IoT Based Smart Helmet for Road Accident Detection & Location Sharing

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***Abstract*- Global road accidents are on the rise, particularly due to the adding number of bikes and motorcycles. Some densely peopled countries with narrower roads face challenges despite government sweats to apply safety regulations. Neglecting helmet use and riding under the influence contribute significantly to this trend. Motorcycle riders without helmets and under the influence are prone to severe accidents, frequently fatal. This paper proposes the Smart Helmet, anIoT- grounded result using Arduino NANO andMega-2560 microcontrollers. exercising2.4 GHz nRF24L01 modules for communication, the system includes an MQ- 3 gas detector to descry alcohol situations, driving a arrestment if detected. A Sharp IR detector ensures the helmet is fastened before the bike's machine starts. For enhanced safety, GPS and GSM technologies track the rider's position, automatically notifying family members in case of an accident. The Smart Helmet is an innovative result for accident discovery and overall rider safety.**

Keywords— Smart Helmet, Internet of Things (IoT), GPS & GSM Technology, Accident Detection, Bike Rider's Safety

I. INTRODUCTION

Road accident has come a huge concern in our everyday life. Due to this huge quantum of population numerous people are facing veritably high road accident casualty and sanctioned figure indicates 60 deaths per 10,000 motor vehicles(1). It's estimated that numerous bike riders die every- day in road accident and due to inadequate information regarding to the accidents those riders can not be saved as they simply find help after the circumstance of the accident. still, with adding number of people the motorcycles are also adding in the roads and thoroughfares. Helmet is one of the most essential and important rudiments a motorcyclist must wear to avoid any possible road accidents. It ensures safety of the motorcyclist's head from the deadly impact caused by accident and provides guarantee protection to the bike riders and give hundred chance stoner trustability. The periodic casualty rate from road accidents is set up to be severe. colorful lives could have been spared if extremity clinical help could get mishap data and reach to the scene(3). further than half all avenue caller's death is among inclined avenue druggies like climbers, motorcyclists, and cyclists(2)The main purpose of our design is to insure a safety and make cost-effective system to help alcoholic people from riding motorcycle. This design is bedded with detectors modules and microcontroller. MQ- 3 detector is used as a breath analyzer which identifies the presence of alcohol in the stoner's breath if it's further than the preset admissible range, ignition won't start. It'll give the communication to the registered number. This design ensures safety of the motorcyclist in two ways. originally, whenever a motorcyclist starts the machine it prevents any drunk rider from riding the vehicle and secondly if any accident occurs also the SW420 vibration detector detects it and an immediate textbook communication is transferred to the motorcyclist's relative or any given person of the motorcyclist. still, the first condition of starting the machine is to wear the helmet for riding motorcycle. It successfully deploys the alcohol discovery technology that prevents drunk bike riders from roving around the thoroughfares making one's own life and other lives in peril. There are two colorful types of microcontrollers which are used in this design. Each of the unit has used a different microcontroller, for bike unit we've used Arduino Mega- 2560 and for helmet unit we've used Arduino Nano. The smart helmet will have sharp IR detector which will be used to descry if the rider has worn the helmet or not. MQ- 3 detector is used for alcohol discovery purpose. Signal transmission between the nhelmet unit and bike unit is making a RF idea. nRF24L01 is used as RF module in our smart helmet. It's in the transmitter side and other is used in receiver side. The receiver unit is to be placed on the bike where it'll admit data and control the ignition. A DC gear motor as an illustration to show how the

ignition system will work. There's a DC appendage that's connected to the Gear motor. A vibration detector module which is SW420 has been used to descry road accident. Using the SIM800L(GSM) in the receiver circuit textbook communication is to be transferred that an accident has happed. Ublox neo 6M GPS module is used which provides navigation points of the accident position on the given mobile phone number. Also, there's an OLED display which will show all the labors

