An Intelligent Microcontroller based System for Driver and Passenger Safety

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***Abstract*— The number of vehicles is increasing rapidly and so is the number of accidents. The root cause of majority of accidents can be traced back to the behavior of the one who drives the vehicle. So it is important to develop cost-effective technological solutions that can accurately identify the behavior of drivers and to assist them. Our project will provide an optimum solution to these drawbacks by performing alcohol detection, sleep detection, call detection, person level identification and accident detection using PIC16F887 microcontroller and various sensors. The ignition is activated only if the driver is confirmed rid of alcohol. When the vehicle is running, continuous monitoring is carried out to detect accidents, incoming calls to the driver and whether the driver is sleeping .A mechanism to detect human presence inside a locked car is also implemented. Each method is used to rectify the carelessness of the driver and immediate intimation of accident is provided by the use of GSM technology. The system will send the accident location acquired from GPS along with the time. This will help the rescue service to reach in time and save the valuable human life. The simulation has been carried out in Proteus and the prototype is devised.**

Keywords*— *GSM, GPS, MQ-3,PIR, PIC16F887 micro-controller, Collision Detection and Accident Avoidance

I. INTRODUCTION

Road accidents and collisions occur frequently. Most of these occur due to the carelessness of the driver or due to drunken driving. Safe driving is a major concern of societies all over the world. The damages caused by careless driving have reached to the maximum. Hence it's high time that we think about required remedial measures to at least reduce the effects of such accidents. Also there are many situations where unattended accidents have resulted in deaths.

The existing system provides a very narrow solution to this problem. But the size, complexity of the circuits and difficulty in incorporating these into the vehicles has limited the implementation of all the above necessities as a single system. This system provides superior safety by integrating the driver monitoring system into the vehicular control system.

Here the complexity of the circuit is reduced to a great extent by using sensor modules which is of very small size and high accuracy. Any damage in any of the sensor module can be easily rectified by replacing the damaged modules.

In this paper we have gone through the various causes of accidents and has taken measures to avoid occurrence of accidents due to driver's carelessness.

II. LITERATURE SURVEY

[1] Describes an approach for effectively designing user-friendly driver vigilance application especially targeted on preventing accidents. This paper aims to design an advanced driver safety awareness and assistance system that will monitor the driver and command the vehicle to take vital safety measures in order to overcome the serious problems. [2] proposes a hardware module and LABVIEW simulation for driver authentication and accident avoidance system. Hardware module for hybrid driver safety system is obtained with three methods namely alcohol detection, heart rate monitoring system, person level identification method, eye blink sensor and theft identification. [3]presents methods for collecting and analysing physiological data during real-world driving tasks to determine a driver's relative stress level. Electrocardiogram, electromyogram, skin conductance, and respiration were recorded continuously. The results show that for most drivers studied, skin conductivity and heart rate metrics are most closely correlated with driver stress level. These findings indicate that physiological signals can provide a metric of driver stress in future cars capable of physiological monitoring. [4] proposes a new concept, i.e., the driving safety field. This concept makes use of field theory to represent risk factors owing to drivers, vehicles, road conditions, and other traffic factors. A unified model of the driving safety field is also constructed. The driving safety field can reveal driver–vehicle–road interactions and their influences on driving safety, as well as predict driving safety trends owing to dynamic changes.

III. HYBRID DRIVER SAFETY ASSISTANCE SYSTEM

In this paper, we have taken great care to avoid occurrence of accidents due to driver carelessness. The first step done as soon as the driver turns the key is to check if the driver is drunk or not. If the sensor detects alcohol, the engine will be automatically turned off. If the driver is alcohol free, the ignition system is activated. While the vehicle is running it continuously monitor the eye blink rate and outputs of the

vibration sensor and call detection circuit. Probability of accidents due to drowsiness is identified by the rate of eye blinks of the driver and the blinking frequency, found out through wearable infrared sensor. If the driver is drowsy, then the system will give buzzer signal to alert the drowsy driver. Accidents due to the attending of phone calls while driving is prevented by detecting incoming calls to the driver and automatically decreasing the speed of the automobile.

