ISSN 2319 – 2518 www.ijeetc.com Vol. 4, No. 2, April 2015 © 2015 IJEETC. All Rights Reserved

Research Paper

BIKE RIDER'S SAFETY USING HELMET

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The idea of developing this project comes from social responsibility towards the society. Bike riding is a lot of fun, but accidents happen. People choose motorbikes over car as it is much cheaper to run, easier to repair, easier to park and flexible in traffic. In India more than 37 million people are using two wheelers. Since usage is high accident percentage of two wheelers are also high compared to four wheelers. Motorcycles have high rate of fatal accidents than cars or trucks and buses. This project aims for accident avoidance, safety and security of bike rider. The main purpose of the project is to encourage wearing helmet. The system will ensure that the motorbike will not start unless the rider is wearing a helmet and has not consumed alcohol. Thus alcohol detection is also an important part in this project. Alcohol detection is done by MQ-3 sensor and helmet detection is done by IR and PIR sensors. The system will also alert the bike rider if any obstacle comes too close while riding the bike. This is found to be useful at night or when the rider is drowsy or tired. By this accidents can be prevented. Also GSM technology is used to inform the family members in case of an accident. Accident detection is done using accelerometer. Wireless communication through Ask module is done between the helmet and motorbike.

Keywords: GSM technology, ASK module, Helmet detection, Alcohol detection, IR and PIR sensor, MQ-3 sensor, Accelerometer

INTRODUCTION

The project aims to provide total safety for bike riders. Recently helmets have been made compulsory, but still people drive without helmets. Pune City has 35 lakh two-wheeler riders, notch 500-600 accidents each year, of which 200-250 are fatal. Pune ranks first in the state when it comes to two wheeler riders, with Mumbai coming a distant second. Pradhan, chief of trauma department, Sancheti Hospital, alleged that the centre receive no less than 50 to 60 cases of road accidents per month, and, in the majority cases, the victims sustain skull injuries. "The likelihood of survival of fatalities

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wearing helmets are high as compared to those not wearing helmets". Many people agree that the headgears should be made obligatory and one of them is S. Patharkar, who works with a multinational bank and helps traffic police to increase awareness concerning traffic related issues. Patharkar said, "Everybody knows that wearing helmets gives security to your head as chances of survival from accidents increase compared to someone not wearing headgear. There are many people riding motorbikes at 60 to 70 km per hour per day. Yet, they do not wear helmets." A RTO officer said that in order to reduce the number of road accidents, Supreme Court had in 2010 instructed twowheeler manufacturers to sell helmets along with their motorbikes and scooters. Recently, Regional Transport Officer Jitendra Patil instructed motor vehicle inspectors that applicants for permanent two-wheeler driving licenses will be allowed to take the test only if they are wearing a helmet. He also sent a notice to all employees stating that those coming on two-wheelers will not be permitted to enter the RTO premises if they are not wearing a helmet. Similar rule will apply to citizens coming to the RTO for any work.

As per Section 129 of Motor Vehicles Act, 1988 makes it compulsory for every individual riding a two-wheeler to wear protective headgear conforming to standards of the Bureau of Indian Standards. Despite creating much awareness, people don't wear helmets. Traffic police monitoring for helmets is not permanent solution. As traffic police cannot be present at all places. Also they do not have adequate manpower to implement the rule as manning traffic is also a priority. Similar is the case with the drunken driving. Moreover they can be bribed easily. In India, drunken driving is customary in commercial vehicle drivers. Personal car owners and youth are also main players in the game. To make the matter worse Indian traffic officials are not well equipped with the necessary equipments required to introduce checks on driving in India. There are laws in India to check the drunken driving but its successful implementation is still to be worked upon. The Motor Vehicle Act, 1939, has a clause which states that "Driving by a drunken person shall be punishable at the first offence with imprisonment for a term which may extend to six months or with a fine which may extend to two thousand rupees or both; and for a next offence, if committed within three years of the earlier similar offence, detention for a period which may increase to three thousand rupees or with both. The law is very much successful if made compulsory, but it fails when the hands of the concerned officials are bribed. A drunken driver is a murderer as he cannot carry out his tasks without risks and endangers road safety. Drunken driving is an illegal act and should be governed by stern laws which entail not only levying heavy fines or revocation of driving license, but also action, same as a criminal offense. Generally, rider escapes from the picture as the public gets involved in getting the injured hospitalized rather than snitch the drunken driver and teaching him a lesson.

