

Smart Helmet: Alcohol Detection and Sleep Alert

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ABSTRACT

In daily aspects of our life safety and security are the two major concerns. Nowadays the scenario that we come across in many cases of human deaths and severe injuries to people is because of two-wheeler road accidents. For every four minutes there is one death being reported in India. According to the World Health Organization, we have identified that 40 percent of the deaths and 70 percent of severe injuries can be reduced if bike rider wears the helmet. There are areas around the world where the traffic of people is less. In such a situation, rider's loss their lives. On considering these factors, no proper methodologies have been implemented to avoid accidents that are caused due to alcohol consumption and unconscious riding. The helmet includes sensors which ensure if the one who is driving the two-wheeler is a sober and also checks if the rider is conscious or not. With the help of alcohol sensor MQ3, we check the alcohol consumption. If detected details of the vehicle is send which includes the vehicle registration number and rider details is send to the authorizes officials. For this a database is implemented. After sleep detection using heart rate sensor, if found to be unconscious the rider is alerted with a beep sound. Thus this helmet not only ensures safe riding but also recognizes the condition of a rider for safe riding.

KEYWORDS: Smart Helmet, Alcohol detection, Accident detection, GSM, MQ3 sensor, Bluetooth module, IR sensor, Ultra-sonic Sensor, Sleep detection, Heart rate sensor

I. INTRODUCTION

There is a highly alarming rise in the morbidity and mortality due to two wheeler road traffic accidents in our country. Based on the various survey in India, it is projected that in each hour, 30 accidents takes place. Statistics from the National Crime Records Bureau indicates that deaths and injuries related to road traffic accident has brought an inclination up to two and four-fold respectively during the period of 1991-2015[9]. Reportedly 98,254 individuals were killed in 2015 on Indian roads.

The riders of two-wheeler are among the common to be affected in road traffic accidents[1]. Even though the safety rules made by the authority, many riders avoid following it. Furthermore, riders in India frequently avoid the key rule of wearing the helmet during driving, as a result deadly injuries during accident.[4].There needs to be a system rather than manual checking that could enforce this rule on the riders and avert them from sidestepping it. One of the prime reasons that leads to accidents is "drunk and drive" in which riders are drinking alcohol above government specified limit[5]. Reducing the drinking of ethanol before or during driving may result in reduction of accident by almost 55% in India.

II. PROBLEM DEFINITION

In this continues world, day by day several bikes are invented and being employed by each individual. As a result of an oversized variety of vehicles, traffic will also increase and rash driving of vehicles will also increase. In case of that scenario, chance of accident occurrence also increases swiftly. By analysing a number of the accidental reports most of the

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accidents occur as a result of drunk and drive , rash driving , unconscious driving etc. The main causes that lead to two wheeler accidents are drunk and drive and unconscious driving. To build proper and full proof system that can't be plagued by accident. It provides more accuracy in detection of alcoholic person and save people's life in the situation of an accident. In accident detection systems assumption regarding use of a full proof system that can't be plagued by accident, associate additionally detects accident occurring probability by considering the bike position and also making use of certain location instruments to provide data regarding where the accident has actually occurred. For sending the data to health aid centres or such institutions in case of emergency.

The factor of vehicle compactness on the road increased dramatically because the population has been increasing rapidly years by years. Moreover the improvement in living standard has contributed to the increasing number of vehicle on the road (private vehicle).These factors are leading to a lot of road accidents. Majority of road accidents may happen when there are drunken driver who driving in dangerous condition. At present the death causes due to the drunken driver have increased radically. Traffic accidents caused by drunk drivers not only causes the fatalities of life but also a distraction of the vehicle instrument. Drunk driving has a high probability to lead to serious accidents. Even with a small amount of alcohol consumption, drivers are found to be twice likely to be involved in traffic accidents. Therefore, many countries have been working on solutions to drunk driving for a long period of time, including publicity and

education and tough drunk-driving laws. The laws have been enforced to prohibit drunk driving and the system have imposed severe penalties on violators of such laws. However, an effective apparatus for preventing such kinds of accidents has not yet been developed or invented in our country.

III. RELATED WORK

After the process of literature survey, we have found lot of smart helmets with different approaches and methodologies. C. J. Behr et al [2] proposed a smart helmet for industry mining so as to identify hazardous event detection and air quality. This system can identify the concentration level of the toxic gases such as CO, SO₂, NO₂, and particulate matter with the use of electro chemical sensor and also used to detect the removal of Helmet by using an IR sensor. It also identifies an incident when miners are struck by an object in confutation to their head with a high force exceeding a value of 1000 by using the Head Injury Criteria. The acceleration of the head after hit and the HIC was calculated in software using an accelerometer. Edna Elizabeth et al [3] introduced the idea of a smart helmet device that is used for detecting and reporting bike accidents. By evaluating uneven or irregular variations obtained from sensor system it detects accidents by implementing various sensors, and a trigger will be sent to Pager Duty from the microcontroller. Pager Duty will then triggers a call to the phone number registered by the rider. If no response is found from the rider for a period of 5 minutes after the first call is initiated, then the emergency contacts will be informed regarding the details of accident. The emergency contacts will be alerted through text messages, e-mail, and phone call until they report the accident. In real time, a reliable and quick delivery of information relating to the accident is assured.

