VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"Jnana Sangama", Belagavi, Karnataka

MINI PROJECT REPORT

On

IOT On Engine Wear

Submitted in Partial Fulfillment of the Requirement for the Award of the Degree of

BACHELOR OF ENGINEERING IN

MECHANICAL ENGINEERING

Submitted by

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Certificate

This is to certify that the seminar entitled **"IOT Of ENGINE WEAR"** submitted by **Samarth Kulkarni (2KL19ME065), Sakshi Utturi (2KL19ME064),**

Neha Kinekar (2KL19ME045), Om Badagi (2KL19ME050) the students of KLE Dr. M. S. Sheshgiri College of Engineering & Technology, Belagavi, in partial fulfillment for the award of Bachelor of Engineering in Mechanical Engineering department affiliated to Visvesvaraya Technological University, Belagavi during the year 2021-2022. It is certified that all the corrections/suggestions indicated have been incorporated in the report deposited in the department library. The project report has been approved as it satisfies the academic requirements in respect of Mini Project work prescribed for the said degree.

Dr. A. H. GADAGI	**`Dr. C. V. ADAKE**	**Dr. B. G. KATAGERI**
Guide	**Head of Department**	**Principal**

ACKNOWLEDGMENT

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DECLARATION

We, **Samarth Kulkarni (2KL19ME065), Sakshi Utturi (2KL19ME064), Neha Kinekar (2KL19ME045), Om Badagi (2KL19ME050)** hereby declare that the project work entitled **“IoT Of Engine Wear”**, has been independently carried out by us at “BELAGAVI”, under the internal guidance of **Dr A. H. Gadagi**, **Department of Mechanical Engineering, KLE Dr. M. S. Sheshgiri College of Engineering and Technology, Belagavi,** in partial fulfillment for the required award of Bachelor of Engineering in Mechanical Engineering at Visvesvaraya Technological University, Belagavi.

We further declare that no part of it has been submitted for the award, degree or diploma to any university or institute previously.

Place: Belagavi Date: 25/07/22

ABSTRACT

Due to continuous development of society the need of transport is also increasing day by day. Transportation of heavy loads from one place to another makes use of either SI or CI engines. Now due to heavy use of transportation system the load on engine is also increasing. This load is directly affecting various engine parts and one of them being piston rings. Due to damaged piston rings, there are chances of leakage of oil in engine and this will lead to reduction in energy of the engine thereby reducing the efficiency of engine. Therefore, the need of piston is being very much essential. In the present world everything has become business. The vehicle which is in a good condition when taken to the garage will still be asked to replace the piston rings by the mechanic as they try to make a good business out of it without giving a proper information to the vehicle owner. So, this makes necessary for us to have a monitoring system which helps us to get a thorough information regarding the present status and condition of the engine. Our project is like a reward to any vehicle owner which helps them to obtain a thorough knowledge about the condition of their engine. Our engine mainly focuses on three things.

· Predictive maintenance of engine.

· Updating the owner with time-to-time status of the engine.

· Prevents the owner of vehicle from getting fooled by the service providers.

CONTENTS

CHAPTER 1: INTRODUCTION

An engine or motor is a machine designed to convert one form of energy into mechanical energy. Heat engines, like the internal combustion engine, burn a fuel to create heat which is then used to do work. Electric motors convert electrical energy into mechanical motion, pneumatic motors use compressed air.

HOW DOES AN INTERNAL COMBUSTION ENGINE WORK?

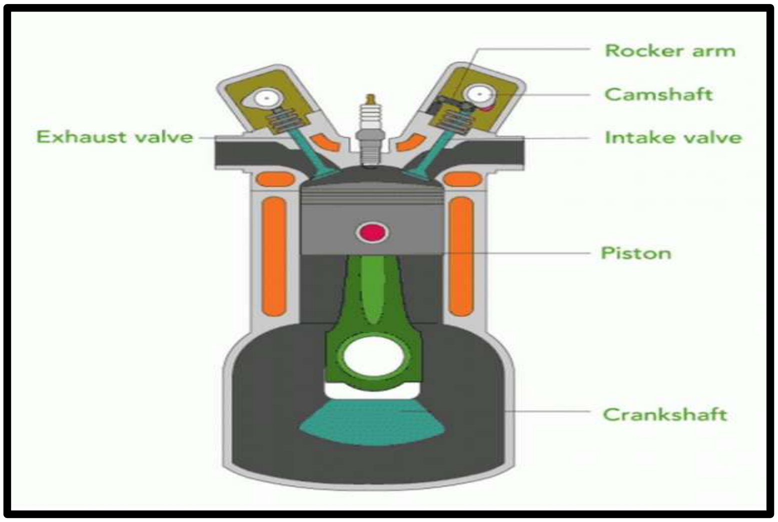

Fig 1.1: Engine

Animation showing the four stages of the four-stroke gasoline combustion engine cycle:

1. Induction (Fuel enters)
2. Compression
3. Ignition (Fuel is burnt)
4. Emission (Exhaust out)

Combustion, also known as burning, is the basic chemical process of releasing energy from a fuel and air mixture. In an internal combustion engine (ICE), the ignition and combustion of the fuel occurs within the engine itself. The engine then partially converts the energy from the combustion to work. The engine consists of a fixed cylinder and a moving piston. The expanding combustion gases push the piston, which in turn rotates the crankshaft. Ultimately, through a system of gears in the powertrain, this motion drives the vehicle's wheels.

There are two kinds of internal combustion engines currently in production: The spark ignition gasoline engine and the compression ignition diesel engine. Most of these are four stroke cycle engines, meaning four piston strokes are needed to complete a cycle. The cycle includes four distinct processes: intake, compression, combustion and power stroke, and exhaust.

Spark ignition gasoline and compression ignition diesel engines differ in how they supply and ignite the fuel. In a spark ignition engine, the fuel is mixed with air and then inducted into the cylinder during the intake process. After the piston compresses the fuel-air mixture, the spark ignites it, causing combustion. The expansion of the combustion gases pushes the piston during the power stroke. In a diesel engine, only air is inducted into the engine and then compressed. Diesel engines then spray the fuel into the hot compressed air at a suitable, measured rate, causing it to ignite.

- **<u>Piston ring</u>**

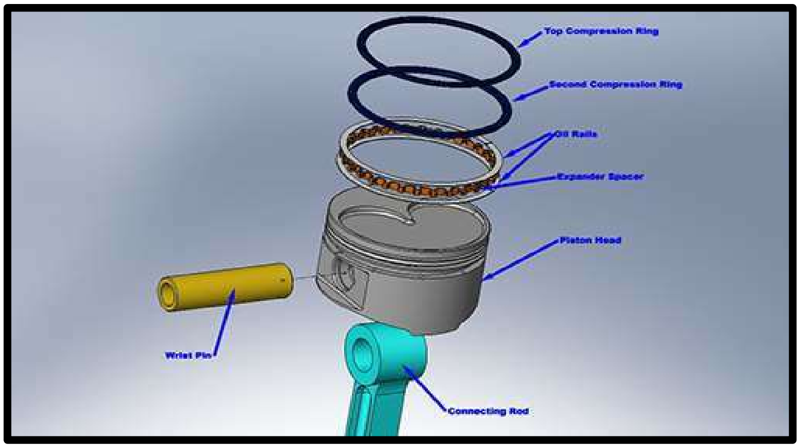

Fig 1.2: Piston ring

A piston ring is a metallic split ring that is attached to the outer diameter of a piston in an internal combustion engine or steam engine. The main functions of piston rings in engines are:

1. Sealing the combustion chamber so that there is minimal loss of gases to the crank case.
2. Improving heat transfer from the piston to the cylinder wall.
3. Maintaining the proper quantity of the oil between the piston and the cylinder wall
4. Regulating engine oil consumption by scraping oil from the cylinder walls back to the sump.