These are the two main issues which inspires us to build this project. The first step will be helmet detection and alcohol detection. When these two conditions are checked then only the bike ignition will start. IR sensor, PIR sensor and MQ-3 alcohol sensor is used for the

same. If accidents are one issue, lack of treatment in proper time is another reason for deaths. Nearly half of the injured people die due to lack of treatment in proper time. The reasons for this may be late arrival of ambulance or no person at place of accident. In fall detection part of our project, if the bike rider falls from the bike, i.e., if he meets with an accident his family is sent a message. People are overworked at their working places and when time comes to driving back home they are tired and drowsy leading them to having less attention to other vehicles in their safety distance. Less accuracy in judgment leads to accidents. In safety zone indication part of our project we will ensure that bike rider is informed of vehicles coming from left and right side of his bike. This application plays important role in long distance driving. The proposed system has been developed in a special motive that should protect not only the bike rider but also the persons around it such as pedestrians, and to prevent collision of vehicles with any other vehicle or obstacles such as trees.

MATERIAL AND METHODS

The intention of this project is to develop vehicle accident prevention and intimation by method of alcohol detection, helmet authentication, fall detection and collision avoidance in an effort to reduce traffic accident cases. The various other technologies used are GSM for sending wireless messages and ASK module for wireless communication between helmet and motorbike. The system consists of two parts one is mounted on the helmet and other on vehicle.

Helmet Authentication

One third of all those who died in road accidents could have survived had they worn a helmet. Studies shows that usage of helmet

can save accident death by 30 to 40%. The rate at which number of two wheelers in India is rising is 20 times the rate at which human population is growing. The risk of death is 2.5 times more among riders not wearing a helmet compared with those wearing a helmet (Sudarsan and Kumaraguru Diderot, 2014). Detection of helmet is done using IR and PIR sensors. The detailed working principle of these two sensors is as follows:

PIR Sensor

First question that comes is how to detect the presence of human head inside helmet. For that we will use PIR sensor. The PIR (Passive Infra-Red) Sensor is a pyroelectric device that detects motion by measuring changes in the infrared levels emitted by surrounding objects. This motion can be detected by checking for a high signal on a single I/O pin. As soon as the bike rider's head is detected while he is trying to wear helmet, the movement of his head from outside to inside of helmet will be detected which will give high output of used PIR sensor. Pyroelectric devices, such as the PIR sensor, have elements made of a crystalline material that generates an electric charge when exposed to infrared radiation. The changes in the amount of infrared striking the element change the voltages generated, which are measured by an on-board amplifier. The device contains a special filter called a Fresnel lens, which focuses the infrared signals onto the element. As the ambient infrared signals change rapidly, the on-board amplifier trips the output to indicate motion. The Figure 1 shows PIR sensor.

IR Sensor

Second question that arises is if the bike rider has played a trick by putting something else in

Figure 1: PIR Sensor



the helmet in order to start bike anyhow. For us not to allow that from happening we are using 2 IR sensors on the left and on the right side of helmet so that(considering the fact that when human has worn helmet there remains no/less free space inside) human head will be detected. Here, both of the IR sensors are used as obstacle detectors. The IR LED transmits the IR signal on to the object and the signal is reflected back from the surface of the object. The reflected signals are received by an IR receiver. The IR receiver can be a photodiode/ phototransistor or a readymade module which decodes the signal and it detects the position of the obstacle and instructs the microcontroller



(Harish Chandra Mohanta *et al.*, 2014). The Figure 2 shows IR sensor.

Alcohol Detection

It is impossible for police to check each and every vehicle for drunken drivers, so an effective system which automatically prevents drunken driving is needed. This system can be integrated with the ignition system thus allowing only sober people to handle the motorbike (Haran and Suriyanarayani, 2012). MQ-3 gas sensor (alcohol sensor) is suitable for detecting alcohol content from the breath. So it can be placed just below the face shield and above the additional face protection. The surface of the sensor is sensitive to various alcoholic concentrations. Generally the illegal consumption of alcohol during driving is 0.08 mg/L as per the government act. But for demonstration purpose, we programmed the threshold limit as 0.04 mg/L. Threshold can be adjusted using variable resistor (Harish Chandra Mohanta et al., 2014). The alcohol sensor circuit will detect the alcohol depends on human breath and the signal will send data to Atmega16 microcontroller. The alcohol sensor MQ-3 is selected in this system due to its sensitivity in detection the small value of BAC. This sensor is manufactured by Hanwei Electronic Co. Ltd., has high sensitivity to alcohol and small sensitivity to benzene. The sensor able to detect BAC with different concentration and classified the range of BAC detected into a few level (Mohamad et al., 2013). The Figure 3 shows MQ-3 alcohol gas sensor.

Fall Detection

Fall is detected using accelerometer. Fall detection indicates accident has occurred. If

Figure 3: MQ-3 Alcohol Gas Sensor



fall is detected then a message is sent to the bike rider's family through GSM. For this purpose we are using accelerometer ADXL335 and GSM module.

