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IMPLEMENTATION OF DRIVER DROWSINESS ALERT AND AUTOMATIC VEHICLE CONTROL SYSTEM USING ARDUINO

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Abstract: *In many cases, drivers who are drowsy make no effort to apply brake or avoid an accident. So, a system is designed which senses the condition of the driver (his/her health) and stops the vehicle immediately if an abnormal condition of the driver is sensed to avoid accidents. In this system a heartbeat sensor, an eye blink sensor, an alcohol sensor and a respiratory rate sensor are interfaced to an Arduino. If any of these sensors senses an abnormal condition of the driver, the vehicle automatically slows down and stops. A buzzer is placed in the vehicle which alerts the surrounding vehicles or the passengers inside the vehicle. At the same time an SMS alert consisting of the location and condition of the driver is sent to the registered mobile number.*

Keywords**:** *GSM, GPS, DC Motors, Alcohol Sensor, Eye blink sensor, Arduino, Pulse sensor.*

I.INTRODUCTION

"Drowsiness" is a state of strong desire for sleep or may cause due to illness. Sometimes high alcohol content in the body causes the wrong kind of sleepiness. Drowsiness is one of the reasons for most of the road accidents. These accidents are most common late at night and early in the morning. This is the body's natural sleep period. Accidents due to drowsy driver most often occur at high speeds on highways and other major roadways. Oftentimes, in this case at least one vehicle may change its direction suddenly which may lead to an accident situation. Heartbeat, respiration rate & the body status of the driver are the most important factors to be considered for a safe driving.
This system expects to reduce the number of accidents caused by drunken driving, which is very essential element for a prosperous life tomorrow. It alerts the driver and the surroundings with which we can save many lives.

II. SYSTEM OVERVIEW

The Driver Drowsiness Alert and Automatic Vehicle Control System (DDAAVCS) consists of Arduino Mega, Heart beat sensor (INVNT11), Alcohol sensor (MQ3), GSM (SIM900), GPS (UBLOX6MNEO), Eye blink sensor (eye gerber), Wi-Fi module (ESP8266), DC motor (12v 10 rpm).

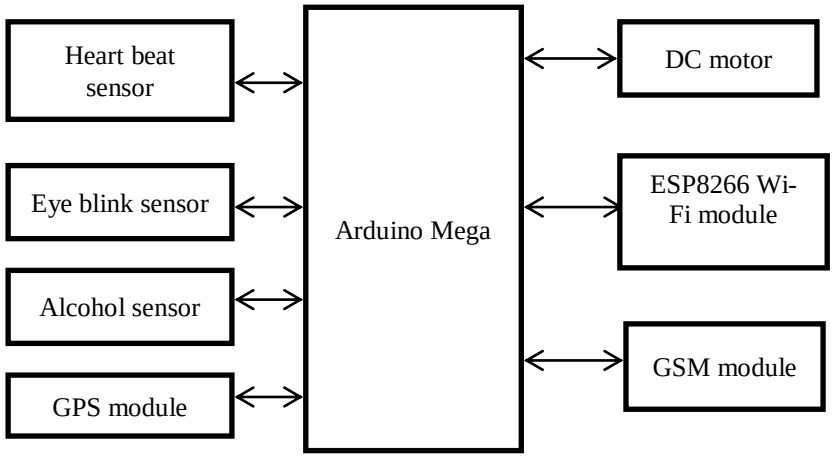
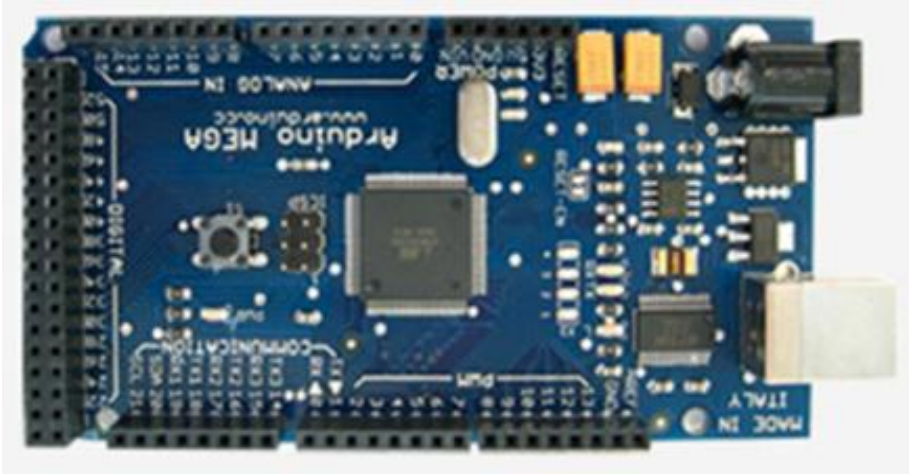


