Smart Accident Detection and Prevention System Using Haar-cascade Algorithm

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Abstract- *In this project, an IoT based vehicle accident detection and prevention system rescue information system is developed in order to detect vehicle accident and send the location information of the accident place to vehicle owner, nearest hospital, family member and police station etc, via a web service. The communication between the web server and hardware device is established via GSM/GPRS shield, and the location is traced by using the GPS shield. In prevention schema eye blink techniques, alcohol sensor, temperature sensor, seat belt detection sensor are fixed in vehicle where if driver loses consciousness, then it is indicated through buzzer. If any of these sensors are activated then warns the buzzer and alert message is sent to the driver or concerned person. This idea is useful in preventing and detecting the accidents precisely by means of sensors fixed in the vehicles*

Keywords- Arduino Controller, GSM, GPS, MQ3, LM35, Piezoelectric Sensor, Eye Blinking

I. INTRODUCTION

The population of our country has been increasing rapidly which indirectly has increased the vehicle density and lead to many road accidents. The main causes of accidents include drunk driving, use of mobile phones, collision of vehicle with obstacles, over speeding etc. A lot of accidents are happening now-a-days because of increased vehicle density, violating rules and carelessness.

If other may see the accident but they don't have the number of hospital or police station. So it takes lots of time to inform a nearest hospital or police station. That increases the vulnerability of life of the people who got into accident. Besides, many people died on the way to the hospital due to lack of information about nearest hospital or delay for waiting for the ambulance. This project will implement a system that can detect accident and show the nearest hospital to the car passengers, also a hospital and police station will get notified about any accident occurred near to the hospital and police station.

The aim of this project is to minimize the road accidents occurring due to of drunk driving, eye blinking etc.

II. LITRATURE SURVEY

Smart Vehicle Accident Detection and Alarming System Using a Smartphone. In this system application is integrated with an external pressure sensor to extract the outward force of the vehicle body. It measures speed and change of tilt angle with GPS and accelerometer sensors respectively on Android phone. By checking conditions, this application also capable of reducing the rate of false alarm. [1] As smartphones become such an important part of our .Life, it is feasible to use smartphones in a post-accident fatality prevention system. This application uses the GPS receiver in phone to detect the rapid change of deceleration that occurred at accident time. It also takes the change of pressure from the pressure sensor and the change of tilt from an accelerometer sensor in a Smartphone. By detecting these three conditions as accident detection, this android app send the accident location for emergency help. An emergency Switch option also added to this app which provides a chance to driver for sending alert message without checking accident detection condition [1].

Alcohol detection and accident prevention of vehicle. In this paper they have used an alcohol detecting sensor in vehicle which senses and detects alcohol gases and sends messages continuously to their relatives within every 5 minutes [2]. The main part of this project is an Alcohol sensor. If the person inside car has consumed alcohol then it is detected by alcohol sensor. Sensor gives this signal to a comparator IC. The output of comparator is connected to the microcontroller. Microcontroller is the heart of this project. It is the CPU of the complete circuit. Microcontroller gives high pulse to the buzzer circuit and the buzzer is turned on. At the same time a relay is off. Due to this the ignition of the car is deactivated. If we don't want to turn off the ignition of car then we can use GSM and GPS modem for track location of vehicle. We have also use GSM and GPS module.GPS detect the location of vehicle with longitude and latitude and GSM will send messages to relatives of the driver [2].

Accident Avoidance and Detection on Highway. In this paper, they describe a real-time online safety prototype that controls the vehicle speed under driver fatigue. The purpose of such a model is to advance a system to detect fatigue symptoms in drivers and control the speed of vehicle to avoid

accidents [3] .In this process arm7 microcontroller is connected with GSM and GPS modules. GPS module gets the position of vehicle with longitude and latitude then via GSM it sends the messages to the relative of the driver until he reaches home safely [3]. By using ARM7 this system becomes more efficient, reliable effective. There are very less number of systems implemented on human behavior detection in or with cars. In this paper, we describe a real-time online safety prototype that controls the vehicle speed under driver fatigue. The purpose of such a model is to advance a system to detect fatigue symptoms in drivers and control the speed of vehicle to avoid accidents. The main components of the system consist of number of real time sensors like gas, eye blink, and alcohol [3].

