

# **IOT BASED DIPSTICK TYPE ENGINE OIL LEVEL AND IMPURITIES MONITORING SYSTEM**

Submitted in partial fulfilment of the requirements for the award of Bachelor of  
Engineering degree in Electronics and Communication Engineering

By

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**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**SCHOOL OF ELECTRICAL AND ELECTRONICS ENGINEERING**

## **SATHYABAMA**

**INSTITUTE OF SCIENCE AND TECHNOLOGY**  
(DEEMED TO BE UNIVERSITY)

Accredited with Grade "A" by NAAC  
JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119

**APRIL - 2023**



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## **DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

### **BONAFIDE CERTIFICATE**

This is to certify that this Project Report is the bonafide work of BHASKAR NAIDU.M (39130070),SIVA JAGADEESH EDARA (39130127)who carried out the project entitled "Iot Based Dipstick Type Engine Oil Level and Impurities Monitoring System" Under our supervision from October 2022 to April 2023.

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Submitted for viva voce Examination held on 20/04/2023

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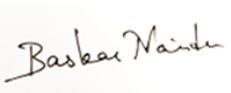
## DECLARATION

We BHASKAR NAIDU.M (39130070), SIVA JAGADEESH EDARA (39130127) hereby declare that the Project Report entitled “**IoT Based Dipstick Type Engine Oil Level and Impurities Monitoring System**” done by us under the guidance of **Dr.A. SAHAYA ANSELIN NISHA** is submitted in partial fulfilment of the requirements for the award of Bachelor of Engineering degree in Electronics and Communication Engineering.

DATE: 20/04/2023

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1. 

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**SIGNATURE OF THE CANDIDATES**

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## **ABSTRACT**

The Internet of things (IOT) describes physical objects (or groups of such objects) with sensors, processing ability, software, and other technologies that connect and exchange data with other devices and systems over the Internet or other communications networks.

This project describes about the design and development of an IOT based oil impurities, level monitoring instrument and its operational methodology. The research work uses a unique approach with customized white LED spectrophotometry.

The instrument has done Qualitative and Quantitative assessment of lubricant oil in IC engine's sump. This in turn is helpful in carrying out decisive task towards maintaining Engine life cycle and carbon footprint. The system has advantages of affordability and portable design.

This project also allows the user to navigate the vehicle live. The live vehicle tracking is achieved by GPS with the help of android app and internet. Thus, this project helps the user to prevent the vehicle theft in effectively.

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# **CHAPTER 1**

## **INTRODUCTION**

Automotive engine characteristics such as efficiency in terms of quantitative and qualitative parameters such as Engine performance parameters are power, torque and specific fuel consumption is directly related to the designed mechanisms of the engine and its smooth functioning within the limit of carbon footprint.

Lubricating oil plays a major role to keep the engine running with desired performance. Engine oil and lubricating oil in internal combustion engines are exposed to varying strains depending on the operating conditions and the fuel quality therefore it is essential to maintain the quality of engine oil and Lubricating oil so as to minimize the friction within the Engine. On one hand the oil must be changed in time to avoid possible engine failures, on the other hand an unnecessary oil change should be avoided for environmental and economic reasons.

Knowing the fact that low engine oil levels can be fatal for the engine, the engine oil pressure sensor comes very handy, But the bitter truth is not all two wheelers come featured with this piece of technology, therefore we still have to rely on our instincts and have to be vigilant as far as monitoring the engine oil levels in our rides are concerned. When we talk about our instincts every biker knows how to communicate with his/her ride. Often when the engine starves for the fluids the roughness starts augment and one can feel the heaviness in the engine, the transmission also becomes clunky and chattering sound becomes audible.

- IoT based Dipstick Type Engine Oil Level and Impurities Monitoring System will be able to detect the quantity of Engine oil present and also detect the impurities present in the Engine oil.
- The quality and quantity of engine oil reports can be generated and transmit through a Wi-Fi module to any mobile application from which the users can make quick decisions.

## **1.1.AIM OF THE PROJECT**

Oil degradation is the process by which the lubricating, cooling, cleaning, protection or sealing performance of the fluid decreases. Chemical reactions such as Oxidation, nitration, temperature rise, external contamination, shearing, corrosive ambient, additive depletion, etc. are the most important factors for accelerating the oil degradation process. Therefore, degradation of lubricant and engine oil impacts the performance of the machines such as gears, transmissions or automatisms where they are being used, and often the degradation of the lubricant properties is the cause of downtimes, dramatic failures and increases carbon footprint. Periodic change of these oils is a basic part of the maintenance program of Engine servicing operation which is not an optimum method economically and qualitatively.

## **CHAPTER 2**

### **LITERATURE SURVEY**

#### **2.1 IoT Based Horn Control and Oil Purity Monitoring System in Vehicles**

**Prof.K. Jeevitha** (2016) proposed by IoT Based Horn Control and Oil Purity Monitoring System in Vehicles Nowadays, we use intelligent devices in every part of our lives mainly in automobiles[1]. Horn is one of the important parts of the vehicle but at the same time, it creates excess noise to the surroundings. To use it wisely, we have restricted the number of the horn to be pressed. The driver can only use a certain number of horns per hour. If the horn exceeds, then fine will be charged from the concerned and also the duration of the horn is limited. During the emergency time, the fine amount is relaxed. To make sure we use a camera which will closely watch the situation of the person. The cautions will be given to the driver through the help of LCD display and speaker. If the additional cost is not paid, then the car will be locked automatically by blocking the engine so after paying the charge it will be released. This all details will be uploaded in both companies as well as in the government's server. One more feature is, a sensor will be used to sense the purity of the oil and will be updated in the server for the change of oil.

#### **2.2 Analysis of Impurities in Used Engine Oil Using Fourier Transform Infrared Spectroscopy**

**Prof.V.A. Poonkuzhali and A. Balasubramanian** (2017), "Analysis of Impurities in Used Engine Oil Using Fourier Transform Infrared Spectroscopy"[2]. This paper discusses the use of Fourier transform infrared (FTIR) spectroscopy to analyze impurities in used engine oil. The authors found that FTIR spectroscopy is a reliable technique for detecting contaminants, such as water and fuel, in engine oil.

## **2.3 Design of Motorcycle Oil Performance Detector**

**Prof. Muhammad Kholid Shalahuddin** (2017) Proposed Design of Motorcycle Oil Performance Detector IOT development currently leads in all fields of science, one of which is the area of the vehicle[3]. One of the important things in a vehicle is a lubricating system. Some accidents happen besides human negligence, but also on the condition of the vehicle is not good that the lubrication system is problematic. Checking the condition and quality of the oil can use a dipstick and a viscometer, but this method is still conventional. To solve this problem, it is necessary to develop technology by applying a microcomputer-based rotor drive to display the results of the calculation of oil viscosity on the LCD, and to make it easier for users to read the results. This study uses a turbidity sensor that is mounted directly on the engine to check the condition of the oil automatically. The method used in this research is to make the concept by designing checking tool performance and quality of oil using an Arduino controller. Results of this research is to design an automatic oil performance testing tool to display the percentage of the oil's condition to avoid the driver's negligence in replacing.

## **2.4 A portable lot based dipstick type engine oil level and impurities monitoring system using rf signals**

**Prof. M Satishwaran** (2018) Proposed A portable lot based dipstick type engine oil level and impurities monitoring system using rf signals. Engine oil and lubricating oil in internal combustion engines are exposed to varying strains depending on the operating conditions and the fuel quality therefore it is essential to maintain the quality of engine oil and Lubricating oil so as to minimize the friction within the Engine[4]. On one hand the oil must be changed in time to avoid possible engine failures, on the other hand an unnecessary oil change should be avoided for environmental and economic reasons. Degradation of lubricant and engine oil impacts the performance of the machines such as gears, transmissions or automatism where they are being used, and often the degradation of the lubricant properties is the cause of downtimes, dramatic failures and increases carbon footprint. Periodic change of these oils is a basic part of the maintenance

program of Engine servicing operation which is not an optimum method economically and qualitatively.

Dielectric constant is important indicator of motor oil quality. The conductivity characteristics are relative to influence of impurities concentration, which have various origins. A Portable IoT based Dipstick Type Engine Oil Level and Impurities Monitoring System contains a circularly polarized antenna which is made up of a series of proposed PCM elements which is used to transmit and receive RF signals which detects the impurities present in the Engine oil. Quantity grading done by using two sets of LDR and light source in the developed dip stick. One set is situated at the bottom of the dip stick and other set is mounted 20 mm above the first detector set. Missing signal from bottom detector depicts the low level of oil present in reservoir. Therefore, the quality and quantity of engine oil reports can be generated and transmit through a Wi-Fi module to any mobile application from which the users can make quick decisions.

