

Sleep and Alcohol Detector

Varsha A¹ Sabin Khader² Roshmi C A³ Sam Vincent⁴ Sandra⁵

^{1,2,3,4,5}Department of Computer Science and Technology

^{1,2,3,4,5}Sahrdaya College of Engineering and Technology, Thrissur, India

Abstract— Drowsy while driving is now being a common issue among all drivers. As this is a very insidious problem, many people have been executed or harmed during crashes related to drowsy, heavy-eyed or exhausted conditions. The officials won't come to know the authentic facts since no one would be aware of when a motorist experiences sleepiness. Often the driver will not admit that he felt drowsy to evade being liable. Also, if the driver can't disclose anything before he/she dies, then public can't know how the crash occurred. So, grabbing the wheels when drowsy is seriously as daring as liquored up driving. Even though people know it's dangerous, it is still treated as an unrecognized traffic safety problem. It has proved from different studies that the main two risky behaviors are sleepy driving and drunk driving, which are interrelated to a reasonable rise in accidents these days. But most of the drivers do not identify the dangers of fatigued driving. It is seen that a person's cerebral and bodily function have been deliberately impaired because of sleepiness, which influence safety-critical tasks such as attention, operating, effective memory and coordination. The proposed system focuses on foreseeing driver lethargy by continuous monitoring the physiological conditions of a driver. The project targets at real time dangerous fatigue behaviors such as eye movements, head nodding and heart pulse activity. Hence it can be seen that these behaviors using motion sensors to timely warn driver to evade a collision.

Keywords: PC (Personal Area Network), OS (Operating System), LCD (Liquid Crystal Display), MEMS (Micro-Electro-Mechanical-System)

I. INTRODUCTION

Drowsy while driving is now being a common issue among all drivers. As this is a very insidious problem, many people have been executed or harmed during crashes related to drowsy, heavy-eyed or exhausted conditions. The officials won't come to know the authentic facts since no one would be aware of when a motorist experiences sleepiness. Often the driver will not admit that he felt drowsy to evade being liable. Also, if the driver can't disclose anything before he/she dies, then public can't know how the crash occurred. So, grabbing the wheels when drowsy is seriously as daring as liquored up driving. Even though people know it's dangerous, it is still treated as an unrecognized traffic safety problem. It has proved from different studies that the main two risky behaviors are sleepy driving and drunk driving, which are interrelated to a reasonable rise in accidents these days. But most of the drivers do not identify the dangers of fatigued driving. It is seen that a person's cerebral and bodily function have been deliberately impaired because of sleepiness, which influence safety-critical tasks such as attention, operating, effective memory and coordination. The proposed system focuses on foreseeing driver lethargy by continuous monitoring the physiological conditions of a driver. The project targets at real time dangerous fatigue behaviors such as eye movements, head nodding and heart pulse activity.

Hence it can be seen that these behaviors using motion sensors to timely warn driver to evade a collision.

II. METHODOLOGY

A. Existing Methodology

1) Breath Analyzer

A police officer in uniform or an officer of the motor vehicle department if required if any person driving or attempting to drive a motor vehicle in public place to provide one or more specimens of breath test, if found drunk then they can be punished under the section 185 MVA'88.

B. Proposed System

- The method for detecting driver drowsiness/sleepiness is developed on Arduino microcontroller board based on Atmega328P for real-time monitoring.
- The readings taken from different sensors used in this project can be seen in an Android based mobile device. It has an MQ-2 alcohol gas sensor to detect alcohol, if consumed by the driver and a relay circuit to stop him from performing the drive if alcohol consumed.
- The output from the relay activates the GSM module which sends a message to the driver family. MPU-6050 Micro-Electro-Mechanical-System (MEMS) accelerometer to read the head nodding conditions combined with a gyroscope and a temperature sensor to know the temperature inside the vehicle.
- The system is also able to monitor the driver physiological conditions such as eye blink detection using pulse sensor and eye blink sensor respectively. The alarm will be activated when the driver has consumed alcohol or driver head nods frequently or heart pulse rate goes above the limit or when driver eyes get closed. The microcontroller communicates with the android mobile through HC-05 Bluetooth module connected on the board.
- The android mobile is provided with the facility to view continuous readings from the sensors connected to the system along with the warning status messages through an android software based application installed in the end device.