Real Time Embedded System for Accident Prevention. The proposed system is composed of two separate design units: transmitter unit and receiver unit .Just before the vehicle is in the transmitter zone, the vehicle speed is controlled by receiving the signal from the RF transmitter. For this, RF transmitter can be kept at a few meters before the zone [4]. The main motive behind this paper is to reduce these reckless accidents for which we propose a system that controls the speed of the vehicle without any inconvenience to the driver. There are circumstances where the speed of the automobile is beyond the expected speed limit or the driver does not obey traffic
Signals. Therefore we are using RF technology [4].

A Novel Vehicle Safety Model: Vehicle speed Controller under Driver Fatigue. The main components of the system consists of a small camera for real-time drivers image acquisition, a nonlinear eye tracking algorithm based on Unscented Kalman Filter for driver fatigue detection, and an adaptive speed controller designed using the theory of sliding mode servo control for providing precise positioning of the throttle valve to control speed of vehicle. This system was tested adequately in a realistic driving environment with subjects of different genders, with/without glasses, day/night driving, commercial/noncommercial drivers, continuous driving time, and under different road conditions. The last experimental results show the validity of the proposed model for vehicle speed controller based on driver fatigue detection [5].

Launch Vehicle Mission Capability Enhancement through Global Positioning System Metric Tracking. The initial phase is development of the GPS MT System. ULA worked closely with the USAF to define and document the requirements for a GPS MT System for an EELV-class launch vehicle in the Range Commanders Council RCC324-1 document (RCC 324-01T-EELV, Global Positioning and Inertial Measurements Range Safety Tracking Systems Commonality Standard Tailored for EELV). The GPS MT System will provide precise LV position, velocity and timing information that can replace ground radar tracking resource functionality. In its initial configuration, the GPS MT System will provide an independent position/velocity S-band telemetry downlink to support the current man-in-the loop ground-based commanded destruct of an anomalous flight. To enhance cost effectiveness, the GPS MT System design is implemented using existing commercial parts, common test requirements for environments, and electrical/

Mechanical interface requirements for both EELVs. The EELV GPS MT System design is complete and the hardware is currently in functional and environmental
Qualification testing. The system utilizes a 50 channel all in view digital receiver with high dynamic environment compensation fed by antennas mounted diametrically opposed on the second stage airframe skin [6].

Drivers Drowsiness Detection Using Image Processing. Due to drowsiness, the driver cannot concentrate while driving, eye blink rate is decreased or increased and unable to keep eyes open. Fall-asleep crashes are very serious in terms of injury severity and may result in death. Drowsiness affects mental alertness and decrease an individual's capability to handle a vehicle safely.[7] The main concept of Drivers Drowsiness Detection is to capture a drivers face using a camera and accurately calculate the level of drowsiness. The proposed system consists of a camera pointing at the driver. A camera continuously captures images of driver. There are main five stages of processing: The first stage is to capture image using camera. Second stage is localization of head and check head position. Third stage is calculation of eye blink rate. Fourth stage is calculation of eye closing duration and fifth stage is to generate the alert. At different levels of drowsiness, different alerts will get generated [7].

