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IOT based Accident Prevention and Detection System using GSM-GPS, Eye blink, and Alcohol Sensor

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Abstract: ***Accidents are major issues these days. There are 2 basic reasons: Several accidents occur due to rash driving caused by drunken drivers. The second kind of accident occurs due to the sleepy-eyed condition of the person driving while driving long distances in the dark while not taking correct sleep. The eye blink sensor monitors the sleep state of a person and alerts the driver using a buzzer when an uncommon sleep state is detected. Accidents because of the associate degree alcoholic state of the person can be controlled and prevented with the assistance of an Alcohol sensing element assembled on a steering wheel. Accidents may be detected employing a vibration sensing element and a vehicle can be located by a GPS module. Accident alerts are then sent to the rescue team.***

Keywords: Arduino UNO, Eyeblink sensor, Alcohol sensor, GPS, GSM, Accident, Location, Drowsy, Vehicle safety.

I. INTRODUCTION

For reducing accidents, the reasons behind it must be understood. According to the records it is found that many accidents take place due to rash driving caused by the alcoholic state of drunken drivers. The second type of accident occurs due to the fatigue condition of the driver while driving a long distance at a stretch or driving at night without taking proper sleep. According to a report presented by the Ministry of Road Transport and Highways Government of India in 2011, 4.97 lakhs of road mishap have occurred, which is 1 accident per minute. Out of which 1.42 lakhs of people were found dead. It is also very common where accident victims do not get any medical help in time because of a lack of accidental information to nearby authority. The situation remains mostly unattended at night and in the streets where traffic is very low. In some cases, lives could have been saved if the medical team would have arrived timely. There are also cases where mishap occurs due to crossing a certain speed limit. In this project, all the major possible conditions have been taken care of.

No. of Accidents and No. of Persons involved: 2002-2011					
Year	No. of Accidents		No. of Persons		Accident Severity*
	Total	Fatal	Killed	Injured	
2002	407497	73650(18.1)	84674	408711	20.8
2003	406726	73589(18.1)	85998	435122	21.1
2004	429910	79357(18.5)	92618	464521	21.5
2005	439255	83491(19)	94968	465282	21.6
2006	460920	93917(20.4)	105749	496481	22.9
2007	479216	101161(21.1)	114444	513340	23.9
2008	484704	106591(22)	119860	523193	24.7
2009	486384	110993(22.8)	125660	515458	25.8
2010	499628	119558(23.9)	134513	527512	26.9
2011	497686	121618(24.4)	142485	511394	28.6
*Accident severity: No. of Persons killed per 100 accidents					

Table 1: Year-wise mapping of the accident [5]

From the above Table 1, it is observed that road accidents are increasing every year. The details of causes of accidents as given by Government of India is due to the driver (77%), weather conditions (1%), vehicle condition (2%), pedestrian fault (2%), cyclist fault (1%), road condition (2%), others (14%). It is also very common where accident victims do not get any medical help in time because of the lack of accidental information to nearby authorities [6]. Various solutions have been proposed for this problem in papers [2] to [10], but our system provides an effective and efficient solution to all the above problems.

II. REVIEW OF LITERATURE

A. The paper titled "Real-Time Google Map and Arduino Based Vehicle Tracking System" [2] stated that

This system can incessantly send SMS to the several mobile ranges if the system detects as per program. The magnetic sensing element notices the space between vehicles when this value crosses the defined value then sends SMS by the usage of Arduino and GSM modules. A buzzer is also used to alert the driver and another person close and liquid crystal display to bear in mind of the people inside the vehicle regarding the danger. This will increase the chance to cut back accidents [1].

B. The paper titled "Vehicle Tracking System Using GPS and GSM Technologies" [3] stated that

This system helps to track and determine the position of each automobile adopting GLOBAL POSITIONING SYSTEM as well as the GSM technology [10]. The motion and the quality of any vehicle can be monitored using the bundled system accordingly. The interaction between a GSM modem and a GPS receiver is controlled, powered and managed using a microcontroller. Processing of the instruction is done using an instruction set and acts as an ally between GSM and GLOBAL POSITIONING SYSTEM [3].

C. The paper titled "An IoT Based Accident Prevention & Tracking System for Night Drivers." [4] stated that

This paper presents an internet-based system entitled 'Eye Blink and head movement watching System', which is able to facilitate drivers to alert in somnolence. This method is predicated on the principle of watching eye movements of the driver unendingly using an IR sensing element and head movement using an accelerometer. If he/she falls asleep, then an alarm can ring to wake him/her up [4].