III. SYSTEM REQUIREMENTS

We are using different modules for the project. It includes

A. Microcontroller (Arduino UNO)

Arduino boards basically entails with an Atmel microcontroller through corresponding modules that aid program writing and unification into supplementary circuits. A significant characteristic of Arduino is its regular connectors, which makes users easily handle in connecting the CPU board to other variety of add-on modules known as shields. Certain shields are capable of communicating with the arduino directly thru certain pins, but mostly

communicate thru I2C serial independently. Arduino's have made use of the mega AVR series of chips. Arduino compatible boards are been in supporting other processors to work on. Most boards have a 5V linear regulator and a 16 MHz crystal. Arduino microcontroller is preprogrammed with a boot loader that makes simpler for uploading programs to the on chip flash memory, because other devices need an external programmer. This makes arduino renowned for its easiness in programming with using a normal computer

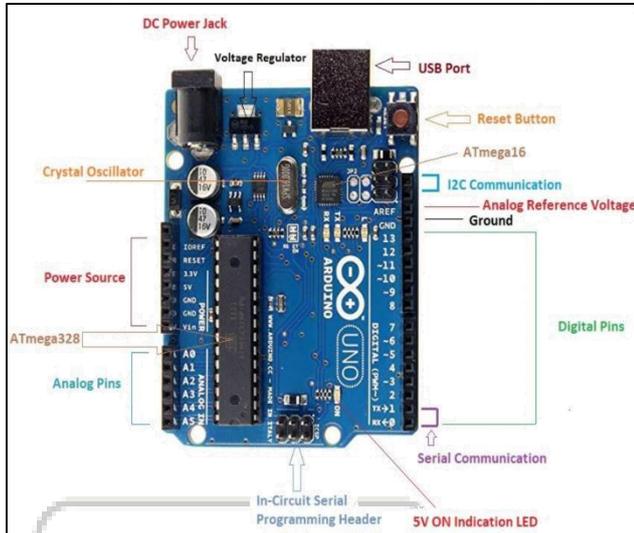


Fig. 1: Arduino Uno motherboard

B. Sensors

There are several type of sensors that we come along in this project

1) Eye Blink Sensor

Eye blink sensor is used to detect sleep in the drivers. It calculates the number of eye blinks and checks if the eye blink rate is less than the normal rate. If it is less then the buzzer rings and thermal energy is produced in the steering. The eye-blink sensor functions by lighting up the infrared light onto the eyelid area, and then monitor the variations in the reflected light with the help of a photo-transistor and a differentiator circuit. To get accurate results it would be determined by how exactly the emitter and detector are placed and targeted.

2) Pulse Sensor

It senses pulse and calculates the pulse rate. For a normal human being the pulse rate is 75 per minute. On an average we can take the input pulse rate as 55 to compare with so if the pulse rate becomes lower than this rate then the person is in verge of sleep. Heart rate data will be really useful for studying human activity for designing a system in which human involvement is really required. So in this system we have used a plug-and-play optical heart-rate sensing device working on the principle of photoplethysmography. The principle says it is a calculation based on the variation of light produced by the photo led with respect to a particular part of the body where the sensor is placed for reading the pulses. It comes up with an amplification and noise cancellation circuitry to achieve fast and consistent pulse readings. It needs a 5V DC supply with current drawn of just 4mA makes it feel as an excellent choice for arduino based projects. The

24" cable on the sensor comes up with standard male headers which means soldering is not needed.

3) MQ-2 Alcohol Sensor

The MQ-2 series gas sensor comprises of a small heater with an electrochemical sensor. They are profound for a range of gases and are used indoors. The output signal is an analog type and it can be read easily with the analog input of the arduino. MQ-2 gas sensor detects gas leakage in home and industries. It can sense LPG, i-butane, alcohol, propane, methane, hydrogen and smoke. It has a built-in potentiometer to adjust the sensor sensitivity.

