1. **INTRODUCTION**

According to WHO approximately 1.3 million people die every year in road traffic accidents there are many factors pf these types of accidents i.e., high speed driving influence of alcohol and drugs calling while during invisibility due to fog, etc. in the world. By the Times of India article “north India has the greatest number of accident cases due to fog especially in four months, November December January February the death rate is also in these accidents as the accident that happened in the fog can be dangerous.

In India, the Ministry of Road Transport and Highways state that 12678 people died in 2018 due to fog-related accident in India. in 2017 this figure is near about 11090, and in 2016 it is 9317. So these type of accident types is increasing day by day in India as well as all over the world. In addition, a proposed system which is very much helpful to avoid this type of accident especially in foggy weather drink and drive cases, etc.

To avoid the accident due to bad weather drinking we are going to implement a system called **“Digital Vehicle Monitoring Systems”.** In this proposed system an IOT based architecture is used. Apart from this, our system will also detect the driver’s alcohol level as well as pulse rate body temperature to monitor the health of the driver remotely, in addition, the location of the vehicle will also be captured by the GPS, GSM modules and to send the data to web servers to see the actual location of the vehicle and further future analysis.

**IoT (Internet of Things)**

IoT represents the physical objects and machines that can communicate with each other with the help of networks. Networks can be LAN (Local Area Network), WAN (Wide Area Network), Wi-Fi, Bluetooth. In this, we used some type of embedded system sensors, Micro-Controllers, Actuators. If we talk about the physical objects so that every physical thing (i.e., Ceiling Fan, AC, Refrigerators as well as Doors, Windows, Table, etc.) go under this category. As we all know that everything has its advantages as well as its drawbacks.

IoT is very useful in our day-to-day life. It can make human life easier and do the boring task automatically and very efficiently for example sometimes a person forgot to lock the door of their house and now he is in their or other work but know he needs to lock that door. So, by using IoT architecture and a particular setup he can easily lock their door from anywhere and at any time. But on the other hand, the implementation of these types of IoT setups has major challenges like Data encryption, Big Data analysis, Data Security (Avoid Cyber-Threats), etc. The sensors and as well as actuators generate a large amount of Data. Handling and storing these types of Data are major challenges. For security purposes, one can use Blockchain technology for Data encryption which is generated by the sensors and other types of microcontroller devices. Sensors are the very basic block of IoT it is not wrong if we state that the sensors are the backbone of this technology. Actuators are electro-mechanical devices that are used to convert electrical signals to mechanical movements. It acts like a human hand for the IoT systems to perform actions after receiving the electric signals.

1. **HARDWARE PARTS**

Toimplement this system, we are using the Arduino-Microcontroller, MQ-3 Alcohol Gas sensor, Pulse sensor, LM-35 Temperature sensor, Ublox Neo-6m GPS module, Sim800L GSM module, Laser Beam, Node MCU ESP8266 Wi-Fi Module.

**Arduino-Microcontroller Board**

It is the CPU of the system. It is based on Atmel 8-bit. AVR-Microcontroller. We will use the Arduino UNO board in this system is based on Atmega328. A UNO is a programmable micro-controller that can be connected to digital as well as analog signals which are generated by sensors, actuators.

It has a total of 14 digital input & output pins together with PWM (Pulse Width Modulation) output pins, a 16MHz crystal ceramic resonator, a USB connection port, a power connector jack, reset button. It is very simple to connect Arduino UNO with a computer by USB Arduino connector.

A screenshot of a computer

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*Fig.- Arduino UNO Micro-Controller*

**Hardware Architecture (Arduino UNO)**

* Operating & Input Voltage 5V, 7-12V
* Min. & Max. Limits of Input Voltage 6-12V
* Digital Pins 14
* PWM (~) Pins 6
* Analog Signal Input Pins 6
* Flash Memory 32KB
* Micro-Controller Chip Atmega328
* Clock speed 16MHz

**Alcohol Sensor MQ-3**

It is a sensor that can easily detect various gases especially Alcohol, Benzene, Methane, etc. The main sensitive material of the MQ-3 sensor is SNO2. SNO2 is less conductive in clean air and high conductive in gaseous atmospheres like Alcohol, Benzene, Methane, etc. It works on analog resistive output based on alcohol concentration.

It has four pins, namely,

A picture containing electronics

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Fig.- MQ-3 gas sensor

1. **Vcc**

This pin is the power source for the sensor. Usually, the power supply for the sensor is +5V.

1. **Ground (GND)**

This pin is connected to the ground terminal of the battery directly.

1. **Digital Output**

It is used to get the digital signal from the sensors to the microcontroller board.