II.LITERATURE REVIEW

A. Background

There's a gradational increase in the number of motorcycles daily. The motorcycles that are lately manufactured has all the attributes in terms of avail and performance. It's also precedence for the manufactures to take the safety factor into consideration as well. The common people are buying motorcycles which are briskly and important. In agreement with the adding number of motorcycles the factor of safety also rises. There are a large number of road accidents those are being every day on the roads. The main reasons are responsible for it similar as careless gestate of the motorist, horrible road condition and mistake from another person on road. Head injury is one of the most severe cases that lead to body palsy and occasionally death. There are three major factors which motivate us for designing our design. The original step is to determine whether the stoner is wearing the helmet or not.However, also the system will automatically initiate ignition of the motorcycle else it'll stay off until helmet is put on by the stoner, If the stoner worms the helmet. To fulfil these tasks, we've used sharp IR detector. The alternate step is the discovery of alcohol situations. It'll give the communication to registered number. This is done with aid of MQ- 3 detector. When these two prerequisites are fulfilled also ignition will start. The third primary concern is in case of accidents, the appearance of medical backing may be late. This is may turn out to be a matter of life or death. As after accident occurs, the longer it takes to admit medical aid, the lower the chances of the rider’s survival. We've set up different situations of Alcohol after changing the IR detector value in our Transmitter circuit. Different situations of Alcohol with respect to IR distance is given below in a table:

TABLE I. DIFFERENT LEVELS OF ALCOHOL WITH IR DISTANCE

IR Distance	Value (cm)	Alcohol Level	Value (%)
IR Distance	14	Alcohol Level	8.0
IR Distance	15	Alcohol Level	8.1
IR Distance	16	Alcohol Level	8.2
IR Distance	17	Alcohol Level	8.3
IR Distance	18	Alcohol Level	8.4
IR Distance	19	Alcohol Level	8.5
IR Distance	20	Alcohol Level	8.6

The receiver unit is to be placed on the bike where it'll admit data and control the ignition. We've used a DC gear motor as an illustration to show how the ignition system will work. We've tried to keep the receiver circuit as compact as possible. We've used a breadboard power force module to get regulated voltage rail. There's a DC appendage that's connected to the Gear motor. Using the SIM800L in the receiver circuit we're transferring SMS that an accident has happened (4). Using the Ublox neo 6M GPS module we're furnishing navigation points of the accident position on the given cell phone number. Also, there's an OLED display which will show all the labels.

B. Related Work

We have tried to construct a smart helmet with a very novel approach. Although the smart helmet has been implemented in many countries, but the idea has not been introduced in South Asian countries where accident occurs frequently in every day. As our smart helmet is a bit different from conventional helmets, Bike riders will not want to use it if it is uncomfortable. So, we tried to keep it as familiar as possible for the users. We have placed all our circuits inside the helmet fabric so that they do not contact the head. Given below is a picture of our smart helmet. There is a receiver circuit unit which is to be placed on the bike. We have tried our best to keep the receiver circuit as compact as possible. A picture of the helmet and receiver circuit is given below:

Fig. 1. Helmet with Receiver circuit

The size of the helmet is just like any other helmet and it is very comfortable to wear. We are calling the entire helmet the transmitter circuit which will transmit data to the bike's receiver unit. The data will be sent via radio frequency communication and for that we have used the nRF24L01 module. Various papers have managed the transmission of accident data [3], [5]. We have placed the MQ-3 alcohol sensor in-front of the rider's mouth keeping a safe distance so that it can analyze the driver's breath and check if he/she is drunk or not. Then there is the Sharp IR sensor which verifies if the helmet is worn or not. There are given conditions for both sensors. If these conditions are met, then the data will be transmitted through communication. All these sensors are connected using an Arduino nano.

III.METHODOLOGY

Sharp Infrared Proximity IR sensor structure is shown in Fig. 2 which is placed in inside of the helmet to detect the head of the motorcyclist and ensures that the wearer is wearing the helmet [18]. This sensor detects the head of the motorcyclist between 10 cm and 80 cm away. So, it is a sensor which can measure distance with integrated signal processing and analogue voltage output. The analogue output vs. distance to reflect object is shown in Figure No 2. The sharp IR has three ports: digital signal, GND and VCC (+5V). The sharp IR has a range of up to 80cm and its typical response time is 39m. It is a special sensor that not only detects light but also gives the measure of how far any object is.

