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An IoT Based Intelligent and Smart Helmet for Bike Riders Using Arduino

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Abstract - The increasing number accidents involving two- wheelers has prompted the need for a safer and more secure riding experience. In this context, the development of a smart helmet integrated with an Arduino nano microcontroller has been proposed. The helmet safety features include that the prevention of bike starting without the helmet, accident detection can be done by using a vibration sensor, and the sending of an emergency message to pre-defined contacts. Additionally, the helmet also detects the rider's consumption of alcohol, and the bike cannot start if the alcohol level is above the permissible limit. This paper describes how the smart helmet was created and put into use, including the hardware and software component part used. The performanceof the helmet was evaluated in real-world scenarios, and the results were found to be promising. The complete system was mounted on the helmet that consists of transmitter and receiver section.

Keywords *- Helmet, alcohol sensor, transmitter, receiver.*

1. Introduction

Riding a motorcycle is nowadays a popular mode of transportation, but it can be dangerous due to the lack of protection for the rider. To overcome this risk, various safety devices have been introduced, including smart helmets. A smart helmet is a helmet that is equipped with smart features such as an alcohol sensor, accident detection, and a locking mechanism. The MQ3 sensor detects the alcoholic level of the bike rider and informs the rider if they are over the legal limit, while the accident detection feature activates and sends an emergency message in case of an accident. The locking mechanism prevents the bike from starting when a rider is not wearing a helmet .The aim of this paper is to present the design and development of a smart and saftey helmet with an MQ3 sensor and accident identification feature using an Arduino Nano microcontroller. The helmet is designed to be user-friendly, accurate, and reliable.

2. Methodology

There is primarily one and the only module mounted on the smart helmet system. A microcontroller unit i.e. Arduino Board is connected to the switches in the helmet. The helmet has sensors like a alcohol sensor, one that detects alcohol, RF decoder, GPS module, microcontroller unit, relay GSM module and Arduino nano make up the this combined module. The helmet has two sensors on it. The first sensor is placed in the front side of the helmet which checks the consumption of alcohol ,and the second sensor is in the middle of the interior surface of the helmet. It continuously monitors the ceaselessly of this helmet, then it sends the status of the helmet to the microcontroller and then to the RF transmitter. When the motorcyclist put the helmet properly on his head, the sensors turned on. Consequently, these two sensors guarantee that the helmet is positioned appropriately. The MQ3 sensor in this section measures the consumption of alcohol in the rider's mouths breathe .Before being delivered to the encoder, the comparator verifies the data from the alcohol sensor. If the bike rider has no alcohol in his breath, the motorcycles ignition will turn on; otherwise, the engine will remain off. The main points to remember while going in the development area of the model are, we require two sections i.e. Transmitter section and the Receiver section, which work on a battery. On the transmitter side we use a small battery which is placed inside the helmet on the receiver side, we use the battery of the vehicle. We use RF technology as a Transmitter Receiver Module which performs the function of data transfer. We use a IR sensor on the transmitter side which will be fitted inside the helmet. With the sensor, data is read to ensure rider is wearing helmet or not if the helmet is worn on the head it will transferthe data to the RF module and transfer the data from microcontroller to vehicle At the receiver end, there are two types of switching systems i.e. open system and closed systems. Only if when rider worn the helmet and turns on the key simultaneously the system works as a close switch, and finally bike gets starts.

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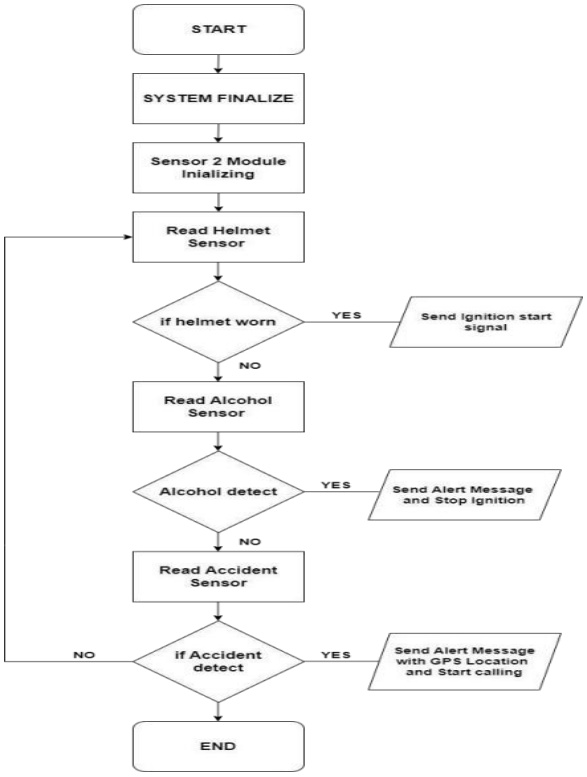

