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Automatic Accident Avoidance and Detection System using LabVIEW

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ABSTRACT

The advancement in technology in transportation sector has widened the risk of traffic mishaps causing loss to property, lives of humans and animals. The proposed system provides a solution to decrease the frequency of death. Infrared sensor, Eye blink sensor, GSM and GPS modules are used in the proposed system. If any accident occur, system informs in the form of message which includes the location of the travelling person using GSM and GPS modules to police, guardians and ambulance and myRIO will control all the operations involved. A drowsiness detection system is congregated in addition to prevention of general road accidents, which continuously monitor the driver's state and if the driver feels sleepy then an alarm is triggered if the time exceeds threshold time and it stops once the driver wakes up. The proposed system is implemented using LabVIEW and the controller is myRIO which can run the operation in stand-alone mode.

Key words: Eye blink sensor, GPS, GSM, Infrared sensor, myRIO.

1. INTRODUCTION

In today's world, the vehicle accidents were increasing day by day and it became one of the major problem in every country. The accidents have been risen drastically with the increasing usage demand of vehicles and automobiles. In the year 2015, 1.5 lakh people were dead due to these road accidents [16] among the reported five lakh accidents in India. Brasilia declaration was signed intending to reduce road accidents by 50% by 2022. The Motor Vehicles Bill, 2016 has been passed for consideration in Indian Parliament. This bill addresses issues associated with road safety, insurance of vehicles and road accidents. "There are more than 1.4 lakh deaths annually in India and One in every ten accidents occurring in the world are from India" says Ms. K.K.Kapila, Chairman, IRF (International Road Federation). With the huge population the risk of accidents is also high in heavily populated country like India. The life of the residents of a country is under threat in prospect of the inadequacy of better emergency resources accessible in our nation [1]. The proposed system will avoid this issue. The vehicle accident is detected in minimal time with the help of infrared sensor using it's range detection property. GSM module embedded in this rescue system provides the car accident position (latitude, longitude) and time of the accident using GPS. When the accident is detected, information related to it is transmitted to police and the family members so that quick treatment will be provided to the victim of vehicle accident using the GSM module. As the message is sent to the rescuers with minimal span, saving the lives of people and reducing the accidents has become easy. Not only it sends the SMS to ambulance but also alerts the driver if the driver is drowsy. The implementation of this system needs hardware progress for the sensor and is controlled by LabVIEW software [2]. The main objectives are as follows:

(i) To design a rescue system model.
(ii) To inspect the output using LabView software in order to alert the driver and detect the vehicle accident.
(iii) To determine the location of the accident vehicle using GSM.
(iv) To transmit the information to concerned authorities using GSM system.

2. RELATED WORK

In [4], vibration sensor is used to detect the accident and sends the information to the concerned person using GSM module. Cost reduction is focused by using single sensor instead of multiple sensors. Author in [5] analyzes the data given by sensors mounted on vehicle and sends health condition of the driver to concerned people. Other variety of sensors also can be used to detect the accident like piezo-electric and MEMS [6], [8], RF module [9]. Authors in [7]-[9] detects accidents using IOT technology. In [10] GPS along with GSM are major part in sending the message. The accelerometer provides the information of car accidents, but it is not reliable as mounting a hill or going down a drain might affect the

readings of the accelerometer. The complication of the disaster can be known with the readings of the sensors. False alarms for rescue team should be minimalized to least extent possible. Authors in [11] proposed a method to find the vehicle accident position and in [12] proposed a fuzzy logic theory. Traffic safety improvement in terms of security and accountability is designed and implemented using microcontroller and oscillation sensor. [13] uses ARM processor to receive the information from sensors, process it and depends on the analysis information location will be calculated using GPS. The use of smartphones in Accident Detection is mainly considered in the reference [14]. It sends message if any road accident is detected. The proper release of air bags when accident occurs is done by calculating the force in the multiples of gravitational force and assessing it if its greater than threshold value reaches. The response is sent either by e-mail, fax or message with location and if there is no response an automatic call is generated, and it informs rescue departments. Traffic regulations are also done by regulating the cars traffic to facilitate the streamline flow in traffic. The use of smartphones can sometimes save lives. The SIM placed inside GSM requires adequate signal to work properly.