1. **Analog Output**

This pin is used to get the data from the sensor in the form of analog signals based on the intensity of gas in the atmosphere. It works on 0-5V analog output.

**Specifications**

* Operating voltage 5V DC
* Operating current 140-160mA
* Detecting concentration for alcohol 0.05-10 mg/L
* Working Temperature -10 0 C – 52 0 C

This sensor is a semi-conductor with an easy SIP header interface. It is compatible with all types of microcontrollers and has a low-power standby mode. The sensitivity of the alcohol gas sensor is quite good and give a fast response to the microcontroller in term of cost and reliability, it is again a good module with low cost and long life. It is a very simple circuit, so anyone can understand the working of the sensor easily.

**Pulse Sensor (SEN-11574)**

Pulseis used to detect the heart rate of the human body. It gives us the live data of heart rate When a person touches it by their finger, the sensor detects heart rate and sends the signals to the microcontroller. It is also compatible with all types of microcontrollers it has three pins i.e., Operating voltage pin, Ground pin & Signal pin. The sensor works +3 to 5V DC voltage supply the sensor gives the data to Arduino in analog form.

A picture containing text, control panel

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Fig.- Pulse Sensor (SEN11574)

**LM-35 Temperature sensor**

Diagram

Description automatically generated This sensor is used for measuring temperature. It gives the analog output voltage proportional to temperature. It provides the output voltage in Celsius, and we don’t need to require any external circuit to use the sensor. The sensitivity of the sensor is in V/Celsius. It can measure temperature ranges between -50 0 C to 150 0 C. It gives a very much precise output. It is very much suitable for remote applications as well as low-cost operators from the 4V-30V input supply.

Fig.- LM-35 Temperature sensor

It has 3 pins Vcc, Signal output, and Ground (GND). The Vcc works as the input pin for the sensor and the GND pin is connected to the ground terminal directly. An output signal pin is used to get the Temperature to the microcontrollers.

**Ublox Neo 6M GPS Module**

This is a very popular GPS module. This module is used to collect the GPS data over the satellites. It gives the data in the form of longitudes, latitudes, etc. It has four pins, Tx, Rx, Vcc, GND. Tx stands for the transmitter, Rx stands for the receiver, GND is directly connected to the ground terminal of the battery & Vcc is the Input voltage of the module. Usually, the Vcc is between 3V-5V. It is a very popular low-cost and high-performance GPS. It has a backup battery and an internal memory chip.

A close-up of a circuit board

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Fig.- Ublox Neo 6M GPS Module

As mentioned above, the GPS module is based on the Ublox NEO6M GPS engine. It contains a configurable UART interface for serial communication on the standard UART (TTL) baud rate is 9,600. Because GPS signals are right-handed circularly polarized (RHCP), the style of GPS antennas is different from the typical whip antennas used for linearly polarized signals. The most popular type of antenna is the patch antenna. The antennas are flat because it has a ceramic and metal body that is mounted on the metal plate. They are often cast into homes. For more information on the Ublox reference design, please visit the company's website. Keep in mind that the position of the antenna bracket is very important for the best performance of the GPS receiver. If you use a patch antenna, it should be placed parallel to the geographic area. The antenna should have a complete view of the sky and should have a line of sight to see as many satellites as possible.

It has four connecting pins which are Vcc, GND, Rx, Tx. The Vcc pin is used to give the operating voltage to the module. GND pin is directly connected to the negative terminal of the battery. Rx and TX are Receiver and Transmitter respectively.

It works on Antijamming technology and the receiver type 50 channels -GPS L1 frequency. It has a maximum 5Hz navigation update rate with a default baud rate of 96000bps. It also has EEPROM with internal battery backup. The sensitivity is approximate -170dBm. The maximum operating voltage and current are 3.3-5V DC and 10mA respectively and the operating temperature range is near about -400 C--850 C.

**SIM800 L GSM Module.**

It is an electronic device that can be used to send data to the server using GPRS. To do that we need to install SIM in it and power it with a 3.7V-5V DC voltage Li-ion battery. GPRS stands for General Packet Radio Service. It can be easily connected to any microcontroller device like Arduino UNO, Raspberry Pi, etc. It works on 2G, 3G, and 4G networks except for LTE networks. This module upholds the baud rate between 1200bps to 115200bps with also auto-baud rate reorganization. This module needs an external antenna to connect to the network, It usually comes up with a Helical antenna that is directly connected to the NET pin to the board.

