"Vehicle Safe" - Preventive Measure for Accident Avoidance by Tracking Eye Blink

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Abstract: Android Applications are used in many areas. The proposed system facilitates to prevent or avoid accidents with the help of Android Applications. It comprises the usage of embedded systems with the Android App. The rate of accidents is increasing day-by-day. One of the reasons for accidents is the drowsiness of the driver. The predictive methods are less in numbers. The proposed system enables the driverto predict and take preventive measures and helps them to avoid the panic state. If the driver drives without the control over the vehicle then the speed would be automatically controlled. The Eye Blink Sensor (CNY 70) helps to predict the condition of the driver. If he/she sleeps then brake is applied automatically. Ultrasonic Sensor(SRF 04) attached to the Vehicle senses the obstacles in the pathway. The Gas Sensor (MQ 2) senses the smell of the alcohol, if at all the driver has consumed any. If then an accident occurs beyond all these preventive measures, a Vibration Sensor (Piezo Electric Crystal) is used to predict the unsafe condition through the vibration of the vehicle. Predicting which the current location is sent to the emergency server via GPS System.

Keywords – Eye Blink Sensor; Ultrasonic Sensor; Safety; MQ2; Android; Alcohol.

I. INTRODUCTION

In India 2015, January to May 31st,there were a total of 325 lives claimed in accidents. 14,000 cases of drunk and drive were filed and 45,158 cases of over speed were filed in the capital city Delhi. The survey of The Indian Express, News Daily states that 16 deaths and 58 roads injures are filed for every hour in India. The rate of fatal accidents have been raised from 18 percent in 2003 to 25 percent in 2012.In the recent years, the vehicle communication technology has gained the popularity in industrial field. By the use of V2P (vehicle to person) communication and V2V(vehicle to vehicle) communication they can be used for the purpose of serving safety and security.

The concept of vehicle communication is in existence due to the accidents caused because of human error or by lack of concentration on road while driving or by applying sudden brake on front vehicle on roads. With the vehicle communication onboard the vehicle theft will reduce significantly because owner can reach the vehicle location simply through the help of vehicle communication.

II. LITERATURE SURVEY

The author [1] had embedded the concept of wireless communications like Zigbee and GSM along with many other sensors. Vehicle to vehicle communication is implemented with the help of Zigbee technology. It transfers the message of the emergency condition of one vehicle to another. Theft of a vehicle can also be kept under control with the DTMF.

In recent days, most of the accidents occur due to the drowsiness of driver. The author [2] had done the analysis of physiological signals using Electroencephalogram and Electrocardiogram in order to detect the drowsiness of the driver. The signal values are transmitted through Zigbee. Eye blink sensor is used to detect the driver's eye. Detecting which it sends a signal to alert the driver.

The GPS system tracks the vehicle by regular monitoring. After which it informs the exact location and route of the target vehicle. The author [3] had used both the GSM and GPS System for transmission. The web applicationpresent at the client sidelets the users to know the location and all possible routes to reach the target.

The author [4] had designed the system to control the speed of induction motor using an android application. It controls the speed remotely. The Android device acts as transmitter and the Bluetooth acts as the receiver. The

Bluetooth consumes less power and so it is more preferable. They are interfaced with AVR Microcontroller of 8051 family. AVR delivers signal to triac through optical isolation.

The voice controlled framework is one of the recent innovations done. The author uses the voice of the human to control the vehicle. The sensitivity of speech varies human to human. And that may lead to lack of recognition precision and helplessness. The system [5] consists of 4 stages – Voltage Regulator, Sound Detection, Controller and Starter.

Zigbeeis also known as WPAN (Wireless Personal Area Network). Zigbee can be used to set small communication network in the area. It is based on IEEE 802.15 standard. Zigbee is like a Bluetooth technology whose area of communication is of 20 meters with the line of sight communication at low power consumption. Its communication range can be increased to 100 meters with high power consumption. It works on 2.4 GHz Radio Frequency to transport the reliable and easy usage across the world. It uses mesh network with 128 bit symmetric encryption keys.The transfer rate of Zigbee is about 250 Kbps which is very suitable for intermittent data transmission. Zigbee chip includesmicrocontroller that have 60 – 256 Kb flash memory. Zigbee has the integrated battery having a life of 2 years. The regular uses of Zigbee are - home automation control system like smart lighting, temperature controller and security system,home entertainment like music and movies, Industry control system, medical field for collecting data of patient, smoke warning and building automation.