3. METHODOLOGY

3.1 Block diagram

The proposed system is the congregation of two parts: accident detection and accident control. Infrared sensor is used for accident detection and Eye blinking sensor is used for accident control as shown in figure 1. IR sensor contains transmitter LED, receiver LED and a comparator as shown in figure 2. The comparator will continuously compare the voltage at both input terminals and produces output either as a low or high depending on the comparing voltages. Resistors R1 (100Ω), R2 (10kΩ) and R3 (330Ω) are used to take care that atleast a current of 10 mA passes through the photodiode and normal LED's. The resistors VR2 (preset= 4.7kΩ), VR1 (preset=10kΩ) are used for adjusting the output.

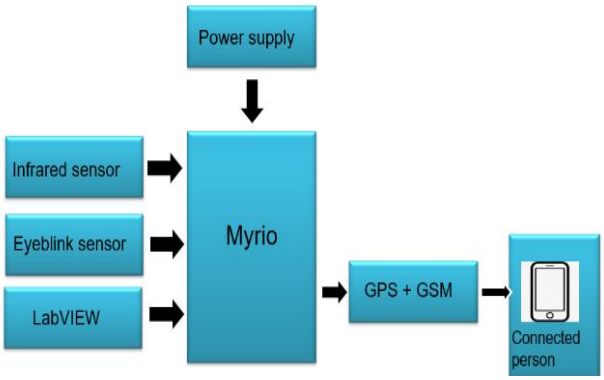

Figure 1: Block diagram

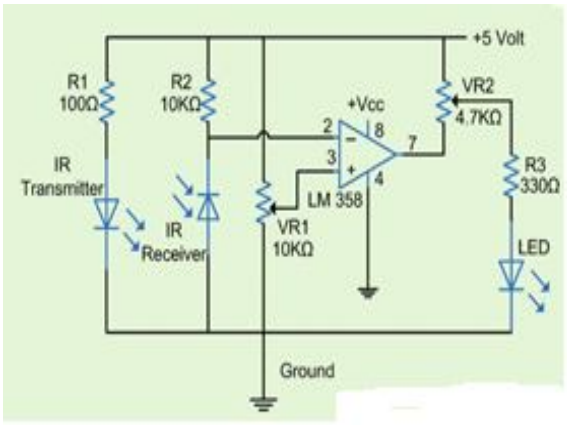

Figure 2: Schematic diagram for infrared Sensor

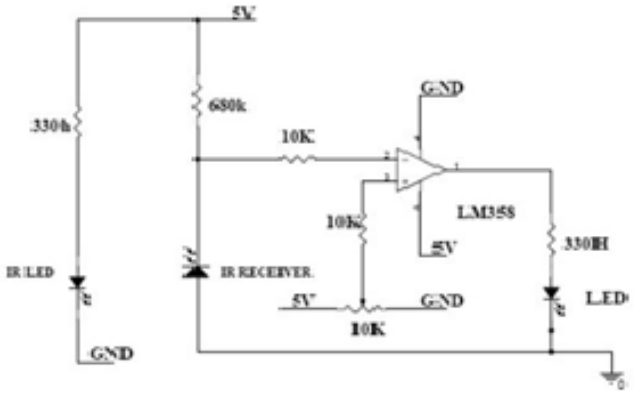

Figure 3: Schematic diagram of the Eyeblink Sensor

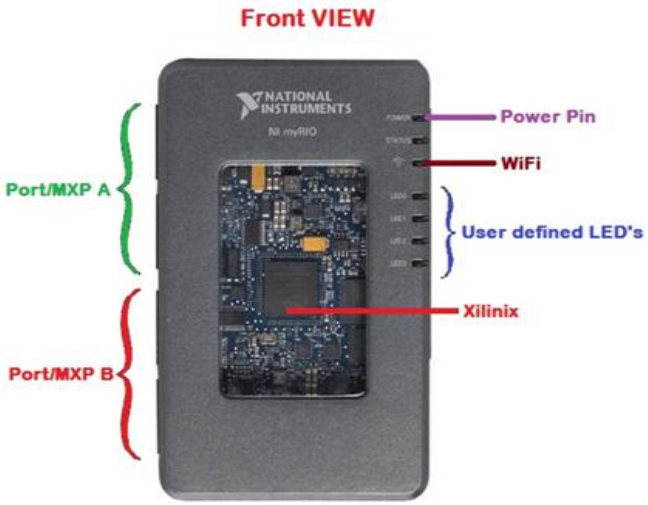

Figure 4: NI myRIO

The condition for acceptable performance is IR transmitter LED and receiver LED should be in a straight line. The transmitter transmits rays into the eye of the driver. If the driver eyes closed, then the output becomes high and appropriate action is made i.e alarm is activated, and it rings till the driver opens his eyes. If the person does not close his eyes for more than the pre-fixed value i.e here 3 seconds, there

will be no triggering of alarm else the alarm gets triggered by eye blink sensor. The comparator, as the name suggests compares two voltages at two different terminals namely inverting and non-inverting terminals as shown in figure 3.

