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Smart accident prevention system using sensors

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Abstract

A wireless-enabled helmet paired with Smartphone will effectively reduce the chance of accidents. Many youngsters choose bike riding for fun, economic, less parking space and are easily manageable in traffic compared to other automobiles. The proposed work ensures the riders are wearing helmets using IR sensors during travel, intimate the accident location to a nearby hospital and family members. This wearable device consists of many sensors which will send the readings to the Arduino application through WIFI. Most importantly, the motorbike ignition system is connected in such a way that it will not trigger on until the rider is wearing a helmet and without consuming alcohol. This system is widely used during night travelling, to find whether the traveller is tired or sleepy. This work is further enhanced with the built-in navigation system to provide a tense free ride.

Keywords: Smart Helmet, Accident, Alcohol detection, Vibration Sensor, GPS, GSM, Arduino, Solar panel.

1. Introduction

Two wheeler accidents happen very often and numerous lives could be saved if emergency medical services reach the patients on time. Many developers have implemented various applications to protect the riders during the accident, but most of them require a single click to begin the task. When the rider met with a major accident, the situation will not be possible for him to take his phone and call for help. Earlier studies indicate more than 40% of accidents happen due to defiance of traffic rules, 60% of riders drive without wearing helmet [3]. Few reasons for road accidents are sleepiness problems, over speeding [7], drunken driving and lack of experience or focus. Around 68% of people from 18-45 age are the major accident victims [2]. As per Indian government report, in

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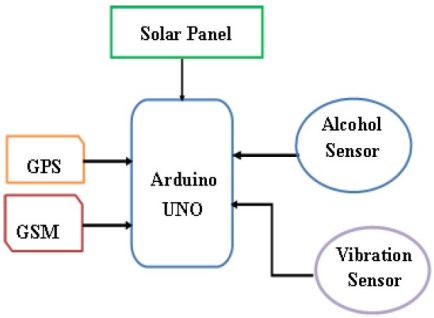

Figure 1: Block Diagram of Proposed Smart Helmet

every hour 60 accidents occur and more than 70% of them lost their life on spot due to accidents. The existing systems has few drawbacks like using internet connection to send message, no method to prevent if emergency signal is triggered mistakenly, and design is complex. To overcome the drawbacks, a novel vehicle module is designed with vibration detector and ignition control. This system collects all the data from different sensors, send to the rider's pre-saved contacts for prevention of accident and safe guard from unwanted loss of life. Figure 1 shows the block diagram of the proposed smart helmet system with GSM and GPS.

2. Proposed Methodology

The application is installed in the rider's Smartphone which is connected with the helmet and protected with the fingerprint biometric of the owner [8]. The communication happens with helmet via WIFI, the average of vibrations and other sensor values are used for the sending message to the riders pre-saved contacts during critical conditions. The proposed system has two modules, one in helmet and other as fixed vehicle module. The application is integrated between both the modules to collect the data using a common mobile hotspot where it is installed.

Smart helmet is a portable device which resembles more like a normal helmet. This helmet consists of Arduino board, alcohol sensor, IR sensor and vibration sensor. When the signal from vibration sensor exceeds the threshold level, then the sensor sends the change in data to the application. Then, the application sends the latitude and longitude message to the nearest hospital and preset contact. The alcohol sensor works in the helmet module, when the rider has consumed alcohol the sensor send information to the Arduino board and the ignition module will remain off. Helmet also contains solar panel to recharge the battery [4].

The application is responsible for checking the readings for unusual values. When the unusual readings are detected, it will make the phone start vibrating for a minute as such notifying the user that the alarm is triggered, asking the user to turn the signal off in case the signal was triggered accidentally. If the user does not turn off the alarm then the Save our Soul (SOS) message along with the location of the rider are then sent to the preset contacts.

3. System Requirements

Android Application is developed using python program. Sensors are used to detect the signal, convert to a human-readable display and transmit electronically over a network for further processing.

3.1. Alcohol sensor

Figure 2 shows the MQ-2 smoke sensor that has a built-in potentiometer by using which we can adjust the sensor sensitivity to detect gas accurately [10].

Figure 2: Alcohol Sensor

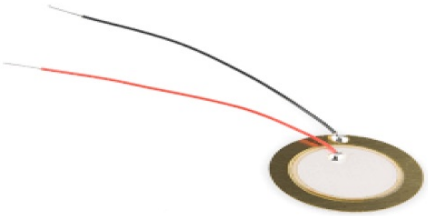

Figure 3: Piezoelectric Sensor

3.2. Vibration sensor

A piezoelectric sensor as shown in Figure 3 is used to identify changes in the pressure, acceleration, strain, or force by converting them to an electrical charge.

3.3. IR Sensor

Infra-Red (IR) Sensor as shown in Figure 4 is used to detect any obstacle coming very close to the bike during driving. IR Sensor consists of an IR Transmitter and Receiver. The IR Transmitter emits radiation and when the obstacle is detected, the radiations are reflected back. The reflected radiations are absorbed by the IR Receiver [1]. The vehicle speed can be controlled from colliding with other vehicle using the potentiometer in the module.