Figure 1. Block Diagram

A. ARDUINO MEGA

The Arduino Mega is a microcontroller board based on the ATmega1280. It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. To program this arduino we have a software called Arduino IDE



. ***Figure 2. Arduino MEGA***

B. BUZZER

A peizo electric buzzer is an electro mechanical signalling device, that are used in emergency or normal alarms, automobiles, household appliances such as a microwave oven, timers and game shows. Piezoelectric buzzer is just a flat piece of piezoelectric material with two electrodes. This type of buzzer requires some oscillators to drive it—if a DC voltage is applied, then a beep sound ocuurs. They are used in places where you need something that emits an audible tone, but don't care about high-fidelity sound reproduction. They are cheap and can be very loud without using very much power. They are also very thin, so they can be used in flat objects like "singing" greeting cards. Initially this device was based on an electromechanical system which is similar to an electric bell (which makes the ringing noise).

Figure 3. Buzzer

C. PULSE SENSOR

Heart beat sensor is designed to give digital output of heat beat when a finger is placed on it. When the heart beat detector is working, the beat LED flashes in unison with each heart beat. This digital output can be connected to microcontroller directly to measure the Beats per Minute (BPM) rate. It works on the principle of light modulation by blood flow through finger at each pulse.

Some of the features and applications of pulse sensor are

- Heat beat indication by LED
- Instant output digital signal for directly connecting to microcontroller
- Compact Size
- Working Voltage +5V DC

Applications

- Digital Heart Rate monitor
- Patient Monitoring System
- Bio-Feedback control of robotics and applications

The pulse sensor works on the principle of photolythesmography. Photo means nothing but light and Plethysmography is a measurement technique that can be used to measure the volume changes in different parts of the body.

A plethysmograph is a measuring instrument used to measure the changes in flow of blood volume within an organ or whole body.

This sensor optically detects the changes in blood flow volume via reflection from or transmission through the tissue. So the change the light intensity indicates the change in blood flow.
The pulse sensor has 2 modes of transmission

- Transmissive mode
- Reflective mode

Figure 4. Pulse Sensor

D. DC MOTOR

A DC motor is a rotary electrical machine that converts electrical energy into mechanical energy. Here the electrical energy supplied to DC motor is direct current (DC). The most common types depend on the forces produced by magnetic fields.
A DC motor consists of a current carrying armature which is connected to the supply end through commutator segments and brushes. The armature is placed in between north and south poles of a permanent or an electromagnet. When the direct current is supplied to the armature, a mechanical force acts on it due to the electromagnetic effect of the magnet and motor starts rotating. In practical DC motor, the permanent magnet is replaced by a field winding which produces the required flux called main flux and all the armature conductors, mounted on the periphery of the armature drum. It gets subjected to the mechanical force. Due to this overall armature experiences a twisting force called torque and armature of the motor starts rotating.

Figure 5. DC motor

E. MOTOR DRIVER

L293D is a Motor Driver IC which allows the DC motor to rotate in both clockwise and anti-clockwise direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously. This IC works on the concept of the H-bridge circuit. When a positive voltage is applied across the motor driver the motor starts rotating in one of the directions and by reversing the voltage the motor starts rotating in the opposite direction. Hence H-bridge ICs are used for driving a DC motor.

In a single L293D chip there are two H-Bridge circuit inside the IC which can rotate two dc motors independently. Due its size it is used in robotic applications for controlling DC motors.

Figure 6. Motor Driver

F. GSM MODULE

GSM stands for Global System for Mobile Communications. It is a standard set that was developed by the European Telecommunications Standards Institute (ETSI) to describe protocols for second generation (2G) digital cellular networks used by mobile phones.

The technology made it very easy to send and receive messages using GSM module that works on a simple AT commands which can be implemented by interfacing it to the microcontroller Rx and Tx pins. The GSM module used is SIM 900 which uses SIM memory to store the mobile number of the owner or housemates to whomever the messages have to be forwarded. It requires very less memory to send and receive text messages and operates on a simple 12 Volt adapter.

