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Internet of Things Based Vehicle Accident Prevention and Detection System

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ABSTRACT

This paper involves development of smart IOT based vehicle accident prevention and detection for overall accidental safety. The primary motivation behind this framework is to alert the unfortunate casualty's family about the incident and it can distinguish the status of the vehicle driver. This paper involves drink and drive situation using alcohol detection-based ignition systems, drowsy driver situation where the vehicle should automatically park the car safely roadside as well as trigger and alert, brake failure indicator, the crash sensor to detect the head on collision implement emergency notification system which will send the SMS to the police station, family members and the hospitals when such accident occurs as well as update in IOT panel.

Keywords: *ESP-32 WIFI Controller, GSM, IOT, Motor drive, Sensors*

I. INTRODUCTION

The Road accidents are increasing day by day with this loss of human lives and injury is also increasing. With more than one death and four injuries every minute, India has the dubious distinction of reporting highest number of road fatalities in the world and the government says the prime reason is "drivers' fault".During the previous years, there were around 490,000 road accidents, which resulted in the deaths of 125,660 people and injured more than five hundred thousand persons in India. The majority of road crashes are caused by human error, Research has shown that driver error accounts for over 80% of all fatal and injury crashes on road collisions. The main causes of death and injury on roads remain speeding, drink driving and non-wearing of seat-belts. Thus, majority of people die in road accidents due to collision of the speeding car with another car or some obstacle. When we think about the serious accident, it could change your life- and not for the better.

The purpose is the need to develop an efficient system which can prevent accidents due to human or non-human errors also make sure help immediately arrives in case of accidents. Thus, contribution of paper involves development of smart IOT based vehicle accident prevention and detection for overall accidental safety.

II. PROBLEM DEFINITION

With the increasing number of accidents day by day lot of people are losing their precious lives. This motivates us to develop an innovative solution where the can automatically alert the user as well as take corrective action to prevent accidents saving lives. The problems of accidents due to drink and drive, drowsy drivers, brake failure and head on collision are increasing day by day. The majority of accidents is due to carelessness of others are also accounted for the loss of lives. There needs to be solution for different problems faced for avoidance of accidents

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and maintain safety.

III. OBJECTIVES

1. The main objective is with IOT based accident prevention and detection due to various errors such as driver drowsiness, drink and drive, collusion and brake failure.
2. To prevent the drink and drive situation using alcohol detection-based ignition systems.
3. To implement drowsy driver driving situation where if the driver who is driving the car feeling drowsy vehicle should automatically park the car safely roadside as well as trigger and alert.
4. To develop a brake failure indicator and alert system which can detect brake failure and immediately alert the driver
5. To implement accident detection system this detects the head on collision of the vehicle automatically trigger an help sms alert in case of accidents
6. To develop an IOT based system which will be used to track the location of the vehicle live on the maps in case of such incidents to make sure the help reaches on time using GPS