Fig. 2.IR Sensor

The structure of MQ- 3 gas detector which detects the alcohol vacuity is shown in Fig. 3. This gas detector module is veritably useful for leakage of alcohol. Because of its veritably high perceptivity and quick response time, measures can be taken in as soon as possible. This detector gives an affair which is analogue resistive grounded on alcohol attention. The voltage of the affair from the MQ- 3 detector raises when the attention of gas increases. The gas detector MQ- 3 uses SnO2 which has veritably low conductivity rate in the atmosphere and this SnO2 material is used as a gas seeing material. In our atmospheric condition where alcohol gas is present, the conductivity of the gas detector MQ- 3 increases along with the attention of the alcohol gas raises. So, this MQ3 gas detector is alcohol detector which can be suitable to identify the alcohol attention on anyone's breath. When the alcohol gas presents in the air, the full detector's conductivity provides lesser value along with the adding value of gas attention.

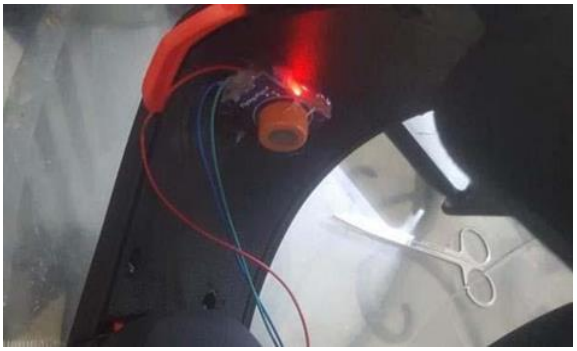

Fig. 3. MQ-3 Alcohol Sensor

SIM800L is a small circuit board. It is set it up with Arduino to send simple text messages. The essential structure of this module is shown in the Fig.4. Pin D8 of Arduino is connected with pin 1(TX) and Pin D9 of Arduino is connected with pin 0(RX) of the SIM800L. One 3.6 Volts Battery is connected between GND of the Arduino and VCC of the SIM800L.The GND and

VCC are connected accordingly shown in the Fig. 4.

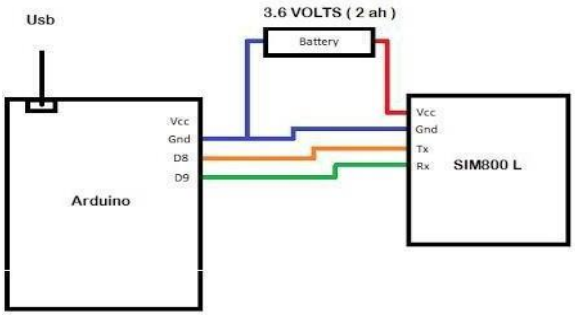

Fig. 4. Connection between Arduino and SIM800L

The IoT is formed of smart machines that imparting and connecting with different machines, articles, situations, and frameworks [17]. The large volume of information hence created, is prepared into valuable activities that will "order and control" things, to shape our carries on with a lot simpler and more secure [6]. This project aims to build an Internet of Things (IoT) application that leverages on ubiquitous connectivity, sensing and data analytics that are the basis of IoT applications [7], [12]. Data will be transmitted from Helmet unit (Transmitter Circuit) to the bike's receiver unit (Receiver Circuit) by nRF24L01 module. This module builds a network between the transmitter circuit and the receiver circuit and it creates a medium for transferring data easily without human to human interaction or human to computer interaction.

IV.PROPOSED SCHEME

This paper describes the design and perpetration of Smart Helmet using IoT. Internet of effects (IoT) and disaster operation are two areas in which fast progress is being made. White metal. concentrated regarding using the smartphone because disaster discovery or announcement (8). Zhao (9) outlines the counterrevolutions regarding region focus of cellular bias or making use of this because of smarter casualty monitoring systems within buses. There are two colorful kinds of micro controllers are used in this design. Arduino Mega- 2560 is used in bike unit and for helmet unit we've used Arduino Nano. The smart helmet will have sharp IR detector which will be used to identify if the rider has worn the helmet or not(16). MQ- 3 detector is used for alcohol discovery purpose. nRF24L01 is used as RF module in our smart helmet. It's in the transmitter side and other is used in receiver side. The abecedarian block illustration of the Transmitter circuit is shown in theFig. 5(11). 5.