- **<u>Piston ring wear</u>**

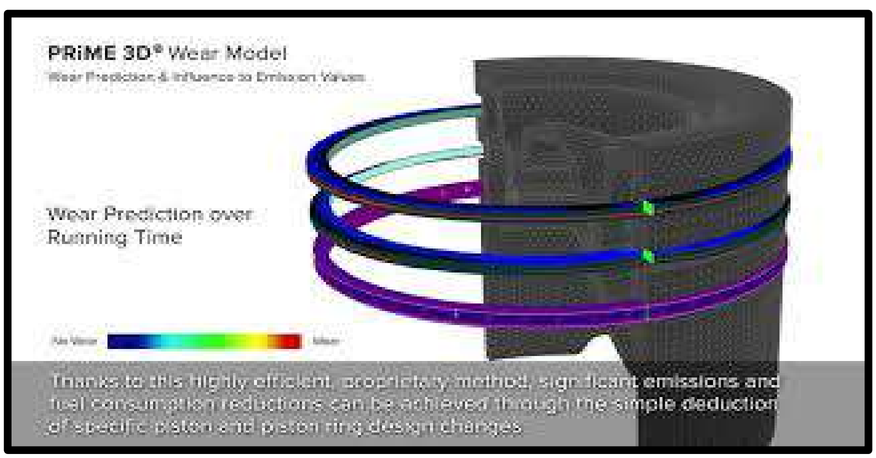

Fig 1.3: Piston ring wear

The piston rings are the most important part in engine which controls the lubricating oil consumption and blowby of the gases. The lubricating film of oil is provided to seal of gases towards crankcase and also to give smooth friction free translatory motion between rings and liner. Of the three rings present top ring is more crucial as it does the main work of restricting gases downwards the crankcase. Boundary lubrication is present at the Top dead centre (TDC and Bottom dead centre BDC of the liner surface). In addition to this, top ring is exposed to high temperature gases which makes the oil present near the top ring to get evaporated and decreasing its viscosity, making metal-metal contact most of the time. Due to this at TDC, excess wear happens on the liner which is termed as Top ring reversal bore wear. The wear rate depends upon many parameters such as lubrication condition, viscosity index, contact type, normal forces acting on ring, geometry of ring face, surface roughness, material property.

- **<u>Node MCU</u>**

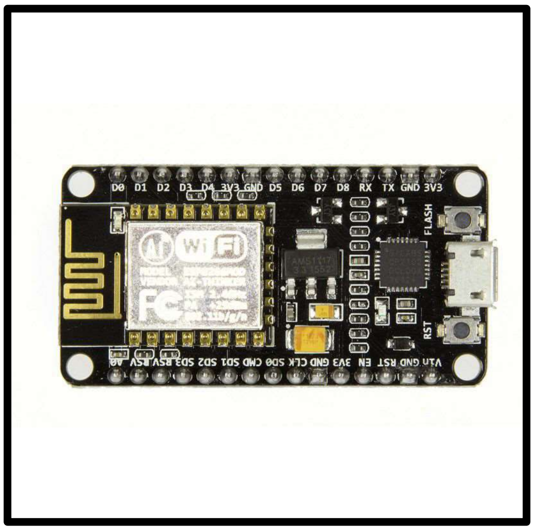

Fig 1.4: Node MCU

NodeMCU is an open-source firmware for which open-source prototyping board designs are available. The name "NodeMCU" combines "node" and "MCU" (micro-controller unit). The term "NodeMCU" strictly speaking refers to the firmware rather than the associated development kits. Both the firmware and prototyping board designs are open source.

The firmware uses the Lua scripting language. The firmware is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson and SPIFFS. Due to resource constraints, users need to select the modules relevant for their project and build a firmware tailored to their needs. Support for the 32-bit ESP32 has also been implemented.

The prototyping hardware typically used is a circuit board functioning as a dual in-line package (DIP) which integrates a USB controller with a smaller surface-mounted board containing the MCU and antenna. The choice of the DIP format allows for easy prototyping on breadboards. The design was initially based on the ESP-12 module of the ESP8266, which is a Wi-Fi SoC integrated with a Tensilica Xtensa LX106 core, widely used in IoT application

As Arduino.cc began developing new MCU boards based on non-AVR processors like the ARM/SAM MCU and used in the Arduino Due, they needed to modify the Arduino IDE so that it would be relatively easy to change the IDE to support alternate toolchains to allow Arduino C/C++ to be compiled for these new processors. They did this with the introduction of the Board Manager and the SAM Core. A "core" is the collection of software components required by the Board Manager and the Arduino IDE to compile an Arduino C/C++ source file for the target MCU's machine language. Some ESP8266 enthusiasts developed an Arduino core for the ESP8266 WIFI SoC, popularly called the "ESP8266 Core for the Arduino IDE". This has become a leading software development platform for the various ESP8266-based modules and development boards, including NodeMCUs.

