INTEGRATED VEHICLE SAFETY SYSTEM (IVSS)

PROJECT PHASE -1

Submitted by

MOHAN A (201914007)

PRASANTH N (201914009)

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TIRUCHENGODE

ANNA UNIVERSITY::CHENNAI - 600025

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BONAFIDE

ANNAUNIVERSITY::CHENNAI - 600025

BONAFIDE CERTIFICATE

Certified that this project phase-1 report **"INTEGRATED VEHICLE SAFETY SYSTEM"** is the bonafide work of **"MOHAN A (201914007), PRASANTH N (201914009)"**who carried out the project work under my supervision.

SIGNATURE

Dr. C. AARTHI, M.E., Ph. D,

Head of the Department,

Department of ECE,

Sengunthar Engineering College,

(Autonomous),

Tiruchengode - 637205.

SIGNATURE

Dr. C. AARTHI, M.E., Ph. D,

Head of the Department,

Department of ECE,

Sengunthar Engineering College,

(Autonomous),

Tiruchengode - 637205.

Submitted for Project Phase-1 and Viva examination held on……..

INTERNAL EXAMINER **EXTERNAL EXAMINER**

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ABSTRACT

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Travelling is important and necessity for human life and now-a days it is turned to be as dangerous due to more number of road accidents. Integrated Vehicle Safety System (IVSS) prevents accidents and helps the driver to reduce the impact at emergency situation. It also limits and controls the speed of the vehicle in specific zones to avoid accidents in low speed areas. A vehicle emission control unit is also integrated to reduce the emission produced by motor vehicles especially internal combustion engines.

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LIST OF ABBREVIATIONS

ABBREVIATIONS	EXPANSION
OBC	On Board Computer
ACS	Attitude And Control System
EPS	Electrical Power System
TTC	Telemetry And Tele command
MPPT	Maximum Power Point Tracking
I^2C	Inter Integrated Circuit
SDA	Serial Data
SCK	Serial Clock
GPIO	General Purpose Input And Output
RISC	Reduced Instruction Set Controller
SRAM	Static Ram
MPU	Memory Protection Unit
SPI	Serial Peripheral Interface
TWI	Two Wire Interface
UART	Universal Asynchronous Receiver And Transmitter
MII	Media Independent Interface
UVLO	Under Voltage Lock Out

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CHAPTER – 1

INTRODUCTION

India is home to the second largest road network in the world with a total road length of approximately 62.1lakh kilometers. This massive network serves as the nation's lifeline transporting over 64.5% of all goods within the country in addition to being the preferred option for move of over 90% of India's passenger traffic. Road safety is emerging as a major social concern around the world especially in India. Driver drowsiness, Drunk & Drive, over speed are the significant factors in vehicular accidents and therefore different technologies are being put in place to bring it to the barest minimum.

This IVSS Project takes in-depth look at vehicle accident prevention mechanism using embedded technology with sensors to monitor and control. 5.04% of total roads in India comprise of National and State Highways and have cumulatively accounted for almost 54% accidents in the country with the balance 94% of Indian roads contributing to 45% of road accidents. The high number of accidents on highways is indicative of over speeding being the primary cause for such accidents. Hence automatic Vehicle Speed Control System is designed to control the speed of the vehicle in specific zones to avoid the accidents in the low speed areas.

A typical passenger vehicle emits about 4.6 metric tons of carbon dioxide per year. This assumes the average gasoline vehicle on the road today has a fuel economy of about 22.0 miles per gallon and drives around 11,500 miles per year. Hence this system is designed to reduce the vehicle CO_2 emission produced by the motor vehicles, hence controls the air pollution.

OBJECTIVE

- To monitor and control the road accidents in India which is caused due to human related issues like driver drowsiness, drunk and drive and over speeding of vehicles.
- To monitor and control the CO_2 emissions in the conventional vehicles with an internal combustion engine (ICE).