## **2.5 Monitoring of Lubricating Oil Condition Based on Viscosity and Conductivity Measurements**

**Prof.Kovalenko et al.'s (2019)** Proposed “Monitoring of Lubricating Oil Condition Based on Viscosity and Conductivity Measurements” method involves measuring both viscosity and conductivity simultaneously using a single sensor. The sensor uses a quartz crystal microbalance (QCM) to measure viscosity and a pair of electrodes to measure conductivity[5]. The QCM measures the change in frequency of a quartz crystal due to the presence of oil, which is directly related to its viscosity. The electrodes measure the electrical conductivity of the oil.

The authors tested their method on samples of new and used lubricating oil and found that it could detect changes in viscosity and conductivity due to contamination and degradation. The method could potentially be used for online monitoring of lubricating oil in industrial machinery to detect early signs of degradation and prevent equipment failure.

## **2.1 SUMMARY**

Analysis of motor oil samples provides a view to relevant characteristics in the scope of continuing degradation processes. Mainly, the viscosity is the most important parameter in evaluation of motor oil condition, but it cannot provide the information about degradation factors. Evaluation of dielectric properties together with electric conductivity focus on character of continuing processes, what support reliable motor oil diagnostics.

Quantity grading is done by using two sets of LDR and light source in the developed dip stick. One set is situated at the bottom of the dip stick and other set is mounted 20 mm above the first detector set. At the time of experimentation both the qualitative grading and quantitative grading uses the both the set of detectors are used. Quantitative measurement is done by checking the signal from both detectors simultaneously. Missing signal from bottom detector depicts the low level of oil present in reservoir. The values are also displayed as symbol LOW, HIGH, FULL. It can detect the undesirable change in level generally occurs during the addition of impurities such as water, coolants etc. The condition and level of the engine oil and can be transmitted to a mobile application through a Wi-Fi module and the same can be monitored by the service agents, which helps them to intimate about the change in oil.

## **CHAPTER 3**

### **INVESTIGATION**

#### **3.1. Existing System:**

In two wheelers, we have seen through glass through which level of the oil is seen, in cars we don't have seen through glass instead we have dipstick which measures the level of oil. But in some high-end cars Audi, BWM etc we have certain oil level indicators, oil pressure indicator or some warning lights. The best way to keep an eye on the engine oil level is by regularly checking the oil level through the oil gauge. The gauge is a dip stick those dips into the oil pan present at the bottom of the engine where the engine oil lies.

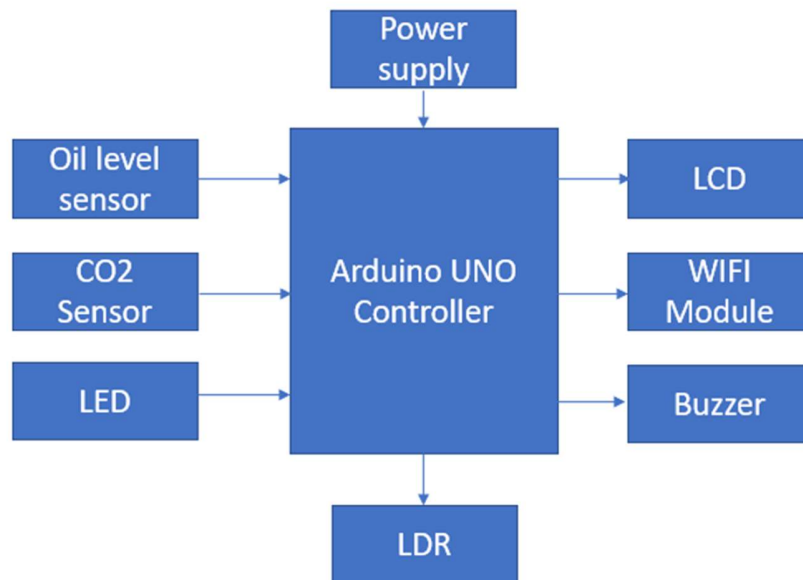
- Here only level of engine oil is measured not the condition or quality of the oil.
- Sometimes, dipstick pops out when the crankcase pressure is too high.

#### **3.2. Proposed System:**

Light-dependent sensor with sensitivity <90% and 500-600nm is used as a impurity detector for experimentation on vehicle's IC engine. Float switch is used to identify the oil level of the engine. Vehicle tracking is monitored by the GPS through IOT. The proposed model focuses the all-type of heavy-duty vehicle like car, bus, trucks. The operational methodology adopted for development using IoT. This tracking system can inform you the location and route travelled by vehicle, and that information can be observed from any other remote location.

- Here engine oil condition is monitored on a real time basis and deterioration of oil condition can be analysed based on the sensor's data.
- Thus, data from used oil can be analysed to assist in identifying inherent mechanical shortcomings, in quality analysis of oil and also the balance lifetime of the oil.

### 3.3. Block Diagram:



*Fig.3.1. Block diagram*

### 3.4. Components used:

- Arduino Controller
- level sensor
- CO2 sensor
- LED
- LDR
- Buzzer
- ESP 8266
- IOT

## CHAPTER 4

### HARDWARE REQUIREMENT

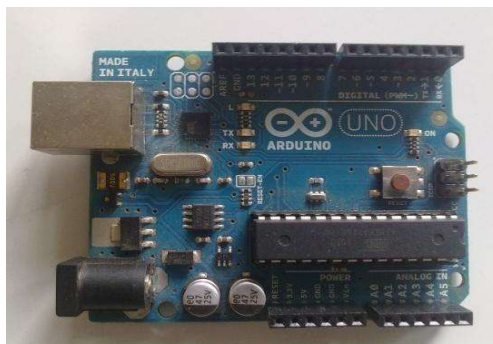
#### 4.1. ARDUINO CONTROLLER

Arduino is a tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board.

Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino projects can be stand-alone, or they can communicate with software running on your computer. The boards can be assembled by hand or purchased preassembled; the open-source IDE can be downloaded for free.

The Arduino programming language is an implementation of Wiring, a similar physical computing platform, which is based on the Processing multimedia programming environment.

**Arduino Uno:**



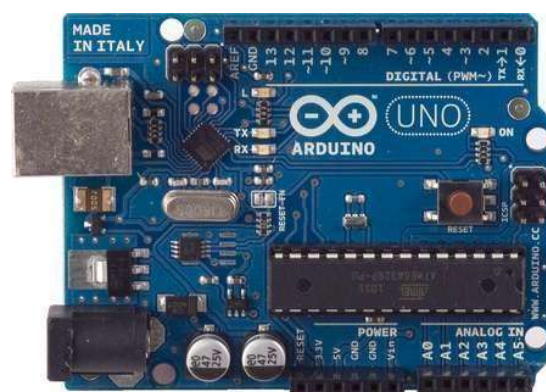
*Fig.4.1. Arduino Uno*

### 4.1.1 Overview

The Arduino microcontroller is an easy to use yet powerful single board computer that has gained considerable traction in the hobby and professional market. The Arduino is open source, which means hardware is reasonably priced and development software is free. This guide is for students in ME 2011, or students anywhere who are confronting the Arduino for the first time. For advanced Arduino users, prowl the web; there are lots of resources.

This guide covers the Arduino Uno board (Spark fun DEV-09950, \$29.95), a good choice for students and educators. With the Arduino board, you can write programs and create interface circuits to read switches and other sensors, and to control motors and lights with very little effort. Many of the pictures and drawings in this guide were taken from the documentation on the

**This is what the Arduino board looks like.**



*Fig.4.1 ArduinoUno*

The microcontroller operating at 5 V with 2 Kb of RAM, 32 Kb of flash memory for storing programs and 1 Kb of EEPROM for storing parameters. The clock speed is 16 MHz, which translates to about executing about 300,000 lines of C source code per second. The board has 14 digital I/O pins and 6 analog input pins. There is a USB connector for talking to the host computer and a DC power jack for connecting an external 6-20 V power source, for example a 9 V battery, when

running a program while not connected to the host computer. Headers are provided for interfacing to the I/O pins using 22 g solid wire or header connectors.

The Arduino programming language is a simplified version of C/C++. If you know C, programming the Arduino will be familiar. If you do not know C, no need to worry as only a few commands are needed to perform useful functions.

An important feature of the Arduino is that you can create a control program on the host PC, download it to the Arduino and it will run automatically. Remove the USB cable connection to the PC, and the program will still run from the top each time you push the reset button. Remove the battery and put the Arduino board in a closet for six months. When you reconnect the battery, the last program you stored will run. This means that you connect the board to the host PC to develop and debug your program, but once that is done, you no longer need the PC to run the program.