Rashmi Vashisth et al [4] had developed a methodology which uses Piezo-electric buzzer to identify over speeding bike and it also invented a feature called velocity limiter, which restricts the performance of the bike. It also has an innovative feature that prevents the drunk and drive cases of the rider called as ALCHO-LOCK and an accelerometer to detect accidents. It is designed such that on detecting accidents it automatically send a message to concerned person. A fog sensor has been used in this system in order to improvise the distinguishability of the rider in case of fog or smog. It also features automatic deduction of required amount from the riders registered virtual wallet in wireless to helps the rider to stop the vehicle and do the payment if necessary.

A system which automatically detects if the rider is wearing a helmet and checks if the rider is a sober before starting the ride was developed by Selvathi et al [5]. In this model the relay attached to the engine will turn ON, if both the conditions are satisfied. The Microcontroller in the system controls the functioning of relay and thus the ignition is also authorised. This system also identifies the occurrence of bike accident at any place and the concerned person is then alerted about the accident.

Archana D et al [6] had proposed a system that will not allow rider to ignite the engine without helmet. Once the rider wore the helmet, it will be locked that results the engine to switch ON. This system also discovers the converging vehicle's speed on either sides of the bike while riding by using ultrasonic sensor and it then alerts the rider by rendering vibrations in bike's handlebar.

Another methodology was proposed by Sayan Tapadar et al [7] for smart helmet which can detect if the rider is wearing the helmet or not, and detect whether the person is a sober or not and can also detects about the accident. This system collects the data generated from the accelerometer and gas sensors and the same will be sent to cloud server through an online application programming interface (API) to train a support vector machine (SVM). SVM can help in detecting accident accurately so in the future enough data will be assembled and evaluated to provide more precision about event detection. The proposed system (smart helmet) can be connected to any smart phone via Bluetooth so as to communicate with the online API, with the use of a smart phone internet connectivity.

IV. TECHNOLOGIES USED

A. Heart rate Sensor

Heartbeat sensor working is based on the principle of photo phlethysmography. A change in the light intensity through the organ (a vascular region) is caused due to change in volume of blood through any organ of the body. Considering applications where heart pulse rate is to be observed, the timing of the pulses is extremely important. The flow of blood volume is decided on the basis of the rate of heart pulses and since light is absorbed by blood, the signal pulses are found to be equivalent to the heart beat pulses due to absorption of light by blood.

B. Node MCU

Node MCU is basically a low-cost IoT platform. Its firmware earlier, was designed on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware was related on the ESP-12 module.[6]. Later on, support for the ESP32 32-bit MCU was appended. Open source prototyping board designs are available for such a device. The prototyping hardware typically implemented is a circuit board working as a dual in-line package (DIP) which integrates a USB controller with a smaller surface-mounted board containing both the MCU and antenna. The option of the DIP format provides support for easy prototyping on breadboards.

C. HC-05

HC-05 is a Bluetooth module which acts as a master-slave circuit. Generally, it is implemented as a method for transparent wireless sequential grouping or arrangement [7]. HC-05 module is an easily accessible Bluetooth SPP (Serial Port Protocol) module, implemented for transparent wireless serial connection setup. It is a fully qualified serial port Bluetooth module V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband contained. It also accommodates CSR Blue core 04-External single chip Bluetooth system with CMOS technology and with the effective AFH feature included (Adaptive Frequency Hopping Feature).

D. Buzzer

A piezo electric buzzer is an electro mechanical signalling device that aims in alerting, used as emergency or normal alarms, in automobiles, in household appliances such as microwave oven, timers and game shows. This requires some oscillators to drive it, in case DC voltage is applied, then the beep sound prevails. They are used in applications where something that emits an audible tone is desired but high fidelity sound reproduction is not expected. It is cheap and can be very loud without much power consumption. These

are also found to be very thin. Initially, this device was built on an electromechanical system similar to an electric bell. A piezoelectric element also creates a response to pressure in the form of voltage, so piezoelectric buzzers can also be widely identified as crude pressure sensors or microphones.

E. GSM

GSM is a universal standard for mobile telephones. It collects and sends the location information using GPS to family members and other responsible authorities via SMS [11]. 2G networks developed as a substitution for first generation (1G) among the cellular networks. The GSM standard was outlined a digital, circuit-switched network enhanced for full duplex transmission via phone. This was improved and developed to include data communications, first by circuit-switched net- working, then by packet data transmission via Enhanced Data Rates for GSM Evolution (EDGE) and General Packet Radio Service(GPRS).

