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IOT Based Smart Helmet System for Bike Riders

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ABSTRACT

India is the second-most populous nation, has a sizable youth population. Today's generation enjoying the bike rides and due to fashion, they often choose not to wear helmets. Because of them, the number of fatal bike accidents is rising every day. The use of a helmet is one of the best ways to prevent head injuries, which are a major cause of death. There are increasing incidents of drunk driving, which leads to accidents and carelessness, which results in serious road accidents. Therefore, in order to overcome these issues, this paper propose smart helmet controlled vehicle using IOT. The component of ARDUNINO UNO microcontroller is the part of helmet system and it is focuses on monitoring the sensor information. By utilizing, the IR sensor is determine whether the someone is wearing helmet or not. The MQ3 sensor detects alcohol in the air, reveals the alcohol gas in the breath of a drunk person, and obtains an alcohol concentration output as a result. The Buzzer is part of the system to notify people nearby so that they can evaluate the scenario and take appropriate action. The IoT device transmits forward a warning signal with collision impact and location information, alerting with the assistance of a voice speaking through the BYLNK APP monitoring system.

Keywords: ARDUNINO UNO microcontroller, IR sensor, Buzzer, Helmet, MQ3 sensor

1 Introduction

Motorcyclists are around 33-35 times more likely than passengers in a car to perish in an accident per vehicle mile. Moreover, unhelmeted riders accounted for more than half of motorcycle fatalities in 2015 [1]. The majority of fatal motorbike accidents are head injuries. Riders should always wear helmets in order to save lives and avoid brain injuries. The mere act of wearing a helmet dramatically reduces serious injuries, both in severity and frequency [2].Road traffic accidents are becoming a major concern for everyone because thousands of people, particularly children, are either killed or maimed every year. Seventy-five thousand children were murdered in traffic accidents last year, according to the Transport Ministry's 2014 road accident report, which emphasizes the urgency of finding a solution [3-4]. This demonstrates the terrible situation that Indian roads present. According to the 2014 road accidents data, the majority of those who died were between the ages of 15 and 34. Today, the majority of individuals travel from one location to another using two-wheeled vehicles. Despite the hoopla, not all riders are aware that they need wear helmets [5]. The few who are used to riding motorbikes at high speeds without a helmet most often cause accidents and severe head injuries. Most collisions are caused by drunk driving and other factors, such as not wearing a helmet [6]. So, the main objective of this research project is to aggressively encourage the

usage of a helmet while riding, and if the rider does not wear a helmet, the bike will not start. This emphasizes the importance of paying attention to raising young people's awareness of concerns related to road safety [7]. A growth in the frequency of accidents and the number of individuals getting killed or injured in those incidents is undoubtedly a huge worry. Calculating the social cost would show how large the damage is happened in that particular place. Yet, it is everyone's obligation, especially for young people just starting out on the road, to be careful and adhere to the regulations of the road [8]. Bikers using helmets suffered much fewer and less serious head and neck injuries than those without helmets. Safety helmets caused minor head and neck injuries in people who got affected; but also prevented them from more serious, potentially deadly accidents [9, 10]. Thus, wearing the helmet significantly decreases the frequency of injuries and fatalities caused by motorcycle accidents. The final contribution of this work is, to propose an innovative helmet for predicting and avoiding accidents. For accident prevention, IR sensors and gas sensors are used. Each accident is detected using a 3-axis accelerometer. Data from sensors is processed using Arduino and developing a connection among mobile applications and sensors. Authorities may track every user's history of accidents owing to the mobile user's link to a centralised tracking system. When an accident occurs, the location is sent to the monitoring database and detecting system notifies the closest hospital and police station of the accident's area. The suggested approach is effective for detecting and avoiding the bike accidents.

2 Recent Works

S. Dhana Lakshmi et al. [2020] [11] proposed a smart electric bike made possible by combining a variety of well-known technologies. The following features turn an electric bike into a smart bike: Bluetooth connectivity, obstacle detection, General Packet Radio Service/Global System for Mobile Communication (GPRS/GSM), GPS, and vehicle-friendly mobile application. In the article, GPS is used to monitor speed, track the location of the automobile remotely, and alert the owner of a theft via GSM. The smart electric bike has an obstacle detector that activates the mobile application's user interface to alert the driver to any vehicles in the electric bike's blind spot and promotes safe travel. The mobile application can be of great help to drivers while they are on the road by providing accurate local information, improving navigation with the right direction, informing them of traffic, alerting them to unusual situations, and maintaining the vehicle's statistics. Nevertheless, there is no parking assistance system.

N. L. Aravinda et al. [2020] [12] have presented a high-speed collision without a helmet can be fatal because the force is so great. A life can be saved and the impact of an accident reduced by using a seat belt. The rule regulating the wear of a helmet while operating a motorcycle is enforced in a number of nations; Malaysia is one such nation. This essay is all about giving bikers a solution by electronically connecting their helmets and ignition switches. The helmet has a sensor which can predict whether the wearer is wearing a helmet or not. A signal is sent from the rider's helmet to the bike's ignition and is turned OFF, and vice versa. The helmet and bike are connected via a wireless connection.