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

#### **4.1.2 Summary:**

- Microcontroller ATmega328
- Operating Voltage 5V
- Input Voltage (recommended) 7-12V
- Input Voltage (limits) 6-20V
- Digital I/O Pins 14 (of which 6 provide PWM output)

- Analog Input Pins 6
- DC Current per I/O Pin 40 mA
- DC Current for 3.3V Pin 50 Ma

#### 4.1.3 Pin Configuration:

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically.

External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector.

The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

The power pins are as follows:

- **VIN**. The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- **5V**. this pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board.
- **3V3**. A 3.3-volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- **GND**. Ground pins.

- **IOREF.** This pin on the Arduino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs for working with the 5V or 3.3V.

#### 4.1.4. Memory:

The Atmega328 has 32 KB (with 0.5 KB used for the bootloader). It also has 2 KB of SRAM and 1 KB of EEPROM.

#### 4.1.5. Input and Output:

Each of the 14 digital pins on the Uno can be used as an input or output, using `pinMode()`, `digital Write()`, and `digital Read()` functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kohms. In addition, some pins have specialized functions:

- **Serial: 0 (RX) and 1 (TX).** Used to receive (RX) and Trans mit (TX) TTL serial data.

These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.

- **External Interrupts: 2 and 3.** These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the `attach Interrupt()` function for details.
- **PWM: 3, 5, 6, 9, 10, and 11.** Provide 8-bit PWM output with the `analog Write()` function.
- **SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK).** These pins support SPI communication using the SPI library.
- **LED: 13.** There is a built- in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

The Uno has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits of resolution (i.e., 1024 different values). By default, they measure from ground to 5 volts, though it is possible to change the upper end of their range using the AREF pin and the `analogReference()` function.

Additionally, some pins have specialized functionality:

- **TWI: A4 or SDA pin and A5 or SCL pin.** Support TWI communication using the `Wire` library.
- **I2C:** 4 (SDA) and 5 (SCL). Support I2C (TWI) communication using the `Wire` library. There are a couple of other pins on the board.
- **AREF:** Reference voltage for the analog inputs. Used with `analogReference()`.
- **Reset:** Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields that block the one on the board.

#### 4.1.6 Communication:

Microcontrollers depend on a host computer for developing and compiling programs. The software used on the host computer is known as an integrated development environment, or IDE. For the Arduino, the development environment is based on the open-source Processing platform ([www.processing.org](http://www.processing.org)) which is described by its creators as a “programming language and environment for people who want to program images, animation, and interactions. “The Arduino programming language leverages an open-source project known as Wiring ([wiring.org.co](http://wiring.org.co)). The Arduino language is based on good old-fashioned C. If you are unfamiliar with this language, don’t worry; it’s not hard to learn, and the Arduino IDE provides some feedback when you make mistakes in your programs.

The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '16U2 firmware

uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a .inf file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1).

A Software Serial library allows for serial communication on any of the Uno's digital pins. The ATmega328 also supports I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus; see the documentation for details. For SPI communication, use the SPI library.

As you go through the list of programming statements available in the Arduino IDE (choose Help->Reference), you might think there isn't much power for doing things like running servos, operating stepper motors, reading potentiometers, or displaying text on an LCD. Like most any language based on C, the Arduino supports the notion of "libraries" code

Repositories that extend core programming functionality. Libraries let you re-use code without having to physically copy and paste it into all your programs. The standard Arduino software installation comes with several libraries you may use, and you can download others from the Arduino support pages and from third-party websites that publish Arduino library code. A good example of a library you'll use with the Robot and likely many other robot projects is

Servo. This library allows you to connect one or more hobby R/C servos to the Arduino's digital I/O pins. The Servo library comes with the standard Arduino installation package Library->Servo. This adds the line

```
#include <Servo.h>
```

Which tells the Arduino IDE that you wish to include the Servo library in your sketch. With the functionality of the library now available to you, you can use its various functions to control one or more servos. For example, you can use the write function to rotate a servo to a specific position, from 0 to 180 degrees. The following code

```
myServo.write(90);
```

Moves a servo to its midpoint, or 90-degree position. Structurally, Arduino sketches are very straightforward and are pretty easy to read and understand. The Arduino program contains two main parts: setup () and loop (). These are programming functions that do what their names suggest: setup () sets up the Arduino hardware, such as specifying which I/O lines you plan to use, and whether

They are inputs or outputs. The loop () function is repeated endlessly when the Arduino is operating.

## **4.2. LEVEL MEASUREMENT**

In industry, liquids such as water, chemicals, and solvents are used in various processes. The amount of such liquid stored can be found by measuring level of the liquid in a container or vessel. The level affects not only the quantity delivered but also pressure and rate of flow in and out of the container. Level sensors detect the level of substances like liquids, slurries, granular materials, and powders. The substance to be measured can be inside a container or can be in its natural form (e.g., a river or a lake). The level measurement can be either continuous or point values.

Wide spectrum of sensors is available in the market and commonly, they are classified based on the specific application of the sensor. Sensor used for measuring humidity is termed as humidity sensor, the one used for measurement of pressure is called pressure sensor, sensor used for measurement of

displacement is called position sensor and so on through all of them may be using the similar sensing principle. In a similar fashion, the sensor used for measurement of fluid levels is called a level sensor.

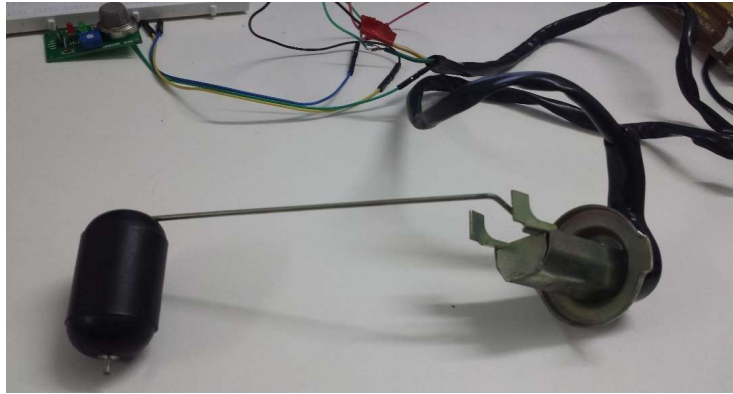
Quite obvious from its name, level sensors are used to measure the level of the freeflowing substances. Such substances include liquids like water, oil, slurries, etc as well as solids in granular/powder form (solids which can flow). These substances tend to get settled in the container tanks due to gravity and maintain their level in rest state. Level sensors measure their level against a pre-set reference.

They are important not only in nuclear plants but in lot many applications. Every car, truck and motorcycle are equipped with a fuel level sensor to measure the amount of gasoline left in the fuel tank. In addition, there are sensors for level measurement of engine oil, brake / power steering fluid, cooling water, windshield cleaning liquid, etc. Industrial applications include liquid level sensing in water treatment tanks, transport and storage tanks, in the petrochemical industry for liquids such as petrol, etc. Liquid level measurement is important in household applications for devices such as automated coffee machines, water dispensers, juice squeezers, water evaporators, steamers, fridges and freezers, boilers, heating systems, dishwashers, washing machines, steam irons, etc

In short, level sensors are one of the very important sensors and play very important role in variety of consumer/ industrial applications. As with other type of sensors, level sensors are available or can be designed using variety of sensing principles. Selection of an appropriate type of sensor suiting to the application requirement is very important.

**Continuous level sensors** measure the level to determine the exact amount of substance in a continuous manner.

**Point-level sensors** indicate whether the substance is above or below the sensing point. This is essential to avoid overflow or emptying of tanks and to protect pumps from dry run.



*Fig.4.2. Level sensor*

From the application point of view the considerations are:

- Price
- Accuracy
- Response rate
- Ease of calibration
- Physical size and mounting of the instrument
- Monitoring or control of continuous or discrete levels

Level measurements are broadly classified in two groups:

- Direct methods
- Indirect methods

**In direct methods**, the level is indicated directly by means of simple mechanical devices. The measurement is not affected by changes in material density. Few examples are:

- Dip Stick
- Resistance Tapes
- Sight Glass
- Floats
- Ultrasonic
- Radar

**In Indirect methods**, the level is converted in a measurable signal using a suitable transducer. Change in the material affects the measurement. A corrective factor must be used in recalibrating the instrument. Few examples are:

- Hydrostatic head methods
- Load cell
- Capacitance
- Conductivity

**Applications:**

Level Probes are used for measuring level of

1. Liquids
2. Powdered and granular solids
3. Liquid metals at very high temperature
4. Liquefied gases at very low temperature

**Disadvantages:**

Light density materials under 20 lb/ft<sup>3</sup> and materials with particle sizes exceeding 1/2 in. in diameter can be a problem due to their very low dielectric constants (caused by the large amount of air space between particles).