AREA OF THE PROJECT

INTERNET OF THINGS (IoT)

The Internet of Things (IoT) describes the network of physical objects things" that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet. These devices range from ordinary household objects to sophisticated industrial tools. With more than 7 billion connected IoT devices today, experts are expecting this number to grow to 10 billion by 2020 and 22 billion by 2025. Oracle has a network of device partners. Over the past few years, IoT has become one of the most important technologies of the 21st century. Now that we can connect everyday objects—kitchen appliances, cars, thermostats, baby monitors—to the internet via embedded devices, seamless communication is possible between people, processes, and things.

CHAPTER – 2

LITERATURE SURVEY

PAPER -1: AUTOMATIC VEHICLE SPEED REDUCTION SYSTEM USING RF TECHNOLOGY.

Authors: Fatema Tahsin Huda Munira , Mehedi Hasan Akash , Sukanta Debnath , Moinuddin Shuvo.

Publish Date: March 2017.

Project Abstract

The objective of this project is to automatically control the speed of the vehicles at speed restricted areas such as school and hospital zone, U-turn etc. and accident avoidance using ultrasonic sensor. At particular zone special kind of transmitters which are tuned at a frequency of 433MHZ are mounted. These transmitters continuously radiate RF signal. When the vehicle comes within this radiation the receiver in the vehicle gets activated. Whenever the vehicle is within the zone, the vehicle speed is controlled by receiving the signal i.e. every time the vehicle speed is decreased to some cutoff and kept constant until the vehicle moves out of the zone, and then the vehicle can get accelerated by itself. The ultrasonic sensor system continuously sends signals and monitors any car or other obstacles which are in front of car. The distance up to which ultrasonic sensor can work is not more than 4 meter. When any obstacle or vehicle detected by ultrasonic sensor system it will send signal to the arduino After receiving this signal arduino sends a signal to the motor driver to stop the car immediately.

PAPER -2: A STUDY ON DRIVER FATIGUE NOTIFICATION SYSTEMS

Authors: Mohammed Hayyan Alsibai, Sulastri Abdul Manap.

Publish Date: April 2018.

Project Abstract

This paper is an introduction to our research which aims to develop a driver safety assistant system using an in vehicle video camera. It is a real-time recognition system which uses vision sensors to detect passengers and driver fatigue conditions. The system assesses the ability of conducting safe driving and notifies the driver for any dangerous situation. Moreover, safety actions are to be performed by an embedded vehicle controlling system. This review paper is to assess the current status of research. The motivating application for this research is to design an integrated system for safety of vehicle users based on visual information only. Restricting the methods to visual information is to reduce the time complexity of integrating information from many sensors and to reduce the expenses on the sensors. This research aims to contribute in reducing number of accidents and consequently the socioeconomic effects of accidents like property losing costs, long-term medical costs, funeral costs, vehicle repair costs or losing the household.

Keywords: Computer Vision; Safety; Fatigue Assessment; Intelligent Transportation System.

PAPER -3: A REAL-TIME DRIVER DROWSINESS DETECTION AND WARNING SYSTEM BASED ON AN EYE BLINKING RATE.

Authors: Mubeen Arif, Khan Bahadar Khan, Khizar Fiaz, and Ayesha Niaz.

Publish Date: May 2022.

Project Abstract

Every year many people lose their lives due to fatal road accidents around the world and drowsy driving is one of the primary causes of road accidents and deaths. The other causes of traffic accidents are due to human errors and/or due to mechanical failures. Driver fatigue is one of the leading causes of Road Traffic Accidents (RTA) in Pakistan. Numerous systems are invented that minimize the impact of these accidents. The research in this area began sixty years ago, to determine the drowsiness of driver using computer assisted techniques. In this paper, we have purposed a method that will detect the drowsiness of driver by its eye behavior, such as, eye blink rate and patterns. This paper presents a system for detecting driver drowsiness, based on analysis of the eyes. The system has the ability to adapt to any person, works in real driving conditions, under varying lighting and generating drowsiness index at every moment, which measures the wakefulness of the driver. In several experiments, the proposed system has shown excellent results regarding the objectives and the problems have been successfully overcome.

Keywords: Driver drowsiness system, Eye blinking rate, Haar-Cascade classifier

PAPER -4: AN ACCIDENT DETECTION AND CLASSIFICATION SYSTEM USING INTERNET OF THINGS AND MACHINE LEARNING TOWARDS SMART CITY

Authors: Mohammed Balfaqih, Soltan Abed Alharbi, Moutaz Alzain, Faisal Alqurashi and Saif Almilad

Publish Date: December 2021.