NodeMCU ESP8266 Specifications & Features

- Microcontroller: Tensilica 32-bit RISC CPU Xtensa LX106
- Operating Voltage: 3.3V
- Input Voltage: 7-12V
- Digital I/O Pins (DIO): 16
- Analog Input Pins (ADC): 1
- UARTs: 1
- SPIs: 1
- I2Cs: 1
- Flash Memory: 4 MB
- SRAM: 64 KB
- Clock Speed: 80 MHz
- USB-TTL based on CP2102 is included onboard, Enabling Plug n Play
- PCB Antenna
- Small Sized module to fit smartly inside your IoT projects

PISTON CROWN DAMAGE

SEIZURE DUE TO OVERHEATING (MAINLY PISTON CROWN)

Fig 1.5: Piston crown wear

- Overheating due to combustion defaults
- Bent/blocked oil injection jet
- Installation of incorrect pistons
- Malfunctions in the cooling system
- Clearance restriction in the upper sliding surface area

IMPACT MARKS

Fig 1.6: Impact mark

- Piston protrusion too great
- Excessive re-machining of the cylinder head sealing surface
- Incorrect valve recess
- Incorrect cylinder head gasket
- Carbon deposits on the piston crown
- Insufficient valve clearance

FUSED/MELTED OFF MATERIAL

Fig 1.7: Melted material

- Faulty injection nozzles
- Incorrect quantity of injected fuel
- Incorrect injection point
- Insufficient compression
- Ignition delay
- Oscillating injection lines

CRACKS IN THE CROWN AND CROWN BOWL

Fig 1.8: Crack in piston crown

- Faulty or incorrect injection nozzle
- Incorrect injection point
- Incorrect quantity of injected fuel
- Insufficient compression
- Lack of piston cooling
- Installation of pistons with incorrect bowl shape

PISTON RING DAMAGE

MATERIAL WASHOUT IN THE RING AREA

Fig 1.9: Piston ring damage

- Incorrectly installed pistons
- Fuel flooding
- Severe axial wear of the ring groove and piston rings
- Ring flutter

RADIAL WEAR DUE TO FUEL FLOODING

Fig 1.10: Radial Wear Due to Fuel Flooding

- Fault during mixture formation
- Combustion defaults
- Insufficient compression pressure
- Incorrect piston protrusion dimension

AXIAL WEAR DUE TO INGRESS OF DIRT


Fig 1.11: Axial Wear Due To Ingress Of Dirt

- Abrasive dirt particles due to inadequate filtration
- Dirt particles that are not completely removed during reconditioning of the engine (chips, blasting agent)
- Abraded particles caused when the engine is being run in

PISTON SKIRT DAMAGE
ASYMMETRICAL PISTON WEAR PATTERN


Fig 1.12: Piston Skirt Damage

- Bent/twisted connecting rod
- Connecting rod eyes bored at an angle
- Cylinder bore not straight
- Individual cylinders not installed straight

- **Excessive connecting rod bearing clearance**

45° SEIZURE

Fig 1.13: 45° Seizure

- Excessively narrow fit of the piston pin
- Seizure in connecting rod eye (inadequate lubrication at initial start-up)
- Incorrectly installed shrink-fit connecting rod

- **DRY RUNNING/FUEL DAMAGE**

Fig 1.14: Dry Running/Fuel Damage

- Over-rich engine running
- Combustion defaults (misfiring)
- Insufficient compression
- Defective cold-start device

CYLINDER LINER DAMAGE

Reasons for Cylinder Liner Wear

- The wear in the cylinder liner is mainly because of following reasons: -
  1) Due to friction.
  2) Due to corrosion.
  3) Abrasion
  4) Scuffing or Adhesion

CAVITATION

Fig 1.15: Cavitation

- Poor/inaccurate seating of the cylinder liner
- Use of incorrect O-ring seals
- Use of unsuitable coolant agent
- Insufficient pre pressure in the cooling system
- Operating temperature too low/too high
- Restricted coolant flow

BRIGHT SPOTS IN THE UPPER CYLINDER AREA

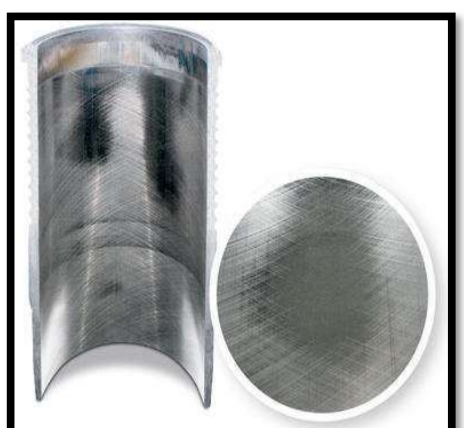

Fig 1.16: Bright Spots In The Upper Cylinder Area

- Carbon deposits on the piston top land due to:
- Excessive ingress of oil into the combustion chamber due to defective components
- Increased emissions of blow-by gases with oil entering the intake air system
- Insufficient separation of oil vapor from the blow-by gases
- Frequent idling or short-distance drives

Reasons for Cylinder Liner Wear

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4) Scuffing or Adhesion

Frictional Wear:

Whenever two surfaces slide over each other, friction is produced which leads to wearing down of both the surfaces. In liner wear, the surfaces are piston rings sliding over the cylinder liner. The frictional wear depends upon various factors like speed of movement between the surfaces, material involved, temperature, the load on engine, pressure, maintenance, lubrication, and combustion efficiency

CHAPTER 2: WIFI – MODULE

What is WIFI module and which are cost effective modules?