### 4.3.CO<sub>2</sub> SENSOR



*Fig.4.3.CO<sub>2</sub> Sensor*

you want to make a project with carbon dioxide sensors also need a good range sensing property on this sensor then this module is good for you. This sensor measures gaseous carbon dioxide levels by monitoring the amount of infrared (IR) radiation absorbed by carbon dioxide molecules. This type of sensor is used in monitoring indoor air quality, landfills, process control, and controlled environment horticulture.

**MG-811** Carbon Dioxide Sensor Module (Carbon dioxide sensor) is a carbon dioxide sensor (CO<sub>2</sub>) sensor that is a Metal Oxide Sensor sensor, which must heat the tank to the specified level. (With the method of supplying power) will cause heat vapor and separate CO<sub>2</sub> from the air. This sensor module has an MG-811 onboard as the sensor component. A signal output circuit for heating the sensor the MG-811 is highly sensitive to CO<sub>2</sub> and less sensitive to alcohol and CO. The output voltage of the CO<sub>2</sub> increases.

Useful for greenhouses and medical projects. Sends an analog signal that decreases as the concentration of CO<sub>2</sub> increases. This module also includes a digital output pin with TTL output. The Potentiometer on board is used to set the Digital Output Setpoint.

After setting the potentiometer threshold, once that threshold is reached, an LED on the sensor will illuminate and the digital pin will give a HIGH voltage signal.

#### **Pinout:**

1. VCC: 6V (You can use a 4 AA battery holder for this).
2. AOUT: Analog Output (voltage decreases as CO<sub>2</sub> Levels increase).
3. DOUT: Digital Output that goes HIGH when the threshold is reached (set the threshold by turning the onboard potentiometer).
4. GND: 0V.

#### **Features:**

1. Wide detecting scope.

2. High sensitivity & stability.
3. Simple drive circuit.
4. Digital output: Active low (When it outputs a low-level signal, the indicator LED will be on)
5. Analog output: Two Range Options: 0 to 2V or 0V to 4V. The default is 0V to 2V DC
6. Compatible with Arduino & Raspberry Pi (for use on analog output with Raspberry Pi you will need an Analog to Digital Converter Chip).

#### **4.4. LIGHT EMITTING DIODE (LED)**

A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons (Energy packets). The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor. White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device.

- Appearing as practical electronic components in 1962, the earliest LEDs emitted low-intensity infrared (IR) light. Infrared LEDs are used in remotecontrol circuits, such as those used with a wide variety of consumer electronics. The first visible-light LEDs were of low intensity and limited to red. Early LEDs were often used as indicator lamps, replacing small incandescent bulbs, and in seven-segment displays. Later developments produced LEDs available in visible, ultraviolet (UV), and infrared wavelengths, with high, low, or intermediate light output, for instance white LEDs suitable for room and outdoor area lighting.
- LEDs have also given rise to new types of displays and sensors, while their high switching rates are useful in advanced communications technology with applications as diverse as aviation lighting, fairy lights, automotive

headlamps, advertising, general lighting, traffic signals, camera flashes, lighted wallpaper, horticultural grow lights, and medical devices.

- LEDs have many advantages over incandescent light sources, including lower power consumption, longer lifetime, improved physical robustness, smaller size, and faster switching.
- In exchange for these generally favourable attributes, disadvantages of LEDs include electrical limitations to low voltage and generally to DC (not AC) power, inability to provide steady illumination from a pulsing DC or an AC electrical supply source, and lesser maximum operating temperature and storage temperature. In contrast to LEDs, incandescent lamps can be made to intrinsically run at virtually any supply voltage, can utilize either AC or DC current interchangeably, and will provide steady illumination when powered by AC or pulsing DC even at a frequency as low as 50 Hz.
- LEDs usually need electronic support components to function, while an incandescent bulb can and usually does operate directly from an unregulated DC or AC power source.

#### **4.5. LIGHT DEPENDENT RESISTOR (LDR)**



*Fig .4.4. LDR Circuit Diagram*

Light dependent resistors, LDRs or photoresistors are electronic components that are often used in electronic circuit designs where it is necessary to detect the presence or the level of light.

LDRs are very different to other forms of resistor like the carbon film resistor, metal oxide film resistor, metal film resistor and the like that are widely used in other electronic designs. They are specifically designed for their light sensitivity and the change in resistance this causes.

These electronic components can be described by a variety of names from light dependent resistor, LDR, photoresistor, or even photocell, photocell or photoconductor.

Although other electronic components such as photodiodes or phototransistor can also be used, LDRs or photo-resistors are a particularly convenient to use in many electronic circuit designs. They provide large change in resistance for changes in light level.

A photoresistor or light dependent resistor is an electronic component that is sensitive to light. When light falls upon it, then the resistance changes. Values of the resistance of the LDR may change over many orders of magnitude the value of the resistance falling as the level of light increases.

It is not uncommon for the values of resistance of an LDR or photoresistor to be several megohms in darkness and then to fall to a few hundred ohms in bright light.

With such a wide variation in resistance, LDRs are easy to use and there are many LDR circuits available. The sensitivity of light dependent resistors or photoresistors also varies with the wavelength of the incident light.

LDRs are made from semiconductor materials to enable them to have their light sensitive properties. Many materials can be used, but one popular material for these photoresistors is cadmium sulphide, CdS, although the use of these cells is now restricted in Europe because of environmental issues with the use of cadmium.

Similarly other cadmium-based semiconductor materials like cadmium CdSe are also restricted. Other materials that can be used include lead sulphide, PbS and indium antimonide, InSb.

Although a semiconductor material is used for these photoresistors, they are purely passive devices because they do not possess a PN junction, and this separates them from other photodetectors like photodiodes and phototransistors.

#### **4.6.LCD DISPLAY**

At present, we look liquid crystal displays (LCDs) everywhere; however, they didn't develop immediately. It took so much time to develop from the development of the liquid crystal to a large number of LCD applications. In the year 1888, the first Liquid crystals were invented by Friedrich Reinitzer (Austrian botanist). When he dissolved a material like a cholesteryl benzoate, then he observed that it initially it turns into a cloudy fluid & cleared up as its temperature rose. Once it is cooled, then the fluid became blue before lastly crystallizing. So, the first experimental liquid crystal display was developed by the RCA Corporation in the year 1968. After that, the manufacturers of LCD have gradually designed ingenious differences & developments on the technology by taking this display device into an incredible range. So finally, the developments in the LCD have been increased.

##### **What is an LCD (Liquid Crystal Display)?**

A liquid crystal display or LCD draws its definition from its name itself. It is a combination of two states of matter, the solid and the liquid. LCD uses a liquid crystal to produce a visible image. Liquid crystal displays are super-thin technology display screens that are generally used in laptop computer screens, TVs, cell phones, and portable video games. LCD's technologies allow displays to be much thinner when compared to a cathode ray tube (CRT) technology.

Liquid crystal display is composed of several layers which include two polarized panel filters and electrodes. LCD technology is used for displaying the image in a notebook or some other electronic devices like minicomputers. Light is projected from a lens on a layer of liquid crystal. This combination of colored light with the

grayscale image of the crystal (formed as electric current flows through the crystal) forms the colored image. This image is then displayed on the screen.



*Fig.4.5.LCD Display*

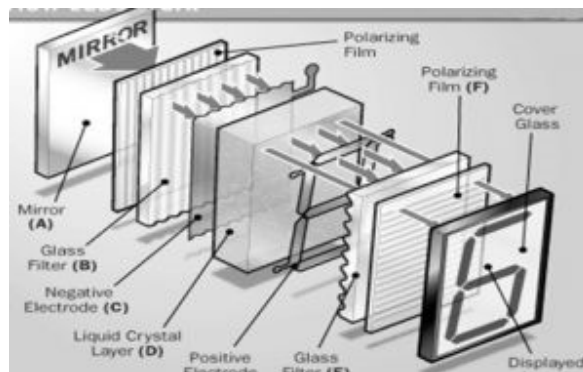
An LCD is either made up of an active-matrix display grid or a passive display grid. Most of the Smartphone's with LCD technology uses active-matrix display, but some of the older displays still make use of the passive display grid designs. Most of the electronic devices mainly depend on liquid crystal display technology for their display. The liquid has a unique advantage of having low power consumption than the LED or cathode ray tube.