Sim900 is used in many projects and hence many modifications of development boards for this hav been developed. These development boards are facilitated with various features to make it easy to communicate with the SIM900 module. Some boards consist of only TTL interface while some boards include an RS232 interface and an USB interface.

Figure 7. GSM Module

G. MQ3 GAS SENSOR:

MQ3 alcohol sensor is a sensor used for estimating blood alcohol content(BAC) from a breath sample. This sensor is sensitive to alcohol concentration on one's breath. This sensor is similar to a common breathalyzer. Mq3 alcohol sensor has high sensitivity and fast response time. The output of this mq3 alcohol sensor is an analog resistive output based on alcohol concentration.

This sensor module has four pins. They are ground, Vcc, digital output pin and an analog output pin. The input voltage required for this sensor is 3.3-5V.

Figure 8. MQ3 Alcohol Sensor

H. EYE BLINK SENSOR:

Eye blink sensor is the sensor which is used to detect whether the eye is closed or open. There are different ways to detect a drowsy driver. Here we are using an eye blink sensor. It is an IR based eye blink sensor. It's working principle is same as IR sensor. If there is any obstacle detected, the output of sensor changes. In the same way, the output varies based on blink of eye.

In this project we are using an eye blink sensor to know whether the driver is drowsy or alert. If the blinking of eye is repeated for certain period of time then we consider that the driver is drowsy. This drowsiness can be due to lack of The eye blink sensor used in this project is Eye Gerber eye blink sensor. It has 3 pins –Vcc (supply) pin, ground pin and a signal pin. The output of this eye blink sensor is a digital output.

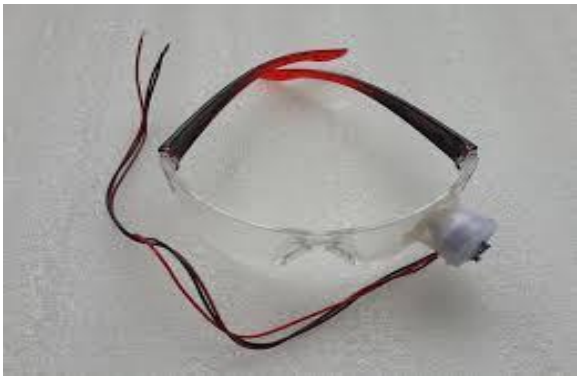


Figure 9. Eye Blink Sensor

I. GLOBAL POSITIONING SYSTEM:

Global Positioning System or GPS is a satellite navigation system that provides location. GPS is used for tracking or navigation of ships, vehicles, planes etc. the system gives critical abilities to military and civilian people around the globe. GPS provides continuous real time, 3- dimensional positioning, navigation and timing worldwide.

GPS system has 3 segments. They are:

- Space segment.
- Control Segment.
- User Segment.

The working of GPS is based on "trilateration" principle. The location of user is determined from the distance measured from the satellites. The target location is confirmed by fourth satellite and the other three satellites are used to trace the location. A GPS system basically consists of satellite, control station, monitor station and receiver. The GPS receiver takes the information from the satellite and uses this method to determine the user's exact location.

In this project the GPS module is used to send the location of the driver or vehicle to any of their relatives through an SMS if any abnormal condition is detected.

Figure 10. GPS Module

J. ESP8266 Wi-Fi MODULE

The ESP8266 Wi-Fi Module is a separate SOC with in built TCP/IP protocol stack that can help any microcontroller access to a Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module has a pre-programmed AT command set firmware that means, one can simply hook this up to one's Arduino device and get as much Wi-Fi ability as a Wi-Fi Shield offers.

The ESP8266 module is an extremely cost effective board.
This module has on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existence interfaces, it contains a self-calibrated RF allowing it to work under all operating conditions, and requires no external RF parts.

Figure 11. Wi-Fi Module

III. WORKING

This system is designed to senses the condition of the driver (his/her health) and stops the vehicle immediately if an abnormal condition of the driver is sensed to avoid accidents. In this system a heartbeat sensor, an eye blink sensor, an alcohol sensor and a respiratory rate sensor are interfaced to an Arduino. If any of these sensors senses an abnormal condition of the driver, the vehicle automatically slows down and stops. A buzzer is placed in the vehicle which alerts the surrounding vehicles or the passengers inside the vehicle. At the same time an SMS alert consisting of the location and condition of the driver is sent to the driver's relatives. Using a Wi-Fi module, the status or condition of the driver is updated in the local server.