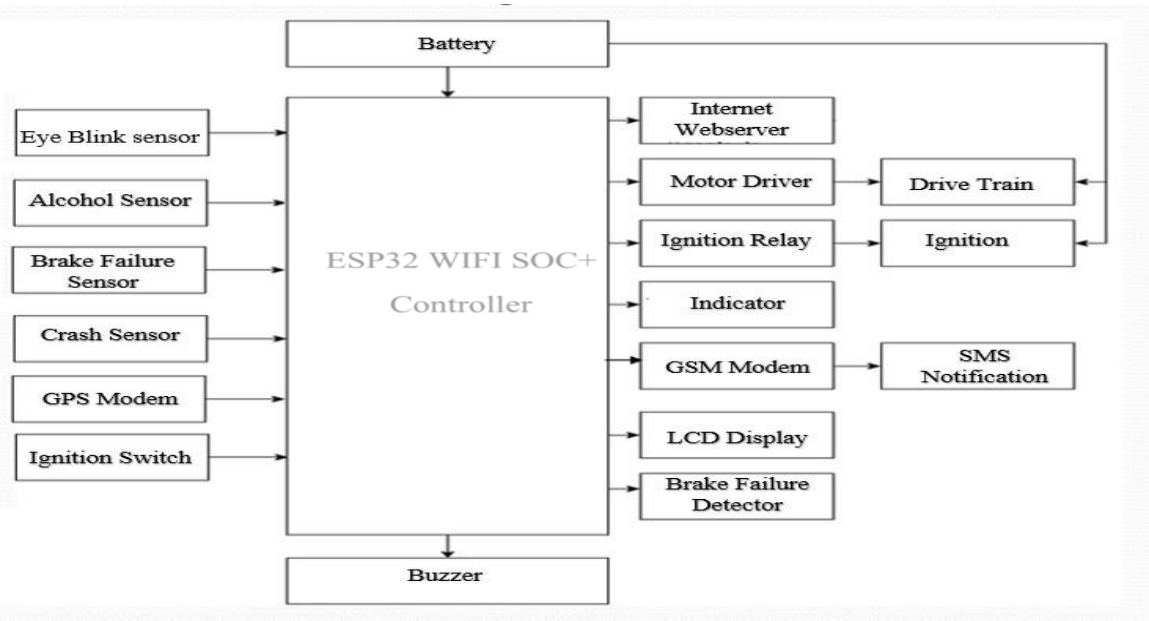

Fig.1: Block Diagram

IV. METHODOLOGY

The figure above shows the block diagram to illustrate the working principle of the system. As shown in the block diagram, the system consists of ESP32 controller as the primary controlling unit. The ESP32 controller board is interfaced to the wireless receiver module which can be used to controlling the remote-controlled prototype of the vehicle. For accident Prevention using Eyeblink Sensor the eye blink sensor is interfaced to the ESP32 which will monitor the drowsy state of the driver. If the drowsy state is detected and the car is moving the smart system developed immediately slows down the vehicle speed and parks the vehicle road side to prevent the accident due to drowsy driving. For alcohol Detection using Alcohol sensor (MQ-3) Alcohol sensor is interfaced to the system which will detect the alcohol intoxication levels and automatic cut off the vehicle ignition relay to prevent the

drink and drive situations. Brake failure Detection for the brake failure indicator sensor will indicate the user in case of brake failure. the ESP32 acts as a primary controller for fetching all the data from the various sensors and prevention of accidents. For accident Detection using Crash sensor the crash sensor is used to detect the accidents and if the accident is detected the esp32 automatically communicates with the GPS modem to fetch the location of the accident and sends sms notification to the police station and family members so that the help can arrive immediately and the IOT based cloud application is developed which can be used by the family members for live tracking on the maps if the accident is detected.

V. HARDWARE USED

ESP32 System on Chip Controller

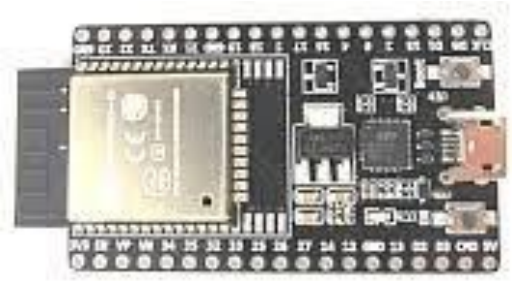

Fig.2:ESP32 system on chip controller

ESP32 is a series of low-cost, low-power system on a chip microcontrollers with integrated Wi- Fi and dual-mode Bluetooth. The ESP32 series employs a Ten silica Extensa microprocessor in both dual-core and single-core variations and includes built-in antenna switches, RF balun, poweramplifier, low-noise receive amplifier, filters, and power-management modules. ESP32 is createdand developed by Expressive Systems, a Shanghai-based Chinese company, and is manufacturedby TSMC using their 40 nm process. It is a successor to the ESP8266 microcontroller. NodeMCU isfamous for the ESP8266E module with LUA programming language. ESP32 is the big brother of ESP8266. It comes with dual core 32- bit processor, built-in Wi-Fi and Bluetooth, more RAM and Flash memory, more GPIO, more ADC, and many other peripherals

HC12 Wireless Trans receiver

The HC-12 is a half-duplex 20 dBm (100 MW) transmitter paired with a receiver that has -117dBm (2×10^{-15} W) sensitivity at 5000 BPS. Paired with an external antenna, these transceivers are capable of communicating up to and possibly slightly beyond 1 km in the open and are more than adequate for providing coverage.

