Proceedings of the Third International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC 2019)
IEEE Xplore Part Number:CFP19OSV-ART; ISBN:978-1-7281-4365-1

IoT Based Intelligent System For Vehicle Accident Prevention And Detection At Real Time

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Abstract— With an increasing number of vehicles, the number of accidents is also increasing at an unprecedented rate. Each year, among the total number of deaths 1.24 million deaths occurred due to the vehicle accident. In India, the root causes of these accidents are due to the drunken driver, drowsiness, and badly designed speed breakers. There is no effective mechanism to prevent these root causes. Our proposed system provides an efficient, cost-effective and real-time solution to prevent vehicle accident. When reading goes beyond predefined threshold values, an alert gets generated and if a driver does not take some action in specified time then our proposed system will handle the situation by cutting the fuel supply. Our proposed system uses a microcontroller named Arduino along with MQ-3 sensor, infrared sensor, accelerometer, and webcam. Arduino is used to regulate all these sensors.

Keywords—IoT, Accident, Arduino, Sensors, Vehicle, Drowsiness

I. INTRODUCTION

[1] It is obvious from the graph that throughout the years 2005 to 2015, an aggregate number of street mishaps, killings and wounds have expanded by 14.2 for each penny, 53.9 for every penny and 7.5 for every penny individually. The quantity of street mishap killings have been expanded alarmingly finished the years 2005 to 2015. The extend of deadly mishaps in all out street mischances has reliably expanded since 2005 from 19.0 for every penny to 26.3 for each penny in 2015. The seriousness of street mishaps, estimated as far as people slaughtered per 100 mischances has additionally expanded from 21.6 to 29.1 out of 2015.

In India, the root causes of these accidents are the drunk driver, drowsiness, and badly designed speed breakers. There is no effective mechanism to prevent this root causes. Our proposed system provides an efficient, cost-effective and real-time solution to all these problems.

The paper is organized as follows: Section 2 contains the review of related work. Section 3 contains Configuration of System. Section 4 contains system objective. Section 5 contains the experimental analysis and section 6 is the conclusions of this research work.

II. RELATED WORK

[2] Author proposed system i.e. smart helmet and report the accidents author used processor which will support WIFI connectivity and sensors. The proposed system is reliable and efficient but not cost effective. [3] Author proposed system i.e. e-NOTIFY which provides assistance to injured passengers and in traffic accidents using V2I and V2V communication. This system have OBU's to estimate the severity of vehicle accident and provide prevention according to situation. The system is feasible and efficient. [4] Author proposed system which uses microcontroller to perform activities like sending SMS alert and performing computational tasks proposed system uses vibration sensor to alert a user. This proposed system does not provide real time communication between vehicle and sensors. [5] Author proposed a system which focuses on HRV AND wheel grip force measurement. System support features like hands free auto-reply SMS, collision pre safe activation, mobile baseband monitoring, drunk and drive prevention. author uses ARM CORTEX M3 to perform all computational functions. In [6] author proposed a integrated system which detect the alcohol consumption of driver using breath analyzer sensor. Author has fixed a default which threshold, if alcohol consumption goes beyond threshold value, then fuel supply is cutoff. Author used microcontroller which is attached with GPS, GSM and alcohol detection sensor. [7] Author proposed a system which uses vehicle black box, seat belt sensor and eye blink sensor. This system uses microcontroller to control all sensors and send text message when accident or abnormal conditions occurs.

III. CONFIGURATION OF SYSTEM

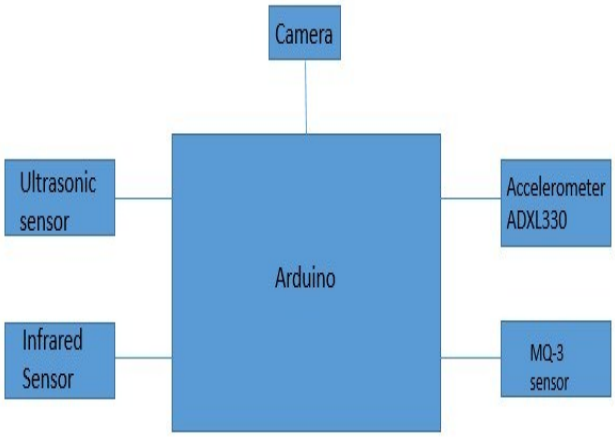

Fig. 2.Configuration of system

Our proposed system contains the camera, Ultrasonic sensor, Infrared sensor, MQ-3 Sensor, Accelerometer ADXL-330 and Arduino Uno R3. Arduino is a microcontroller which is used to process data and control sensors. Our proposed system uses MQ-3 sensor to detect the alcohol consumption. Our proposed system uses infrared sensor to monitor the eye of the human being. The infrared sensor contains IR LED and IR photo-diode. Our proposed system uses "OpenCV Library" to monitor mouth. Our proposed algorithm detect the number of yawns from the detected mouth. Our proposed system uses ultrasonic sensor to detect speed Bumpers on road [8-14].