D. The paper titled "Controlled Inducement and Measurement of Drowsiness in a Driving Simulator" [7] stated that

This paper presents briefly the driver's drowsiness, looking for patterns psychologically and biomechanically that allow characterizing the somnolence cycle, and detecting its phases with new technologies. Physical signals, eye closure, longitudinal and lateral control of the vehicle have been recorded in a driving simulator [9]. This paper presents a laboratory experiment conducted with non-intrusive instrumentation during a driving machine, with a threefold objective: (a) to assemble info of medical speciality signals, and driving performance parameters, and movements of the eyes and therefore the body, from drivers in each wakeful and drowsy conditions. (b) Outline a variable supported EEG and PERCLOS, as recommended in the literature, to classify the sleepiness phases [7].

E. The paper titled "Vehicle Accident Prevent cum Location Monitoring System." [6] stated that

This paper presents very effective solutions to reduce road accidents and another post of accidental medical help. It provides an eye blink watching system, accident site locator, alcohol detector and safe distance watch and control system. It detects the somnolence and provides an alarm signal to the driver. Even after the alarm, the driving condition continues the brake mechanism of the vehicle is activated and further movement is restricted.

Proposed Papers	Different Features Included in the System				
	Alcohol Detection	Drowsiness Detection	Engine Locking System	Messaging System	Location Tracking
Our Proposed System: Location Tracking, Accident Detection, and Prevention using Eyeblink and Alcohol Sensor.	Present	Present	Present	Present	Present
Real Time Google Map And Arduino Based Vehicle Tracking System [2].	Absent	Absent	Absent	Present	Absent
Vehicle Tracking System Using GPS and GSM Technologies [3].	Absent	Absent	Absent	Present	Present
An IoT Based Accident Prevention and Tracking System for Night Drivers [5].	Absent	Present	Absent	Absent	Absent
Vehicle accident prevent cum location monitoring system [6].	Present	Present	Absent	Absent	Present
Controlled inducement and measurement of drowsiness in a driving simulator [9].	Absent	Present	Absent	Absent	Absent

Table 2: Comparison of our system with other systems

Table 2 provides a comparison of various features among our system and other proposed systems. It describes the presence and absence of different features in other systems and how our system overcomes those drawbacks, providing a complete solution for accident detection and prevention.

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III. PROPOSED SYSTEM

The accident prevention and detection system are used to detect and prevent road accidents. The accidents are caused due to the drowsy condition of the driver or due to the consumption of alcohol. This system makes use of various sensors and control units, along with some prevention mechanisms to make the system a complete one.

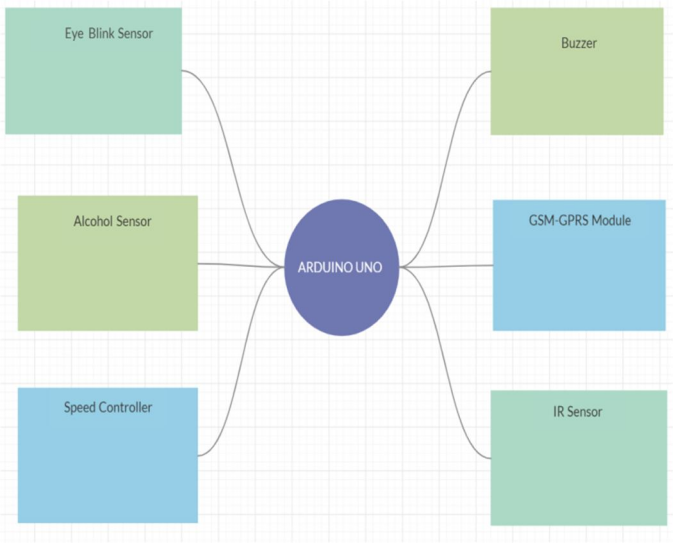

Fig 1: Block diagram of our system

The process of operating the above block diagram is explained as follows:
This project involves the measuring of eye wink using an IR sensing element. The IR transmitter transmits the infrared rays whereas the receiver receives the infrared rays back to the sensing element. If the eye is closed then the output of the IR receiver would be 1, else, the IR receiver output is 0, to grasp whether the eye is in closing or in gap position. The output is provided to Arduino UNO for alert indication. An associate measuring component placed on the driver's forehead measures the lean angle of the drivers in all directions. If the lean angle exceeds a precise threshold range, this output is given to the Arduino to indicate the buzzer. In conjunction with drowsiness detection, alcohol is also detected which restricts the driver to start the vehicle by an engine locking system. The location finding system which makes it a complete system for accident detection which makes use of GSM and GLOBAL POSITIONING SYSTEM systems for location identification and messaging system. The message will be automatically sent to the registered mobile numbers including the police station and ambulance numbers when a driver meets an accident.