R. Hegde et al. [2020] [13] have suggested numerous improvements in the transportation system, where accidents are very frequent. In most motorcycle accidents, the rider sustains head injuries, which result in fatalities, as evidenced by the rising number of motorcyclists in our nation and the number of collisions that occur every year. Because riders and drivers frequently break the laws set forth by the Indian government and also because they have a drinking habit, road accidents happen on a regular basis. The researcher "EHelmet" system has been presented as a solution to these problems. Three main applications are the main focus. First of all, the rider must always wear a helmet before the bike can start. Also, utilising this helmet prevents drunken riding. Accident detection makes up the third use. When a rider has an accident, a sensor inside the helmet notices the movement and tilts and sends a message through GPS and GSM to the rider's family and the ambulance, alerting them of the accident's occurrence. This helmet's key characteristic is that it will not only make the wearer's safety a priority while also making the helmet fashionable.

M. M. Islam et al. [2020] [14] have proposed a system that uses the MPU6050 (gyro sensor and accelerometer), SIM808 (GPS+GPRS+GSM), Raspberry Pi 3 Model B, and Arduino Uno to detect bike accidents. The suggested system has been set up on the bike's frame. The sensors will activate in the event of an accident and send a message with the biker's identification number and location to the closest medical facilities, police stations, and registered family members.

R. K. Sharma et al. [2020] [15] have presented a smart helmet module should be created. Several sensors in this module can determine whether the rider has ingested alcohol and whether or not they are wearing helmets. If the rider is intoxicated, without wearing a helmet, and also has a GSM module that alerts the accident alert, they won't be able to start the vehicle. Yet, this prototype module has to be used in real-world applications in vehicles like cars and bicycles.

3 Proposed Work Explanation

In the suggested methodology, an automation system that was designed to remedy the shortcomings of the preceding system ensures a person's safety. Figure 1 illustrates the schematic diagram for proposed method. The vibrational sensors and IR sensors are appropriate for accurate accidental situation detection. It is simpler to spot an accident because the entire system builted by the helmet and the vehicle. The vibrating sensors is utilized in the accident detection process. The vibrational sensors will be installed on the vehicle and the helmet, and the IR sensor must be installed within the helmet. The presence or absence of the rider's helmet is determined via IR sensors.

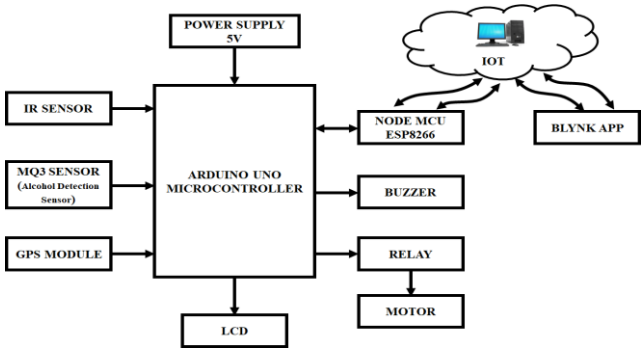

Figure 1: *Proposed Model*

When an intoxicated individual breathes close to a MQ3 sensor, the sensor discloses the alcohol gas in his breath and generates an output based on the amount of alcohol in his breath. It is positioned in the helmet so that it can easily detect the wearer's breathing. A driver IC connects Ports 0.3 and 0.4 on the development board to the buzzer. When the MQ3 sensor detects alcohol, it becomes active. Using Internet of Things (IoT) technology, the alcohol detection system was created for road transportation safety in smart cities. IoT is primarily used to make this work. When it monitors the host's respiration and takes the required steps, such as denying driving privileges, it minimises the majority of drunk driving accidents.

3.1 Arduino microcontroller

Electronics platform with open source Easy-to-use hardware and software are the foundation of Arduino. It is a microcontroller board based on the ATmega328. It has a USB port, a power jack, an ICSP header, a reset button, a 16 MHz ceramic resonator, 6 analogue inputs, 14 digital input/output pins, and all of these things. It already has everything needed to support the microcontroller; to start using it, simply connect a USB cable, an AC-to-DC adapter, or a battery.

Figure 2: *Arduino microcontroller*

3.2 IR Sensors

A sensor is an electrical device that emits infrared light to detect specific elements of its surroundings. An IR sensor may detect movement in addition to tracking the heat of an item. These sensors are known as passive IR sensors since they only measure infrared radiation rather than emitting it**.**

Figure 3: *Infrared Sensor*

3.3 MQ3 Sensor

One of the most reliable and often used alcohol sensors is this one. This sensor makes the detection process much more accurate because it can detect the presence of alcohol up to a distance of 2 meters. The sensor is more adaptable because the sensitivity may be changed based on requirements.