Project Abstract

Daily traffic accidents increase annually, causing a significant number of death and disability cases. Most of fatalities occur because of the late response to these emergency cases. The time after the traumatic injury is called the golden hour, where providing essential medical and surgical aid at that time increases the probability of saving human lives by one-third an average. Thus, the focus of this paper was to develop a system based on IoT for accident detection and classification. The system detects and classifies vehicle accidents based on severity level and reports the essential information about the accident to emergency services providers. The system consists of a microcontroller, GPS, and a group of sensors to determine different physical parameters related to vehicle motion. In addition, different types of machine learning classifiers were examined with the developed system to determine the most accurate classifier for the system. The classifiers are the Gaussian Mixture Model (GMM), Naive-Bayes Tree (NB), Decision Tree (DT), and Classification and Regression Trees (CART). The implementation of the system showed that GMM and CART models were better in terms of precision and recall. It was also shown that the severity of accidents depends mainly on the g-force value and fire occurrence.

Keywords: accident detection and classification; internet of things (IoT); sensor fusion; machine learning classifiers

PAPER -5: ALCOHOL DETECTING AND NOTIFICATION SYSTEM FOR CONTROLLING DRINK DRIVING

Authors: Oloyede Mukhtar Abiodun, Michael David, and Waheed Moses Audu.

Publish Date: September 2008.

Project Abstract

It takes being alive and healthy to tackle challenges for sustainable development as well as harness the benefits thereof. The scourge of drink driving has led to loss of life and properties. Control measures to ensure drivers are not under the influence of alcohol while driving such as Blood Alcohol Content (BAC) check remains unrealizable due to the huge personnel, equipment and maintenance cost involved. A less consuming effort has been proposed using mq3 gas sensor mounted on the steering wheel, powered by the ignition of the vehicle, to detect alcohol level of the subject controlling it. The alcohol detected from the subject is processed by an ATMEGA 16 Microcontroller that compares it with a set threshold for compliance. If the threshold is exceeded three modules are simultaneously triggered. The fuel supply control module is activated by a relay to cutoff supply towards bringing the vehicle to a momentary halt. The Liquid Crystal Display (LCD) module is activated to show alcohol has been detected. The Global System for Mobile communication (GSM) module sends the same notice on the LCD to subject's next-of-kin/lawenforcement-agent phone line for immediate attention. This system was developed and tested using a toy car. The result showed that it could be implemented in real life situation provided that all specifications are taken into consideration.

Keywords- drink driving; mq3 gas sensor; ATMEGA 16 Microcontroller; GSM module; LCD; relay

PAPER -6: AN APPROACH TOWARDS INTELLIGENT ACCIDENT DETECTION, LOCATION TRACKING AND NOTIFICATION SYSTEM

Authors: Dr. Supriya Sarker, Md. Sajedur Rahman, and Mohammad Nazmus Sakib.

Publish Date: Feb 2021.

Project Abstract

In the past few years a marvelous growth in the field of technology and sciences has been observed. This rapid improvement in the field of science and technology has proved to be a blessing in order to make the human lives easier. No doubt, advancing technology has helped humans to provide themselves with a more reliable and efficient form of transportation, but with increasing population and thus increasing demand of transportation media, the traffic on roads have rapidly increased and with this increase, the number of accidents and road casualties are unstoppable. Many efforts have been taken to limit the number of road casualties such as updating design techniques of automobiles, lane design and heavy traffic control systems. But still there is a great need of implementation of a system for vehicle tracking, accident detection and notification and a plenty of work has been done for the same. Many people lose their life just because the families of the people are not timely informed and thus the medical requirements are not fulfilled on time. In vehicle tracking and accident detection and notification systems, any kind of accident is detected automatically and an alert is sent to the required person. Whenever the accident detection system implemented in a vehicle, detects an accident with the help of sensors installed (maybe an accelerometer sensor or a vibration sensor), it will automatically send SMS/ Email notification to the registered numbers. These numbers could be of his family members or a police station or maybe nearest hospital. Along with the notification, the co-ordinates of the location at which accident has taken place can be shared using the Global Positioning system (GPS).