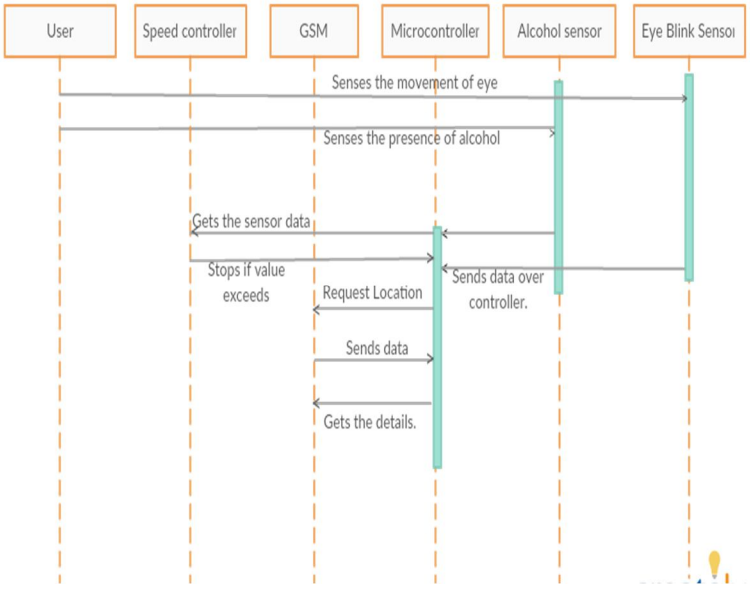

Fig 2: High-level diagram of implementation prototype.

A. Monitoring Eye Movement

We can determine whether he/she is sleeping or not by continuously watching the eye movement of a person. The eye is illuminated by an IR LED, that is steam-powered by the +5V power supply and also the mirrored light is recorded by an IR photodiode present inside the sensing element. The IR photodiode converts this reflected light into an associated electrical signal and given to Op-Amp. The Arduino drives the buzzer according to the output of Op-Amp.

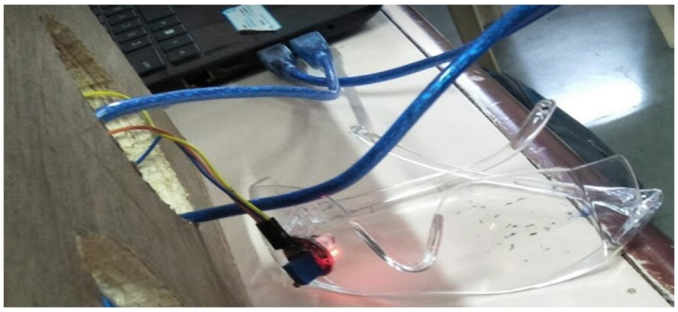

Fig 3: Eyeblink sensor module of our system

B. Alcohol Detection with Engine Locking

Drunken state of the driver is detected using an alcohol sensor which is generally used for the detection of alcohol concentration from the breath of the person driving the vehicle. It works like a common breath analyzer. It is very sensitive and also can give fast responses. Based on the alcohol concentration in-breath, the sensor provides an analog output. This sensor consists of SnO2, which is the most sensitive material. The conductivity of SnO2 is lower in the clean air. So if there is a presence of alcohol in the air, then the conductivity increases the accident rate. The sensing element will be placed on the steering wheel. This data will be logged and sent to Arduino which stops the engine according to the allowed threshold value of alcohol concentration.

Fig 4: MQ3 Alcohol sensor of our system

C. Location Identification using GPS

Location identification can be done using the Global positioning system which will be attached to the vehicle. On the detection of an accident, the GLOBAL POSITIONING SYSTEM will trigger and the current location of the vehicle along with the latitude and longitude will be sent to the registered mobile numbers. In this way, a person related to the driver will get the message as soon as the accident happens and can save the person's life with an immediate rescue.