IV. System Objective

A. Alcohol Detection

Our proposed system uses MQ-3 sensor to detect the alcohol consumption. The reason to choose MQ-3 sensor is that it is low cost and have high sensitivity to alcohol. It actually detects the ethanol in the air or human breath. It contains total 6 pins. It is basically alumina tube covered by tin oxide. When alcohol molecules in the human breath meet the electrode between SnO2 and alumina, ethanol burns into acetic acid and because of this more current is produced. More the alcohol molecules, more current we will get.

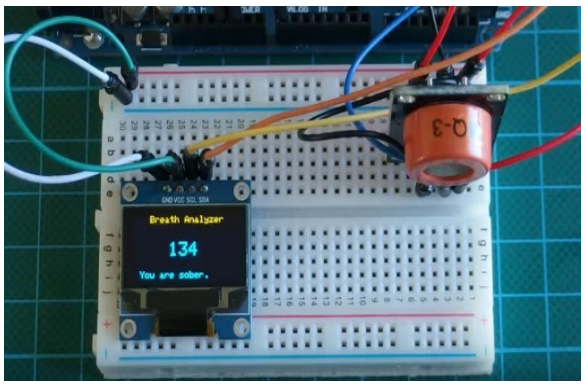

Fig. 3.Alcohol Detection Mechanism

B. Identify The Headings

Our proposed system uses infrared sensor to monitor the eye of the human being. The infrared sensor contains IR LED and IR photo-diode. Our proposed system uses IR LED to detect eye blink rate. A maximum amount of light is reflected from the eye when the eye is close because when an eye is closed, our skin part of the eye becomes opaque. If minimum amount of light is reflected then we can conclude that vehicle driver is feeling drowsy.

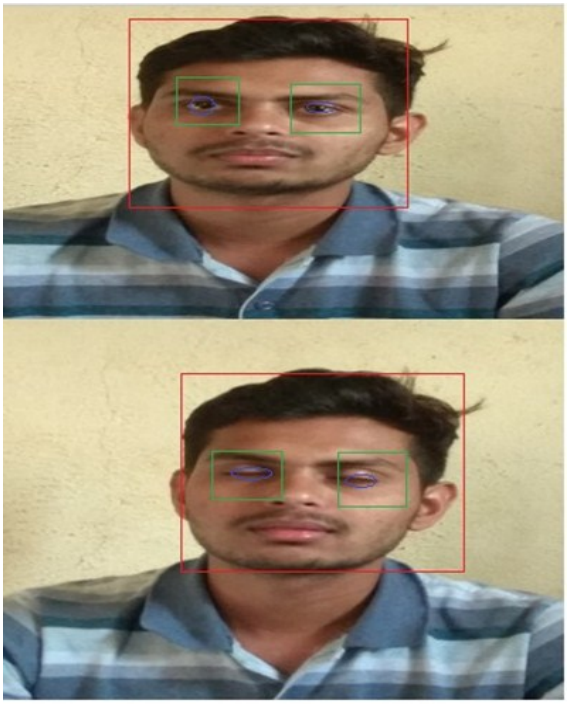

Fig. 4.Eye Blinking Detection

C. Head Movement Detection

Our proposed system uses accelerometer ADXL330 for detection of head movement. ADXL330 provides 3-axis detection. We have set each accelerometer axis two dedicated LED indicators - red and green. Both LEDs become off when there is no acceleration. One LED become "ON" if there is acceleration in any one direction. There are two methods to calculate new head position:-

1-Relative Mapping of coordinates

In this, every tilt angle corresponds to head step size and then this amount is added to the head's old position coordinates to calculate the new position.

2-Absolute Mapping of Coordinates

In this, every tilt angle corresponds to a position on the screen.