Eye Blink Sensor

The eye-blink sensor works by illuminating the eye and eyelid area with infrared light, then monitoring the changes in the reflected light using a phototransistor and differentiator circuit. The exact functionality depends greatly on the positioning and aiming of the emitter and detector with respect to the eye.

Alcohol Sensor

The MQ series of gas sensors utilizes a small heater inside with an electro chemical sensor these sensors are sensitive to a range of gasses are used at room temperature. MQ135 alcohol sensor is a Sno2 with a lower conductivity of clean air. When the target explosive gas exists, then the sensor's conductivity increases more increasing more along with the gas concentration rising levels. By using simple electronic circuits, it converts the

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charge of conductivity to correspond output signal of gas concentration

Crash Sensor

Limit Switch are used as crash sensors. The crash sensors are used to detect the crashing or headon collision of cars

Sim800L GSM modem

Fig.3 Sim800L GSM modem

Ublox Neo 6m GPS Modem

The NEO-6M GPS module it comes with an external antenna, and does not come with header pins. So, you'll need to get and solder some has an external antenna and built-in EEPROM

LCD display

The 16x2 LCD used in this experiment has a total of 16 pins eight of the pins are data lines (pins 7-14), two are for power and ground (pins 1 and 16), three are used to control the operation of LCD (pins 4-6), and one is used to adjust the LCD screen brightness (pin 3). The remaining two pins (15 and 16) power the backlight

Buzzer

The buzzer consists of an outside case with two pins to attach it to power and ground. Inside is a piezo element, which consists of a central ceramic disc surrounded by a metal (oftenbronze) vibration disc. When current is applied to the buzzer it causes the ceramic disk to contract or expand. Changing the this then causes the surrounding disc to vibrate. That's the sound that you hear. By changing the frequency of the buzzer, the speed of the vibration's changes, which changes the pitch of the resulting sound.

DC motor driver

This L298 Based Motor Driver Module is a high-power motor driver perfect for driving DC Motorsand Stepper Motors. It uses the popular L298 motor driver IC and has the onboard 5V regulator which it can supply to an external circuit. It can control up to 4 DC motors, or 2 DC motors with directional and speed control

This motor driver is perfect for robotics and mechatronics projects and perfect for controlling motors from microcontrollers, switches, relays, etc. Perfect for driving DC and Stepper motors formicro mouse, line following robots, robot arms, etc. An H-Bridge is a circuit that can drive a current in either polarity and be controlled by Pulse Width Modulation (PWM).

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Features:

- Driver chip: L298 dual H-bridge driver chip.
- Operates up to 35V DC
- Drive part of the peak current Io: 2A / Bridge
- Logical part of the terminal power supply range Vss :4.5V-5.5V
- Logical part of the operating current range: 0 ~ 36mA
- Maximum power consumption: 20W

DC geared Motors

DC Motor 12Volts 60 RPM geared motors are generally a simple DC motor with a gearbox attached to it. This can be used in all-terrain robots and variety of robotic applications. These motors have a 3 mm threaded drill hole in the middle of the shaft thus making it simple to connectit to the wheels or any other mechanical assembly

Battery

The battery or power supply unit provides the required power to the entire system. As the goal was to develop a remote-controlled system, the battery used is 12V 1.2 Ah

VI. SOFTWARE USED:

Wamp server

WAMP Server 2.0 is a collection of web development tools & software's. It provides an environment for developing web pages & applications. It contains Apache Web Server, MySQL Database Management System & PHP Programming Language. So now you can develop your applications locally on you home PC and once you have developed your applications you can upload it to your webhost. Wamp Server 2.0 also provides some nice little tools for easymanagement of your databases, php my adl1 in & Sql Lite Manager are already installed. Interfaceof Wamp Server 2.0 is neat and clean. Being an open-source software, you can customize it the way you want. Most of the settings of this software can be accessed using a menu. You can directly access these setting right from the taskbar. It is available in around 20+ languages. You can also update it automatically using the menu from the taskbar. Apache & MySQL are the most popular software used in web development and if you use PHP as your language for developing web application then this software is a must.