D. Accident Alert using GSM

Sometimes an accident occurs at a remote location where medical help is not provided within the required amount of time and many lives are lost. To avoid this, we fixed a transmitter in the vehicle, which continuously sends the signal to the nearest receiver station. If a sudden accident occurs, the transmitter stops working and the receiver station does not receive any signal. A help message would be sent to the nearest station with the help of the GSM module. So the accident location can be predicted between two stations and medical help can be provided as exact locations with longitude and latitude are traced.

Fig 5: GSM 900A module of our system

E. Alerting the Driver

A buzzer is used here to alert the driver if the driver is entering into the drowsy or sleepy state. Thus, this system will make sure that if accidentally a person sleeps or feels drowsy while driving the vehicle buzzer will ring alerting the driver.

IV. RESULT

The below diagram shows how different sensors such as Eyeblink connected to the glasses and Alcohol sensor are connected to the main microcontroller.

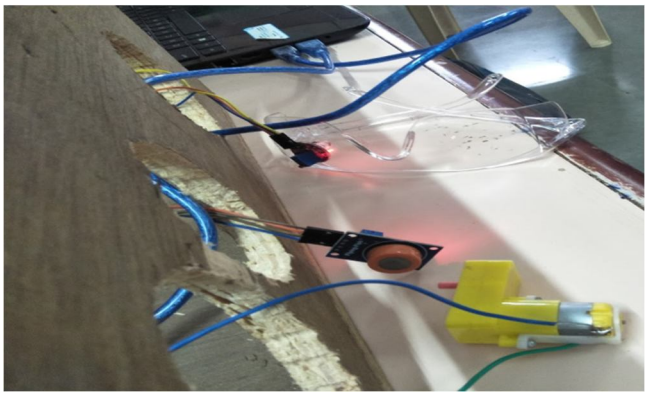

Fig 6: Our system

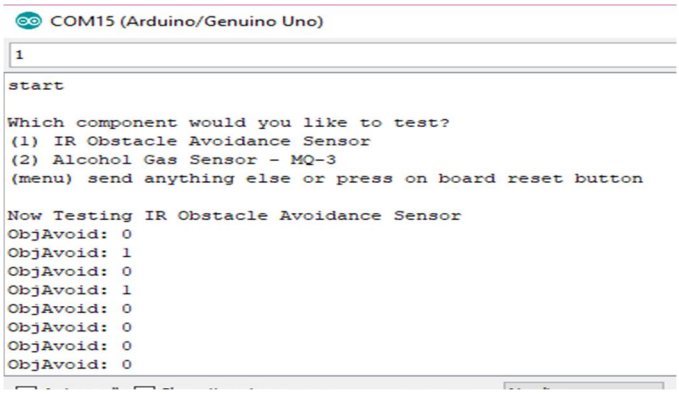

Fig 7: Result of IR of our system

Whenever the IR encounters an obstacle, it gives output 1, else gives 0. This demonstrates that whenever the distance between two vehicles is less than 0.5m it gives 1, so the driver gets the alert.

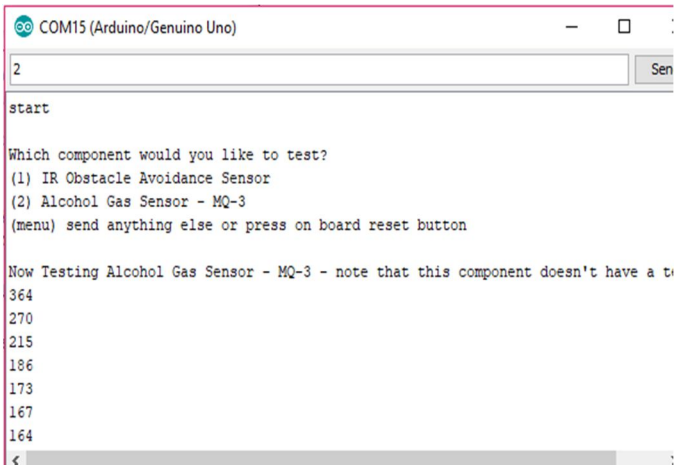

Fig 8: Result of MQ3

Whenever the sensor detects alcohol, it gives values, above 200 parts per minute, for a distance of 40 cm.