III. PROPOSED SYSTEM

1). System Components

The Fig1. shows the system architecture of the proposed system. Different types of sensors such as Eye Blink, Gas, Ultrasonic and Vibrations sensors are used. Each sensors are loaded with predefined set of threshold values and conditions are set to respond according to their input recognized.
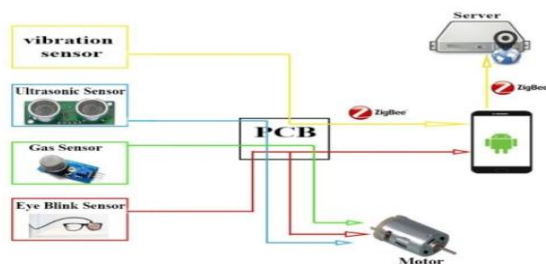

Fig.1. System Architecture

2) Eye Blink Sensor :

The sensor which is used for tracking the eye blink of the user is CNY 70 which is an Infrared Sensor shown in Fig.2. It consist of IR Transmitter and IR Receiver. Its signal is processed in terms of voltage. The voltage received from the IR receiver by the pupil (Open Eye) is comparatively high when compared with the voltage received from the skin (Closed Eye).

The deviation in the value leads to the threshold value for sensing the drowsiness of the user. The voltage of open eye will be ranging from 3.5V to 5V. If the voltage drops below 3.5V for a long time then it senses and then the buzzer is triggered. Fig.2 shows the Eye Blink Sensor.
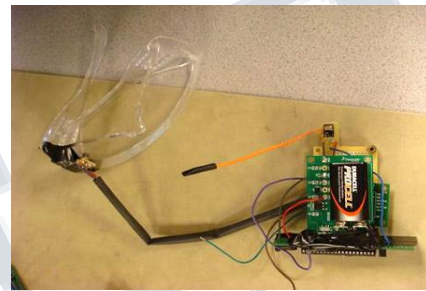
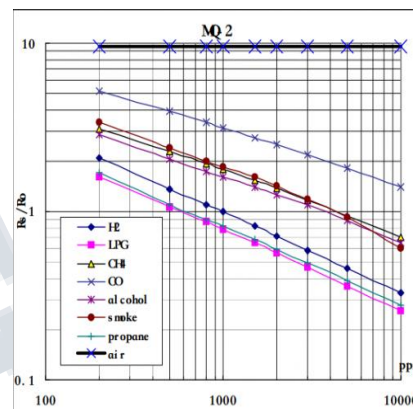*Fig.2. Eye Blink Sensor*

3) Ultrasonic Sensor :

Ultrasonic sensor senses the obstacles in the pathway. SRF04 is used as an ultrasonic sensor. The signals are transmitted and received in the form of voltage. The high-frequency sound waves that are transmitted when the sensor receives the waves. To determine the distance between the system and the object, the sensor measures the elapsed time between sending and receiving the waves. These sensors are ideal for measurement in different environments where measurements cannot be affected by the surface, material, light, dust, or other noises. The Ultrasonic sensors are used in a wide range of applications which includes the measurement of distance, presence detection, or detect the position of an object. Table I refers to the list of specifications used of the Ultrasonic Sensor.