PAPER -7: A LIGHTWEIGHT IN-VEHICLE ALCOHOL DETECTION USING SMART SENSING AND SUPERVISED LEARNING

Authors: Qasem Abu Al-Haija, and Moez Krichen.

Publish Date: Jan 2020.

Project Abstract

According to the risk investigations of being involved in an accident, alcohol-impaired driving is one of the major causes of motor vehicle accidents. Preventing highly intoxicated persons from driving could potentially save many lives. This paper proposes a lightweight in-vehicle alcohol detection that processes the data generated from six alcohol sensors (MQ-3 alcohol sensors) using an optimizable shallow neural network (O-SNN). The experimental evaluation results exhibit a highperformance detection system, scoring a 99.8% detection accuracy with a very short inferencing delay of 2.22 µs. Hence, the proposed model can be efficiently deployed and used to discover in-vehicle alcohol with high accuracy and low inference overhead as a part of the driver alcohol detection system for safety (DADSS) system aiming at the massive deployment of alcohol-sensing systems that could potentially save thousands of lives annually.

Keywords: alcohol detection; smart sensing; MQ-3 alcohol sensors; supervised learning; neural networks.

PAPER -8: AUTOMATIC SPEED CONTROL SYSTEM BY THE COLOR SENSOR FOR AUTOMOBILES -AN INNOVATIVE MODEL BASED APPROACH

Authors: Sunil R. Kewate, S.V. Karmare, Nehal Sayankar and Siddharth Gavhale

Publish Date: November 2014.

Project Abstract

Speed control is in the need of the hour due to the increased rate of accidents reported in our day-to-day life. During 2011, in India a whole of 4, 97,686 road accidents were reported which is a result of lack of speed control and violating the road rules. Road accidents can be prevented by adopting measures such as Traffic management, improving quality of road infrastructure and safer vehicles. The existing techniques still doesn't able to reduce the number of accidents. Hence there is a need to implement Intelligent Speed Adaptation (ISA) in which vehicles speed can be automatically controlled by various limit techniques which are based on zones, highway, traffic density etc. In this research work, it proposes automatic speed control system based on color strips for highway road and the roads where the speed control within limit is required. The methodology explains that a various color strips are marked on highway road or the roads where the speed control within limit is required and vehicle will have a color sensor attached which will recognize the color marked on the highway road and accordingly maintain the vehicles speed in that particular limit. In this developed system, the color detecting sensor of specific intensity is used to activate/deactivate the system of speed control within the color strips marked on the road. the vehicle sensor detect the color to activate the system and send the signals to programmable ECU/MCU and the programmable ECU /MCU controls the position of throttle valve/fuel 224 Sunil R. When the system activated then our vehicle is controlled at given limited speed or below that limiting speed and can not exceed beyond that limit till the next color strip crossed. This reduces the road accidents and gets driving comfort for the driver, after implementation of this automatic speed control system.

PAPER -9: MODELING AND CONTROL FOR EMISSION MANAGEMENT IN HYBRID ELECTRIC COMMERCIAL VEHICLES

Authors: Olov Holmer.

Publish Date: January 2022.

Project Abstract

Electrification of power trains is a major trend in the vehicle industry. The reason behind this is mainly that electrification of a power train generally results in better fuel economy, by eliminating inefficient, low load, operation of the engine. This can be done in two ways: load shifting to shift the operation point of the engine to a more efficient one, or by turning off the engine completely. When it comes to emissions, load shifting generally have positive effect since it usually result in higher exhaust temperatures which are beneficial for the after treatment system. The effect from turning off the engine completely is more complicated. When the engine is turned off the after treatment system will start to cool down and will eventually lose its effectiveness, resulting in higher emissions when the engine is restarted. So-called green zones, zones established by legislation or demand of costumers, where the use of combustion engines is prohibited, are a good example of where this can be expected and is therefore a focus of this thesis. The applications are not limited to hybrids but also useful for all vehicles that make stops, e.g., commercial vehicles that make regulated 45 minutes breaks and loading/off-loading cargo. A model of a complete hybrid electric heavy-duty vehicle is developed and validated. The model is a compilation of several sub models of the different components in the vehicle. To correctly estimate the pollutive emissions, the components in the after treatment system are the most important components and emphasis is put on how the concentrations in them are calculated. It is shown that a quasi-static model for the concentrations gives the best balance in terms of accuracy and simulation time for the application.

