SMART SAFETY SYSTEM FOR BIKERS USING IOT

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Abstract - It is a well-known fact that the young generation prefers bikes and motorcycles over four-wheelers. The riders avoid wearing helmets for no specific reason. Moreover, Overspeed and drink and drive have become common issues. Due to the lack of experience or focus and violation of traffic rules, which leads to accidents. Due to that people get injured or might be dead and one of the main reasons is not wearing the helmet and proper treatment is not given. Many peoples could have saved their lives in accident cases if they wear helmets at the time of the accident. So to overcome such cases, we have reviewed the latest trends in developing the Smart safety system for bikers. It is used to prevent accidents through bikes and to identify bike accidents on time for the wellness of human beings. It also contains helmet detection, alcohol detection, uneven road detection, and application for guardians to follow up their children.

*Key Words***:** Smart safety Helmet, Internet of Things, and Wi-Fi enabled processor, Parental access, Accident Detection.

1. INTRODUCTION

In each part of our life safety and security are the major important areas. Presently a-days the situation that we go over much of the time of human deaths and severe injuries to people is because of road accidents. And it is a crucial part that requires everybody's attention, for every four to five minutes there is one death being reported in India due to road accident. As per World Health Organization (WHO) [1], we have identified that more than 45 percent of the deaths and 70 Percent of severe injuries can be reduced if bike rider wears the safety helmet during the ride.

Nowadays using a safety helmet is compulsory for every two-wheeler biker and also it is equally important for co-riders too to wear the helmet, but the discomfort or inconvenience caused due to wearing a conventional helmet makes the rider not using the helmet and finally it leads to death of the rider or severe injuries. Although helmets are being available to everybody, people are just not wearing them and the main reason behind it is that the conventional helmets are generating unconditional temperatures inside them which makes inconvenience to the person. Currently in the existing system, when the person is met with an accident, we are not able to ensure immediate first aid treatment; due to this late medication the person may die. The proposed system in this paper sends an alert to the relatives of the biker or to the ambulance in case of any emergency like an accident. The alert message consists of the details such as geographical location i.e. longitude and latitude of the accident and time of the accident, which will help to speed up the first aid service to the casualty. The Internet of Things (IoT) can provide infrastructures such as a network, cloud platform which integrates the smart services with situational responses and allows mutual communication between smart things or devices and people over the internet. So, we have thought of this idea of an Internet of Things-based smart helmet which ensures the safety of the biker while riding

2. LITERATURE SURVEY

In the process of the literature survey, we have found a lot of smart helmets and accidental detection with different approaches and with different methodologies.

(Akash Pawar, 2021) et al [1] has designed a system that uses a limit switch to detect helmet and accelerometer to detect an accident and uneven roads and alert the biker using the buzzer and LCD display and if an accident occurs immediate message with the user name, bike number, and location of the accident will be sent to emergency contacts. The system also has Alcohol detection using an MQ3 sensor which detects the presence and the concentration of alcohol present in the air. All this information is stored in the database so that the guardians can have all the information about their children.

(C. J. Behr, 2016) et al [3] had proposed a smart helmet for the mining industry in order to identify hazardous event detection and air quality. This system can identify the concentration level of harmful gases such as CO, SO2, NO2, and particulate matter by using an electrochemical sensor and detects the removal of the Helmet by using an IR sensor. It also identifies an incident when miners are struck by an object in contradiction to their head with a high force exceeding a value of 1000 by using the Head Injury Criteria. An accelerometer was used to calculate the acceleration of the head after hit and the HIC was calculated in software.

(S. Chandran, 2016) et al [3] had developed a smart helmet device for detecting and reporting bike accidents. Smart helmet system builds with number various sensors, and it detects the accident by evaluating uneven or irregular variations obtained from the sensor, and a trigger will be sent to Pager Duty from the controller. Pager Duty will then trigger a call to the phone number registered by the motorist. If the driver does not respond to it for a period of 5 minutes after the first call is initiated, then the emergency contacts will be informed of the details about the accident. The emergency contacts will be alerted through text messages, e-mail, and phone calls until they acknowledge the incident. In real-time, this system assures a reliable and quick delivery of information relating to the accident.