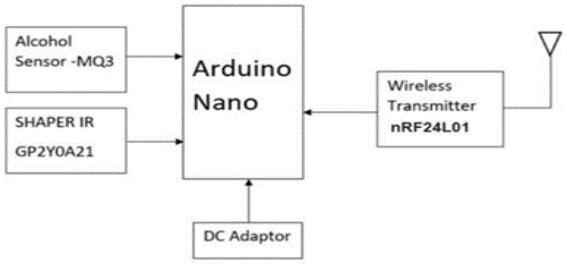

Fig. 5. Block diagram of Transmitter circuit

Motor Driver L298 is a dual motor controller and it can support 12V power supply as Source Voltage. In Receiver circuit, we have used Arduino Mega 2560 as a microcontroller [13]. DC Gear motor is used for L298.

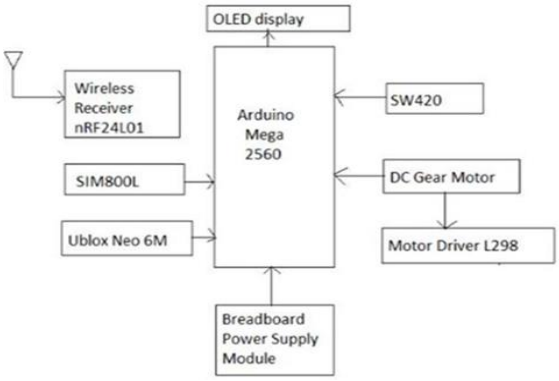

Fig. 6. Block Diagram of Receiver circuit

We have also provided a working diagram of the entire system which is presented below [11]:

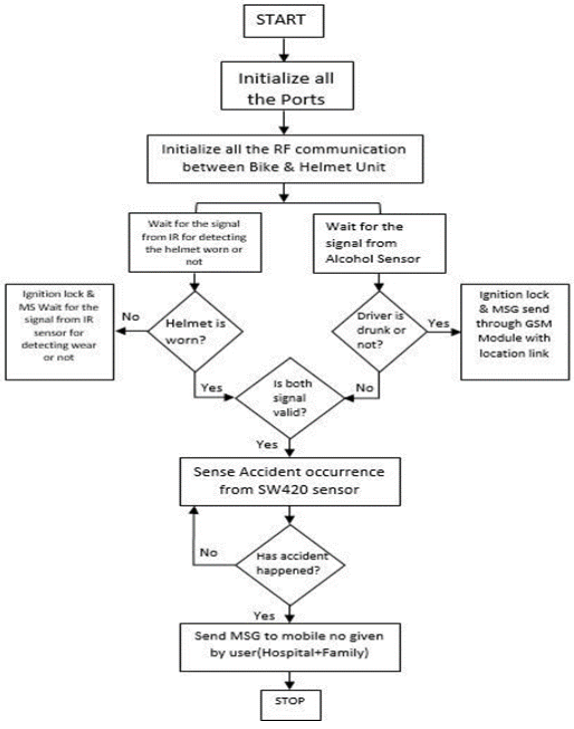

Fig. 7. Flow Chart of the Entire System

V.RESULTS

The smart helmet is developed and tested for colorful conditions to find out how effectively it operates. There are substantially 4 different conditions the smart helmet is tested for. When the stoner is drunk and he's not wearing any helmet, the bike won't start. The propinquity IR detector will descry no helmet and the MQ- 3 Alcohol detector will descry alcohol and disable the ignition of the bike. When the stoner is wearing helmet the propinquity IR detector will give positive signal but since the stoner is drunk the MQ- 3 detector will give negative reading and as a result the bike won't be suitable to start. When motorist is drunk, "BE SOBER AND WEAR HELMET" is shown in the OLED Display.