PAPER-10: IOT BASED SMART SYSTEM FOR CONTROLLING CO2 EMISSION

Author: Dr. M. Newlin Rajkumar, Sruthi M. S, Dr. V. Venkatesa Kumar.

Publish Date: March 2021

Project Abstract

Pollution has a major role in damaging our earth. The rapid industrialization, fast urbanization , rapid growth in population, drastic increase in vehicles on roads and other activities of human beings have disturbed the balance of natural atmosphere. It changes the quality of climate and those climate change is brought about by the accumulation of greenhouse gases in the atmosphere. One of the greatest environmental problem facing the world today is global warming caused by emission of greenhouse gases. Carbon dioxide ,which is an important constituent of environment is causing a warming effect on the earth's surface. To save our environment, monitoring and controlling these changes is a big challenge. In terms of a long range control of CO2 emission at their source is a more desirable and effective method through preventive and control technologies. The main objective of this paper is to implement IoT to measure the CO2 emission from public transports, industries and forest fires using Raspberry pi which is sensitive to CO2. The amount of Carbon dioxide emitted is sensed continuously in a city and also finding the area which is polluted the most. Also implement a smart system for early detection of forest fires or wild fires. wild fires, are uncontrolled fires occurring in wild areas and cause significant damage to natural and human resources and the wildfires emits more CO2 gas than assumed in state climate target. These are then integrated to the IOT which is more securable and many services of can be used along with it. This would enable a Simple Notification Service (SNS) to the mobile phone if the particular area is causing higher level of CO2.

CHAPTER – 3

METHODOLOGY

The IVSS system is an integrated system which gives more control to the vehicles during dangerous situations. In this project the IR sensors, Alcohol level monitoring sensors, Carbon level monitoring sensors are used for continuous monitoring of drivers fatigue and carbon emission. The IR LED sensor and alcohol sensor is fixed in the eye glass with screening mask which transmits the infra-red rays. IR rays get reflected back if drowsiness and fatigue level detected based upon the difference in distance calculation and the transmitted signal is received by the photo diode. The change in anode voltage is depending on the IR radiation received by the photo diode.

Once the fatigueless is detected the sensor intimates the alerts the main controller to give alert sound and also the alert message which will be displayed in the monitor and the message is sent through GSM. If the same process repeated the vehicle stopped automatically. The alcohol content is monitored by the mq-2 sensor and the same process is repeated when the drunken state is identified. The CO_2 emission is controlled by the mq-9 sensor and the information is passed to the registered number and the alert is given to avoid the air pollution. The IVSS is an integrated vehicle safety system which is the most wanted and safety system to avoid accidents and to avoid air pollution.

EXISTING AND PROPOSED SYSTEM

3.1 EXISTING SYSTEM:

- Automatic vehicle accident detection and messaging system uses accelerometer in Cr alarm application.
- The accident can be sensed by using the vibration sensor.
- Using ARM controller the mobile number can be saved in EEPROM and sends the message when accident occurs.
- The driver drowsiness was detected send alert the driver.
- Alcohol level was detected and alert the passengers.

3.2 PROPOSED SYSTEM:

- The proposed system is an integrated system which integrate all the sensors into a single module.
- In the existing system, sometimes the drive don't consider the alert and drive continuously .The proposed system is establishing a technique to avoid the drawbacks of existing system.
- The system will detect early symptoms of drowsiness and alcohol content before the driver has fully lost attentiveness and warn the driver and automatically stop the vehicle.
- Then sensor are monitoring the carbon emission level and increase the carbon level automatically lock or stop the engine.

ADVANTAGES:

- Traffic management can be maintained by reducing accidents.
- Detected abnormal behavior is corrected through alarms in real time.
- To prevent accidents due to drunk and driving.
- Accident Detect to send current location.