3.2 NI myRIO

NI myRIO is a hardware component manufactured by National Instruments. myRIO can be operated either by using plugin option or wifi option. So, once the code is simulated in LabVIEW and dumped in myRIO, then myRIO can be operated in stand-alone mode. The NI myRIO consists of an inbuild ARM processor and FPGA. Large number of external sensors can be operated or controlled by using this device since it has 10 analog input pins, 6 analog output pins, 40 digital input and digital output pins, inbuild accelerometer and programmable LEDs as shown in figure 4.

3.3 Infrared Sensor

An infrared sensor (IR) is used to sense the object moving. It has two LEDs working as transmitter and receiver. The radiations which are invisible also can be detected by transmitter LED and depends on the intensity, voltage change will be received by receiver LED as shown in figure 5.

3.4 Eye blink Sensor

Eye Blink sensor works on IR rays to show the output. With the blinks of eye, the eye blink sensor gets triggered. The response will be high if the eye is closed, else output will be low. The output of this sensor is connected to alarm via a transistor (if required to raise the voltage required to trigger alarm). The output from eye blink sensor might not always suffice the alarm input requirements. The functionality depends on the position of the emitter and detector with respect to the eye as shown in figure 6.

3.5 GSM Module

To establish communication between myRIO and mobile phone, GSM module [3] as shown in figure 7 is required. It works as wireless modem to transmit or receive information. It requires atmost +5V power supply to work, which can get from myRIO itself. For communication, a SIM card need to be inserted into GSM module and using AT commands information will be transmitted or received between the devices.

Figure 5: Infrared Sensor

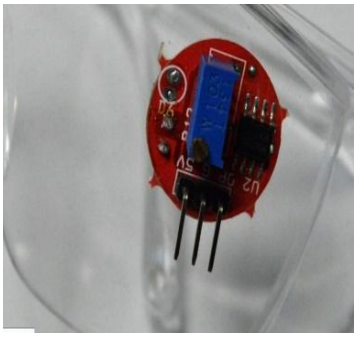

Figure 6: Eye blink sensor

Figure 7: GSM modem

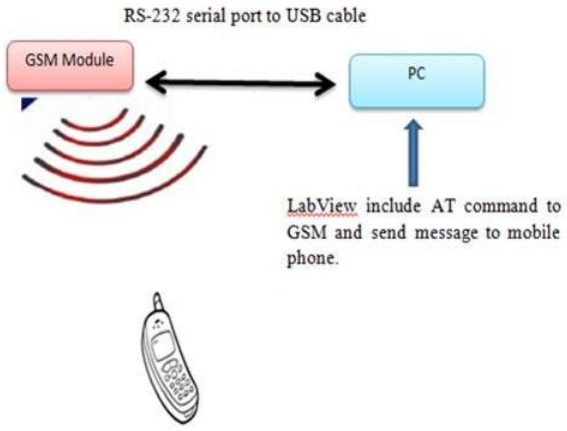

Figure 8: Message sending process by GSM

The GSM module is interfaced to myRIO using LabView Software. Figure 8 depicts how a message is sent by GSM to mobile phone by using LabView software.

3.6 GSM Module

GPS is used as a navigation system made by 24 satellites network placed into a particular orbit and the satellites used in GPS system [3] revolves around our planet two times a day in a particular orbit and transmit signal information to earth. The receiver present on earth receives this information and then calculate the user's exact location i.e. location data and its surrounding environment. The standard baud rate of serial data output is 9600 as shown in figure 9.

Figure 9: GPS module

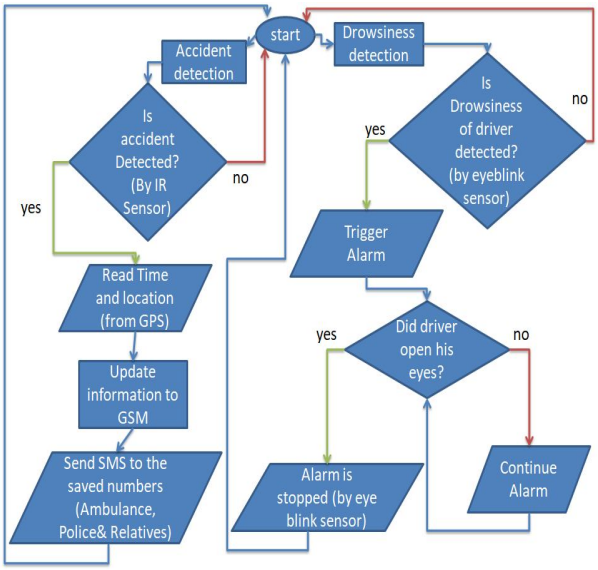

Figure 10: Flow chart of the proposed system

The flowchart of the proposed system is shown in figure 10. Two operations are performed:

(i) Accident detection.
(ii) Drowsiness detection.