To convert acceleration to an inclination angle, our proposed system uses

$$\frac{A_{XOUT}}{A_{YOUT}} = \frac{1 \times \sin(\theta)}{1 \times \cos(\theta)} = \tan(\theta)$$

$$\theta = \tan^{-1}\left(\frac{A_{XOUT}}{A_{YOUT}}\right)$$

Where θ is the inclination angle in radians.

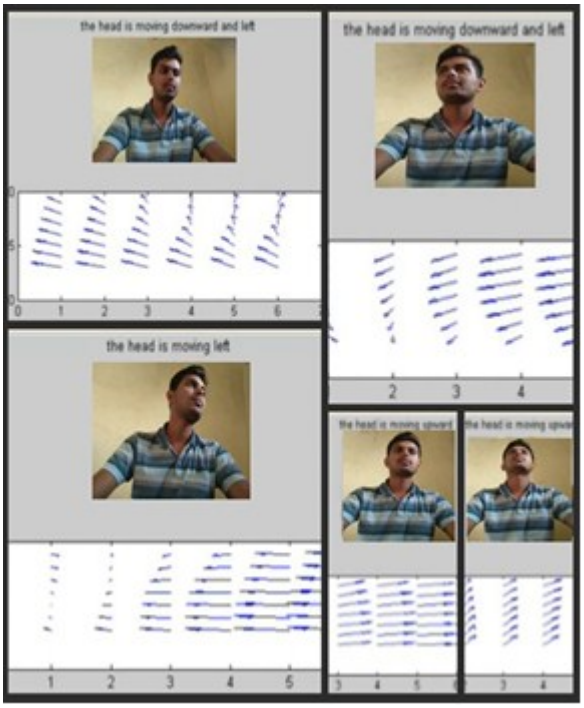

Fig. 5.Head Movement Detection

D. Mouth Detection

Our proposed system uses OpenCV library to monitor mouth. Our proposed algorithm detect the number of yawns from the detected mouth. An closed mouth is often brighter than open mouth. Image captured by camera is converted into Binary Image. As shown in Figure B image has less number of back pixels which indicates mouth is closed and D image indicates mouth is open because of yawn. If the detected yawns are more than threshold then driver gets alerted using voice messages.

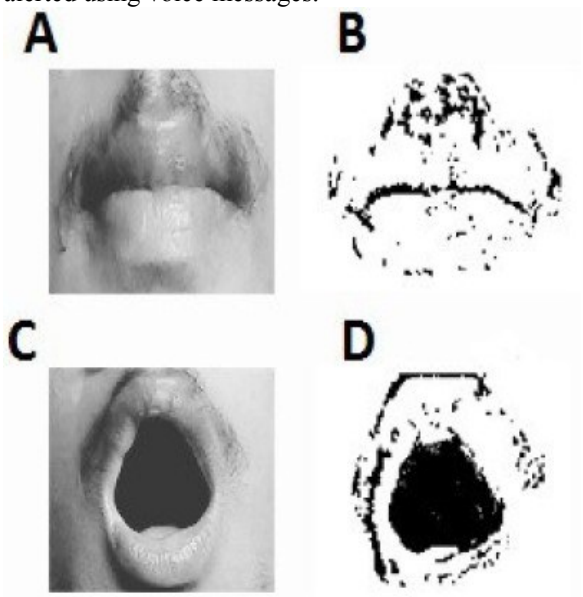

Fig. 6.Mouth Detection cases

E. Speed Bumper (or Speed Breaker) Detection

The proposed system uses ultrasonic sensor to detect speed bumpers on road. At night, many times these speed bumpers are not visible to us. To solve this problem our system uses the HC-SR04 sensor. It is fixed on the front side of vehicle. It changes its angle of rotation after defined threshold. If the transmitted ray is received by receiver then Speed Bumper is detected else not detected.