V. PROPOSED SYSTEM

A system to detect alcohol consumption and sleep with the use of embedded system. Variety of sensors are used namely: MQ3 sensor for alcohol detection which consists of a tin dioxide (SnO₂), a perspective layer inside aluminium oxide micro tubes (measuring electrodes) and a heating element inside a tubular casing. The back side of the sensor holds the connection terminals and the end face of the sensor is enclosed by a stainless steel net. Ethyl alcohol contained in the breath is oxidized into acetic acid passing with the help of heating element. With the ethyl alcohol flow on the tin dioxide sensing layer, the resistance goes down. With the use of external load resistance the variation in the resistance is converted into a suitable form of voltage alternative. Gyroscopic sensor and Heart rate sensor is used for sleep detection. Heart rate sensor working is based on the principle of photo phlethysmography. It measures the change in volume of blood through any organ of the body which causes a change in the light intensity through that organ (a vascular region). In case of applications where heart pulse rate is to be monitored, the timing of the pulses is more important. The flow of blood volume is decided by the heart pulse rate and since absorption of light is performed by blood, the signal pulses are said to be equivalent to the heart beat pulses

A database implemented to store rider details Including license and register number, to inform authorised officials in case alcohol consumption detected. The helmet is designed such that the sensors start working once the engine of the vehicle is on. This helmet includes MQ3 sensor for alcohol detection, in case rider is found to be drunk details will be send to the authorized officials. This is implemented using a Node MC Unit. The helmet also contains a gyroscopic sensor to detect movements. If movement detected further set of detection is done. Using heart rate sensor we detect if the rider is conscious or not, if not the rider is alerted with a beep sound.



Fig.1. A block diagram of smart helmet with sleep and alcohol detection

VI. CONCLUSION AND FUTURE WORK

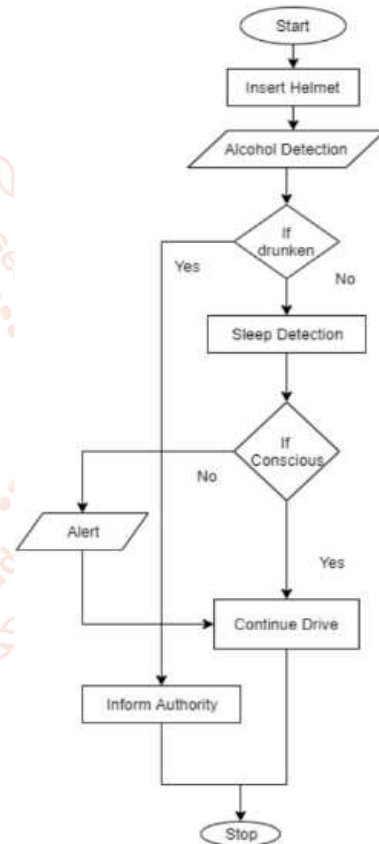


Fig.2. A flow chart describing the working of the helmet

The present stimulation in our country is that we are not using this protective type of Helmet. To reduce the manual efforts and human errors, we need to have some kind of automated system monitoring all the parameters. It makes the motor vehicle driving safer than before. The compulsory rule of Helmet and NO Drink and Drive was initiated by the government. Thus fatal road accidental deaths can be controlled to some extent. According to analysis only 10% bike riders are found to be obeying these rules. Most of the times these rules are destructed. The previously developed Helmet only detects the presence of alcohol only. This paper discusses a system for aiding the driver which is very effective to control major accidents occurring due to driver drowsiness and alcohol consumption. A buzzer alerts the driver if he/she is sleepy. With the use of gyroscope sensor the head position

of the driver is purposed and accordingly the present state of driver is recognized. A heart rate sensor is used to detect the pulse of the driver so that variations can be determined. A sensor is used to detect whether the driver is drunken or not. In order to achieve perfect accuracy proper distance between the sensor and the driver is to be maintained. The alarm generated aims in alerting the driver in order to reach his/her destination safely. Despite the fact that there is more scope for research, the proposed system can contribute successfully in detecting the driver's state and highly reduce the frequency of road accidents. This system brings revolution to the existing technology in the vehicles and also incorporates new safety features thus providing to be an effective advancements in the automobile industry. As the increasing public perception is that vehicle safety is more relevant, enhancements in public safety is acquiring appreciations than in the past. The system focus in improving the safety of human beings.

In future try to reduce the cost of the system when it can be made as a product. Most of the users must be bothered with the high cost of the alcohol detection system. The cheaper it is, the more chance it will be familiarized. Since our system is in the period of examining and designing, the cost may be higher than the altering products. Here Arduino Mega ADK serves as the developing board. It is costly because it is suitable for us to learn how to use developing board and is convenient to implement the connection of wires with the sensor and the Bluetooth module. In future, we can design a printed circuit board to simplify the circuit that is currently in use and also consider the use of small chip instead of the currently popular developing board. We can design an intelligent system to notify No parking and No entry area so as to reduce crowding of vehicles. No entry area is mainly allocated during the development or repairing of the road. A speed limiter can be interfaced so as to restrict driving at high speed can also be implemented in the future.

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