III . SYSTEM ARCHITECTURE

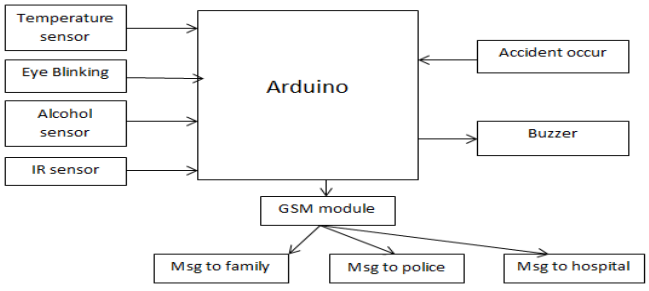

Fig. Car black box architecture

Whenever a person sits in a vehicle, the system checks for following parameters with the driver. The alcohol sensor - checks if the person has consumed alcohol or not.MQ3 sensor is suitable for detecting alcohol concentration from driver's breath. It has high sensitivity and fast response time. It provides an analog output based on alcohol concentration .If a drunk driver tries to sit on a driver seat, then the alcohol sensor MQ3 detects the presence of alcohol and blow the buzzer and unless the alcoholic person is replaced by a normal person, the vehicle wouldn't ignite .The camera used ensures that the person in driver seat does not fall asleep, through image processing. If an accident has occurred, the piezoelectric sensor provides a high value and it indicates the occurrence of an accident .Location of car is acquired using the GPS module. When accident is occurred message will be displayed in the android phones having GPS and GSM in it.GSM is a globally accepted standard for digital mobile communication.

The components used in this system are as follows:

• Arduino:

Arduino is an open-source platform used for building electronics projects. An arduino consist of both a physical programmable circuit board and a piece of software or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

• Alcohol Sensor:

The MQ-3 sensor will sense the alcohol content from human breath and gives its value to aurdino. The MQ3 is useful for detecting alcohol. SnO2 is sensitive element which is used to sense the alcohol.

• GSM:

GSM (Global System for Mobile Communication)it is technique it' operate over a SIM(subscriber identification module). In GSM techniques separate frequency slots are available for each SIM. The spacing between two band of frequencies channel is 666KHz. All over mobile phone system operate over frequency spectrum.

• **GPS:**

A GPS (Global Positioning System) navigation device is a device that accurately calculates geographical location by receiving information from GPS satellites. Initially it was used by the United States military, but now must receivers are in automobiles and smart phones.

• Buzzer:

Buzzer is audio signaling device, it is used in household appliances and automotive system. It consists of two transistor and buzzer ON and OFF is controlled by the pair of transistor.

• Piezoelectric sensor:

Detect and measure the vibration frequency created when accident will occur. It is the device that uses the piezoelectric effect, to measure changes in pressure, temperature, force by converting them to an electrical charge.

• Temperature sensor:

It measure the Temperature of Engine body. It senses the overheating of the vehicle by using buzzer.

IV. PROPOSED SYSTEM.

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If an accident has occurred, the piezoelectric sensor provides a high value and it indicates the occurrence of an accident .When accident is occurred message will be displayed in the android phones having GPS and GSM in it.GSM is a globally accepted standard for digital mobile communication.

• Stage I:

When person seats in car the system checks the values of alcohol, temp and seat belt condition. For e.g. For detection of proper seat belt is put on or not, for this purpose IR sensor is used for counting pulses of sensing how much length is pulling of seat belt and it is properly locked or not. An output of these both sensors is given to the Arduino. Arduino decides the seat belt is properly attached or not.

• Stage II:

Check stored data is in process or not. The system will compare both the threshold values. If the threshold crosses the stored threshold then buzzer will turn on which will notify the person seating in car that he is not in the condition of driving the car and should stop driving. .

• Stage III:

If over limit condition occur then the motor will not ignite and buzzer will be turned on. The circuit is designed to control the buzzer.

• Stage IV:

If accident occurs then system checks the force and sends the msg to the respective numbers saved in the SIM card depending upon the condition occurred. GPS helps in both tracking and navigation purpose. Tracking systems is used to keep track of the vehicle without the intervention of the driver. But a navigation system guides the driver to reach the destination without any disruptions. Both tracking and navigation uses the same architecture. As accident occurs the tracking stem detects the accident prone vehicle and a message is sent to the rescue team through a call or SMS.

