracker

Figure 10: GPS Tracker

The global positioning system is known as GPS. A GPS tracker figure 10 is a navigation tool to find moving objects, including people, cars, and animals. The information gathered from the gadget is kept inside it before being sent over a cellular or wireless network. The vehicle's information is its current location, which is shown almost instantly on a map. All cell phones will have access to the vehicle tracking software.

D. DC Motor

Figure 11: DC Motor

A motor that converts energy from a direct current into mechanical energy is known as a figure 11 direct current (DC) motor.

IV. IMPLEMENTATION

This system's installation is inexpensive and offers efficient accident detection. This technology prevents traffic accidents and offers safety precautions for motorcyclists. The "Smart Helmet" solution achieves the following goals:
• Location sharing, accident detection, alcohol content detection, and the status of the helmet-wearing rider.

A. Helmet Section

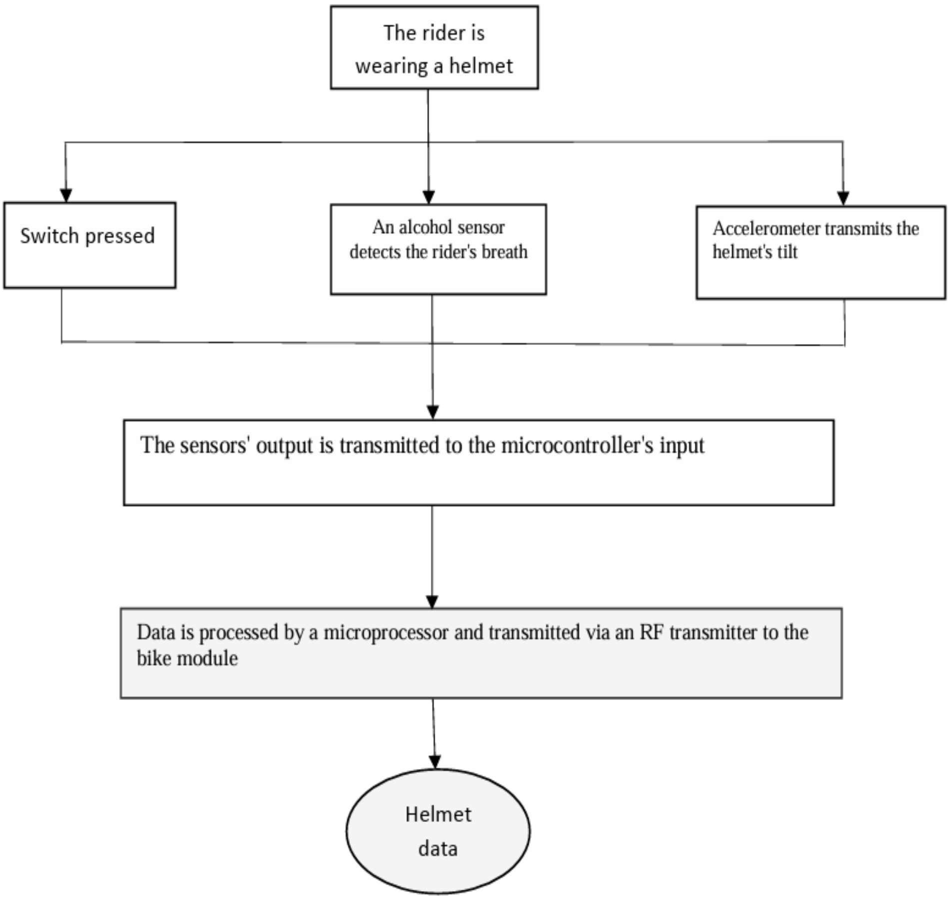

Figure 12: Helmet Section Flow Chart

While the receiver is mounted on a specific bike, the transmitter is located in the helmet portion. The helmet section and the bike section will thus be able to communicate wirelessly.

In the above figure 12, the switch in the helmet is pressed when the bike rider puts it on. Because it is positioned within the helmet in a way that makes it easy to detect the rider's breath, the alcohol sensor inside the helmet detects alcohol gas while the rider is breathing. The threshold value will drop and the value will be changed if the alcohol sensor determines that the rider is intoxicated beyond a reasonable limit. The bike will not start because the ignition will be turned off.

An accelerometer that is integrated inside the helmet detects tilting. The microcontroller that is integrated inside the helmet will receive the output from these parts. The bike module receives the processed data, which is the helmet's microcontroller's output, via an RF transmitter.

In the below figure 13, the helmet data is received by the bike module's RF receiver and sent to the microcontroller. The microcontroller will then examine all of the helmet's data and decide whether or not to start the bike. Two requirements must be met in order to start a bike's ignition:

The rider should not exceed the threshold value of alcohol consumption. The helmet has a switch that, when pressed, activates the ignition. The rider is required to wear the helmet.

The output of the helmet data must meet the two requirements above in order for the bike to start; if it doesn't, the bike won't start. The accelerometer will determine whether or not the helmet is tilted with respect to the ground. If it is tilted more than a certain amount, an accident has occurred. A notification will be sent right away via GSM to the registered contact number and will also include the location of the accident. In order to treat the sufferer medically and promptly transport them to the hospital, they must also promptly notify the police station about the event.