3.3 TOOLS USED

- Arduino Mega
- GSM Module
- Accelerometer sensor
- Alcohol Sensor
- IR Photo diode Sensor
- Carbon Emission Sensor
- L293D Motor Driver Shield
- 16X2 LCD Display
- GPS Module
- Buzzer
- DC Motor
- Board for making the components
- Other components

3.3.1 ARDUINO MEGA

Arduino Mega 2560 is a development electronic board based on the Atmega2560 microcontroller. This board is a good match for projects that require more GPIO pins and memory space because it carries 16 analog pins and 54 digital I/O pins out of which 15 pins are used for PWM output.

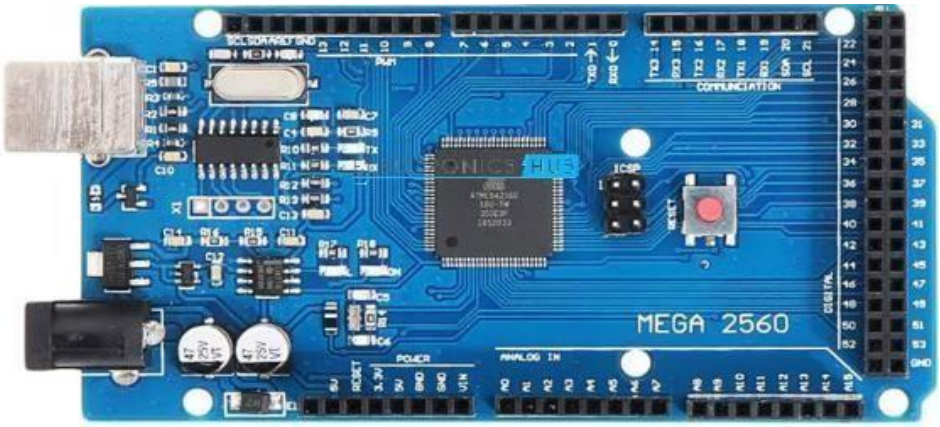

Fig.3.3.1 Arduino Mega

3.3.2 GSM Module

A GSM modem or GSM module is a device that uses GSM mobile telephone technology to provide a wireless data link to a network. GSM modems are used in mobile telephones and other equipment that communicates with mobile telephone networks. They use SIMs to identify their device to the network.

Fig.3.3.2 GSM Module

3.3.3 ACCELEROMETER SENSOR

An accelerometer sensor is a tool that measures the acceleration of any body or object in its instantaneous rest frame. It is not a coordinate acceleration. Accelerometer sensors are used in many ways, such as in many electronic devices, smartphones, and wearable devices, etc.

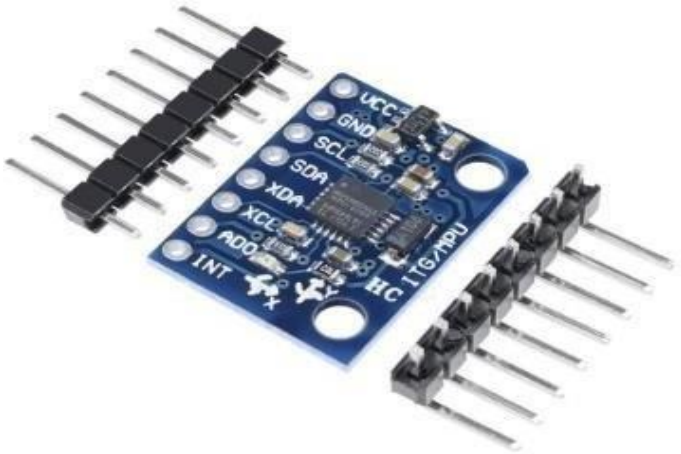

Fig.3.3.3 Accelerometer Sensor

3.3.4 L293D MOTOR DRIVER SHIELD

L293D shield is a driver board based on L293 IC, which can drive 4 DC motors and 2 stepper or Servo motors at the same time. Each channel of this module has the maximum current of 1.2A and doesn't work if the voltage is more than 25v or less than 4.5v. Accelerometers can be used to measure vibration on cars, machines, buildings, process control systems and safety installations. They can also be used to measure seismic activity, inclination, machine vibration, dynamic distance and speed with or without the influence of gravity.