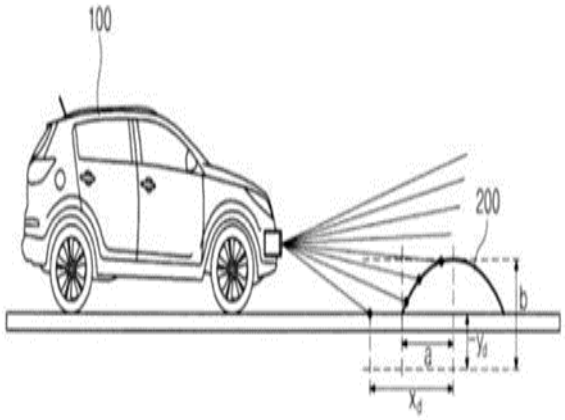

Fig. 7.Speed Bumper Detection

V. EXPERIMENTAL ANALYSIS

The below Figure describe the experimental setup

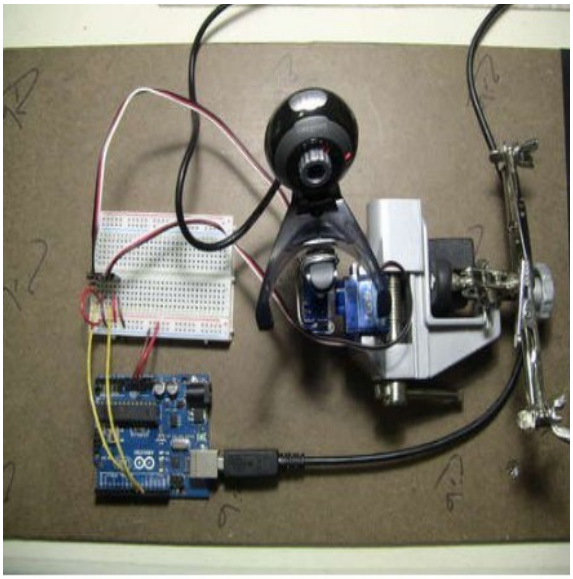

Fig. 7.Experimental Setup

Alcohol detection

Drinks	Approximate Blood Alcohol Percentage							
	Body weight in pound							
0	.00	.00	.00	.00	.00	.00	.00	.00
1	.04	.03	.03	.02	.02	.02	.02	.02
2	.08	.06	.05	.05	.04	.04	.03	.03
3	.11	.09	.08	.07	.06	.06	.05	.05
4	.15	.12	.11	.09	.08	.08	.07	.06
5	.19	.16	.13	.12	.11	.09	.09	.08
6	.23	.19	.16	.14	.13	.11	.10	.09
7	.26	.22	.19	.16	.15	.13	.12	.11
8	.30	.25	.21	.19	.17	.15	.14	.13
9	.34	.28	.24	.21	.19	.17	.15	.14
10	.38	.31	.27	.23	.21	.19	.17	.16

Table.1 –Alcohol Detection result

Eye Blink detection

Method							
		Our Method		Template matching		Motion Template	
User	Total Blinking	Detected	Accuracy(%)	Detected	Accuracy(%)	Detected	Accuracy(%)
User 1	32	32	100	31	96.88	26	81.25
User 2	30	30	100	22	73.33	23	76.67
User 3	30	30	100	13	43.33	28	93.33
Average			100		71.18		83.75
varience			0		720.15		74.13

Table.2 –Eye Blink Detection result

Head movement detection

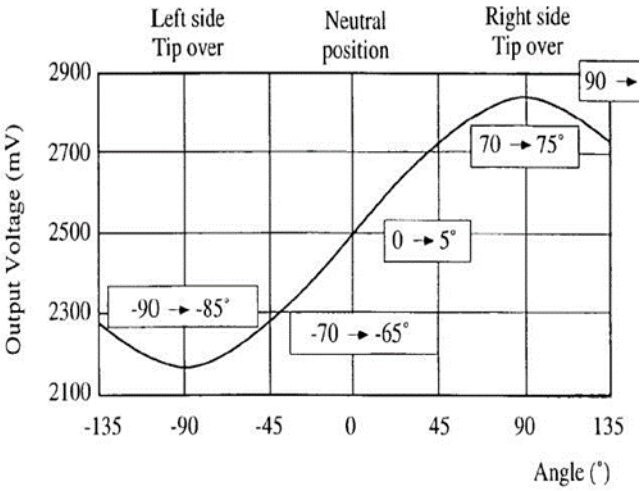

Fig.9-Head Movement Result

Shows the head movement detection in which the voltage changes with respect to change in accelerometer angle. Initially 0V is set at 5^0 i.e. at neutral position. Change in head movement beyond certain specified limits changes the output voltage & thus head movement is detected.

CONCLUSION

With an increasing number of vehicles, the number of accidents is increasing. The main factor for accidents is Consumption of alcohol, drowsiness, and badly designed speed bumpers. Our proposed system provides the efficient, cost-effective and real-time solution to all these problems. Our Model provides the efficient way to minimize the increasing number of accidents.

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