(R. Vashisth, 2017) et al [5] had proposed a methodology that uses a passive buzzer in order to detect over the speeding bike and it is also equipped with a feature called a speed limiter, which restricts the speed limit of the bike. It comes with a feature that prevents the drunk and drives scenarios of the biker called ALCHO-LOCK and a gyroscope to identify accidents, upon detecting accidents it automatically sends an alert to the concerned person. A fog sensor has been

used in this system in order to improve the safety of the rider in case of fog or smog. It also features automatic deduction of the required amount from the rider's registered virtual wallet in wireless to helps the biker to stop and do the payment.

(D. Selvathi) et al [5] had designed a system that detects if the rider is wearing a helmet and checks whether the rider has drunk before starting the ride. The relay attached to the engine will turn ON ignition if and only if both the conditions are met. The controller in the system controls the functioning of the relay and thus the ignition. This system also identifies the accident at any place and alerts the concerned person about the accident.

(Archana D., 2017) et al [6] had proposed a system that will not allow the rider to start the engine without wearing the helmet. When the rider wore the helmet, the engine will be switched ON. This system also identifies the approaching vehicle's velocity on both sides of the bike while riding by using a sonar sensor and alert the rider by generating vibrations in the bike's handlebar.

OBJECTIVES:
1. The main objective of this system is to design a helmet that provides safety to bikers and prevents drink and drive.
2. It detects an accident and alerts the guardian about the accident.
3. To prevent overspeeding through an alert.
4. To develop an android application to monitor motorcyclists and send an alert.

3. PROPOSED ARCHITECTURE

Smart Safety System for Biker is a cost-effective technology to provide security to the biker against road accidents and make guardians easy to follow up on their children through the application. This system consists of an ESP32 controller, GPS receiver, Alcohol sensor, Wi-Fi modules, and power supply. Here we propose a design that always checks two conditions before the biker starts the engine of the bike. The first condition is whether the rider wearing a helmet or not and the second condition is the detection of alcohol in the rider's breath.
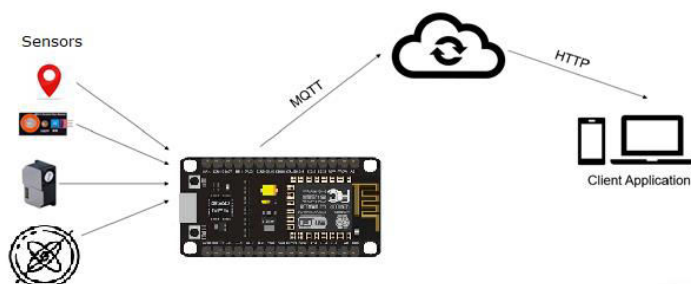

Fig -1: System Architecture

The Controller unit in the system collects and processes the data and sends it to the cloud. If the conditions mentioned above are not met, then the engine will not start, and this will be indicated by a buzzer sound. If the biker is wearing a helmet and the alcohol is not detected, then the ignition of the engine will starts.

Once the rider starts the bike, during the ride, the attached GPS module fetches the current (longitude, latitude, and speed) location and updates it to the number with the defined periodicity. If any accident occurs, then an accelerometer detects the accident then an alert message will be sent using an IoT modem.
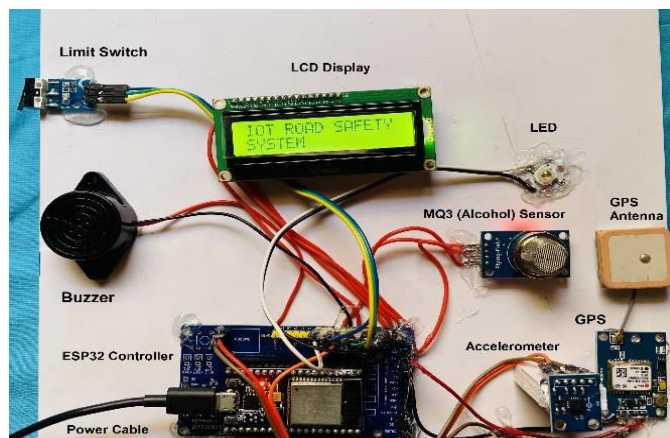
4. IMPLEMENTATION