B. Bike Section:

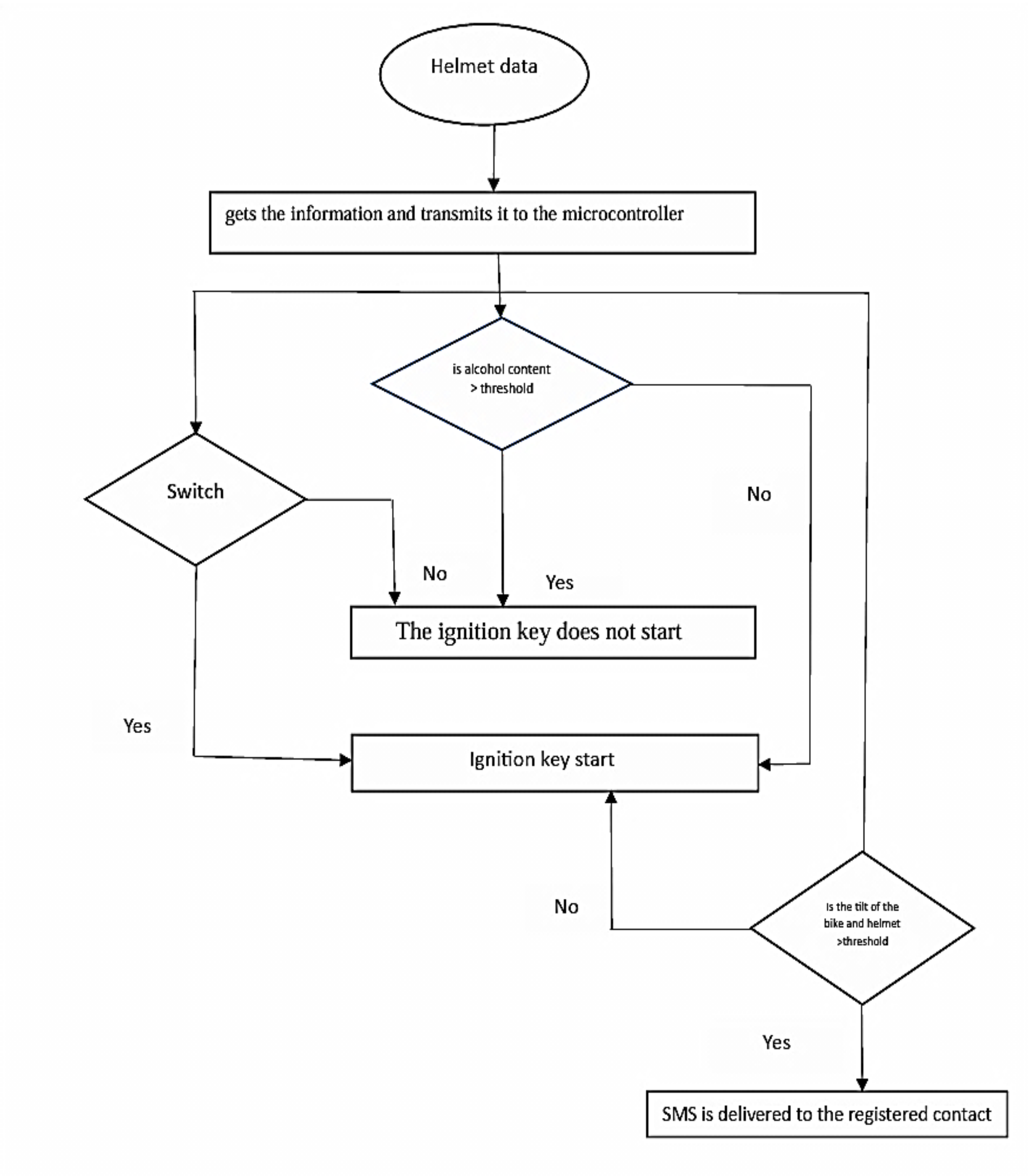

Figure 13: Bike Section Flow Chart

V. CONCLUSION

The system is meant to ensure rider safety; in the event of an accident, it will promptly alert the registered contact and provide a safety measure based on the accident location. This also stops cases of drink and drive by detecting alcohol usage. This guarantees that the helmet is worn by the wearer at all times.

VI. APPENDIX

A comprehensive overview of the technical specifications governing the Smart Helmet system is presented. The specifications encompass details regarding the Smart Helmet components, microcontroller specifications, alcohol detection sensors (MQ3), specifics of the accelerometer and gyroscope sensors, GSM module characteristics, and details about the chosen mobile app development framework and cloud service specifications. To provide a clearer understanding of the intricate interplay within the Smart Helmet system, this section includes detailed diagrams illustrating the architectural design. These diagrams visually represent the relationships between different components, the data flow, and the overall structural configuration of the system. Delving into the outcomes of the conducted feasibility study, this section presents comprehensive data and calculations related to technical feasibility, economic feasibility, operational feasibility, and adherence to legal and regulatory standards. The data serves as a quantitative foundation affirming the project's viability.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

ACKNOWLEDGMENT

We would like to thank my advisor and all the contributors who helped me in completing this research work.

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