V. CONCLUSION

An effective solution is provided to develop the intelligent system for vehicles which will monitor alcohol consumption concentration of the driver of the vehicle and will send this data to the base unit, by using a hardware platform consisting of Alcohol sensor MQ3, Arduino, GSM and GLOBAL POSITIONING SYSTEM module. The system is highly reliable and cost-effective. To realize the system, all traffic police stations need to install dedicated electronic units. Installation of eye blink sensor and alcohol sensor has to be made compulsory for each and every vehicle. Adaption of this system will provide safer transportation and would reduce the increasing number of accidents caused due to the ignorance of drivers. Data collected would be used by government organizations and can take strict actions on a global level.

VI. ACKNOWLEDGEMENT

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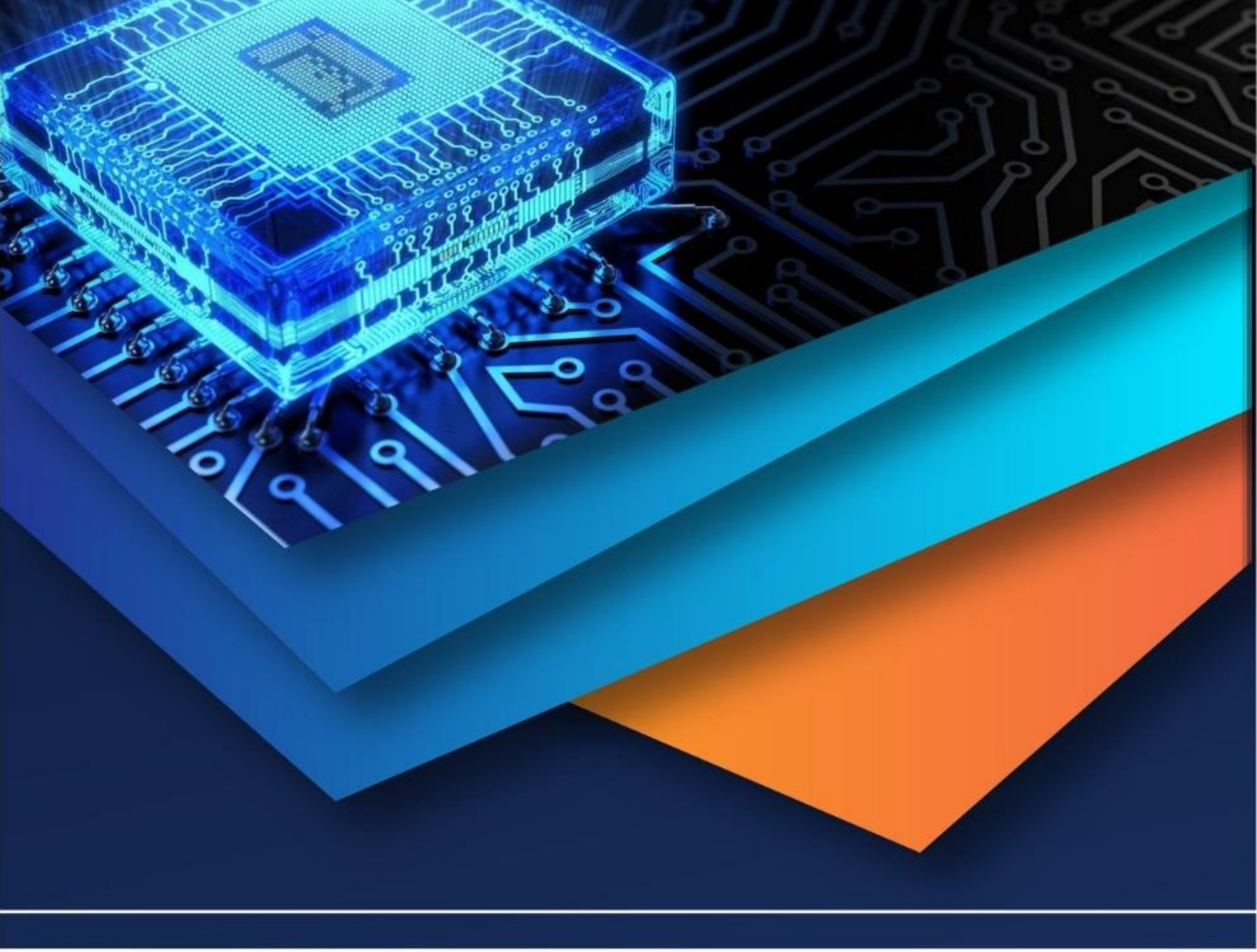

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