SMART VEHICLE MONITORING

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Abstract: Drowsiness and fatigue are one of the main causes leading to road accidents. They can be prevented by taking effort to get enough sleep before driving, drink coffee or energy drink, or have a rest when the signs of drowsiness occur. The popular drowsiness detection method uses complex methods, such as EEG and ECG. This method has high accuracy for its measurement but it need to use contact measurement and it has many limitations on driver fatigue and drowsiness monitor. Thus, it is not comfortable to be used in real time driving. This paper proposes a way to detect the drowsiness signs among drivers by measuring the eye closing rate and yawning.Gas sensor measures the concentration of gas in its vicinity. Gas sensor interacts with a gas to measure its concentration. Each gas has a unique breakdown voltage i.e. the electric field at which it is ionized. Sensor identifies gases by measuring these voltages. The concentration of the gas can be determined by measuring the current discharge in the device.Micro-electromechanical systems (MEMS) is a process technology used to create tiny integrated devices or systems that combine mechanical and electrical components. They are fabricated using integrated circuit (IC) batch processing techniques and can range in size from a few micrometers to millimeters.

Keywords: LCD, MEMS, ADC

I. INTRODUCTION

Drowsiness is a state of near sleep, where the person has a strong desire for sleep. It has two distinct meanings, referring both to the usual state preceding falling asleep and the chronic condition referring to being in that state independent of a daily rhythm . Sleepiness can be dangerous when performing tasks that require constant concentration, such as driving a vehicle. When a person is sufficiently fatigue while driving, they will experience drowsiness and this leads to increase the factor of road accident. A sensor is a technological device that detects / senses a signal, physical condition and chemical compounds. It is also defined as any device that converts a signal from one form to another. Sensors are mostly electrical or electronic. Gas sensor measures the concentration of gas in its vicinity. Gas sensor interacts with a gas to measure its concentration. Each gas has a unique breakdown voltage i.e. the electric field at which it is ionized. Sensor identifies gases by measuring these voltages. The concentration of the gas can be determined by measuring the current discharge in the device.The mechanical design of microscopic mechanical systems, even simple systems, first requires an understanding of the mechanical behavior of the various elements used. While the basic rules of mechanical dynamics are still followed in the miniaturized world, many of the materials used in these structures are not well mechanically characterized. For example, most MEMS systems use polysilicon to build mechanical structures.

II. OBJECTIVES OF THE PROJECT

- The project is mainly focusing on monitoring our vehicle to prevent from unwanted accidents.
- It aims at designing an Image processing and Sensors which can detect Drowsiness of driver, by capturing the images of the driver, to detect the Hazardous gas inside the vehicle and message alerting system.
- It will reduce the laziness of the driver and prevent our vehicle from any kind of unnecessary accidents.
- The gas sensor is used to detect the unwanted gase's inside the vehicle, if the gas is present inside the sensor detect and remove the car's window automatically
- MEMS technology is used to detect the little bit amount of distraction it sense and alert the respected person.

III. LITERATURE REVIEW

1. IoT Device for Sewage Gas Monitoring and Alert System

This smart solutions to monitor poisonous sewage gases and works on a system of live sewage level detection and monitoring. Whenever, a certain threshold is crossed, an alert is sent to the observer who is examining the conditions from a remote location. The information is then forwarded along with different gas ppm values indicating whether it is safe for the worker to clean or work in that environment or not. The remotely placed IoT monitoring equipment and IoT

platform are integrated to create proposed system. This requires calibration of gas sensors for industrial purposes and determining the correct threshold levels for septic plants and facilities.