- You might have heard about ESP WIFI module. This is quite famous among electronics hobbyist and enthusiasts. ESP8266 module is easily available online. For beginners who want to start with WIFI-based project can choose this module. This article will give you a overview about the ESP8266 WIFI module.

- There are many types of ESP8266 module available in the market. It ranges from 01 to14. There are some development boards available as well which are named as NodeMCU.

- The ESP8266 is a cost-effective Wi-Fi chip with full TCP/IP stack. It also contains a MCU (Micro Controller Unit). This Module has an independent SOC. It comes with an AT command set firmware. This provides a feasibility to connect with Arduino.

- It's an exceptionally viable for IOT based activities. This module has a sufficiently intense on-board handling and capacity ability that enables it to be coordinated with the sensors and other application particular gadgets through its GPIOs.

- ESP8266 accompanies 1 MB of implicit blaze, taking into consideration single-chip gadgets equipped for interfacing with Wi-Fi.

What Is A Bread Board?

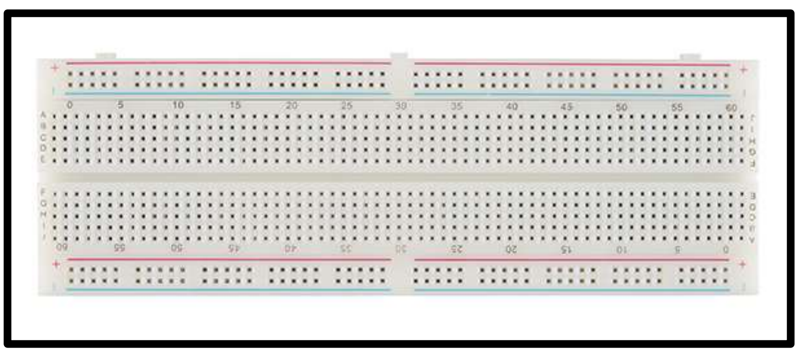

Fig 2.1: Bread board

- A breadboard, solderless breadboard, protoboard, or terminal array board is a construction base used to build semi-permanent prototypes of electronic circuits. Unlike stripboard (Veroboard), breadboards do not require soldering or destruction to tracks and are hence reusable. For this reason, breadboards are also popular with students and in technological education.
- A variety of electronic systems may be prototyped by using breadboards, from small analog and digital circuits to complete central processing units (CPUs).

- Compared to more permanent circuit connection methods, modern breadboards have high parasitic capacitance, relatively high resistance, and less reliable connections, which are subject to jostle and physical degradation. Signalling is limited to about 10 MHz, and not everything works properly even well below that frequency.

WHAT IS JUMMPER WIRE?

- Jump wires (also called jumper wires) for solderless breadboarding can be obtained in ready-to-use jump wire sets or can be manually manufactured. The latter can become tedious work for larger circuits. Ready-to-use jump wires come in different qualities, some even with tiny plugs attached to the wire ends. Jump wire material for ready-made or homemade wires should usually be 22 AWG (0.33 mm2) solid copper, tin-plated wire - assuming no tiny plugs are to be attached to the wire ends. The wire ends should be stripped 3⁄16 to 5⁄16 in (4.8 to 7.9 mm). Shorter stripped wires might result in bad contact with the board's spring clips (insulation being caught in the springs). Longer stripped wires increase the likelihood of short-circuits on the board. Needle-nose pliers and tweezers are helpful when inserting or removing wires, particularly on crowded boards.