Fig.2.1. Flowchart

3. Literature Review

Intelligent Smart Helmet System: A Review, January 2020, A portion of the exploration papers connected with smart helmet with driver conduct examination to be dissected in this survey paper. The new concept of the Smart helmet makes motorcycle driving safer than ever before. By reading some of the papers, they learned that all of the systems have basic features like auto ignition bases on whether helmet is worn or not, alcohol content, and accident detection. They have also learnt more about smart helmets, including how to use the helmet's sensors in the right way and how to use different sensors to identify various features. Some of the papers have used the similar sensors, such as MQ3 sensors and accelerometer sensors, with small change in implementation differences. This system's goal is to make it mandatory for all motorcycle riders to wear helmets and follow traffic rules. The most remarkable studies from the past six years were thoroughly researched in this paper. It uses GPS and GSM to detect accidents and notify the driver's emergency contacts via SMS of the bike's location and speed before an accident occurs [1]. Smart Helmet, May 2017, the drivers of vehicles are given numerous instructions by the traffic officials. However, many of them disregard the regulations. Nowadays, most nations require motorcycle riders to wear helmets and refrain from operating motor vehicles while intoxicated. However, users continue to break the rules. Smart Helmet, an intelligent system that checks whether a driver is wearing a helmet and has non-alcoholic breath while driving, is a solution to this problem. The receiver is on the bike, and the transmitter is on the helmet. A switch is used to make sure the helmet is on the head. When the switch is turned on, the helmet will be positioned correctly. In order to detect the presence of alcohol, an alcohol sensor in the helmet is positioned close to the driver's mouth. If either of the two conditions is not met, the engine should not turn on. The arm controller board receives information from the sensors when the rider falls and the helmet hits the ground. The controller then uses the GPS module that is interfaced with it to extract GPS data. The GSM module automatically sends a message to the ambulance or family members whenever the data exceeds the minimum stress limit [2]. In May 2017, it was observed that many drivers ignored traffic rules despite being instructed by traffic officials. In response to this problem, the Smart Helmet system was introduced, which checks whether the driver is wearing a helmet and has not consumed alcohol before driving. The system consists of a receiver attached to the bike and a transmitter attached to the helmet. A switch is used to ensure that the helmet is properly positioned on the driver's head. An alcohol sensor is installed near the driver's mouth to detect the presence of alcohol. The engine will not start if either of the two conditions is not met. When the rider falls and the helmet hits the ground, the arm controller board receives information from the sensors, and the GPS module collects GPS data. When the data exceeds the minimum stress limit, the GSM module sends a message to an ambulance or family member automatically [3].

4. Proposed Work

The main purpose of this work, which was completed successfully, sought to determine how the small microcontroller system can assist with transportation system issues and driver safety. By self-regulating the necessary inputs that will promote better results, the research demonstrates that the system, when fully implemented, will help in decreasing the number of accidents and also overcome the involvement of other people. In order to accomplish the development of this system, a combined system was mounted on the helmet that consists of transmitter and receiver section. All the sensors which detect the essential part are done by wireless communication between transmitter and receiver circuit. The speed sensing sensor, alcohol sensor, GSM, GPS and other components were incorporated into the system to monitor several factors the alcohol sensor has detected the alcohol consumed by the person before driving, GSM in the model has helped in wireless communication with the alert messages to victim's family and medical section and GPS has detected the victim's location in case of accidents. Sensing all the input data, then the data is given to the Arduino board, which is the brain of this system, where the code is loaded and the whole is controlled. The LCD shows the values that we got from the sensor readings. Also the alert messages after accident is given to family or health care centers through mobile communication.