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2. ACCIDENT ALERT SYSTEM APPLICATION USING A PRIVACY-PRESERVING BLOCK CHAIN-BASED INCENTIVE MECHANISM

In this era of rapid growth of vehicles, the ratio of road accident increases day by day. Nowadays, Traffic incidents are persistent problems in both developed and developing countries which result in huge loss of life and property. No one in this world is ready to gaze what's happening around them. Nobody cares even when an accident occurs. This paper provides an innovative solution by developing an Accident Alert Message System using an Android Smartphone Application that can be used from the accident zone. The application uses GPS technology for location mapping and sends an alert and notification of an accident. The generated accident alert message is endorsed by the nearby registered users who also witness the accident to ensure the increased reputation of the message. Based on the endorsement of the message, the system will instantly transmit the location of the accident to the nearby emergency services. In this case, users usually lack the enthusiasm to generate or endorse alert messages because they might fear that their privacy will be breached.

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Date of Conference: 15-16 March 2019

3. A SMART SYSTEM FOR DRIVER'S FATIGUE DETECTION, REMOTE NOTIFICATION AND SEMI-AUTOMATIC PARKING OF VEHICLES TO PREVENT ROAD ACCIDENTS

Drowsy driving is one of the main reasons of road accidents. Different techniques have been reported in literature to detect driver's drowsiness, but almost all the prevailing systems only alert the driver if drowsiness is detected. Consequently, the drowsy driver continues driving, with a high risk of devastating accident. In this paper, we proposed and verified an EEG based system which not only alerts the driver by alarm, but also puts the vehicle in semiautomatic parking mode by controlling fuel supply if drowsiness is detected. At the same time, it reports nearby police station by SMS which contains necessary information to take essential steps locating the vehicle. Stored EEG signals, obtained with wireless wearable headsets from numerous subjects in different conditions by different research groups, were used in this work.

Published in: 2016 International Conference on Medical Engineering, Health Informatics and Technology (MediTec)
DOI: 10.1109/MEDITEC.2016.7835371
Date of Conference: 17-18 Dec. 2016

4. DETECTING DRIVER DROWSINESS USING WIRELESS WEARABLES

The National Highway Traffic Safety Administration data show that drowsy driving causes more than 100,000 crashes a year. In order to prevent these devastating accidents, it is necessary to build a reliable driver drowsiness detection system which could alert the driver before a mishap happens. In the literature, the drowsiness of a driver can be measured by vehicle-based, behavior-based, and physiology-based approaches. Comparing with the vehicle-based and behavior-based measurements, the physiological measurement of drowsiness is more accurate. With the latest release of wireless wearable devices such as biosensors that can measure people's physiological data, we aim to explore the possibility of designing a user-friendly and accurate driver drowsiness detection system using wireless wearables. In this paper, we use a wearable biosensor called Bio Harness 3 produced by Zephyr Technology to measure a driver's physiological data. We present our overall design idea of the driver drowsiness detection system and the preliminary experimental results using the biosensor.

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   DOI: 10.1109/MASS.2015.22
   Date of Conference: 19-22 Oct. 2015

IV. PROPOSED SYSTEM

The web camera is mainly used to Monitor the driver's face to detect the driver is Drowse or Sleeping. The most popular technology Image processing is used to capture the image of the driver and compare the captured image and live image to identify the driver is sleeping or not, if the driver is sleep the buzzer makes an alert sound to distract the driver's laziness.The Gas sensor is placed inside the vehicle, if any Hazardous gas flow inside the vehicle, the gas sensor detect the gas and make an alert sound and down the car's window automatically.The autonomous system (MEMS) which is mainly used to send an alert message in case of vehicle met any accident and open air bag's inside the car to prevent the passengers inside the car.The program is written in the MATLAB, all the sensors are connected in the Arduino UNO and the programming code is delivered from the MATLAB.

> **DROWSINESS DURING DRIVING**
> **HAZARDOUS GAS**
> **Micro-Electro-Mechanical-System (MEMS)**