Output	Level of Drunkenness		
	130 ppm – 260 ppm	261 ppm – 390 ppm	391 ppm – 650 ppm
LCD Display	Alcohol not detected	Alcohol detected	Alcohol detected
Buzzer	OFF	ON	ON

Table 1: Alcohol Detection Value Specification

4) MEMS MPU – 6050 Sensor

The MPU-6050 sensor is designed for the low power, low cost, and high-performance requirements. The MPU-6050 unites InvenSense's Motion-Fusion and run-time calibration firmware to reduce complex and costly system level integration for discrete devices in different motion facilitated products to supply best performance. The MPU-6050 devices come together with a 3-axis gyroscope and accelerometer on the same die, with an on-board Digital Motion Processor (DMP) which can deal with complex 6-axis algorithms. It can also access external sensors thru I2C or SPI communication port to allow the devices to collect all set of sensor data without interrupting system processor. The devices are offered in a 4 mm x 4 mm x 0.9 mm QFN package.

C. Other Components

1) Control Unit

The control unit is embraced by arduino mc board based on ATmega328P microcontroller. The Atmel ATmega328P is an individual from the Atmel 8-bit microcontroller family. Every individual of the family has distinctive measures of RAM, ROM, I/O ports, and so forth. Contingent upon the no. of outside pins necessary they are packaged with more than 100 or as less to eight.

2) GSM Module

The GSM module used is SIM900 Quad-band GSM/GPRS module. It is an ultra-compact and consistent wireless module. It communicates with the controllers by making use of AT commands and it supports software power on and reset.

3) Alarm Unit

Buzzer is used for giving warning signal. It indicates that the driver starts getting drowsy. Here we are using 5V DC, HXD piezo-buzzers. Piezo-buzzers are working under the principle of piezoelectric effect. When a mechanical pressure is applied to certain materials it produce electricity and vice-versa. When exposed to an alternating electric field they stretch or

compress, in accordance with the frequency of the signal by this means producing sound.

4) Bluetooth Module

The bluetooth device used here is HC-05 module which is an easy going Bluetooth SPP module (Serial Port Protocol) for translucent wireless serial connection. The HC-05 module can either be set in a Master or Slave configuration creating a notable resolution for wireless communication. This module is a fully fit Bluetooth V2.0 + EDR (Enhanced Data Rate), 3Mbps modulation with 2.4GHz radio transceiver and baseband [5]. It is benefited with CSR Bluecore 04 single chip with CMOS technology. The HC-05 module is a Slave by default factory settings. The AT commands determines the role of the module to work as master/slave. The slaves are limited to initiate a connection to another bluetooth module, but instead it can accept connections. Connection initiation to other devices can only be done by Master module. The user can easily make use of it to form connection between MCU, GPS, PC to project etc.

5) Relay

A relay can be defined as an electrically activated device. Relay circuit can be divided into two sections: - Input circuit and Output circuit. Input circuit is called control system and output circuit as controlled system. A relay is widely exploited in automatic circuit controlling. So it is said that, as an automatic switch actuated by a low-current signal to control a high-power circuit. A relay has many advantages like moving with lower inertia, stability, highly reliable, compact in size. It is widely applied in devices which need power protection, automation field, remote controlling, electro-mechanics and power electronics. The middle part between input and output part is for coupling and isolating input current besides output actuation.

6) LCD Display

LCD (Liquid Crystal Display) is been made use as a part of all the electronics works to show the status of the procedure. A 16x2 alphanumeric LCD is most generally utilized module of LCD these days. There are a few other kind of LCD obtainable too. The intention for selecting LCD above other display components is because it is:

- Low cost
- Easily programmable
- Large number of display character etc.

16x2 LCD owns 2 horizontal lines, embracing a room for 16 displaying characters. It has 2 types of registers in-built:

- Command Register
- Data Register.

Command register is made use to supplement special commands into the LCD. A command is a special form of data which makes use of giving internal commands to LCD like clear screen, move to line 1 character 1, setting up the cursor etc. Whereas data register is made use to supplement a data into the LCD.

D. IDE And The Programming Language Used

The programs are programmed in Integrated Development Environment (IDE) using Arduino IDE and the latest version of Arduino software is used for developing and compiling the program. The programming language that mainly support the Arduino software is the embedded C so the same

programming language is used for developing the project code here.