4.1 Transmitter

A microcontroller, alcohol sensor and RF transmitter are included in this section. The first part is in the inner surface of the helmet. It constantly monitors the correct fix of the helmet and sends the state of the helmet to the microcontroller before sending it to the RF transmitter. Only when the rider is wearing his or her helmet properly may the switch be switched on. Consequently, this part guarantees that the helmet is positioned appropriately. The alcohol sensor in this section measures the amount of alcohol in the rider's breath. Before being delivered to the RF encoder; the comparator verifies the alcohol sensor data. In case rider has present alcohol in their breath, the motorcycle's ignition will not turn on and the engine will remain off.

4.2 Receiver

The main function of this section are to send information to the helmet outside unit's microcontroller and receiver using an RF receiver, the helmet location data is obtained from the environment. The outside unit of helmet will turn on the vehicle ignition system when it receives the helmet unit's transmitted signal. An Vibration sensor is used to detect the helmets vibrations on hard impact when helmet touches the ground in the event of an injury. The helmet's GPS module finds the location of the vehicle. Using GSM, the accident status is sent to predetermine individuals. A microcontroller is used to control all of these sensors and parameters, allowingusers to log in to the server.

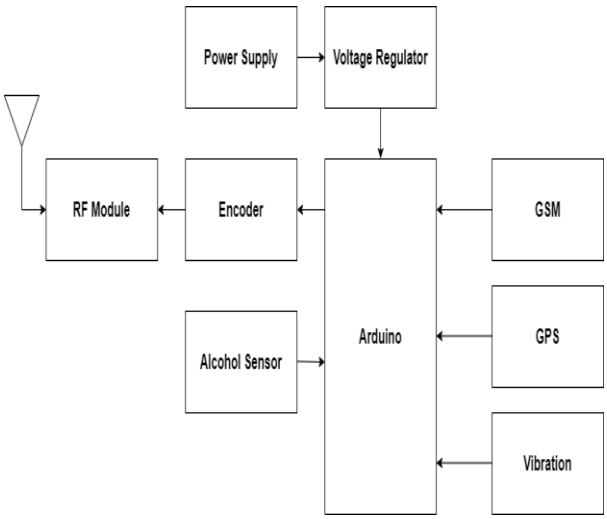

Fig. 4.1. Block Diagram of Transmitter Section

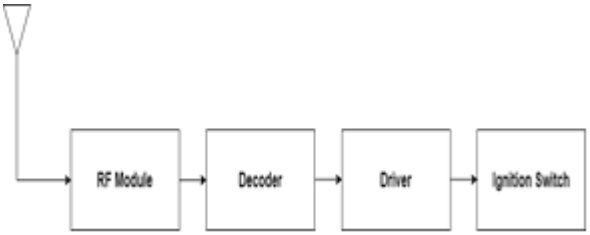

Fig. 4.2. Block Diagram of Receiver Section

The circuit diagram of the smart helmet model is attached below with all the connections of the sensors with the Arduino Nano which controls and monitors the actions received from the surroundings. Then, all the results are circuit is shown as follows:

displayed on the LCD display and alert messages are given to the victim's family or police in case rider is met with an accident.