A close-up of a motherboard

Description automatically generated with medium confidence

Fig.- SIM800L GPRS Module

**Specifications**

* Supported quad-band are GSM 850, EGSM 900, DCS 1800 & PCS 1900.
* It can easily connect any global GSM network with any 2G SIM.
* Make and receive voice calls using external speakers & microphones.
* Send & receive GPRS data using TCP/IP, HTTP module, etc.
* It also accepts the micro-SIM card.

**LASER Light**

Laser stands for Light Amplification Stimulated Emission of Radiation. It is different from other lights Because it has narrow spectral bandwidth. In this prototype, we will try to print words using laser and vehicle speedometer connections. As speedometer sends the information or data to the laser printer internal memory. All wires are heated up and are ready to transfer their positive static charge to the metal drum cylinder. After this laser-activated and beamed to a chain of mirrors and reflected throughout the surface. As positive charge carbon toner is gradually released from the toner cartridge onto the drum while it rolls. Popular media slider across the printer and receiver gets positive charge by the transferring bell.

There is not every beam of laser cross successfully some lasers beam fused and melts the toner onto the paper. These laser beams jam the way, but excess toner is then deposited into a waste riser. A newly electric drum receives a fresh negative charge on its surface, a charge roller, after this the final beam appears which is printed as a laser.

**Node MCU ESP8266 Wi-Fi Module**

It is an open-source development board specially used for IoT-based applications. The word Node stands for the ‘firm’ & MCU stands for ‘microcontroller’. We can give the power supply to the board through micro-USB (integrated on the board), a 3.3V power supply. It has also an analog pin which is used to measure analog voltage between a range of 0 to 3.3V. This module has 16 general input/output pins & four pins available for SPI communication. It also has two UART interfaces, UART0(RxD0 & TxD0) & UART1(RxD1 & TxD1). This module uses Tensilica 32-bit RISC C.P.U, X-tensa LX106. The input voltage range is between 7 to 12V.

A close-up of a microchip

Description automatically generated with medium confidence

Fig.- NodeMCU ESP8266 Wi-Fi Module

This Wi-Fi module consists of 4 megabytes of flash memory & an S-RAM of 64 kilobytes. It also works on 80 Mhz. It is very reliable as well as popular in the IoT world. The microcontroller supports RTOS and 80 MHz to 160 MHz adjustable clock frequency. This board has 128 KB RAM also as well as flash memory to store data & programs. It has high processing power with Wi-Fi / Bluetooth features which makes it the ideal Wi-Fi module for IoT. The NodeMCU ESP8266 module can be easily programmable with Arduino IDE (Integrated Development Kit) which makes it more compatible, reliable, easy to use. The programming part takes hardly 5 to 10 minutes, you just need the Arduino IDE and the ESP8266 module itself.

**Applications**

* Providing internet to the microcontroller such as Arduino board, Raspberry Pi.
* It is suitable for low power consumption IoT applications.
* Networking-related projects required multiple input-output interfaces and Wi-Fi Bluetooth functionalities.

1. **PROBLEM STATEMENT**

As we know that 1.3 million people die each year in the world as a result of road traffic accidents. This figure is very large in terms of death. In the given figure, many of them are the only person who was earning in their family and due to this not only one person die but also their family will not be able to survive. In India, 1,33,201 people died due to road accidents during 2020. More than 3.54 lakh road accidents happened in India and approx. 60% of cases were due to overspeeding. If we talk about the percentage of death rate in India from the given of 1.3 million by W.H.O is 10% of 1.3 million. According to National Crime Record Bureau (NCRB), the drink & drive road accidents that occurred in 2019 were 12,256 and this figure is the registered cases & the unregistered cases can be a huge figure. Around 2% of overall road accidents are due to drinking and drive. According to the Times of India’s article, “Approx. 10,007 road accidents occurred due to fog out of which 7205 people lost their lives in 2019”.

Many of the injured people due to the road accidents also lose their life as if accidents happened, there were not any people to help them and also we can’t track their location to send them to the medical facility. Many of the people’s lives can be saved if we know their exact location. Due to these accidents only not the driver lost their life but also many innocent people die. If we talk about the buses a mistake by a driver can risk all the life of passengers. A small mistake can risk the lives of innocent people. If we analyze the factor of accidents, then the major factor is overspeeding drink and drive and weather conditions. To reduce these accidents, we are establishing a system in which the figure of road accidents due to over speeding drink and drive foggy weather and the bad health of drivers can be reduced and also to get the exact location of accidents that happened so that we can send them medical facilities instantly.