DROWSINESS DURING DRIVING

Drowsy driving is a major problem for the Drivers. The risk, danger, and often tragic results of drowsy driving are alarming. Drowsy driving is the dangerous combination of driving and sleepiness or fatigue. This usually happens when a driver has not slept enough, but it can also happen because of untreated sleep disorders, medications, drinking alcohol, or shift work.No one knows the exact moment when sleep comes over their body. Falling asleep at the wheel is clearly dangerous, but being sleepy affects your ability to drive safely even if you don't fall asleep.
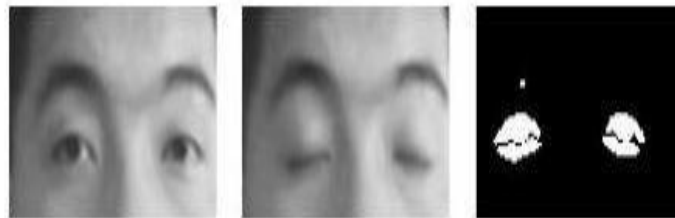

Fig.4.1 Detection of Drowsiness

HAZARDOUS GAS

Motorized vehicles including motorcycles, cars, trucks, and buses produce exhaust emissions that contain substances that would pollute the air. Of all components of vehicular emission, the most dominant pollutant is carbon monoxide (CO) and Hydrocarbon (HC). Carbon monoxide (CO) gas is the product of imperfect combustion. The nature of CO gas is colorless, odorless and tasteless and if inhaled by humans at certain levels will be able to affect human health ranging from dizziness and nausea to the danger of death in a short time Extreme lethargies and death may happen in the event that somebody is exposure with excessively genuine of carbon monoxide gas. At the point when blood oxygen is replaced by carbon monoxide, the condition is called as carboxyhaemoglobin (COHb).
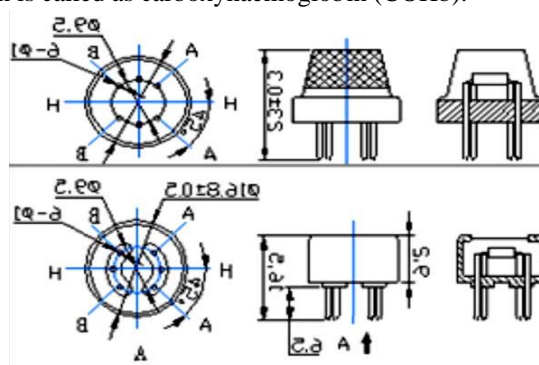

Fig.4.2 CONFIGURATION OF GAS SENSOR

MICRO-ELECTRO-MECHANICAL-SYSTEM (MEMS)

Micro-Electro-Mechanical Systems, or MEMS, is a technology that in its most general form can be defined as miniaturized mechanical and electro-mechanical elements (i.e., devices and structures) that are made using the techniques of microfabrication In early MEMS systems a multi-chip approach with the sensing element (MEMS structure) on one chip, and the signal conditioning electronics on another chip was used.
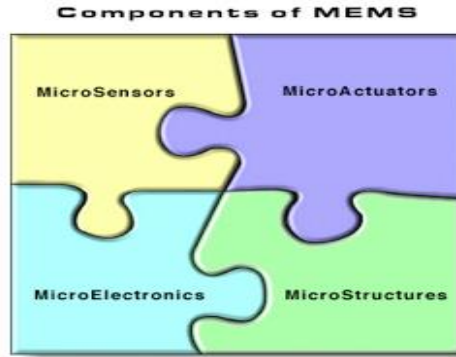