Fig -2: Implementation

A. Helmet Detection

A limit switch is used to detect the rider has worn the helmet properly or not. A limit switch is an electric component for ON/OFF the gadget, it is utilized to control the progression of power by hindering or redirecting the flow starting with one transmitter then onto the next. This switch is set inside on top of the helmet and it is squeezed when the rider wears the helmet and it releases when the helmet is taken off. So, if the helmet is not worn properly an alert signal is generated through the ESP32 controller and then it alerts the rider by giving necessary instructions on the LCD display, and if the biker doesn't wear a helmet then the bike will not start.

B. Alcohol Detection

MQ3 alcohol sensor is used for the process of alcohol detection. It is a low-cost semiconductor that is helpful in measuring the concentration of alcohol consumed by the rider. MQ3 alcohol sensor has a fast response time and it is easily affected by alcohol gas. It has a concentration range of 0.05 - 10 mg/L of alcohol. So, if the alcohol concentration level is excessive than the sanctioned BAC value, the bike won't start, and an alert will be given through a buzzer. Also, a notification will be sent to guardians.

C. Road Condition Based Alert

To check the road condition ADXL335 accelerometer is used as its low-power accelerometer with a minimum measuring range of ±3g. With the help of it, we can measure spatial variation in the vertical axis to analyze the road condition.

And if there is an uneven road then it alerts the rider to slow down the bike through the buzzer and alert message

on LCD. So, we can avoid accidents on the road which occur due to over-speeding.

D. Speed Measurement and Online Database

For speed measurement, a NEO-6M GPS module is used. NEO-6M GPS module is a GPS receiver with a built-in 25 x 25 x 4mm ceramic antenna, which provides a strong satellite search capability. It is connected to the controller, and then the average speed is calculated. After that, with help of the ESP32 controller, the speed of the bike is continuously transmitted on the cloud. So, the speed of the bike can be easily accessed by the guardians through the android application.

E. Location Tracking and Accident Detection

Accelerometers are used for accident detection which detects a sudden significant shift in the G-force reading. If such a situation appears, then the message is sent to the emergency number and guardians with help of SMS gateway protocol. The accident location and GPS coordinates are included in the message. Using the NEO-6M GPS module to track the location.

This offers an easy and effective method for accident detection. Therefore, the person will be given urgent treatment as required to decrease the seriousness of injury complications after the road accident has happened.

F. SMS Gateway

SMS (Short Message Service) is a service offered by the mobile network to send short text messages to mobile phones. To use that service and to be able to send SMS messages, you need an interface to the GSM mobile network. On the market, you can find boards and modules that allow a direct connection to the mobile network.

An alternative is to use service providers on the Internet, called SMS Gateways. SMS Gateways offers a way to send (and also receive) SMS messages using standard Internet protocols (HTTP, SMTP…).

The SMS gateway is connected to the ESP32 controller through gateway API. Which helps to connect the controller to the server. When ESP32 detects accidents or alcohol it sends a signal to the SMS gateway server. Then the SMS gateway sends an SMS with all the details to the registered Numbers. SMS gateway helps to make the system compact and fast.

4. RESULT

1. When we start the system alert message is given to the biker to wear a helmet and the value of the helmet will be 1, and after the biker wears the helmet then the helmet will become 0 and the bike will start as shown in Fig 3.