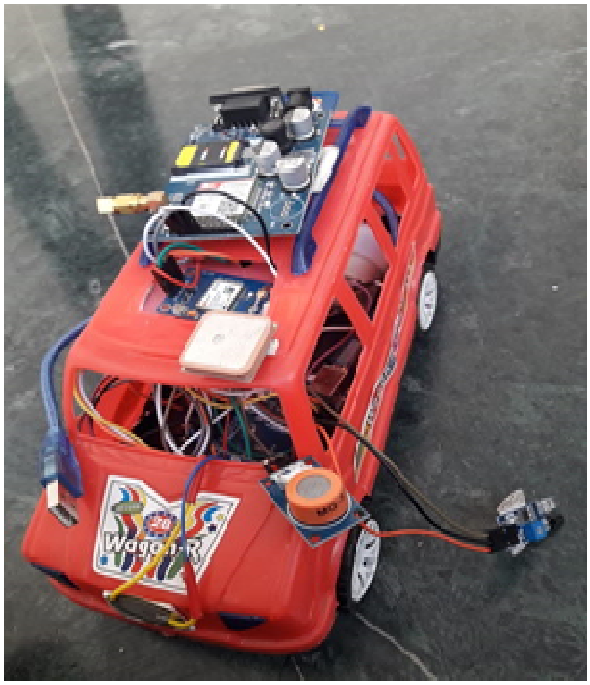


Fig. System Implementation

V. ALGORITHM

The main concept of 'Driver's Drowsiness Detection' is to capture a driver's face using a camera and accurately calculate the level of drowsiness. The proposed system consists of a camera pointing at the driver. A camera continuously captures images of driver. There are main five stages of processing: The first stage is to capture image using camera. Second stage is localization of head and check head position. Third stage calculation of eye blink rate .Fourth stage is calculation of eye closing duration and fifth stage is to generate the alert. At different levels of drowsiness, different alerts will get generated.

Let P (xF, yF) = (0, 0) be the vertex point of the captured frame. Let P (standX, standY) be the standard centre point for head position. Let fRect be the Region of Interest in which head is present.

Algorithm Drowsiness detection ()
{

Apply Haar Cascade algorithm to get vertex point P (xSelect, ySelect) of fRect.

currCX = ((xF+ xSelect + f Rect.x()) + f Rect.width ()/2) (1)
currCY = ((yF+ ySelect + f Rect.y()) + f Rect.height()/2) (2)

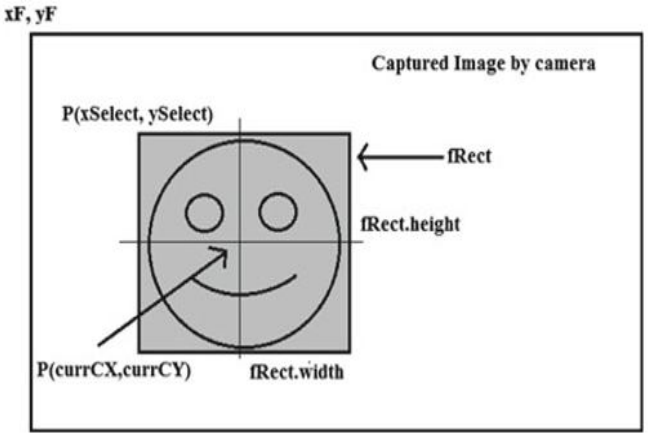


Fig. Terminology used in algorithm

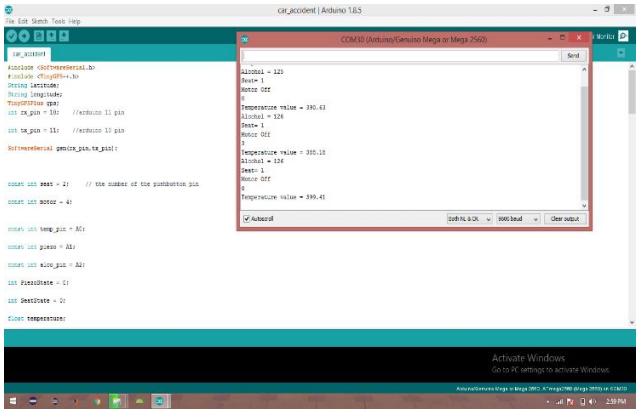
Find the distance between,
P (standX, standY) and P (currCX, currCY)

