



ALCOHOL IMPAIRED VEHICLE TRACKING SYSTEM USING WEARABLE SMART HELMET WITH EMERGENCY ALERT

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Abstract

With the growing number of 2-wheel motor vehicles, frequency of accidents is on the rise. We propose mechanisms that can detect if one is wearing the helmet, detect accidents, and detect whether the person has over-consumed alcohol. During the course of the accident the helmet uses the services of GSM with the help of GPS and sends the message body containing the precise location of the vehicle, which helps in fast medication to the victim. Here helmet makes it mandatory for the rider without which the vehicle won't start. The wireless communication is established between helmet and bike modules. Thus, by making use of the ubiquitous connectivity which is a salient feature for the smart cities, a smart helmet for accident detection is built.

Key Words: Smart helmet, GPS, GSM, Alcohol detection.

1 Introduction

Motorcycles and bikes form an integral part of personalized transportation in India. However, unfortunately, it also involves innumerable accidents and subsequent loss of lives. Every year, about 300,000 teenagers go to the emergency department because of bike injuries, and at least 10,000 teenagers have injuries that require a few days in the hospital.

When a survey conducted by the Department of Health, it was found that 90% of the motorcycles rider killed in accidents were not wearing a helmet at the time of impact. This, along with drunken driving are a major reason of accidents. . It is estimated in a survey that 5% accidents can be prevented if the driver does not consume alcohol while driving. After the accident the people have to be taken to the nearest hospital for further treatment or for first aid, but there is a lag in bringing the people injured to hospitals. The Hospitals and police station nearby must be intimated about the accidents so that they can be taken to the hospitals immediately.

We aim to mitigate these problems and hence the associated casualties by ensuring that the rider will wear the helmet all the time during his/her ride, thus ensuring safety.

2 LITERATURE REVIEW

In the literature, we found several smart helmet system but with different approach and proposed solution.

Wilhelm Von Rosenberg et al [1] has Proposed a smart helmet with embedded sensors for cycling and motor racing to monitor both vital signs and the electroencephalogram (EEG) simultaneously. They have embedded multiple electrode within a standard helmet and a respiration belt around the thorax for validation and a reference ECG from the chest. Also a multivariate R-peak detection algorithm has been applied to get data from real life noisy environment.

Sreenithy Chandran et al [2] monitored the value received from accelerometer embedded in helmet and detects an accident by analysing those values and sends an emergency notification to contacts with Global positioning system location.

C. J. Behr et al [3] has developed a smart helmet for the mines industry keeping focus air quality, helmet removal and collision. It detects the presence of hazardous gases like CO, SO₂, NO₂ and detects the helmet removal using an off-the self IR sensor. An

accelerometer is implemented to detect accident by calculating the HIC (head injury criteria) by software using those reading.

Sudhir Rao Rupanagudi et al [4] has made a helmet which monitors the real life traffic scenario behind the motorcycle rider and a intimation system to inform him / her. A MATLAB based algorithm is implemented to perform the task along with a cost effective setup and priority has been given to some special cases such as turning and all.

A. Ajay et al [5] has proposed a smart helmet with 4 different functionality : accident identification and alert system, voice based navigation system using map, a bluetooth device based voice call which uses voice recognition to attend cellular call and a solar panel for external power source. A GSM module attached arduino board is used for accident alert system and a smart mobile phone is interfaced with the helmet to serve the navigation process.

Mohd Khairul Afiq Mohd Rasli et al [6] has designed a PIC16F84a microcontroller controlled smart helmet with force Sensing Resistor (FSR) to detect riders head and a BLDC Fan for speed detection. Helmet starts its alarm system whenever the speed crosses a certain limit and motorcycles engine will start only after the rider buckles the helmet.

Muthiah M et al [7] proposed an helmet which contains a automatic safety headlight that reacts according to riders facial movement with the help of accelerometer and other sensors and motors.

3 HARDWARE COMPONENTS ARDUINO UNO BOARD

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable

or power it with a AC- to-DC adapter or battery to get started.

Figure.1 Arduino Board

ALCOHOL SENSOR

This module uses an Alcohol Gas sensor MQ3. It is a low cost semiconductor sensor and can detect the presence of alcohol gases at concentrations from 0.05 mg/L to 10 mg/L. The sensitive material used in this sensor is SnO₂, whose conductivity is lower in clean air. Its conductivity increases as the concentration of alcohol gases increases. It has high sensitivity to alcohol and has a good resistance to disturbances due to smoke, vapour, and gasoline. This module provides both digital and analog outputs. MQ3 alcohol sensor module can be easily interfaced with microcontrollers.