TABLE II. DIFFERENT USER CONDITION DUE TO MQ-3 SENSOR READING

User Condition	MQ-3 Sensor Reading	Condition of Bike
Drunk and No Helmet	Positive	0
Drunk and Wearing Helmet	Negative	0
Sober and No Helmet	Positive	0
Sober and Wearing Helmet	Positive	1

When the user is sober the MQ-3 sensor will give positive reading but since the user is not wearing any helmet so the proximity IR sensor will send negative signal and the bike will not start. It means Bike condition is 0. There is only one condition where the bike will start which is considered as bit 1. The user is sober so the MQ-3 sensor will send positive signal and the user is wearing the helmet so the proximity sensor will also send positive signal. As a result, the bike can now be started. There are also other components that work together to detect the bike accident and help locating the Bike Rider. The GSM- GPS module is built into the smart helmet system [10]. The GPS part of the system detects the location where the accident has happened and shows its location in the Google maps. The GSM circuit is responsible for sending Text Message to the mobile phone of the bike rider's family member informing that an accident has happened. So, for a scenario where an accident has taken place the bike rider's family member will be notified that an accident has happened at location at xxx.xxxx.xxx coordinates on the Google map. Then it will be easy for the family members of the bike rider to reach the accident spot quickly and save the life of bike rider. This way the bike rider's life can be saved. A screenshot of Text Message is given in Fig. 8.

VI. CONCLUSION

Our Intelligent Helmet is a sophisticated system designed to enhance the safety of motorcycle riders. Given the poor state of our roads, high accident rates, frequent business rule violations, and shy non-supervisory systems, smart helmets are necessary for icing rider safety(14). Wearing a helmet is pivotal during motorcycle lifts as it can cover the rider from severe head injuries in the event of an accident(16). The sharp IR detector plays a crucial part in this safety medium(15). Addressing the contemporary issue of drunk driving, the alcohol detector checks whether the motorist is intoxicated, feting the heightened threat of accidents on bikes compared to buses .

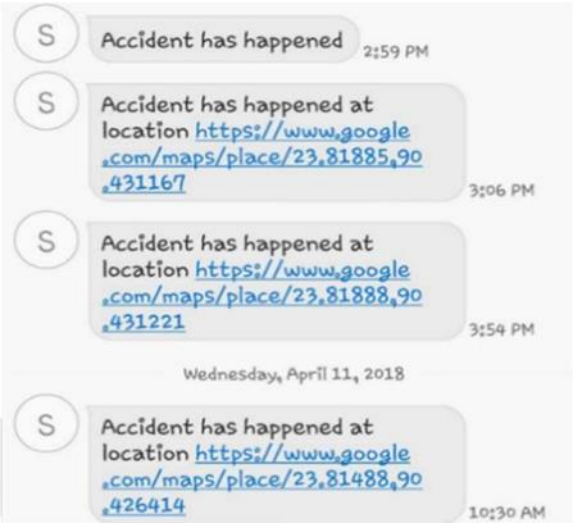

Fig. 8. Screenshot of Text Message

VII.FUTURE WORK

The smart helmet design can be bettered by adding fresh factors which will make this design doable. We can add a variety of bio-electric detectors to cover colorful aspects of the motorcycle similar as the position of its battery, tire pressure of the bike and energy left on its main tank. We can attach a small camera at the front of the motorcycle or the helmet to track colorful conditioning of the bike rider and control which route is he she allowed to go or not to go there. We can add detectors so that a motorcycle can pass a communication to another motorcycle about colorful information regarding business traffic in certain area or an accident or just general- purpose

communication(3). We can add solar power for the helmet it can also also be used for charging the mobile phone of the stoner. For security purposes we can add multiple detectors similar as a temperature detector. The smart helmet is formerly a veritably compact technology. Since the helmets outside will be contain the riders head so there's nothing to add there. But the detectors and cables that we add outside the helmet can be made more compact by using lower IC and shorter length cables.

It can be made to look good by painting the IC and using various cables, so it becomes presentable. The costs of the design are substantially conforming of cost of outfit, cost of travelling to buy the outfit and the cost for announcement. The cost can be reduced by vindicating the price of a element from multiple shops and also buying. Also doing the work oneself as much as can be done will also reduce the cost. And eventually, the announcement should be done oneself rather than paying others which will reduce the cost.

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