Accelerometer

An accelerometer is a Micro-Electro Mechanical System (MEMS) sensor. It measures static (earth gravity) or dynamic acceleration in all three axes. It measures level of acceleration where it is mounted which enable us to measure acceleration/ deceleration of object like car, or tilt of a platform with respected to earth axis, or





vibration produced by machines. Accelerometers measure in terms of 'g' ('g' is acceleration measurement for gravity which is equal to 9.81 m/s²). Accelerometer converts mechanical motion into electrical output (Aboli Ravindra Wakure *et al.*, 2014). Figure 4 shows Triple Axis Accelerometer ADXL335 and Figure 5 shows ADX335 Pin diagram.

GSM Module

GSM is global system for mobile communication and used to send message to pre-programmed number. The modulation technique used is GSMK. The protocol used by GSM modem for setup and control is based on the Hayes AT-Command set. AT is the abbreviation of Attention. GSMAT commands are extension commands. Extension command +CMGS (Send SMS message) is used in our project (Aboli Ravindra Wakure et al., 2014). A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone. A GSM modem exposes an interface that allows applications such as SMS to send and receive messages over the modem



interface. The mobile operator charges for this message sending and receiving as if it was performed directly on a mobile phone. To perform these tasks, a GSM modem must support an "extended AT command set" for sending/receiving SMS messages, as defined in the ETSI GSM 07.05 and 3GPP TS 27.005 specifications. Due to some compatibility issues that can exist with mobile phones, using a dedicated GSM modem is usually preferable to a GSM mobile phone. It should also be noted that not all phones support the modem interface for sending and receiving SMS messages. In particular, most smart phones, including Blackberries, iPhone, and Windows Mobile devices, do not support this GSM modem interface for sending and receiving SMS messages at all. Additionally, Nokia phones that use the S60 (Series 60) interface, which is Symbian based, only support sending SMS messages via the modem interface, and do not support receiving SMS via the modem interface (Ramya et al., 2012). The Figure 6 shows GSM module.

Safety Zone for Rider

In this part the bike rider will be alert if any

vehicle comes too close through LED and buzzer. An IR Sensor is used to detect the static obstacle in front of the vehicle and the bike rider is alerted if obstacle is detected. This may avoid accidents due to collision of vehicles with any static obstacles (Ramya *et al.*, 2012).

RESULTS AND DISCUSSION

Thus to ensure bike rider's safety we have designed this project. So far many projects were developed for vehicle safety. But they all concentrated more on four wheelers. Very less importance was given to motorbikes. Today accidents caused by motorbikes are more than cars. Thus in this project safety of bike rider is major concern.

The project consists of 4 parts:

- 1. Helmet Authentication; to ensure that the bike rider is wearing a helmet.
- 2. Alcohol detection; to ensure that the bike rider has not consumed alcohol
- 3. Safety zone indication; to alert the bike rider if any vehicle comes too close.
- 4. Fall detection; in case of accident, to inform bike rider's family about the accident.

This project could be highly developed with upcoming technologies to provide further more safety and security to the vehicle systems.

- Using GSM technology we are sending message is case of accident. In future scope we can use GPS to send the location of accident along with the message.
- 2. Also the message and location can be sent to ambulance or police stations.
- 3. The vehicle tracking system can be implemented. This will protect the vehicle

from theft. This can also be used to ensure that rider is not misusing the bike.

- 4. The rider can also use the GSM technology to send messages to his family if he is fine.
- 5. The developed system senses the obstacles in front of the vehicle and so that the accidents due to static obstacles could be avoided. The developed system is greatly helpful to avoid accidents which happen during the night time. The distance between the vehicle and the static obstacle supported by the IR sensor is three feet, and in future the distance could be increased by replacing the IR sensor with the ultrasonic sensor.
- In future if all the bike manufacturing companies include this system on each bike before the sell, accident rates will drastically all down.

CONCLUSION

Automatic accident detection and reporting system is deliberate in this project. The main aim of this project is to encourage people to wear helmet and to prevent road accidents, which is achieved. Thus road accidents can be prevented to some extent and safety of bike riders is ensured. When accident occurs, it is sensed by Accelerometer. Short message is sent via GSM network to the family member of bike rider. If bike rider has consumed alcohol bike will not start. The proposed system also senses the obstacles or static objects in front of the vehicle so that the accidents due to static obstacles could be avoided. The system has been designed for a special objective that should protect not only the person riding the vehicle but also the persons around it like pedestrians and also to prevent collision of vehicles with the other vehicle or obstacles such as trees. The designed system is highly useful to avoid accidents which happen around the night time. It provides more than 70% safety for two wheelers. It is the fact that implementation of system will increase cost of vehicle but it is better to have some percent safety rather than having no percent of safety. This system could be further enhanced with future technologies to provide further more safety and security to the vehicle systems.

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