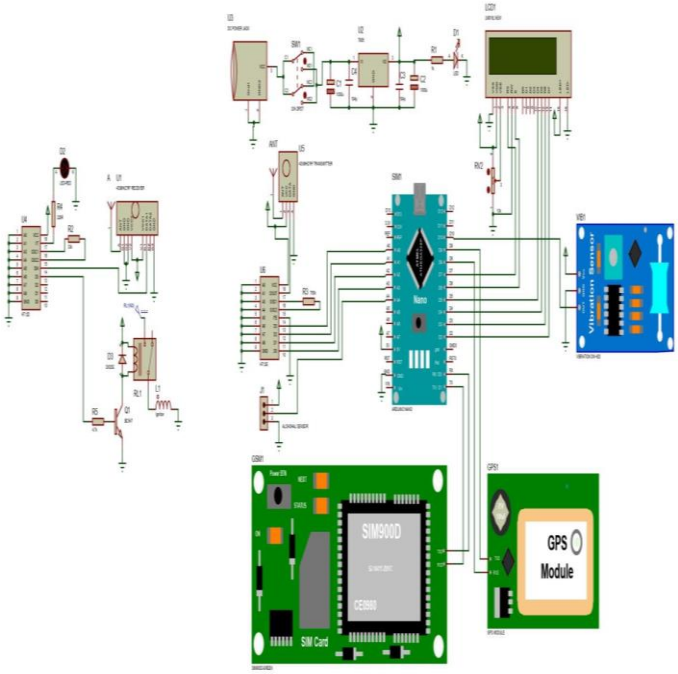

Fig. 2. Circuit Diagram

5. Result

In conclusion, the smart helmet system ought to be very useful and necessary for providing bikers with safety. The smart helmet gives the rider more safety by using sensors like MQ3 sensor, speed sensor, vibration sensor and force sensing resistor. In the intelligent smart helmet system, sensors are used in conjunction with microcontroller like Arduino Board as well as technologies like GSM and GPS for locating victim where the accident takes place. India's development will be safer as a result of this idea. The user is required to wear the helmet in accordance to ride the vehicle and this will lead to following of traffic rules. The system's functions are simple and easy to operate by anyone. This kind of automated system monitors all the parameters and the operation of the connections between the two-wheeler and the parents in order to cut down on manual labour and human error. If an accident occurs, this ensures that the victims receive prompt and appropriate medical care.

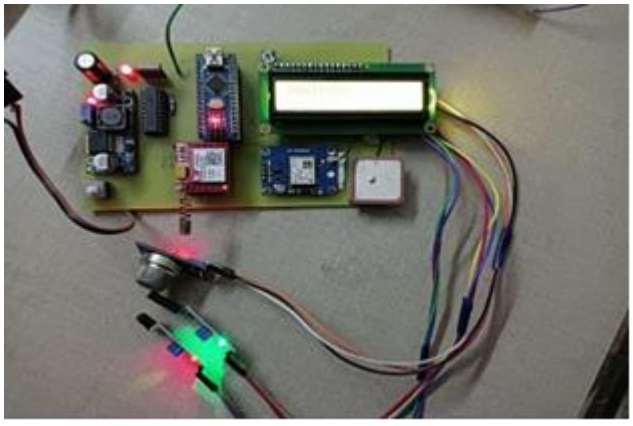

Fig. 4.1 Helmet Section

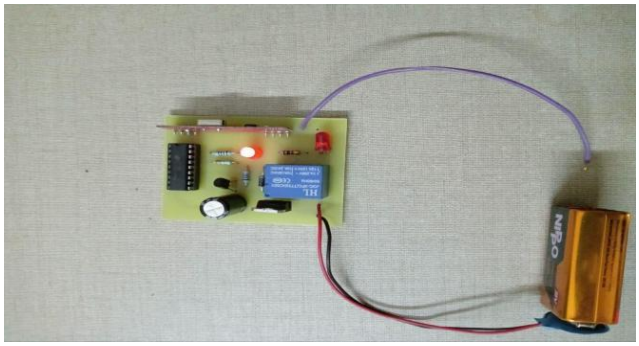

Fig.4.2. Bike Section

4. Conclusion

In conclusion, the development of a smart helmet integrated with an Arduino Nano microcontroller has been proposed to improve among the safety of riders. The helmet features include the prevention of bike starting without the helmet, accident detection through a vibration sensor, and the sending of an emergency message to pre-defined contacts. Additionally, the helmet also detects the rider's consumption of alcohol, and the bike cannot start if the alcohol level is above the permissible limit. The results ofthe evaluation showed that the smart helmet was able to accurately perform its functions, providing a safer and more secure riding experience for motorcycle riders. In conclusion, the development of a smart helmet integrated with an Arduino Nano microcontroller has been proposed to improve the safety of motorcycle riders. The helmet features include the prevention of bike starting without the helmet, accident detection through a vibration sensor, and the sending of an emergency message to pre-defined contacts. Additionally, the helmet also detects the rider's consumption of alcohol, and the bike cannot start if the alcohol level is above the permissible limit. The evaluation showed that the smart helmet is able to accurately perform its functions, providing a safer and more secure riding experience for motorcycle riders.

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