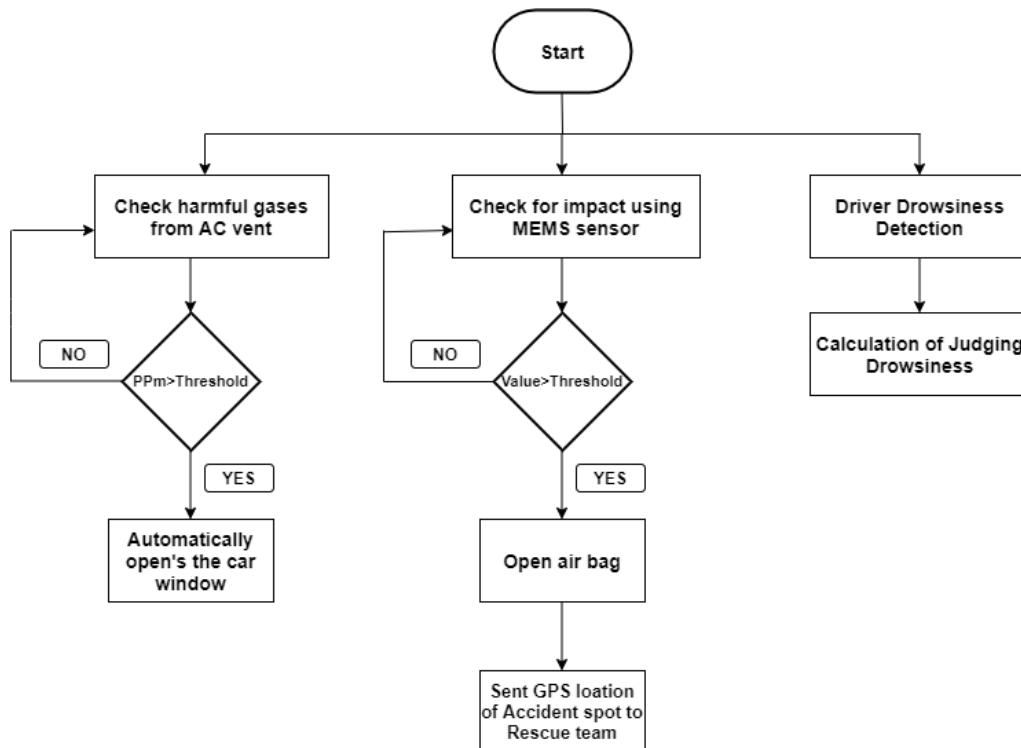**Fig.4.3 COMPONENTS OF MEMS**

V. FLOW CHART

Fig. 4.4 Flow Chart

VI. TECNIQUES IMPLEMENTED

Image Processing

- Automation

Introduction:

- It is used to classify and recognize the image, extract the needed features from it to give the appropriate results.

- The input image is compared with the images in the dataset by the image processing techniques. The comparison will give the results of nutrient deficiencies.
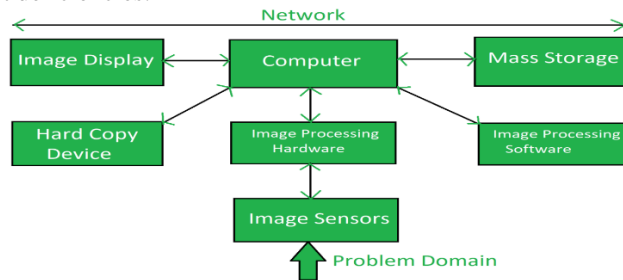

Fig 4.5: IMAGE PROCESSING TECHNIQUE

- **Automation**-Automation can be defined as the technology by which a process or procedure is performed without human assistance.
- **Embedded**-An embedded system is a computer system—a combination of a computer processor, computer memory, and input/output peripheral devices—that has a dedicated function within a larger mechanical or electrical system.

Why we use Image Processing:

- Image processing is a method to perform some operations on an image, to get an enhanced image or to extract some useful information from it. Digital image processing techniques help in manipulation of the digital images through the use of computers.
- The first step of a digitization project is the capturing of documents, images and pages with a scanner to obtain a raw file (ex: raw file format). This raw file coming from the scanner is a file that has not been altered (ie sharpened, cropped), cleaned up or has metadata added.
- Professional book scanners that are used today have basic tools included for image adjustments, so the operator can apply it while it is being digitized by the scanner. However, to get an optimized workflow and to avoid losing time, it is important to process images after the capture, in a post-processing step.

Why we use MATLAB:

- MATLAB is a programming platform designed specifically for engineers and scientists to analyze and design systems and products that transform our world. The heart of MATLAB is the MATLAB language, a matrix-based language allowing the most natural expression of computational mathematics.