The liquid crystal display screen works on the principle of blocking light rather than emitting light. LCDs require a backlight as they do not emit light themselves. We always use devices which are made up of LCD's displays which are replacing the use of cathode ray tube. Cathode ray tube draws more power compared to LCDs and is also heavier and bigger.

### **How are LCDs Constructed?**

Simple facts that should be considered while making an LCD:

1. The basic structure of the LCD should be controlled by changing the applied current.
2. We must use polarized light.
3. The liquid crystal should be able to control both of the operations to transmit or can also be able to change the polarized light.



*Fig.4.6. LCD Construction*

As mentioned above that we need to take two polarized glass pieces filter in the making of the liquid crystal. The glass which does not have a polarized film on the surface of it must be rubbed with a special polymer that will create microscopic grooves on the surface of the polarized glass filter. The grooves must be in the same direction as the polarized film.

Now we have to add a coating of pneumatic liquid phase crystal on one of the polarizing filters of the polarized glass. The microscopic channel causes the first layer molecule to align with filter orientation. When the right angle appears at the first layer piece, we should add a second piece of glass with the polarized film. The first filter will be naturally polarized as the light strikes it at the starting stage.

Thus, the light travels through each layer and guided to the next with the help of a molecule. The molecule tends to change its plane of vibration of the light to match its angle. When the light reaches the far end of the liquid crystal substance, it vibrates at the same angle as that of the final layer of the molecule vibrates. The light is allowed to enter into the device only if the second layer of the polarized glass matches with the final layer of the molecule.

## 4.7. BUZZER

There are many ways to communicate between the user and a product. One of the best ways is audio communication using a buzzer IC. So, during the design process, understanding some technologies with configurations is very helpful. So, this article discusses an overview of an audio signaling device like a beeper or a buzzer and its working with applications.

### What is a Buzzer?

An audio signaling device like a beeper or buzzer may be electromechanical or piezoelectric or mechanical type. The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc. Based on the various designs, it can generate different sounds like alarm, music, bell & siren.



*Fig 4.7. Buzzer Pin Configuration*

The **pin configuration of the buzzer** is shown below. It includes two pins namely positive and negative. The positive terminal of this is represented with the '+' symbol or a longer terminal. This terminal is powered through 6Volts whereas the negative terminal is represented with the '-' symbol or short terminal and it is connected to the GND terminal.

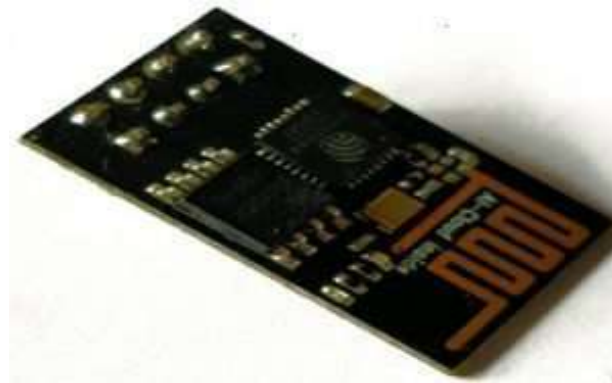
## 4.8. ESP8266 Wi-Fi MODULE

In 2014, an ESP8266 Wi-Fi module was introduced and developed by third-party manufacturers like AI thinkers, which is mainly utilized for IoT-based embedded applications development. It is capable of handling various functions of the Wi-Fi network from another application processor.

It is a SOC (System On-chip) integrated with a TCP/IP protocol stack, which can provide microcontroller access to any type of Wi-Fi network. This article deals with the pin configuration, specifications, circuit diagram, applications, and alternatives of the ESP8266 Wi-Fi module.

### What is the ESP8266 Wi-Fi Module?

An ESP8266 Wi-Fi module is a SOC microchip mainly used for the development of endpoint IoT (Internet of things) applications. It is referred to as a standalone wireless transceiver, available at a very low price. It is used to enable the internet connection to various applications of embedded systems.



*Fig 4.8. ESP8266 Wi-Fi Module*

Press if systems designed the ESP8266 Wi-Fi module to support both the TCP/IP capability and the microcontroller access to any Wi-Fi network. It provides the solutions to meet the requirements of industries of IoT such as cost, power, performance, and design.

It can work as either a slave or a standalone application. If the ESP8266 Wi-Fi runs as a slave to a microcontroller host, then it can be used as a Wi-Fi adaptor to any type of microcontroller using UART or SPI. If the module is used as a standalone application, then it provides the functions of the microcontroller and Wi-Fi network.

The ESP8266 Wi-Fi module is highly integrated with RF balun, power modules, RF transmitter and receiver, analog transmitter and receiver, amplifiers, filters, digital baseband, power modules, external circuitry, and other necessary components. The ESP8266 Wi-Fi module is a microchip shown in the figure below.

A set of AT commands are needed by the microcontroller to communicate with the ESP8266 Wi-Fi module. Hence it is developed with AT commands software to allow the Arduino Wi-Fi functionalities, and also allows loading various software to design the own application on the memory and processor of the module.

The processor of this module is based on the Tensilica Xtensa Diamond Standard 106 micro and operates easily at 80 MHz. There are different types of ESP modules designed by third-party manufacturers. They are,

- ESP8266-01 designed with 8 pins (GPIO pins -2)
- ESP8266-02 designed with 8 pins (GPIO pins -3)
- ESP8266-03 designed with 14 pins (GPIO pins- 7)
- ESP8266-04 designed with 14 pins (GPIO pins- 7)

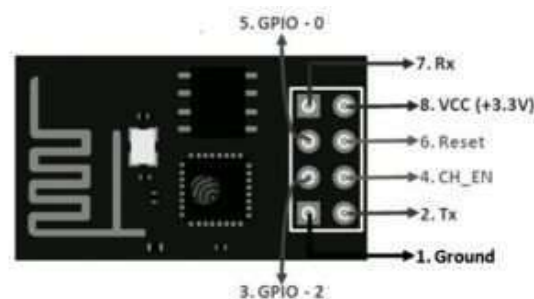
The ESP8266 Wi-Fi module comes with a boot ROM of 64 KB, user data RAM of 80 KB, and instruction RAM of 32 KB. It can support 802.11 b/g/n Wi-Fi network at 2.4 GHz along with the features of I2C, SPI, I2C interfacing with DMA, and 10-bit ADC. Interfacing this module with the microcontroller can be done easily

through a serial port. An external voltage converter is required only if the operating voltage exceeds

3.6 Volts. It is most widely used in robotics and IoT applications due to its low cost and compact size.

### **Pin Configuration/Pin Diagram:**

The ESP8266 Wi-Fi module pin configuration/pin diagram is shown in the figure below. The ESP8266-01 Wi-Fi module runs in two modes. They are;



*Fig 4.9. Pin Configuration of ESP8266*

**Flash Mode:** When GPIO-0 and GPIO-1 pins are active high, then the module runs the program, which is uploaded into it.

**UART Mode:** When the GPIO-0 is active low and GPIO-1 is active high, then the module works in programming mode with the help of either serial communication or Arduino board.

### **ESP8266 Wi-Fi Module Specifications**

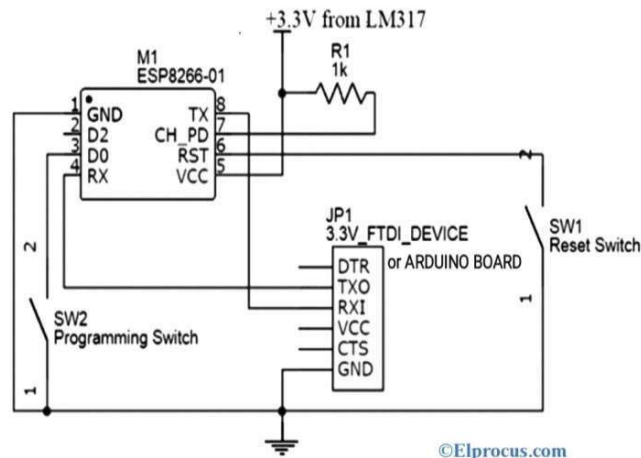
The ESP8266 Wi-Fi module specifications or features are given below.