**PROPOSED SOLUTION**

To get the location of the vehicle, we need three devices i.e., Arduino UNO, Ublox Neo 6-M, and SIM800L GSM. In this, we need to connect the GND terminal of Arduino to the GND terminal of Ublox Neo 6m and Vcc to Vcc simultaneously. Now we will be connecting Pin 8 of Arduino to Tx of Neo 6m and Pin 9 to Rx. By doing this our Arduino will be connected to Ublox Neo 6m. Now our device will be getting GPS data from satellites. To set the GPS data to the web server, we will be connecting the SIM 800L GSM module to Arduino. First, we need to install a SIM card in the GSM module and power it with a 3.7V lion battery. After that, we need to connect the GND of both devices to the -ve terminal of the battery and the +ve terminal to Vcc of SIM 800L GSM module, Pin3 will be connected to Rx of SIM 800L GSM Module and Pin2 to Tx simultaneously. Now we need to send the data to the server, this data will be fetched from the SIM 800L GSM module in the form of latitudes and longitudes. For this, we need a web server and a database where the GPS data will be stored. We have to create the table of latitudes and longitudes in the database and to send this information instantly, we will connect the database to a web server. To view the location of the vehicle, we will use Google Map API Key. We will create an API key from the google cloud platform to connect it with the webserver in order to view locations. After implementing it, we will be getting the location of the vehicle and we can see it on the map.

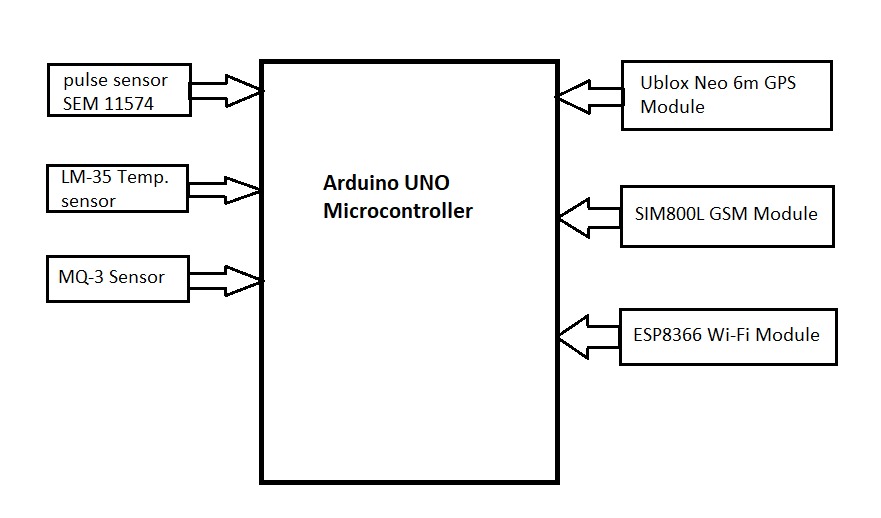


Fig.- Hardware Architecture

For the monitoring of health-related information of the driver like drinking, pulse rate, temperature, etc. we design steering in which some pulse sensors and LM-35 temperature sensors will be fitted. All the sensors are connected to the Arduino microcontroller to collect the data and future analyses. The ESP8266 Wi-Fi module is also connected to the Arduino to provide internet connectivity to the microcontroller and a platform to collect the data remotely. By doing this we can easily monitor the pulse rate, the body temperature of the driver.

To monitor the alcohol level of the driver, the alcohol sensor (MQ-3) will be fitted in the seatbelt of the driver seat. The alcohol sensor will be connected with the Arduino UNO microcontroller so that it will send the alcohol level data. This data will be sent to the database and after the data is stored in the database the management team can check the level of consumption. Getting the alcohol level of drivers instantly can save future accidents.

To avoid accidents due to foggy weather, we will introduce a laser light system that is placed on the back top of the vehicle. The idea behind this strategy is that the visibility in foggy weather is very low due to this the possibility of accidents increases i.e., we can’t see the road properly as well as vehicle in front of our vehicle. In this proposed system we try to decrease the accidents by using a LASER projection system. In this system, a laser projector is connected with the speedometer of the vehicle. This is a specific type of speedometer, in which a speed limit is already set. When the speed goes down to the predefined limit, the speedometer gives the signal to the laser projector and a laser beam is projected behind the vehicle at a predefined distance.

The distance of the projection point from the vehicle depends on the angle of the laser projector.

Diagram

Description automatically generated

Fig.- Laser Projection System

In the given figure, the projector is placed on the back top of the vehicle and the angle A is the projection angle. O is the projection point at which some words like “BUS”, “STOP”, etc will be projected. Suppose that the speed limit of projection is 15 kmph under this limit the laser will start projecting the laser beam. So, in the foggy weather the vehicle which is coming from behind the bus can easily understand that any other vehicle which is under the 15 kmph speed, is moving front of it and the driver press the break. By this system the possibilities of road accidents can be reduced.