In case any person is inside the vehicle when it is not in use, Passive Infrared Sensor is used to detect human presence. If anyone is present, then the carbon dioxide level inside the vehicle is identified and the window is automatically opened if required.

After all the above said precautions, if an accident occur, then the vibration sensor detects shock intensity caused by sudden hit and sends an emergency message to a pre-stored number along with the location acquired from the GPS module. PIC16F877 microcontroller is programmed to integrate all the sensors to provide the hybrid driver assistance system. The fundamental block diagram is shown in Fig. 1.

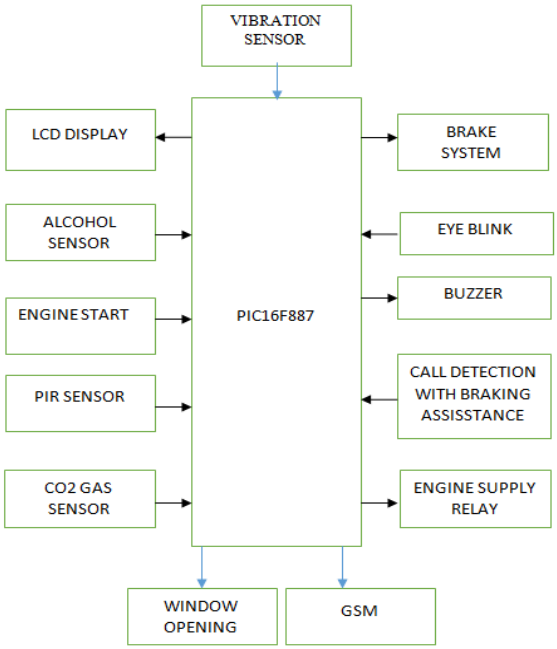

Fig. 1 Fundamental Block Diagram

A. *Alcohol Detection*

Alcohol Detection system is used to measure the alcohol content present in our body. If alcohol content is high, then there is a reduction in the breathing level and due to this accidents may occur. Alcohol level in the blood is measured by use of the alcohol detecting sensor. There is an MQ3 alcohol sensor, which is used to detect the alcohol level and their values are sent to controller. If the value is higher than the threshold value then ignition system will not be activated.

For this there is an alcohol testing feature which instructs the driver to blow air into the sensor unit and then it checks the alcohol content present in the driver's breath. If the value has crossed a certain limit the vehicle ignition will be locked which prevents a drunken driver from starting the vehicle. In this method the analog signal is converted to the digital form and then the signal is given to the PIC circuit because the controller consumes only the digital form. The PIC is programmed with certain threshold voltage. The low, medium and the high threshold level of an alcohol condition are programmed into the PIC circuit. If higher, then indication is given to the vehicle to stop the engine. If the alcohol consumption is less, then the condition is verified to start the engine.

If the driver consumes more alcohol then the condition is not satisfied. Therefore the power supply is insufficient to the controller and the relay switch. Hence the ignition system will not be connected and the DC motor will turn to OFF condition. From this alcohol consumption of the driver is checked hence the crash or accident is avoided.

B. *Sleep Detection*

Driver fatigue resulting from sleep deprivation or sleep disorders is an important factor in the increasing number of accidents on today's roads. Most of the accidents occur due to drowsiness. This drowsiness level is detected by use of an eye blink sensor. IR sensor is used to detect the blink of an eye. In this IR transmitter is used to transmit the infrared rays in eye. The IR receiver is used to receive the reflected infrared rays of the eye. If the eye is closed it means the output of IR receiver is high otherwise the IR receiver output is low. This is to know whether the eye is in closing or opening position. The signal is given to the IR transmitter. Whenever the signal is high, the IR transmitter LED conducts it and passes the IR rays to the receiver.

Eye blink detection sensor identify the blink of person while driving and their range is compared .The compared output is given to the PIC controller and if the value is greater than the threshold value, then an alarm sound is produced. Here the counting of man eye blink is done. For every 20sec, eye blink is counted and if the count of eye blink is less than the threshold value then alarm sound is produced and immediately intimation is send to owner of the vehicle.

C. *Human Detection*

The PIR (passive infrared) sensor is a pyro-electric device that detects motion by measuring changes in the infrared levels emitted by hot objects. This motion can be detected by checking for a high signal on a single input/output pin. The features of a PIR sensor includes single bit output, small size, compatibility with parallax microcontrollers etc.