- It is a powerful Wi-Fi module available in a compact size at a very low price.
- It is based on the L106 RISC 32-bit microprocessor core and runs at 80 MHz
- It requires only 3.3 Volts power supply
- The current consumption is 100 m Amps

- The maximum Input/Output (I/O) voltage is 3.6 Volts.
- It consumes 100 mA current
- The maximum Input/Output source current is 12 mA
- The frequency of built-in low power 32-bit MCU is 80 MHz
- The size of flash memory is 513 kb
- It is used as either an access point or station or both
- It supports less than 10 microAmps deep sleep
- It supports serial communication to be compatible with several developmental platforms such as Arduino
- It is programmed using either AT commands, Arduino IDE, or Lua script
- It is a 2.4 GHz Wi-Fi module and supports WPA/WPA2, WEP authentication, and open networks.
- It uses two serial communication protocols like I2C (Inter-Integrated Circuit) and SPI (Serial Peripheral Interface).
- It provides 10- bit analog to digital conversion
- The type of modulation is PWM (Pulse Width Modulation)
- UART is enabled on dedicated pins and for only transmission, it can be enabled on GPIO2.
- It is an IEEE 802.11 b/g/n Wi-Fi module with LNA, power amplifier, balun, integrated TR switch, and matching networks.
- GPIO pins – 17
- Memory Size of instruction RAM – 32 KB
- The memory size of instruction cache RAM – 32 KB
- Size of User-data RAM- 80 KB
- Size of ETS systems-data RAM – 16 KB

#### Circuit Diagram/How to Use?

There are several techniques and IDEs are available by using ESP8266 Wi-Fi modules. The Arduino IDE is the most commonly used technique. Now, let's learn the working of the Arduino IDE using the ESP8266 Wi-Fi module. The circuit diagram/how to use the Arduino IDE or FTDI device is illustrated in the below figure.



*Fig 4.10. Circuit Diagram of ESP8266 Module*

The power supply required for the ESP8266 module is only 3.3 Volts. If it is more than 3.7 Volts, then the module gets damaged, and this leads to circuit failure. Hence it is necessary to program the ESP-01 Wi-Fi module by using either Arduino board or FTDI device, which supports the programming 3.3 Volts supply. It is recommended for the user to buy either one FTDI device or an Arduino board.

The most common issue with the ESP-01 module is the powering up issue. The 3.3 Volts pin on the Arduino board is used to power up this module or simply we can use the potential divider. So, to provide a minimum current of 500 mA, the voltage regulator that supports 3.3 Volts is mandatory. The LM317 voltage regulator does this work very easily and effectively.

The programming switch SW2 is pressed to connect the GPIO-0 pin to the GND (Ground). This is the programming mode to upload the code by the user. After uploading the code, the switch is released.

#### Where to Use/Applications of ESP8266 Wi-Fi Module

The applications of the ESP8266 Wi-Fi module are given below

- Access points portals
- IoT projects

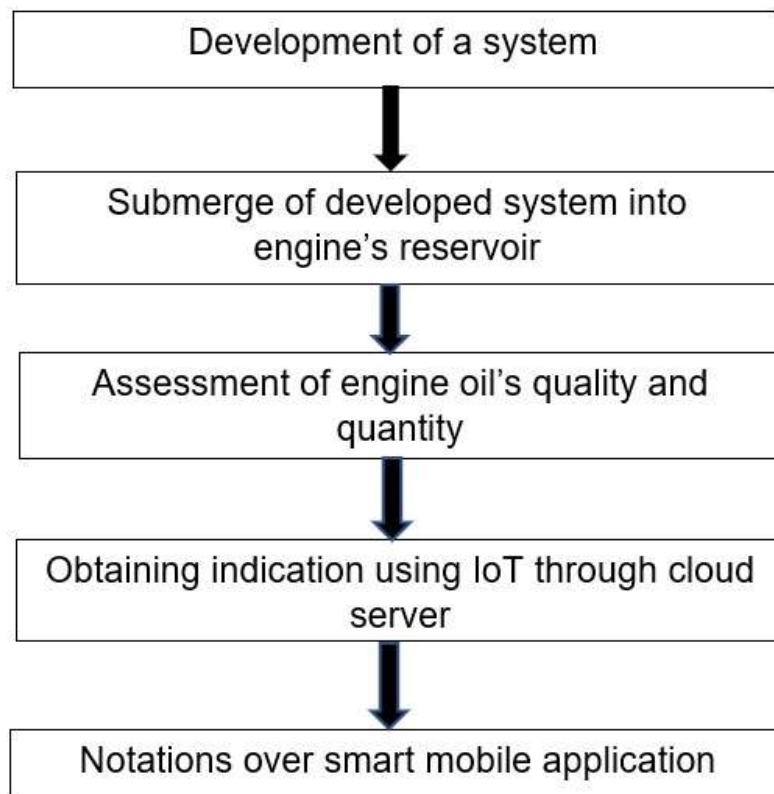
- Wireless data logging
- Used in learning the networking fundamentals
- Sockets and smart bulbs
- Smart home automation systems

## CHAPTER 5

### ANALYSIS

#### 5.1. PROPOSED METHODOLOGY

The research work uses a unique approach with customized white LED spectrophotometry. A lightdependent sensor (LDR) with sensitivity <90% and range 500-600nm is used as a detector for experimentation on four stroke IC Engine [12] . The operational methodology adopted for development of the IoT based dipstick type.



*Fig.5.1. Flow diagram to demonstrate operations*

Design of instrument is done over CAD software, which involves mechanical, logical and operational difficulties. Position and attributes of the embedded components are precisely designed. After that submerge of designed system into

engine oil's sump. After few seconds computation of data processed over microcontroller and stored over cloud server. At cloud server all the calculations are done for qualitative and quantitative assessment. Developed GUI represents graphical information for user.

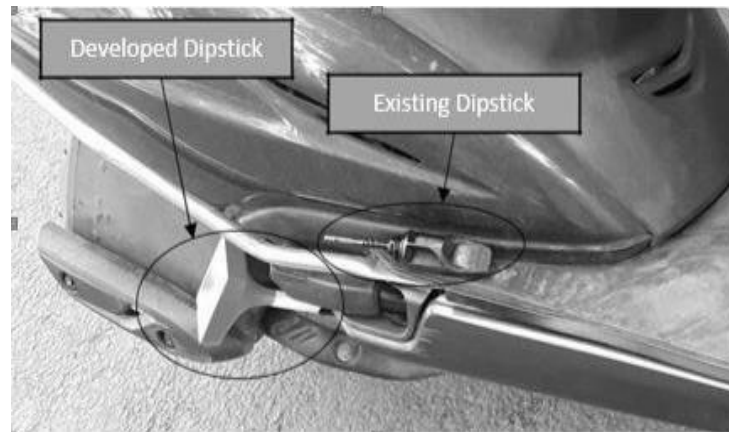
## 5.2. PROJECT IMPLEMENTATION

As mentioned, different types of sensors are connected to the Arduino UNO board as follows:

- **Level Sensor** is connected to detect the amount of liquid level by measuring the liquid in a container or vessel. .
- **CO2 Sensor (MG-811)** is connected to measures gaseous carbon dioxide levels by monitoring the amount of infrared (IR) radiation absorbed by carbon dioxide molecules. This type of sensor is used in monitoring indoor air quality, landfills, process control, and controlled environment horticulture.
- **Light dependent resistors (LDR)** are electronic components that are often used in electronic circuit designs where it is necessary to detect the presence or the level of light.
  - Here it is used for detecting the quality of oil by transmitting the white light through it.

## 5.3. EXPERIMENTAL SYSTEM ANALYSIS AND DISCUSSION

The trial setup used to lead this investigation is represented in Figure 2. There are two sections of the experiment which are i) Quality Grading and ii) Quantity Grading. This investigation was done on six different types of engine oils are used in these experiments, which belongs from fresh and degraded samples of a SAE 10W30 engine oil category.



*Fig.5.2. Experimental setup installation*

This oil was deteriorated by running 4 stroke motor bike engines for 0 Km, 84Km, 196 Km, 832 Km, 3117 Km, and 4000 Km travel as shown in Figure 3. So as to guarantee no predisposition on the capacity impact, all the oil tests were kept in the organizer at room temperature.