Table I – SRF04 Range of Values

Ultrasonic type	SRF-04
Operational Voltage	DC 5V
Static Current	2mA
Working Frequency	40Hz
Distance Measurement Range	3cm – 400cm
Measurement Angle	15°
Measurement Accuracy	0.3mm
Output Voltage	H – 5V L – 0V

4) Gas Sensor :

The Grove-Gas sensor (MQ2) shown in Fig.4.is useful in detecting the sense of hydrogen, LPG, Methane, Carbon Monoxide, Alcohol and smoke. Each gas has its own threshold value which is sensed. The sensitivity of the sensor can be adjusted using Potentiometer. The maximum voltage a gas sensor can withstand is 5V which is connected to the V_{cc}, as shown in Fig.3.
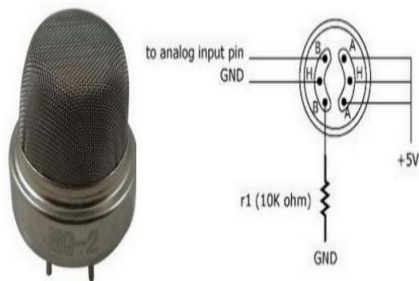
Fig.3. Gas Sensor

The maximum pH value of the MQ2 sensor is 800mW. The sensing resistance R_s ranges from 3 to 30. R_0 value is the division of R_s value to 9.8. The ratio of R_s and R_0 gives the threshold value for the detection of the alcohol and other gases. The value of R_o is a constant value of resistance when the system is ideal. The Fig.5 shows the graph of variation of the threshold values of the Gas Sensor.

Fig.4. Gas Sensor MQ

Fig.5. Threshold Value for the Gas Sensor

5) Vibration Sensor :

Piezo Electric crystal is used as a Vibration Sensor which detects the amount of vibration in the circuit, as shown in Fig.6. This can be used for the detection of accident since accidents cannot occur without vibrations. This sensor is pre-loaded with the Boolean function. That is either 0V or 5V. If there is no vibration the voltage across this sensor will be 0V and if there is a vibration then the voltage will be 5V.

Fig.6. Vibration Sensor

6) Bluetooth :

Bluetooth is used to connect one electronic device to another, without the usage of wires and cables. It is a wireless technology to send and receive data between two devices. Those two devices must be of Bluetooth supporting devices. The data transfer is done

at a rate of 0.5 Mbps. There are 79 different frequency channels at 2.40 Giga Hertz through which the devices send and receive data to each other.

When two devices are trying to be paired, they are actually searching for a common frequency through which they can communicate. When the desired frequency is discovered, the devices are "found". This is an optional technology which can be used when Radio Frequency is used instead of Zigbee. The connecting of two devices does not hamper the connecting of other devices because they usually use different channels of frequency and hence do not overlap. This is the principle of the Bluetooth.

7) *Analog To Digital Converter :*

The most important element of the proposed system is to convert the input signal from analog signal to digital signal. So that it can be used by the controller. The mathematical equation to calculate the resolution of the sound level using the voltages that have been measured is given below:

$$\frac{Resolution\, of\, ADC}{Voltage(VDD)} = \frac{ADC\, Reader}{Voltage\, Measured}$$

The Analog-to-Digital Converter (ADC) module has five inputs for the 28-pin devices and eight for the 40/44-pin devices. The conversion of an analog input signal results in a corresponding 10-bit digital number. The ADC module has high and low-voltage reference input that is software selectable to some combination of VDD, VSS, RA2 or RA3. The ADC has a unique feature of being able to operate while the device is in Sleep mode.

8) *Zigbee :*

Zigbee technology is a standard Wireless based Technology designed at a very low cost and high level communication protocol. It is also known as Wireless Personal Area Network (WPAN). This is based on IEEE 802.15 standard. It is similar to Bluetooth. Using Zigbee data can be transferred to the distance of 20 to 25 meters at the rate of 250 Kbps. This can be increased to 100 meters using high power consumption. Zigbee can be used to cover greater distance using Radio Frequency. This is reliable and ultimately long life for more than 3 years.
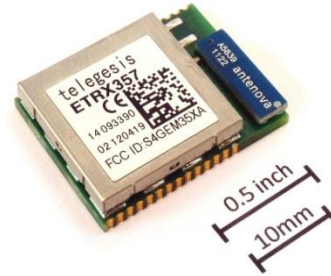

Fig.6. Zigbee Module

a) ***Zigbee Coordinator (Zc) :*** Zigbee Coordinator is the root of the network tree and acts as the bridge to the other network. It is responsible for storing the information about the network.
b) ***Zigbee Router (Zr) :*** Zigbee Router is like the ordinary router which is responsible for the transmission of data from server to the receiver. This information is transformed to the Zigbee Devices.
c) ***Zigbee Devices (ZED):*** Zigbee Devices are the devices which acts on the receiver end. Such as mobile phone or centralized server.