Figure 4: *MQ3 Sensor*

3.4 Wi-Fi Module

The Wi-Fi Module, a self-contained SOC with a built-in TCP/IP protocol stack, enables any microcontroller to connect to your Wi-Fi network. The ESP8266 is capable of hosting an application or delegating all Wi-Fi networking duties to another application processor. Because to its extensive on-board processing and storage capabilities, this module's GPIOs may be connected to sensors and other application-specific devices with the least amount of upfront development and runtime loading. It only needs a tiny amount of external circuitry due to its high level of on-chip integration, and even the front-end module is designed to take up little room on the PCB.

Figure 5: *Wi-Fi Module*

3.5 Buzzer

The technology employs a buzzer to notify those in the area so they may assess the situation and take appropriate action. When the MQ3 sensor detects alcohol, it becomes active. You can adjust the frequency and tone of it and utilize it as needed.

Figure 6: *Buzzer*

4 Results and Discussion

There are numerous varieties of power sources. The majority are made to transform AC mains power into a suitable low voltage source for electronic circuits and other devices. A power supply can be divided into a number of blocks, each of which serves a specific purpose. The

step-down transformer is provided the AC supply main in this instance. The transformer that has various voltages. Figure 7 demonstrates the diagram for regulated power supply. The rectifier circuit receives the transformer's output. In this rectifier circuit, the AC power is converted to DC voltages. The rectified DC voltage is delivered to the regulator circuit. The regulator IC used in the circuit determines the regulator's output.

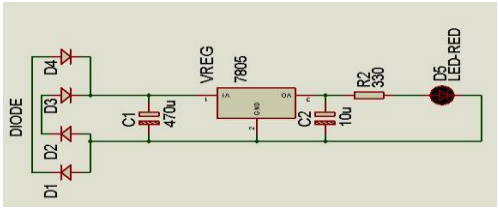

Figure 7: *Circuit Diagram of Regulated Power Supply*

4.1 Bridge Rectifier Model

The bridge rectifier made up of 4 separate diodes, but this is required certain package to process the signal. An example of one is a full-wave rectifier. As the rectifier's variable DC voltage drops, a large value electrolytic capacitor acting as a reservoir and connected across the DC supply sends current to the output, smoothing the signal.

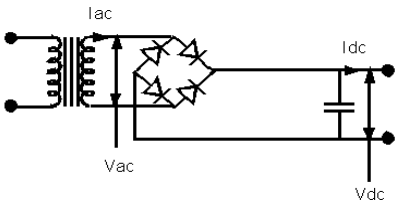

Figure 8: *Bridge Rectifier*

Figure 8 shows the un-smoothed DC after smoothed by filter capacitor. At the peak of the changing DC, the capacitor rapidly charges and discharges while supplying current to the output. According to the equation below, which gives the smoothing capacitor its necessary value, a ripple of 10% of the supply voltage is sufficient for many circuits. Less ripple will be produced with greater capacitance. It is necessary to double the capacitor amount while smoothing half-wave DC.

4.2 Regulator

Power dividers the output voltages of ICs can be either fixed or variable. Moreover, they are rated using the maximum current they can carry. Negative voltage regulators are available, mainly for usage with numerous supplies. Most regulators are equipped with a combination of automatic overload and thermal protection against high current flow.

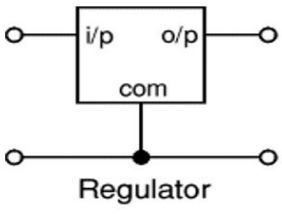

Figure 9 (a): *Regulator* **Figure 9 (b):** *Regulator IC*

Several of the power transistor-like integrated circuits (ICs) has four leads and it's needed an attachment of heat sink whole.

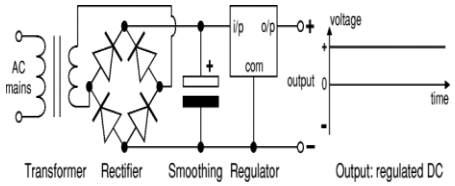

Figure 10: *Rectifier Circuit Diagram and Waveform*

The rectifier circuit diagram and the controlled output voltage are shown in Figure 10 above. The regulated DC output has no ripple and is quite smooth. There are typically two types of regulators in use. Specifically, regulators of the positive and negative types. Regulators from the 78** series are used with positive type regulators. Regulators from the 79** family are utilized for negative type regulators. The voltage and type of voltage are factors in the decision of the regulator IC.

5 Conclusion

The smart helmet protects the motorcycle rider and also takes the necessary steps to reduce accident causality. The system is not let rider start the motorcycle if any safety elements are disregarded. With this approach, a smartphone with an integrated GPS is used. Poor mobile signal, rapid movement, and GPS modules of an older generation are the main causes of decreased GPS accuracy. The ratio of fatal accidents will drop if manufacturers or people implement this strategy. The medical team will effectively treat the casualty since they will be well-prepared for an emergency scenario. In the event of an accident, the system alert the designated contact, and the accident's location will give a prompt safety action. Also, this detects alcohol consumption and discourages driving after drinking.

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