VII. HARDWARE IMPLEMENTATION

1. Arduino UNO

Fig.7.1 Arduino UNO

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type

B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts

2. LCD Display

Fig.7.2 LCD Display

LCD is a flat –panel display or other electronically modulated optical device that uses the light –modulating properties of liquid crystals combined with polarizers. A 16x2 **LCD** means it can display **16** characters per line and there are **2** such lines. In this **LCD** each character is displayed in 5x7 pixel matrix. The **16** x **2** intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols.

3. Step down Transformer
Step down voltage level

Fig.7.3 Step-down Transformer

The step-down converters are used for converting the high voltage into low voltage. The converter with output voltage less than the input voltage is called as a step-down converter, and the converter with output voltage greater than the input voltage is called as step-up converter. There are step-up and step-down transformers which are used to step up or step down the voltage levels. 230V AC is converted into 12V AC using a step-down transformer. 12V output of stepdown transformer is an RMS value and its peak value is given by the product of square root of two with RMS value, which is approximately 17V. Step-down transformer consists of two windings, namely primary and secondary windings where primary can be designed using a less-gauge wire with more number of turns as it is used for carrying low-current high-voltage power, and the secondary winding using a high-gauge wire with less number of turns as it is used for carrying high-current low-voltage power.
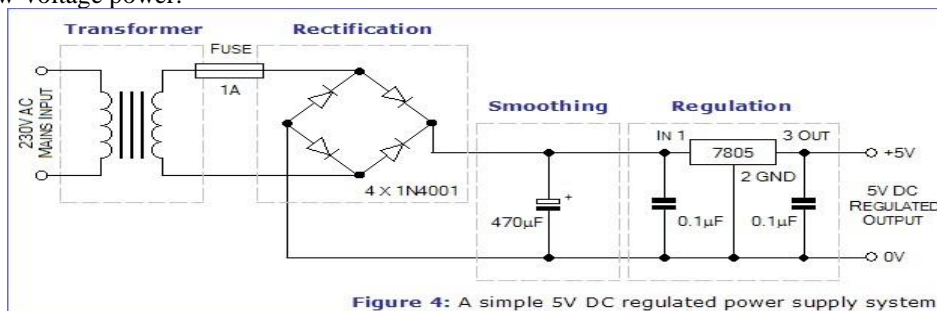

Fig.7.4 Bridge Rectifier

ii. Convert AC to DC
230V AC power is converted into 12V AC (12V RMS value wherein the peak value is around 17V), but the required power is 5V DC; for this purpose, 17V AC power must be primarily converted into DC power then it can be stepped

Transformers works on the principle of Faraday's laws of electromagnetic induction. Step-down transformer consists of two windings, namely primary and secondary windings where primary can be designed using a less-gauge wire with a greater number of turns as it is used for carrying low-current high-voltage power, and the secondary winding using a high-gauge wire with a smaller number of turns as it is used for carrying high-current lowvoltage power. Transformers works on the principle of Faraday's laws of electromagnetic induction.

down to the 5V DC. But first and foremost, we must know how to convert AC to DC? AC power can be converted into DC using one of the power electronic converters called as Rectifier. There are different types of rectifiers, such as half-wave rectifier, full-wave rectifier and bridge rectifier. Due to the advantages of the bridge rectifier over the half and full wave rectifier, the bridge rectifier is frequently used for converting AC to DC. Bridge rectifier consists of four diodes which are connected in the form a bridge. We know that the diode is an uncontrolled rectifier which will conduct only forward bias and will not conduct during the reverse bias. If the diode anode voltage is greater than the cathode voltage then the diode is said to be in forward bias. During positive half cycle, diodes D2 and D4 will conduct and during negative half cycle diodes D1 and D3 will conduct. Thus, AC is converted into DC; here the obtained is not a pure DC as it consists of pulses. Hence, it is called as pulsating DC power.

4. GSM Modem

Fig.7.5 GSM Modem SIM 800C

The GSM system is the most widely used cellular technology in use in the world today. Global System for Mobile Communications was designed as a second generation (2G) cellular phone technology by using a digital TDMA (time division multiple access approach).GSM cellular technology uses 200 kHz RF channels. These are time division multiplexed to enable up to eight users to access each carrier. In this way it is a TDMA / FDMA system.