IV. UNITS

The units used for various measurements in this system are; The alcohol content in the air exhaled by the driver is measured in PPM (parts per million), the readings are taken by the MQ-2 Gas sensor and passed over to the microcontroller. If the alcohol content in the air >261 ppm, then the driver is drunk. The heart pulse rate of the driver is measured in BPM (beats per minute), which is calculated by the pulse sensor. For a normal person, the pulse rate is 75 bpm; If the pulse rate < 55 bpm then the person is about to sleep. The steering is heated to 360 K in case the driver is feeling sleepy and refuses to take rest even after warnings, with the help of nichrome wire that heats up when voltage becomes high.

V. SYSTEM ARCHITECTURE

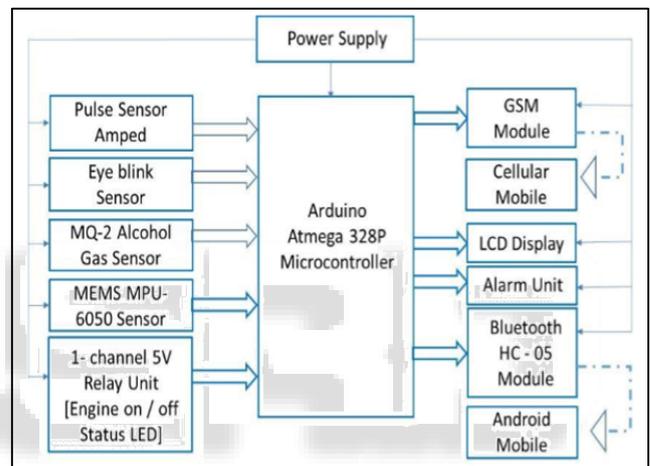


Fig. 2: Architecture of Sleep and Alcohol Detector

VI. CONNECTIONS

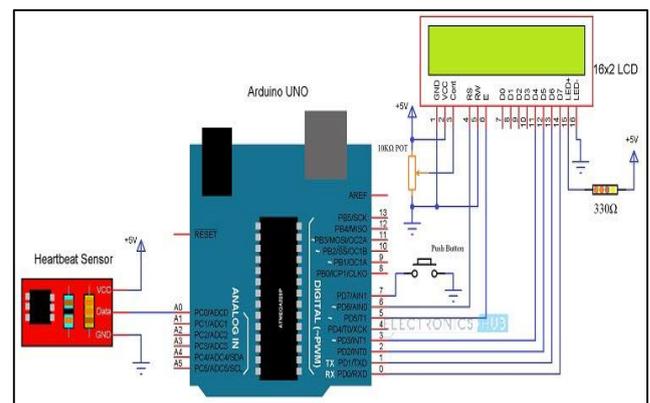


Fig. 3: This connection is given with Arduino Uno Heart beat / Pulse sensor and LCD Display