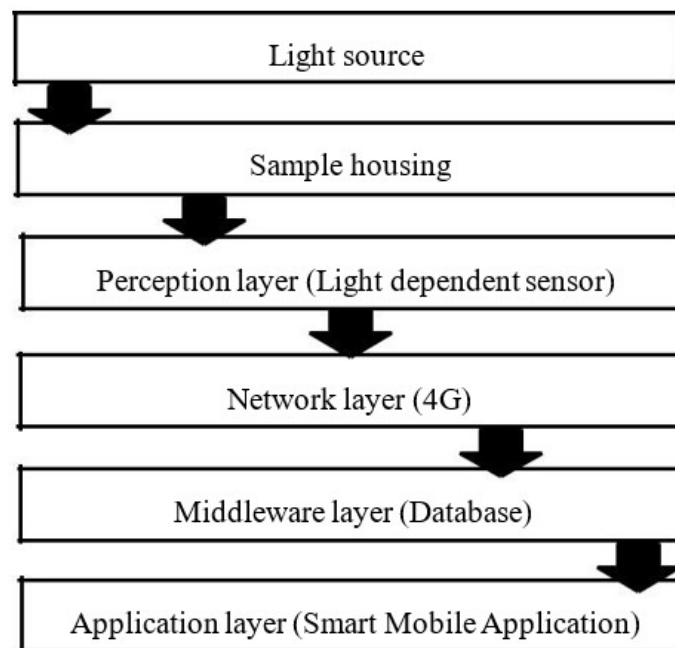


*Fig.5.3. Degradation of oil sample*

For each section, six samples are utilized. Therefore, 12 samples altogether are set up for the two trials which are Quality and Quantity Grading.

### 5.3.1. Quality and Quantity Grading Experimental Setup

The system is based on Lambert-Beer's law, in which material transmittance is considered [13]. A portable version of the device has been developed using Rapid prototyping for reducing the cost of manufacturing. It includes a hollow cylinder dipstick consists of LDR sensor and light source mounting attachments. The light source and LDR are being placed axially face to face on the two side of measuring cylinder. The Cylinder is dipped into oil to be measured and come in contact of source and detector surface. It is considered that the amount of light varies with the varying density or refractivity of oil due to presence of impurities. Therefore, a new sample of oil is tested with the device first and result is used as reference for the measurement of oil quality.

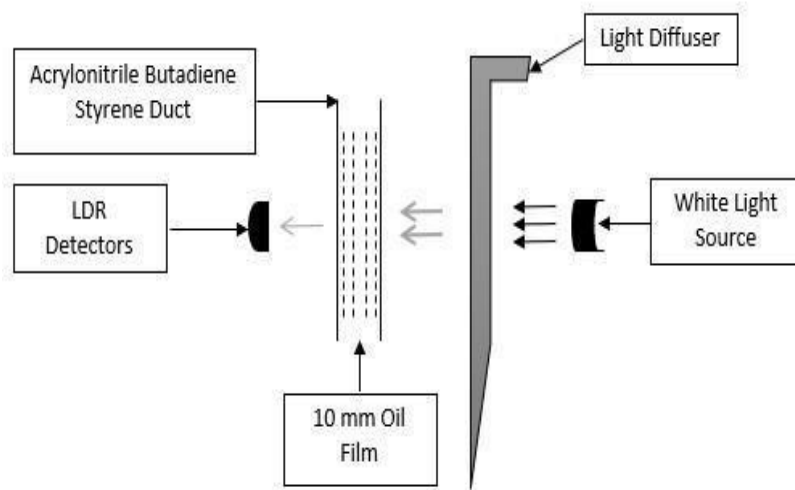


*Fig.5.4. Block diagram of instrument*

The Controller sends the processed signal to Cloud server, which are accessed by smart phone thereafter. IoT setup with microcontroller is shown in Figure 4. An advance mobile application is developed to display the end results in graphical mode. A partial number of light travels through the oil to the detector which sends

the electrical signal to the controller. The signal is processed by Arduino controller. Block diagram of instrument.

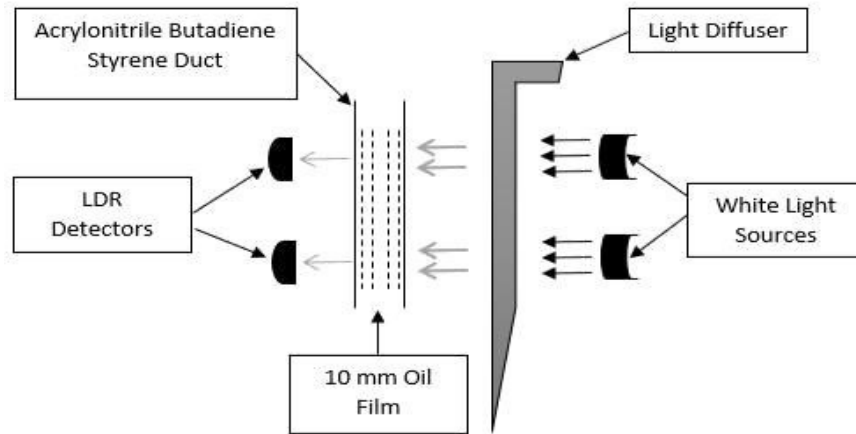
### 5.3.2. Quality Grading Analysis



*Fig.5.5. The light source and detector*

Oil was tested first at 0 Km travel by developed instrument and the measured value was considered as reference value i.e. 973 Lux. After running engine for 96 Km again test was conducted and value was sent to cloud server and compared with reference value. The test schedule may be automised according to user's requirement. In present experimentation, one reference value and three test value has been taken for generating a table as shown in Table I, which are then classified into three category i.e. GOOD, MEDIUM and BAD quality as shown in Figure 8. At the time of experimentation qualitative grading uses the two set of detectors for more reliable result.

### 5.3.3. Quantity Grading Analysis



*Fig.5.6. The light transmission and detection through oil*

Quantity grading are done by using two sets of LDR and light source in the developed dip stick. One set is situated at the bottom of the dip stick as shown in Figure-7 and other set is mounted 20 mm above the first detector set. At the time of experimentation both the qualitative grading and quantitative grading uses the both the set of detectors are used. Quantitative measurement is done by checking the signal from both detectors simultaneously. Missing signal from bottom detector depicts the low level of oil present in reservoir. The values are also displayed as symbol LOW, HIGH, FULL. It can detect the undesirable change in level generally occurs during the addition of impurities such as water, coolants etc. During experimentation, top detector gets a value of 1230lux, then instruments shows there is no addition of unwanted solutions in engine oil, because the value of source light is 1230lux without any transmissive medium. At second condition top detector got a value of 973, then the instrument indicates for high level that means addition of unwanted solution begins. At third condition bottom detector obtains a value of near about 973lux, then it is a detection of fresh engine oil and instrument shows oil sump is full of fresh oil and there is no need of lube oil to be added. If bottom detector gets a value of 1230lux it means level of engine oil in sump is very low & need to refill with fresh engine oil.

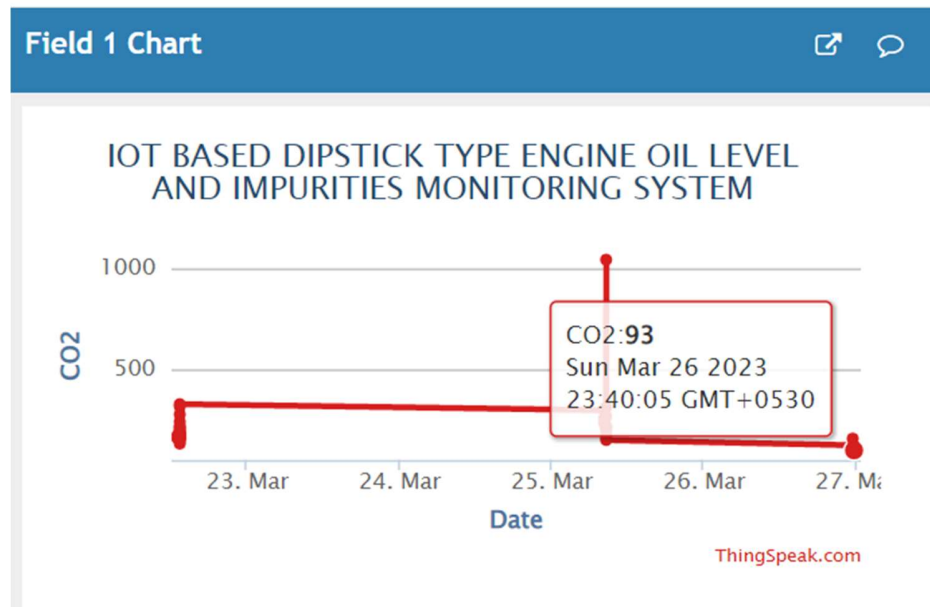
## **CHAPTER 6**

### **RESULTS AND DISCUSSIONS**

In the following, we present sample results as shown in Table I and II and comparisons to results obtained with developed dipstick instrument. To evaluate the sensor principle, we used oil samples taken every predefined interval of distance run by engine.