3.4. GSM

Global System for Mobile Communications (GSM) is a standard used for mobile communication of both data packet and voice. Figure 5 represents the GSM Module which is programmed according to the cellular network.

Figure 4: IR Sensor

Figure 5: GSM module

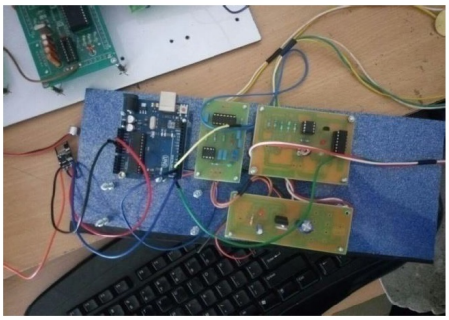

Figure 6: Smart helmet module

3.5. GPS

Global Positioning System (GPS) uses a global navigation satellite to calculate the device's geographical position [5].

4. Results and Discussions

The various modules programmed in the proposed system are discussed in the below section.

4.1. Smart helmet module

Figure 6 shows the experimental setup of the smart helmet module in the proposed system. The module is able to measure the data from the required sensors, encrypts data and writes the encrypted data in the thingspeak.api.

4.2. Smart Phone Application Module

As shown in Figure 7 the Smartphone application module captures data from the Thingspeak channel and Figure 8 shows the respond accordingly such as sending message with location to preset contacts [6].

4.3. Vehicle Module

Figure9 shows the experimental setup of the vehicle module in the proposed system. When an accident happens, signal from the required sensors and the helmet is calculated and the emergency message is send to the preset contacts. If the rider rides the vehicle by consuming alcohol [9] then the alcohol sensor sends signal to the vehicle module to keep it off.

Figure 7: Data reading window

Figure 8: Accident message to the preset contact

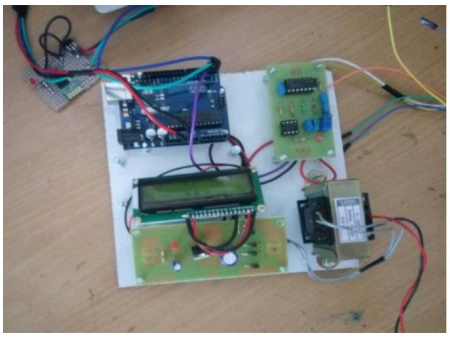

Figure 9: Vehicle module

5. Conclusion

The proposed system efficiently ensures the riders uses the helmet during the entire travel and send the accident location to nearest hospital and family until the first aid reaches the driver. The driver can attend the calls while driving using Wireless Bluetooth speaker attached to helmet module. In future the work can be fabricated to compact size which can be fitted to all two wheelers. This module can also be modified to four wheelers by adding few more options like identifying parking space and no entry. Government has to impose laws such that all vehicles are manufactured with suitable mechanism to prevent accidents.

References

[1] M.G. Anand, A. Dhanyakumar, N. Bhaskar and S.B. Mahaling, *Sensor based accident prevention system in curving*, Int. J. Adv. Res. Innovat. Ideas Educat. 4 (2016) 2705–2712.
[2] B. Anjali, V.T. Thasni, N.S. Reshma, K.P. Yadhu and K.N. Deepak, *Intelligent smart helmet system: A review*, Int. J. Adv. Res. Comput. Commun. Eng. 9 (2020) 16–23.
[3] N. Chaturvedi and P. Srivastava, *Automatic vehicle accident detection and messaging system using GSM and GPS modem*, Int. Res. J. Eng. Tech. 3 (2014) 252–254.
[4] P. Dileepkumar, G.N. Kodandaramaiah, A. Subramanyam and M. Dharani, *A solar powered smart helmet with multifeatures*, Int. J. Eng. Invent. 4 (2015) 6–11.
[5] N. Manjesh and R. Sudarshan, *Smart helmet using GSM & GPS technology for accident detection and reporting system*, Int. J. Electric. Electron. Res. 2 (2014) 122–127.
[6] V.O. Matthews and E. Adetiba, *Vehicle accident alert and locator (VAAL)*, Int. J. of Elect. Computer Sci. 11 (2011) 35–38.
[7] M. Meenatchi and S. Santhoshkumar, *Smart self automated speed breaker system to control vehicle speed using IOT*, J. Critical Rev. 7(3) (2020) 1255–1259.
[8] B. Nivedetha and I. Vennila, *FFBKS: Fuzzy fingerprint biometric key based security schema for wireless sensor networks*, Comput. Commun. 150 (2020) 94–102.
[9] S. Tapadar, S. Ray, H.N. Saha, A.K. Saha and R. Karlose, *Accident and alcohol detection in bluetooth enabled smart helmets for motorbikes*, 8th IEEE Annual Comput. Commun. Workshop Conf. 8 (2018) 584–590.
[10] J. Vijay, B. Saritha, B. Priyadharshini, S. Deepeka and R. Laxmi, *Drunken driving protection system*, Int. J. Sci. Eng. Res. 2 (2011) 1–4.