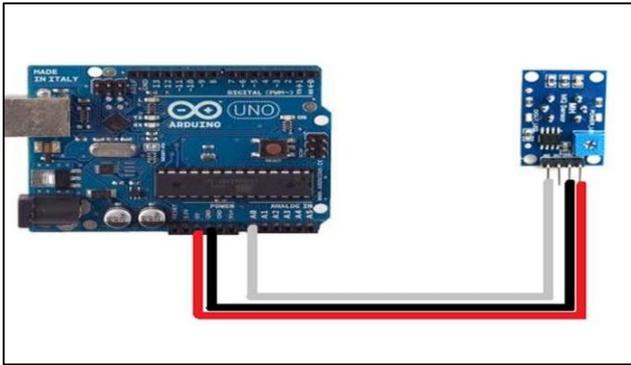


Fig. 4: This connection is given with Arduino Uno and MQ-2 Alcohol Sensor

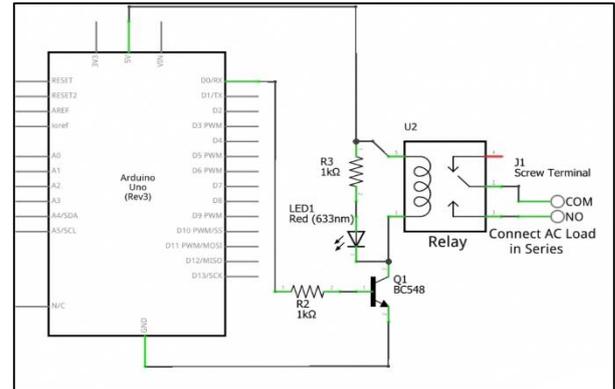


Fig. 8: This connection is given with Arduino Uno and Relay

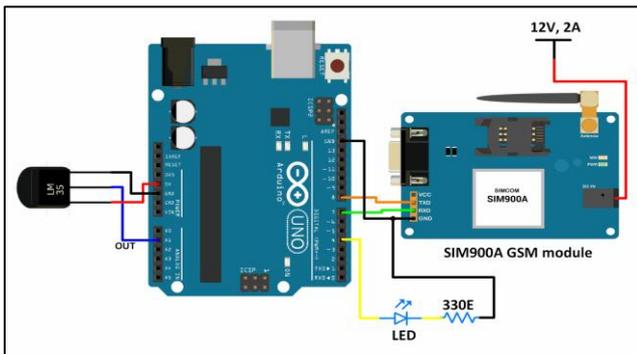


Fig. 5: This connection is given with Arduino Uno and GSM Module

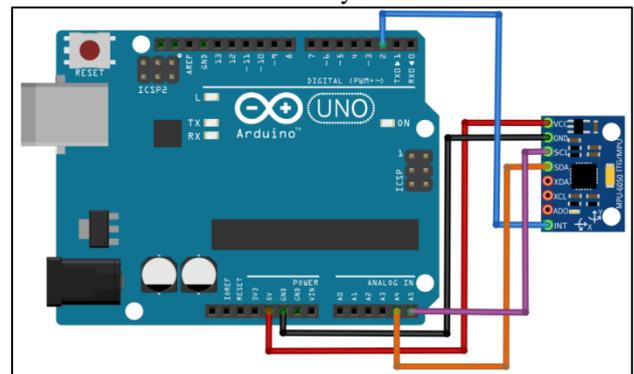


Fig. 9: This connection is given with Arduino Uno and MEMS MPU – 6050 Sensor

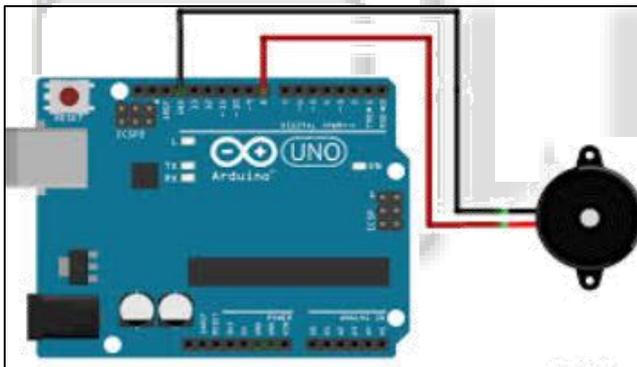


Fig. 6: This connection is given with Arduino Uno and Buzzer / Alarm Unit

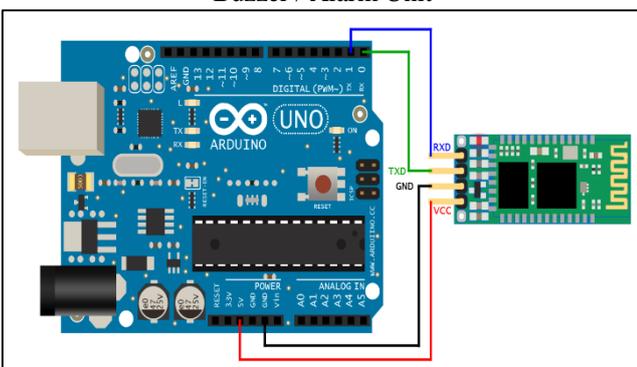


Fig. 7: This connection is given with Arduino Uno and Bluetooth Module

VII. IMPLEMENTATION AND TESTING

A. Implementation

The language used for coding the project is C/C+. The program is implemented on a system by transferring the appropriate folder in which the program exists to the user's computer. The program is written using Arduino Software (IDE) on a Linux and Windows PC respectively. Before implementing the code, the code was tested and analyzed by all members of the group and made sharper and more efficient.

B. Testing

The folder in which the program is stored is transferred onto the testing PC. The testing PC was a normal PC with average technical specifications. Then connected the PC with the arduino and the program was loaded to it. The heart pulse input was given to test the system. Also using eye blink sensor the number of eyeblink were calculated and upon which the output, the buzzer rang for coded cases.