(i)

(ii)

(iii)

Fig -3: **(i),(ii)** Alert Message to Bikers and Helmet Value 1, **(iii)** Helmet value 0 Biker is wearing a helmet.

2. After the biker wears the helmet, the alcohol consumption level is detected in the biker's breath and will be displayed on the LCD screen. If the level of alcohol detected by the MQ3 sensor is greater than a specific value then the buzzer will start beeping and the bike won't start and a text message will be sent to the guardians with location as shown in Fig 4.

(i) Value of Alcohol.
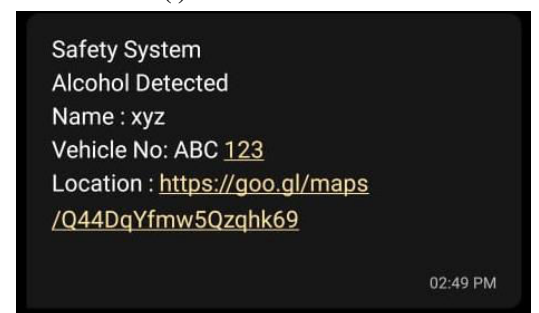
(ii) Message sent to the guardian.

Fig 4: Message displayed on the LCD.

3. GPS tracks the location of the system in the format of latitude and longitude gives an update on the LCD shown in Fig 5 and uploads it to the database.

Fig 5: Location Tracking.

4. If an accident occurs the system starts beeping for 3 to 5 minutes if the biker presses the reset button the system gets reset and no text msg will be sent but if the reset button is not pressed then a text message will be sent to all the emergency contacts including guardians sent as shown Fig 6.
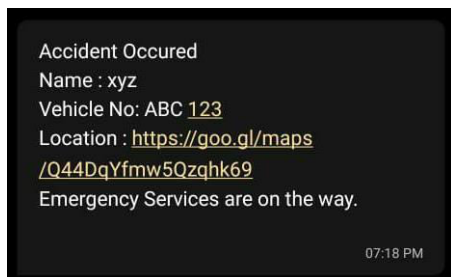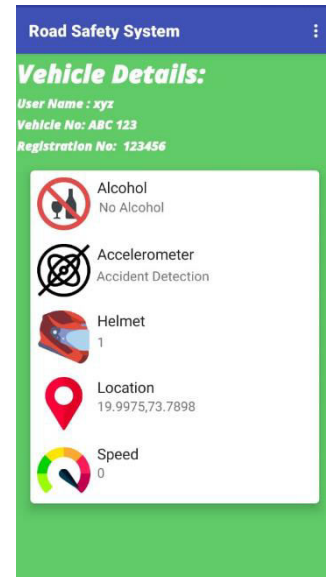

Fig 6: Text message sent to Emergency Services.

5. Android application is there for both users and guardians. Users can use the app to locate the bike and see the status of the bike and guardians can keep eye on their children easily. It will show the speed of the bike, location, and also if any accident occurs or alcohol is detected as shown in Fig 6.

(i)

(ii)

Fig 7: (i), (ii)GUI of Android App.

5. CONCLUSIONS

The system implemented is a very useful and advantageous application for two Wheelers or with some modifications even for cars. Implementation of this system by manufacturers or by individuals will decrease the death ratio from accidents. The medical staff will be well prepared for an emergency case and will efficiently treat the casualty. Hence it can be inferred that the "Smart Safety System for Bikers is a flexible system" to operate and remarkably improve the life expectancy of the victim.

Currently, we are in the process of finding an appropriate system for the smart helmet. The proposed helmet should accommodate all the needed functionalities compactly. In parallel, the selection of controllers and sensors is being taken care of. The proposed design will give the best solution in terms of cost-effectiveness and the latest technology front for all kinds of helmets. The aim of the proposed system is the two-wheelers segment and then bicycle users with a lighter version. This cheap solution can be integrated with ignition start and other needed safety aspects.

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