The proposed system continuously monitors for these two cases and responds to that accordingly. Sometimes drowsiness might be reason for accidents, so even if the cause of accident is drowsiness of driver [15], system first trying to make him alert his consciousness and alert the rescue services if accident still happens.

4. EXPERIMENT RESULTS

The proposed system will send a message to concerned mobile numbers (Rescue services) when the system is alerted using GSM module and location of driver using GPS module. Figure 11 shows the front panel for the overall system.Once the code is run, if there is no problem with the signal of SIM in GSM, the pop-up shown in the figure 12 appears on the front panel when the accident is detected.

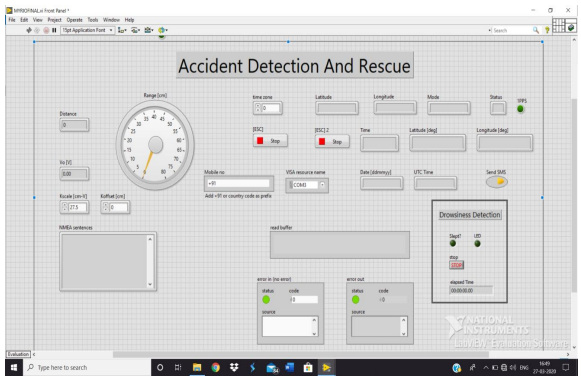

Figure 11: Front panel of the proposed system

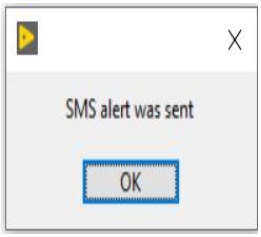

Figure 12: Pop-up if message sent

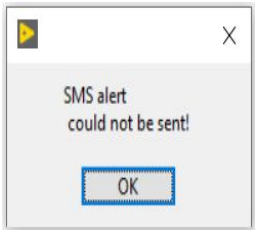

Figure 13: Pop-up if message could not be sent

Figure 14: Drowsiness Detection

Similarly, if the GSM is unable to send the message due to any issue like low signal, GPS unable to locate the position of the accident then the pop-up in figure 13 appears on the front panel.

Whenever driver feels sleepy an alarm is set to ring till the driver opens his eyes. This operation is also included in the front panel. The Elapsed time indicates the duration till which driver is sleeping. The LED named Slept? will glow if driver is closing his eyes for more than two seconds. The front panel sample output for drowsiness detection is shown in figure 14.

If there are no issues like lack of signal for GSM and location not determined by GPS, then the message will be sent showing the details of time and location of the accident. A sample message output received by a rescue service is shown in figure 15. The last line indicates the time of the accident in 24-hour clock format as 01:23:09.

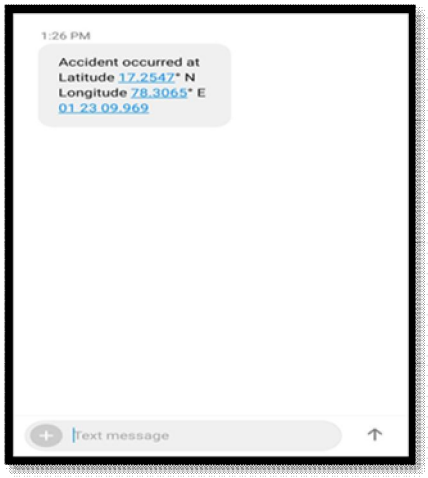

Figure 15: Sample message received by emergency services

5. CONCLUSION

The proposed system is designed based on eye blink sensor which gives alarm to driver, infrared sensor which gives information when accident occurs and implemented using LabVIEW that triggers alarm automatically when the driver feels sleepy and sends information when the accident occurs so that no injured will not be left without getting rescued in time. This system is suitable for all types of vehicles i.e two, three, four or more wheeled vehicles and effective than the accelerometer-based accident rescue systems. GSM alert and GPS tracking algorithm is implemented using myRIO. In future, the proposed system can extend by adding a feature to send information to nearest hospital and ambulance, so that emergency cases may get treatment using video conferencing.

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