VIII. FLOWCHART

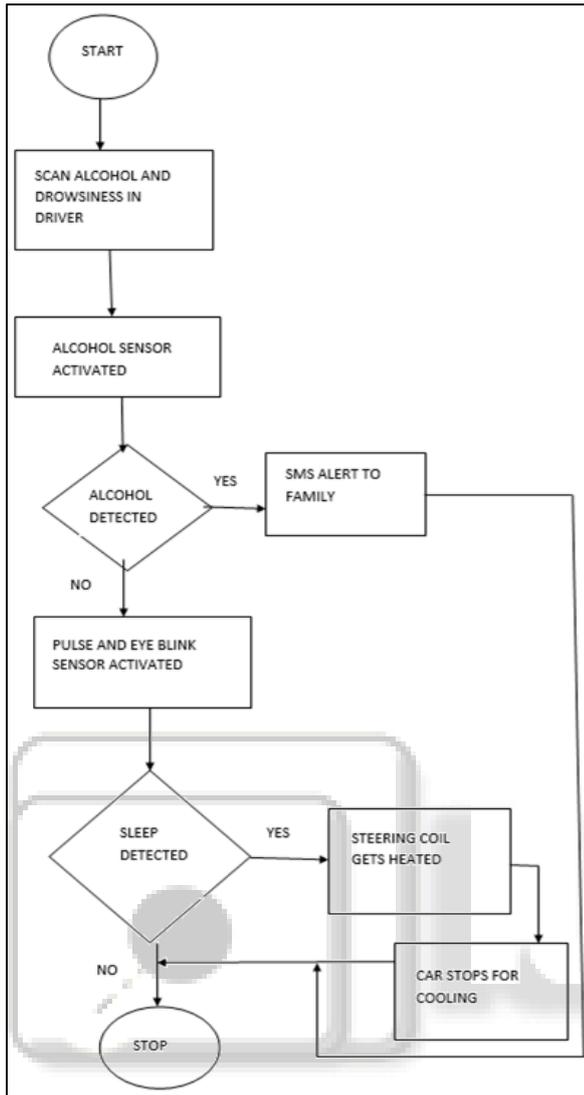


Fig. 10: This flow chart describes on the working of Sleep and Alcohol Detector

IX. CONCLUSION

The system implemented is a progressive prototype of driver drowsiness detection and alerting system. This system is focused on bringing safety while driving. The alcohol sensor output was linked with relay and SMS facility is also incorporated to notify the driver's family. The behavioral and physiological sensors resulted in providing appropriate safety measures for safe driving. The project work was put up for study and the implementation on Arduino board with the Atmega328P microcontroller was done. The hardware and programming was prepared in care for successful operation. The aim of this project was to detect and alert the driver when he feels drowsy. That was achieved by doing assessments with this system. The results shows a promising output as it is being a progressive prototype. This project carried out the research in learning about different types of sensors and modules and its application. The user friendly approach made it easy to understand and operate the system. This system uses very low power, with less complexity in a low cost manner so it can be implemented on road transport vehicles.

REFERENCES

- [1] Lestin Jills Joseph, "Arduino based real time driver drowsiness detection and mobile alert system using Bluetooth", International Journal of Engineering and Computer Science ISSN: 2319-7242.
- [2] Dr. Lokesha .M, Arduino based real time driver alcohol detection and mobile alert system", International Journal of Engineering and Computer Science.
- [3] UMME SAIRA HABIBA," Eye blink detection system with heart rate sensing", BRAC University, Dhaka.
- [4] Pankaj Verma & J.S Bhatia, "GPS and GSM based vehicle tracking system", International Journal of Computer Science, Engineering and Applications (IJCSEA).
- [5] Pranjali Ingalepatil, Priyanka Barhate, Bhagyashri Nemade & Vijay D. Chaudhari, "Alcohol Detection System in Vehicle Using Arduino", International Research Journal of Engineering and Technology (IRJET) Volume: 04 Issue: 06 | June -2017.
- [6] Rajesh Shrestha," Study and Control of Bluetooth module HC-05 using Arduino Uno", Department of Physics, Tribhuvan University, Nepal.