IV. SYSTEM IMPLEMENTATION

The Gas Sensor, Ultrasonic Sensor, Eye Blink Sensor & Vibration Sensor are interconnected and controlled by an embedded circuit in Printed Circuit Board. The first step of execution is that the Gas sensor will sense the smell of alcohol. The Gas sensor is pre-loaded with the hexadecimal values and if the level of alcohol content exceeds 600 ADC, the system automatically sends the message to the driver's Guardian and the motor will not start. This process will be checked every time the system starts. Then the eye blink sensor will be tracking the eye ball, if the driver tends to sleep or if he/she takes long time to open his/her eyes, the voltage to the sensor drops from 3.5 V to 1.5 V.

In this case, the controller will be sending an alarm to the user's phone in order to wake him up and buzzers as an alternative if phone cannot be reached. It also decreases the speed of the motor in order to prevent from accident or from heavy damage. An ultrasonic sensor is connected with the PCB which alerts the user about the obstacles in the Road space. This is done by using the voltage drops in the ultrasonic sensor. The threshold value for the ultrasonic sensor is already encoded in the circuit. This sensor senses the obstacles in front of the user, say around 10 meters. If it decreases from the particular value then the motor is stopped to

prevent the accidents. These are the general causes of accidents. Fig.7 shows the complete flow chart of the proposed system.

The Vibration Sensor is used in order to sense the vibration in the vehicle that may tend to loose control of the driver. This vibration sensor is made up of Piezo Electric Crystal. It is defined with the Boolean value. Either 0V or 5V. If the sensor senses greater than 5V. The GPS system in the smart phone is initiated and it automatically sends the current location of the vehicle to the User's Guardian and to the Emergency line. In case the phone is not reachable or the internet is not connected thenthe GSM modulesends the textual geographical values to the Emergency server. These functions are done automatically by the system. The manual part of the proposed system is that the user can control the speed of the vehicle using an android device with the help of Bluetooth. The speed of the vehicle can be controlled by the driver and also by the microcontroller during the emergency situation.

V. WORKING ALGORITHM

The algorithm which is used for this paper is proactive analysis. The prevention is done with the predefined set of data which are the reasons for the destruction. The step by step procedure is given below:

Step 1: Determine whether the positive input (lesser than 600ADC) is obtained from the gas sensor.

Step 2: If the volt<=600ADC then move to step 3. Else move to step 9.

Step 3: Engine ignites and run without any defect.

Step 4: Determine the output from the eye blink sensor.

Step 5: If the output is lesser than 1.5 V then move to step 3. Else move to step 9.

Step 6: Determine the output from the ultrasonic sensor. If the distance is greater than 10m then move to step 3. Else move to step 9.

Step 7: Determine the output from the Piezo Electric crystal (Vibration). If the output is 0V Move to step 3. Else move to step 8.

Step 8: Check whether the mobile data is turned ON. If yes send the location to Emergency server through online. Else send the textual geographical value through the GSM module.

Step 9: Stop the Engine.

VI. CONCLUSION

This project enables the users to prevent themselves from an accident. At times it also helps them to avoid it. It is a new way for vehicle safety with which the driver as well as the passengers are being safe guarded.

The app predicts and prevents from the unsafe situation of the vehicle. At the time of drowsiness of the driver, a message to the Emergency Server saves the life of the passengers. The location of the vehicle is sent to the Emergency Server via GPS System. The drowsiness of the driver is intimated by alarm or a buzzer. The unsafe overtaking is overcome by the Vehicle to Vehicle communication. Warning of a car's failure can be transmitted throughthe offline communication such that theaccident is prevented.

The advancement in the Vehicle to Vehicle communication can be done in many ways. Increase in population is a greater challenge to avoid the day-to-day accidents. The future enhancements of the proposed system could be done by usage of the wireless sensors and the offline mode of communication using Radio Frequencies.

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