VII. PHOTO OF MODEL:

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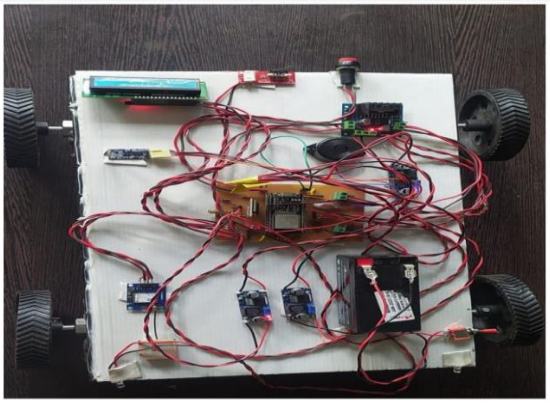

Fig.4:Working system

VIII. RESULT

Table 1 Result of Implemented model

Test case expected	Expected Result	Observed result	Test Result
Eye Blink Sensor test case	If drowsy state detected then speed of the vehicle slow down and indicator will on and park on the road side.	If drowsy state detected then speed of the vehicle slow down and indicator will on and park on the road side.	Pass
Alcohol Sensor test case	If it detects the alcohol toxication levels and automatic cut off the vehicle ignition relay to prevent the drink and drive situations	If it detects the alcohol intoxication levels and automatic cut off the vehicle ignition relay to prevent the drink and drive situations	Pass
Brake Failure detector test case	If the brake failure is detected it will not allowto start the ignition	If the brake failure is detected it will not allowto start the ignition	Pass

. IOT System:

The System was observed for the different Readings and the results were plotted. The table shows the readings recorded.

Table 2 IOT System for different readings

Parameter	Dataset	Readings actually Recorded	Efficiency
GPS	50	45	90

From the above table we can conclude that the efficiency of the system to take the readings is 90 percent. Since

the system uses light weight MQTT protocol, the webservice hit percentage was almost equal to complete.

The System was monitored for 8 minutes taking 50 sets of readings and the following wasobserved

Table 3 IOT System monitored for 8 minutes taking 50 sets

No of Readings	Time interval	Total time of observation	Readings recorded by server	Readings expected	Efficiency
50	10 seconds	8.3 mins	48	50	96%

From the above table we can conclude that the readings are being triggered to server reach at 96 percent. There was loss of 4 readings to 3 readings every 50 readings recorded. However, this lossis due to the network problem. Therefore, the system is expected to work at least 96 percent.

IX. ADVANTAGES

1. Can detect collisions between vehicles and triggers help alert so that help can reach immediately.
2. Can be implemented in all vehicles with little modification.
3. Automatically detects drowsy state and parks the vehicle to prevent accidents due to drowsy driving.
4. Brake failure indicator alerts in brake failure case before the start of ignition there bypreventing potential damage.
5. IOT based system demonstrates connected car there by helping family members to track the status in case of accidents.
6. Cost effective thus economically affordable.
7. Can also be used for parking assist.
8. Can avoid the drink and drive situation as the car won't start if the driver is drunk.

X. DISADVANTAGES

1. This system cannot be used in two-wheeler vehicle.

XI. APPLICATIONS

1. Can be used in all cars.
2. Can be used in commercial vehicles.
3. Can be used in public transport system.
4. Can be used in cabs.

XII. CONCLUSION

In this paper it is conclude that the concept can be usedto save lives of the people in accidents. The proposed system is expected to prevent the drowsy driving situations automatically by implementation of eye blink sensor based automated drowsy detection system. The system can detect the drowsy driver state and automatically control the vehicle speed to slow down the vehicle and park road side to alert and prevent accidents due to drowsy driving.

The proposed system is also expected to prevent accidents due to other errors suchas brake failure and drink and drive situations. The system is also expected to perform automatic accident detection using the crash sensor and send the notification to the police station so that helpcan arrive immediately using the GPS coordinates of the accident. The system is also expected to provide the android application using IOT protocols which can be used for live tracking of the accident on maps. Thus, proposed system is expected to provide a smart system using IOT whichcan be used to prevent as well as detect accidents as well also make sure help reaches on time in case of accidents.

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