Distance=√ (currCX−standX) ∗ (currCX−standX) + (currCY −standY) ∗ (currCY −standY)……(3)
If (Distance>threshold value of head position)
Generate alarm.

wF = f Rect.width ()…….. (4)
hF = f Rect.height ()…….. …… (5)

Select (0, 0, wF/2, hF) and (wF/2, 0, wF/2, hF) as Rect1 for left eye and Rect2 for right eye, respectively.
Apply Haar Cascade algorithm on Rect1 and Rect2 to detect eyes.
If (Rect1==null && Rect2==null)
Blink_count++;
If(Blink_count>highthresholdvalueofeyeblinkrate||Blink_count<lowthreshold value of eye blink rate)
Generate the alarm.

VI. RESULT



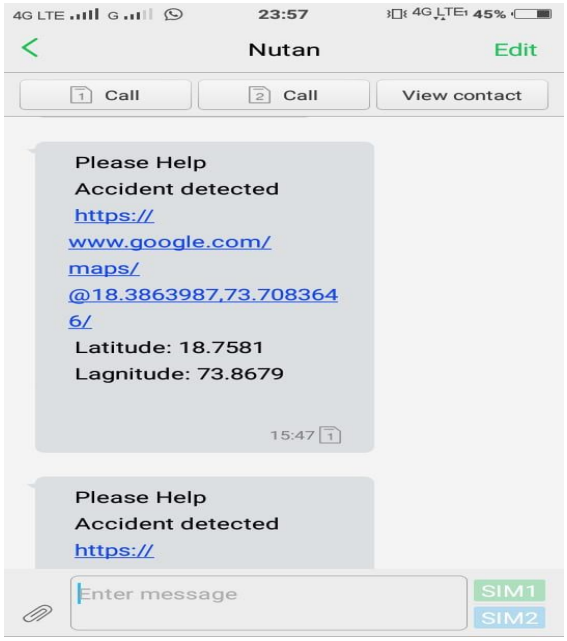


Fig. Alert message came to mobile

VII. CONCLUSION

Our system has been mainly designed in order to avoid accident. Accidents due to over speed, drowsy and drunken condition of the driver are prevented. Thus we can reduce alcohol and drowsy related road accidents. Because of the flexibility of the system it is compatible to any type of vehicle and is affordable to common man.

VIII. FUTURE SCOPE

In future scope we can use automatic brake system to stop the car automatically and also sound sensor can be used, in order to make it more accurate and efficient to detect an accident.

REFERENCES

[1] Adnan Bin faiz , Ahmed Imteaj , mahufuzulhoq Chouwdhury,"Smart Vechical Accident Detection and Alarming Syste Using a Smartphone", Institute of Electrical and Electronics Engineers 26-27 November 2015.

[2] Vijay Savani,Hardik Agarwal,Dhrumil Patel,"Alcohol detection and accident prevention of vehicle",International Journal of Innovative and Emerging Research in Engineering,Volume 2,Issue 3,2015.

[3] S.P. Bhumkar , V.V. Deotare , R.V.Babar,"Accident Avoidance And Detection On Highways",International Journal of Engineering Trends and Technology-Volume3,Issue2, 2012.

[4] Ancy John ,Asst.Prof.Nishanth P.R,"Real Time Embedded System For Accident Prevention",International Conference on Electronics, Communication and Aerospace Technology ICECA

[5] Zutao Zhang , Jiashu Zhang, A Novel Vehicle Safety Model: Vehicle speed Controller under Driver Fatigue, IJCSNS International Journal of Computer Science and Network Security, VOL.9 No.1, January 2009

[6] Theodore C. Moore , Tim Gray , Hanchu Li , Andrei Doran , Launch Vehicle Tracking Enhancement Through Global Positioning System Metric Tracking , 2013 IEEE

[7] Prajakta Gilbile, Pradnya Bhore, Amruta Kadam and Kshama Balbudhe,"Drivers Drowsiness Detection Using Image Processing," in Proceeding ofInternational Conference on Informatics, Electronics Vision, 2016