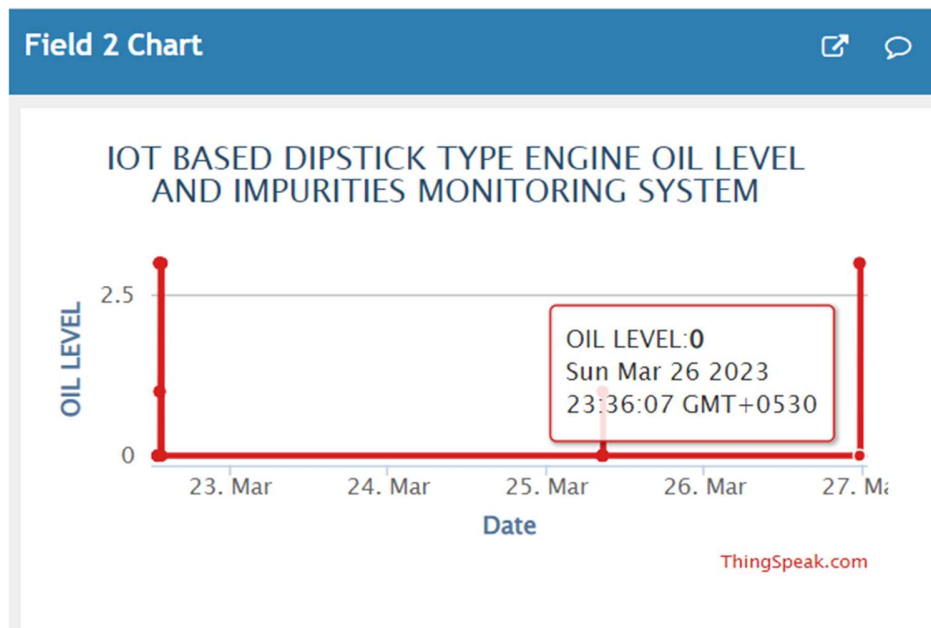
- A rigorous experimentation has been conducted for the qualitative measurement of engine oil. At initial stage total empty engine sump with filled with new engine oil. Therefore, the sample oil is considered as reference oil. In every experimentation reference value was measured by dipping the developed dip-stick instrument and after specific kilometre run the test was repeated. The following Table represents the amount of light transmitted through the used oil.
- Quantitative analysis was performed using the difference of Lux values obtained by two detectors In order to evaluate the quantitative assessment of engine oil. Based on the result obtained as shown in Table, it can be observed that Quantity of engine oil in engine sump are successfully classified.The final result of quantitative analysis at different stages. For better result of quantification two sensor systems were used. Precision level of this instrument can also be increased by using alteration of sensors.
- CO2 Sensor (MG-811) is connected to measures gaseous carbon dioxide levels by monitoring the amount of infrared (IR) radiation absorbed by carbon dioxide molecules. This type of sensor is used in monitoring indoor air quality, landfills, process control, and controlled environment horticulture

## 6.1 OUTPUT



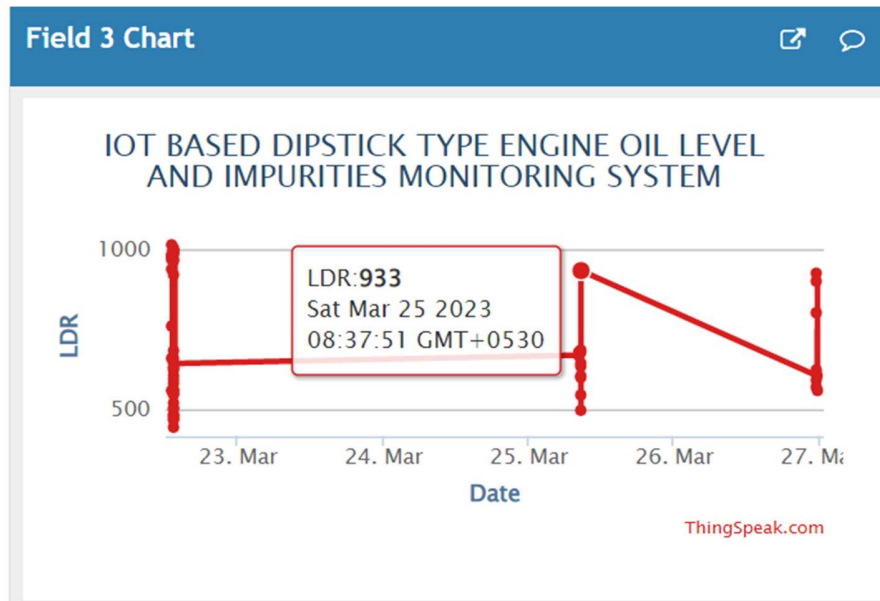
*Fig.6.1.Co2 results*

- CO2 Sensor is connected to measures gaseous carbon dioxide levels by monitoring the amount of infrared (IR) radiation absorbed by carbon dioxide molecules. This type of sensor is used in monitoring indoor air quality, landfills, process control, and controlled environment horticulture.
- When the Toxic gases are released internally or any damage from the engine the CO2 sensor will detect the toxic gases and send the data to user by IOT application.



*Fig.6.2. Quantitative analysis*

- Quantitative analysis was performed using the difference of Lux values obtained by two detectors In order to evaluate the quantitative assessment of engine oil. Based on the result obtained as shown in Table, it can be observed that Quantity of engine oil in engine sump are successfully classified. The final result of quantitative analysis at different stages. For better result of quantification two sensor systems were used. Precision level of this instrument can also be increased by using alteration of sensors.
- The level of the oil will measure by dipstick, it indicates the oil level as high, medium, and low.
- The dipstick will measure the engine oil and sends the data to use by IoT application.



*Fig.6.3. Qualitative analysis*

- A rigorous experimentation has been conducted for the qualitative measurement of engine oil. At initial stage total empty engine sump with filled with new engine oil. Therefore, the sample oil is considered as reference oil. In every experimentation reference value was measured by dipping the developed dip-stick instrument and after specific kilometre run the test was repeated. The following Table represents the amount of light transmitted through the used oil.
- Light dependent resistors are electronic components that are often used in electronic circuit designs where it is necessary to detect the presence or the level of light.
- Here it detects the quality of oil by transmitting the white light through it and indicate the oil quality as Pure, Good, Medium, Degraded and sends the data through IoT application.

## 6.2. TABULATION:

| OIL      | CO2 | OIL LEVEL | OIL QUALITY |
|----------|-----|-----------|-------------|
| PURE     | 90  | 3         | 1014        |
|          | 91  | 3         | 1003        |
|          | 92  | 3         | 999         |
|          | 93  | 3         | 920         |
|          | 93  | 3         | 900         |
|          | 126 | 3         | 890         |
|          | 138 | 3         | 856         |
|          | 150 | 3         | 853         |
|          | 154 | 3         | 843         |
|          | 158 | 3         | 802         |
|          | 164 | 3         | 801         |
|          | 169 | 3         | 762         |
|          | 170 | 3         | 759         |
| GOOD     | 179 | 2         | 684         |
|          | 180 | 2         | 677         |
|          | 188 | 2         | 630         |
|          | 189 | 2         | 629         |
|          | 192 | 2         | 614         |
|          | 198 | 2         | 598         |
|          | 207 | 2         | 592         |
|          | 215 | 2         | 590         |
|          | 228 | 2         | 545         |
| MEDIUM   | 268 | 1         | 495         |
|          | 279 | 1         | 484         |
|          | 300 | 1         | 479         |
|          | 308 | 1         | 475         |
|          | 325 | 1         | 468         |
|          | 348 | 1         | 442         |
| DEGRADED | 372 | 0         | 302         |
|          | 398 | 0         | 245         |
|          | 487 | 0         | 189         |
|          | 519 | 0         | 76          |

*Fig.6.1. Output tabulation*

## **CHAPTER 7**

### **CONCLUSION AND FUTURE SCOPE**

IoT based Dipstick Type Engine Oil Level and Impurities Monitoring System said in the above will be able to detect the quantity of Engine oil present and also detect the impurities present in the Engine oil. Therefore, the quality and quantity of engine oil reports can be generated and transmit through a Wi-Fi module to any mobile application from which the users can make quick decisions.

The device used a very much cost effective and reliable method of detecting the impurities and level of oil. It is also able to successfully send the measured value using cloud network and displayed on smart mobile app. Instrument is working properly. Output resolution of this instrument is up to satisfactory level also data can be remotely accessed. It is very useful for statically analysis. This instrument can be used for different grades of oil like vegetable, edible oil, reagent solution, organic solvent for their adulteration analysis.

#### **7.1 Future Scope**

- Results show the device used a very much cost effective and reliable method of detecting the impurities and level of oil. It is also able to successfully send the measured value using cloud network and displayed on smart mobile app. Instrument is working properly.
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