Figure.2 Alcohol Sensor

GPS MODULE

This module helps to get the present GPS coordinates of the device. The coordinates are required when an accident is detected or high alcohol consumption is detected. The phone GPS could be also used, but having a GPS module build in the helmet guarantees the accuracy of the reported location. The module we use follows the NMEA protocol, and thus the output coordinates need to be converted into a more usable form. Thus we use tiny GPS library to perform the necessary conversion. It is an open source library for Arduino, for NMEA GPS data.

Figure.3 GPS module

GSM MODULE

GSM (Global System for Mobile Communications) is the most popular standard for mobile telephony systems in the world. GSM devices are used to make voice calls or send messages through a circuit switched networks. GSM provides a high degree of security by using subscriber identity module (SIM) cards and an advanced encryption scheme. In addition, it offers a bi-directional short message service (SMS) for up to 160 bytes (about 160 characters) long alphanumeric messages which can also be used for broadcasting news clips. Figure.4 GSM module

RF MODULE

This RF transmitter establishes a wireless communication between the helmet and the headlamp. It uses a transmission frequency of 433 MHz. Different ranges are set for the values (x,y,z) in each direction and if the output values from accelerometer are

present in between these ranges then specific switches in the RF transmitter are made high by bypassing the high Arduino output signals. In RF Receiver the signals transmitted from RF transmitter is received by the receiver and is sent to the Arduino board. Then according to the signal received, the two servo motors are operated to move the head lamp up, down, straight, left and right.

Figure.5 RF module HT12E and HT12D

VIBRATION SENSOR

This sensor buffers a piezoelectric transducer. As the transducer is displaced from the mechanical neutral axis, bending creates strain within the piezoelectric element and generates voltages. These vibration levels could be given to any controller/processor and necessary decisions could be taken through it. vibration sensors are placed in different places of helmet where the probability of hitting is more which are connected to Arduino.so, when the rider crashes and the helmet hit the ground, these sensors sense and gives to the Arduino, then necessary decision could be taken through it.

Figure.6 Vibration sensor

4 FLOW DIAGRAM

5 SYSTEM DESIGN

The system consists of Push button through which we can identify whether it has been worn by the user or not. If the smart helmet is not worn by the user, he/she cant start the vehicle. It also indicates the ignition off state of the vehicle. After wearing the helmet he/she can start the vehicle. The helmet and the bike was interfaced using the HT12E and HT12D RF module.

The system ensures the safety of the biker, by making it necessary to wear the Helmet, as per the government guidelines, also to get proper and prompt medical attention, after the person is met with an accident. A module is fixed in inner side of the helmet and hence this module will sync with the module fixed on the bike. The system performs following Functions:

- It will ensure that the rider has worn the helmet.
- If he fails to wear the helmet, then the bike wont start.
- It will also ensure that driver of the vehicle has not consumed

alcohol. If the rider is drunk, then the bike wont start When the user wears the helmet, the alcohol sensor attached to the helmet senses whether the user has consumed alcohol or not. If the user does not consume alcohol the vehicle moves smoothly or else the alcohol consumption message is sent to the microcontroller. The ignition of the vehicle will OFF and the message indicating the user has consumed alcohol was send to the friends and relatives.

6 RESULTS AND DISCUSSION

The prototype setup in bike and helmet are Figure.7 Prototype setup in helmet Figure.8 Prototype setup in bike The time taken for the signal from transmitter to receiver is given below Table 1 Time required for transmission of signal. Figure.9 GPS output in Serial Monitor The following tabular column shows the observation for with and without wearing an helmet. Table 2 Helmet wear detection test results.

ALCOHOL DETECTION USING MQ3 SENSOR

The following set of data was generated by testing the substance containing alcohol. The results are tabulated below. Table 3 Analysis of the alcohol detection. The sensor is programmed in such a way whenever the alcohol is greater than the 700 g/l the bike does not start. Figure. 10 Alert message for alcohol consumption. The following data was generated by physically driving a motorbike while wearing the helmet NOTE: Time may vary according to the traffic. Table 3 Live tracking of the vehicle. NOTE: Time required to detect GPS location may vary according to network availability. Table 2 Time requirement

ACCIDENT DETECTION USING VIBRATION SENSOR

In case of any accident, the vibration sensor sense the vibration caused due to the collision of the vehicle. Then the latitude and longitude position of the accident spot and the exact location of accident is shown using Google Maps from the information received from microcontroller.

Figure.11 Alert message for consumption of alcohol Figure.12 Location of the accident taken place

7 CONCLUSION

An effective solution is provided to develop the intelligent system for bike which can monitor various parameters of vehicle in-between constant time period and can send this data to the base unit as explained, by using hardware platform Arduino, Alcohol sensor MQ3, Vibration sensor, GPS & GSM module. The designed system would finish the function of communicating with the base station via GPS, GSM and send the information regarding the accident of bike. The whole Control system has the advantage of small volume and high reliability. This system brings innovation to the existing technology in the vehicles and also improves the safety features, hence proving to be an effective development in the automobile industries.

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