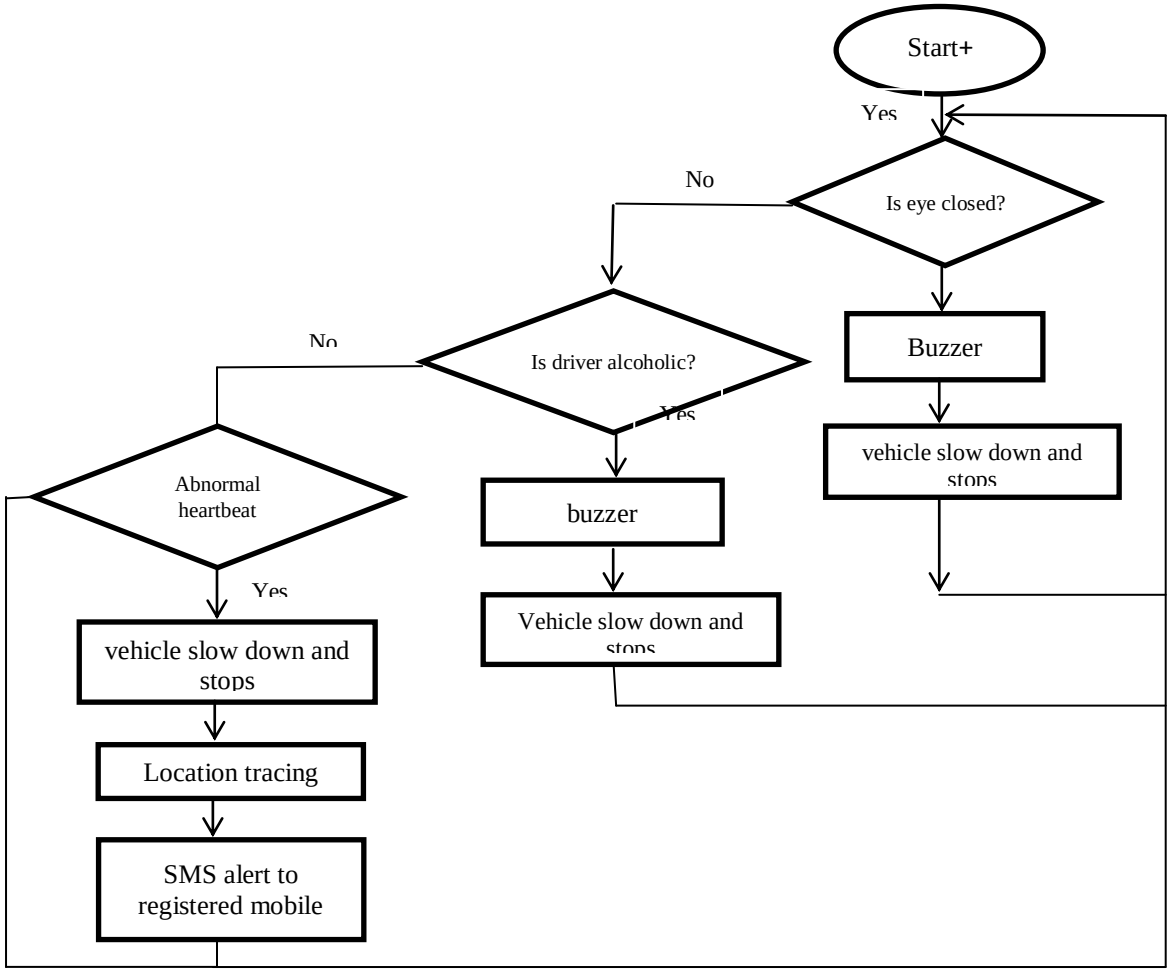


Figure 13. Flow Chart

IV. REULTS

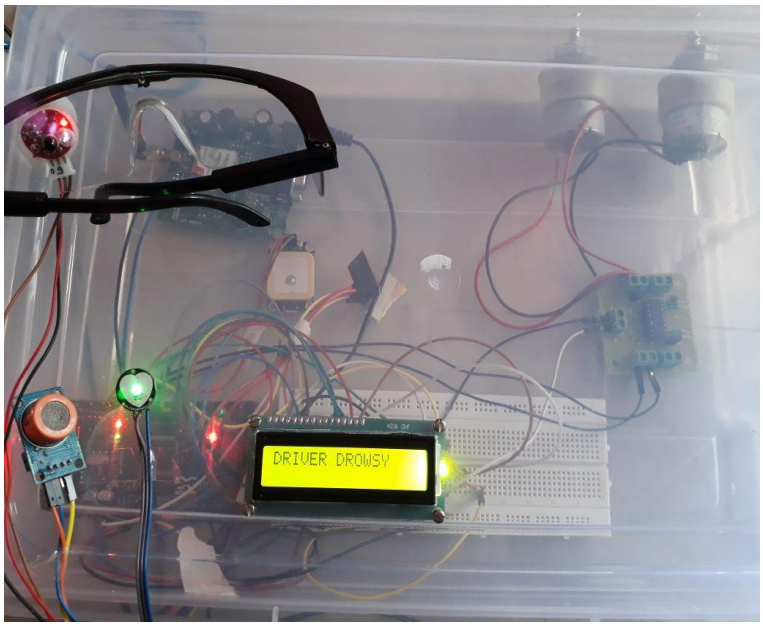


Figure 14. Top view of DDAAVCS

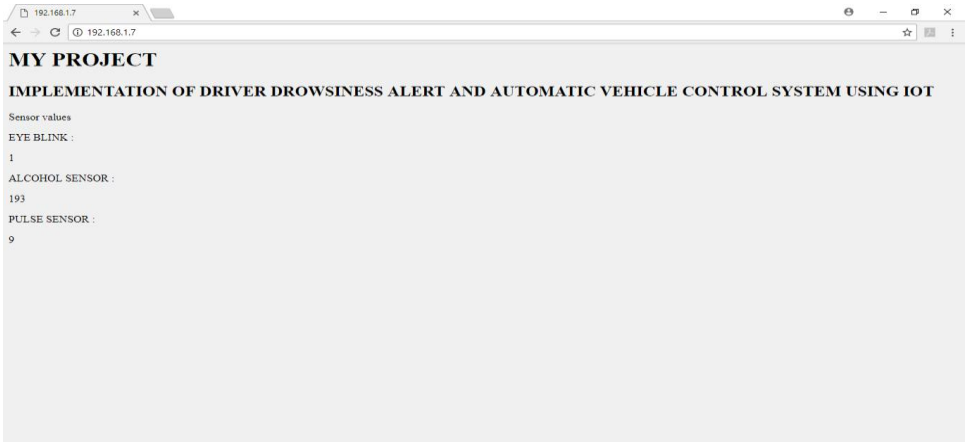


Figure 15.Sensors information in webpage

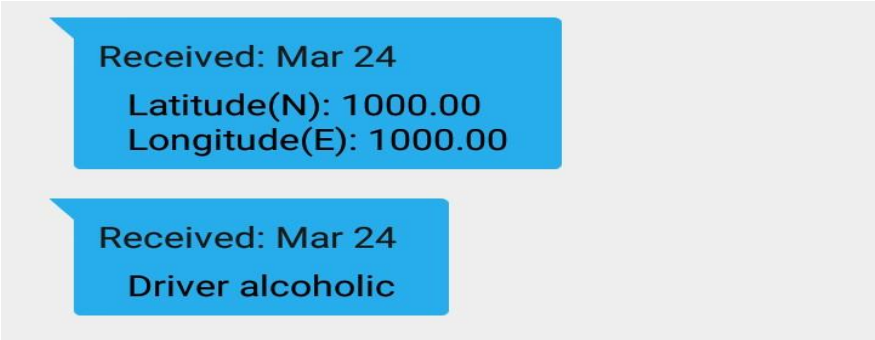


Figure 16.Recieved SMS

V. CONCLUSION

In this paper we have seen the system designed to reduce accidents caused due to a drowsy driver or drunken driver. So it helps in saving many lives and as the status of the driver is being updated in a local server, it can be verified from time to time to know the status or condition of the driver.

VI. FUTURE SCOPE

Drowsy driver alert system can be implemented in aeroplanes to alert the pilot if he faces any abnormal condition is detected.

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