PIR sensor is used here to detect human presence inside a locked car and intimation is given to the driver as soon as the human presence is detected. Pyro-electric devices 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 PIR sensor has a range of approximately 20 feet. This can vary with environmental conditions. The sensor is designed to adjust to slowly changing conditions that would

happen normally as the day progresses and the environmental conditions change, but responds by toggling its output when sudden changes occur, such as when there is no motion.

Once the human presence in detected then the carbon dioxide level inside the locked car is continuously monitored using an MQ3 gas sensor and then subsequent measures are taken to open or close the windows corresponding to the CO2level inside the car. If the carbon dioxide level falls below a minimum threshold value set to the controller then the windows of the car is automatically opened.

D. Accident Alert System

Despite all the above precautions if an accident happen then prime concern must be to inform about the occurrence of the accident. The main objective of the system is to provide security for the vehicle user and also detects the accident if occurred and informs the respective authority through wireless technologies. If any accident occurs in highway or any other place, the accident information system will get activated and message will be transmitted to respective authority. To do so we should sense or detect the accident using some mechanism. Here we use a vibration sensor which detects any serious hit or crash of the vehicle. The intensity levels of the shocks or vibrations can be set in the sensor beforehand so that small bumps or sudden brakes won't be interpreted as accidents.

Highly intense shocks are considered which will give high signal to the controller thus activating GPS and intimation is given to the pre-fed number via GSM. SIM800 is used here as the GSM module to send accident alert to a pre-fed number with respect to the output of vibration sensor.SIM800 is a quad-band GSM/GPRS module that works on frequencies GSM 850MHz,EGSM 900MHz, DCS 1800MHz and PCS 1900MHz .

E. Call Detection

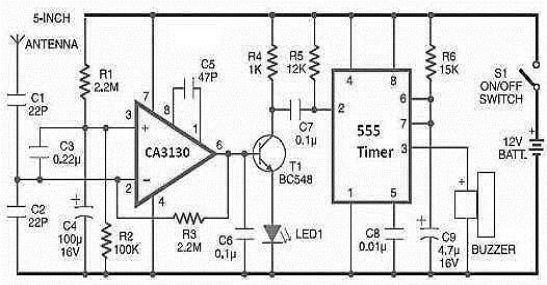

Fig. 2 Call Detection Circuit

An ordinary RF detector using tuned LC circuits is not suitable for detecting signals in the GHz frequency band used in mobile phones. The transmission frequency of mobile phones ranges from 0.9 to 3 GHz with a wavelength of 3.3 to 10 cm. So a circuit detecting gigahertz signal is required for a mobile bug as shown in Fig. 2. Here the length of capacitor is adjusted to limit the range of detection to the driver seat alone. When the signal is detected by the capacitor C3, the output of the op-amp becomes high and low according to the frequency of the signal and is indicated by the LED. This triggers 555 timer which sends a high signal to the PIC microcontroller. And as soon as the controller receives a high signal at it's input, it decelerates the vehicle.

IV. CONCLUSION

As a move to reduce the number of accidents due to careless driving a driver safety assistance system have been developed. Here the alcohol content and sleepiness of the driver is tested and the required measures are taken. Also attending calls while driving have been avoided. The chances of persons unnoticed inside a locked car is also taken into consideration and necessary measures are taken to avoid such accidents. Any occurrence of accidents is also detected at the earliest and an intimation is given to the hospital to take necessary safety measures. All the above mentioned circuits have been incorporated into a single compact system which can be mounted on the vehicle easily and the hardware module have been obtained. The working has been simulated in Proteus.

V. FUTURE SCOPE

Along with above circuits, heart rate monitoring can also be implemented to check the health conditions of driver. The eye blink sensor can be better developed using image processing. Also, password identification can be included to ensure the safety of the vehicle. By suitable modification, any fault in the braking system can be detected and the driver can be alerted to avoid accidents. Temperature sensor can be included in the system to detect any fire in the vehicle. As there is a scope for improvement and as a future implementation we can add a wireless webcam for capturing the images which will help in providing more details of accident.

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