Fig.3.3.4 L293D Motor Driver Shield

3.3.5 ALCOHOL SENSOR

MQ135 gas sensor has high sensitivity to ammonia gas, sulfide, benzene series steam, also can monitor smoke and other toxic gases well. It can detect kinds of toxic gases and is a kind of low-cost sensor for kinds of applications. t is suitable for detecting of NH3,NOx, alcohol, Benzene, smoke, CO2 and other dangerous gases.

Fig.3.3.5 Alcohol Sensor

3.3.6 IR PHOTO DIODE SENSOR

The emitter is an IR LED and the detector is an IR photodiode. The IR phototdiode is sensitive to the IR light emitted by an IR LED. The photo-diode's resistance and output voltage change in proportion to the IR light received. This is the underlying working principle of the IR sensor.

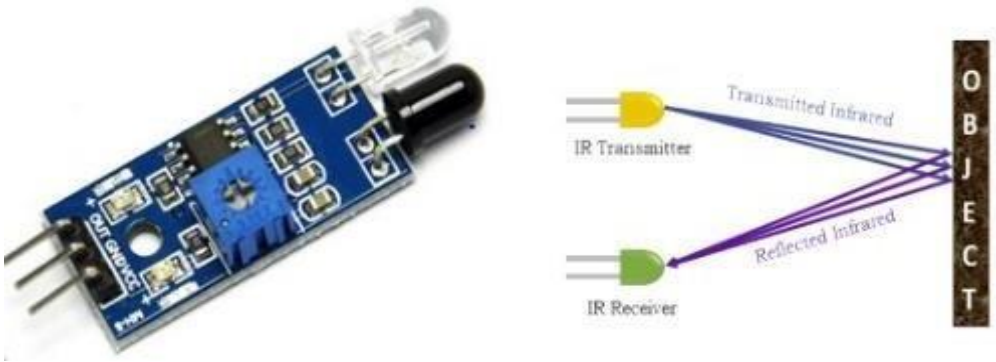

Fig.3.3.6 IR Photo diode Sensor

3.3.7 CARBON EMISSION SENSOR

Electrochemical carbon dioxide sensors measure electrical current to determine how much CO2 is present in the air. When CO2 enters the sensor, it chemically reacts within a polymer surface, resulting in an electrical charge. The type and amount of electrical charge is then used to determine how much CO2 is present.

Fig.3.3.7 Carbon Emission Sensor

3.3.8 GPS MODULE

GPS modules contain tiny processors and antennas that directly receive data sent by satellites through dedicated RF frequencies. From there, it'll receive timestamp from each visible satellites, along with other pieces of data.

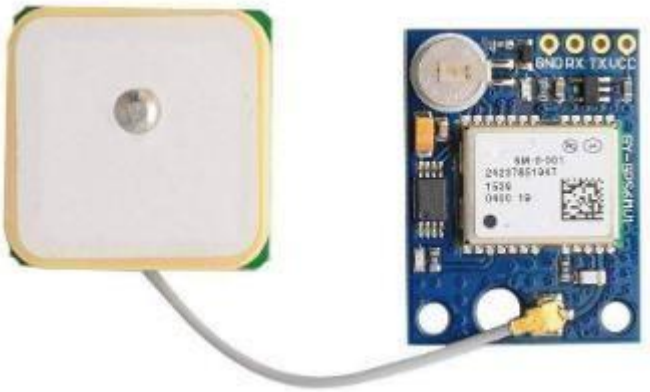

Fig.3.3.8 GPS Module

CHAPTER – 4

FUTURE WORK

- We will uses 4 types of sensor to overcome the problem.
- IR photo diode sensor is used to detect identify the driver drowsiness.
- Mq-135 sensor are used to detect the alcohol level to the diver.
- To detect the Driver drowsiness in the entire travelling.
- Accelerometer sensor are used to identify the accident.
- Mq-9 sensor are used to monitoring the vehicle carbon emission level.
- LCD and GSM will provide the information about the Vehicle statusand monitoring the drowsiness, alcohol and CO2 level of vehicle.

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