5. RELAY

Fig 7.6: RELAY

A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof.Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal. Relays were first used in long-distance telegraph circuits as signal repeaters: they refresh the signal coming in from one circuit by transmitting it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

6. WEBCAM

Fig 7.7: WEB CAM

A webcam is a video camera that feeds or streams an image or video in real time to or through a computer to a computer network, such as the Internet. Webcams are typically small cameras that sit on a desk, attach to a user's monitor, or are built into the hardware. Webcams can be used during a video chat session involving two or more people, with conversations that include live audio and video. For example, Apple's iSight camera, which is built into Apple laptops, iMacs and a number of iPhones, can be used for video chat sessions, using the Messages instant messaging program. Webcam software enables users to record a video or stream the video on the Internet. As video streaming over the Internet requires much bandwidth, such streams usually use compressed formats.

7. MEMS SENSOR

Fig 7.8: MEMS SENSOR

Micro-Electro-Mechanical Systems, or MEMS, is a technology that in its most general form can be defined as miniaturized mechanical and electro-mechanical elements (i.e., devices and structures) that are made using the techniques of microfabrication In early MEMS systems a multi-chip approach with the sensing element (MEMS structure) on one chip, and the signal conditioning electronics on another chip was used.

8. GAS SENSOR

Fig 7.9: GAS SENSOR

Gas sensor module is useful for gas leakage detection (home and industry). It is suitable for detecting H2, LPG, CH4, CO, Alcohol, Smoke, or Propane. Due to its high sensitivity and fast response time, a measurement can be taken as soon as possible. The sensitivity of the sensor can be adjusted by the potentiometer.
Features
1. Wide detecting scope
2. Stable and long lifetime
3. Fast response and High sensitivity

VIII. SOFTWARE IMPLEMENATION

SOFTWARE:

The MATLAB makes it easy to write code and upload it to the board. This software can be used with multipurpose connection circuits.

ALGORITHM:

For Gas sensor:

Step 1: Include the required MATLAB files.

Step 2: Connect the gas sensor in A1, D0, GND, and VCC.

Step 3: Set the Load Resistance about 20KΩ

Step 4: Set the Concentration level up to 400ppm

For MEMS SENSOR:

Step 1: Include the required MATLAB files.

Step 2: Connect the MEMS sensor in 5V, GND, A1, GND.

Step 3: Connect the Air bag motor with MEMS.

Step 4: Send message Alert message to the given number.

For Drowsiness Detection:

Step 1: Include the required MATLAB files.

Step 2: Turn on the Web cam in the laptop.

Step 3: Run the program to detect the drowsiness.

Step 4: To monitor the Fatigue and Non-Fatigue state of the driver

IX. EXPERIMENTAL RESULTS

The SMART VEHICLE MONITORING system monitor's the driver Drowsiness through the Web cam, to monitor the Hazardous gas inside the vehicle, the Accident alert message to the imported person's through GSM module. Each module consists of an Arduino Uno – At mega32Launchpad. A 16x2 LCD display unit is interfaced with the modules to display the level of the gas inside the vehicle.

✓ **Hazardous Gas inside the vehicle:**

If the Hazardous gas inside the vehicle, The MQ-16 Gas sensor sense the gas inside the vehicle and it will automatically open the car door window to evacuate the harmful gases inside the vehicle to save the passengers.

✓ **Drowsiness Detection:**

One of the careless accident's in vehicles is Drowsiness of the driver. To avoid that Minor accident we use a mat lab code to monitor the driver's face, a webcam is placed before the driver's face to monitor him.

✓ **MEMS Technology:**
✓ Micro-Electro-Mechanical Systems, or MEMS, is a technology that in its most general form can be defined as miniaturized mechanical and electro-mechanical elements. This technology is used to detect the accident and send an alert message to the important person through GSM module.

✓ **GSM Modem Initialization:**
The GSM Modem SIM 800 initialization setup. The SIM800, a GSM modem is initialized through the AT Commands through software

✓ **Message Sent to Phone:**
The MEMS detected the accident and the Message is sent to the mobile phone through GSM. The message received in the mobile phone
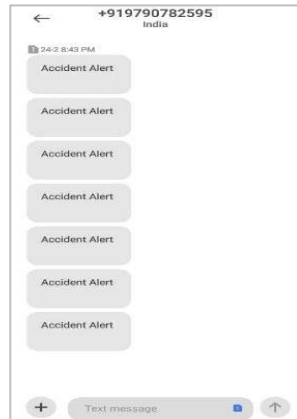
Fig 9.0: MESSAGE SENT TO THE PHONE

X. FUTURE WORK

Here there is more rooms for upgrade this project. The next step is using of raspberry pie to build this project for better results. The driver Drowsiness detection is built over the raspberry pie in case the driver is in Drowse state it will alert the driver and gradually slow down the vehicle with parking lights. Using the gas sensor to detect the gas inside the vehicle, if the gas is present inside the cabin it will automatically slow down the car with a Voice alert. With the help of MEMS sensor, if accident occurs the sensor detect and send the Accident Location to the Ambulance to rescue the injured persons.

XI. CONCLUSION

Thus the Smart Vehicle Monitoring is used to monitor our car from any unwanted damages or accidents. The first system is Driver Drowsiness detection, the web cam is used to monitor the driver. The gas sensor is used to detect the Hazardous gas inside the vehicle, if the gas present inside the vehicle it will automatically down the windows. The MEMS sensor is used to detect the fast collision in the vehicle it sense and send an alert message using a GSM module to send the message to the required person to know about their vehicle.

REFERENCES

[1]   S. T. Lin, Y. Y. Tan, P. Y. Chua, L. K. Tey, and C. H. Ang, "PERCLOS Threshold for Drowsiness Detection during Real Driving," Journal of Vision, vol. 12, pp. 546-546, 2018.
[2]   Picot, S. Charbonnier, and A. Caplier, "On-line automatic detection of driver drowsiness using a single electroencephalographic channel," in Engineering in Medicine and Biology Society, 2008. EMBS 2008. 30th Annual International Conference of the IEEE, 2017, pp. 3864-3867.
[3]   Tianyi Hong, Huabiao Qin, "Drivers drowsiness detection in embedded system" 13-15 Dec. 2007
[4]   T. Jap, S. Lal, P. Fischer, and E. Bekiaris, "Using EEG spectral components to assess algorithms for detecting fatigue," Expert Systems with Applications, vol. 36, pp. 23522359, 2020.
[5]   Piantadosi, "Carbon Monoxide Oxygen Transport and Oxygen Metabolism", 24, December 2017.
[6]   Fauzi Imaduddin Adhim; Ciptian Weried Priananda; Lucky Putri Rahayu; Josaphat Pramudijanto; Dzulfikar Ats Tsauri "Carbon Monoxide and Methane Gas Identification System" 9-10 Oct. 2018
[7]   Sidi Mohammed Hadj Irid; Mourad Hadjila; Haroun Errachid Adardour "Design and Implementation of an IoT Prototype for the Detection of Carbon Monoxide" 24-25 Nov. 2019
[8]   Ahmed Abdullah Ibrahim, "Carbon Dioxide and Carbon Monoxide Level Detector" 21-23 Dec. 2020
[9]   Nazia Parveen; Ashif Ali; Aleem Ali "IOT Based Automatic Vehicle Accident Alert System" 30-31 Oct. 2020
[10] S Dhanya; P.E. Ameenudeen; Aiswarya Vasudev; Alisha Benny; Saumya Joy "Automated Accident Alert" 11-13 July 2016
[11] Himanshu Arora, Samyak Jain, Sanket Anand, Dharmveer Singh Rajpoot, Neha Yadav, "Real Time Safety Alert System for Car" 7-9 March 2019
[12] Shanidmalayil Mohammed, M.K. Ashique, P.K. Kaleshma, P.K. Karishma, P.P. Mohammed Arshad, "Anti Accident System" 11-13 July 2019