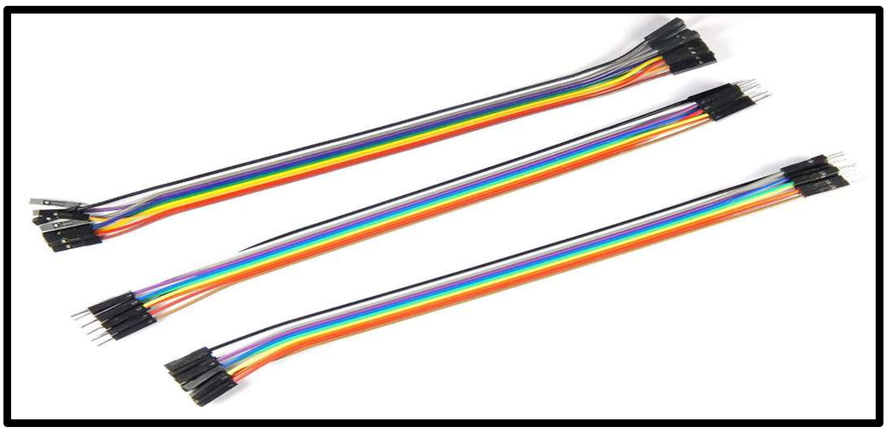

Fig 2.2: Jumper cables

- Differently coloured wires and color-coding discipline are often adhered to for consistency. However, the number of available colours is typically far fewer than the number of signal types or paths. Typically, a few wire colours are reserved for the supply voltages and ground (e.g., red, blue, black), some are reserved for main signals, and the rest are simply used were convenient. Some ready-to-use jump wire sets use the colour to indicate the length of the wires, but these sets do not allow a meaningful color-coding schema.

CHAPTER 3: SOUND SENSORS

- **SOUND SENSOR**

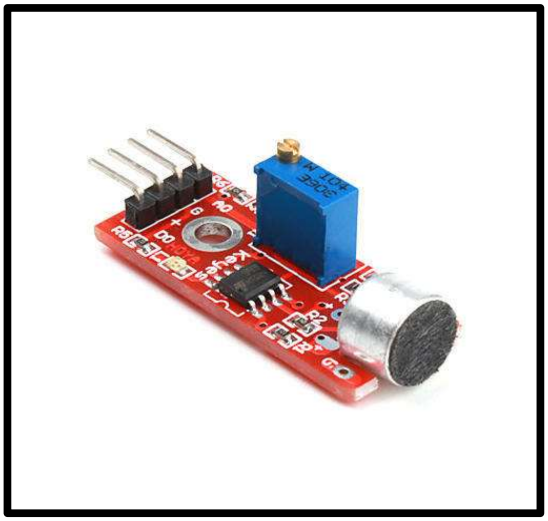

Fig 3.1: Sound Sensor

A sound sensor is defined as a module that detects sound waves through its intensity and converting it to electrical signals.

How does a sound sensor work?

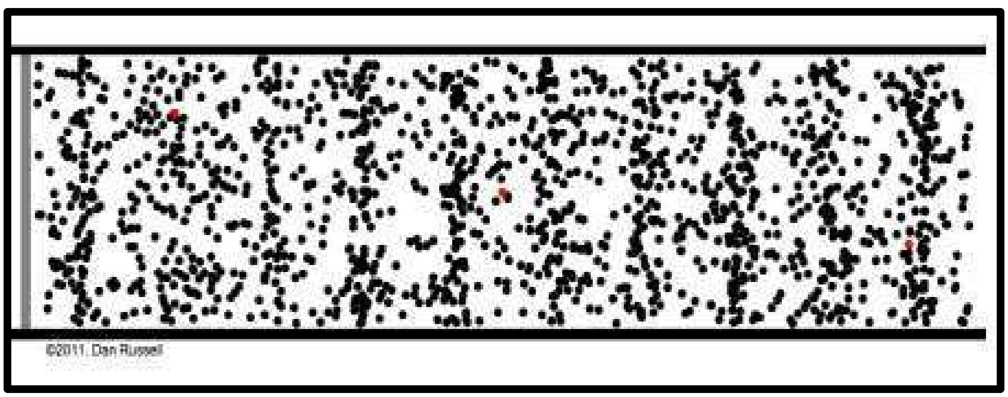

Fig 3.2: Sound waves

- Sound waves propagating through air molecules
- Sound detection sensor works similarly to our Ears, having diaphragm which converts vibration into signals. However, what's different as that a sound sensor consists of an in-built capacitive microphone, peak detector and an amplifier (LM386, LM393, etc.) that's highly sensitive to sound.
- With these components, it allows for the sensor to work:
- Sound waves propagate through air molecules

- Such sound waves cause the diaphragm in the microphone to vibrate,
- resulting in capacitance change
- Capacitance change is then amplified and digitalized for processing of
- sound intensity.

Sound Sensor Specification

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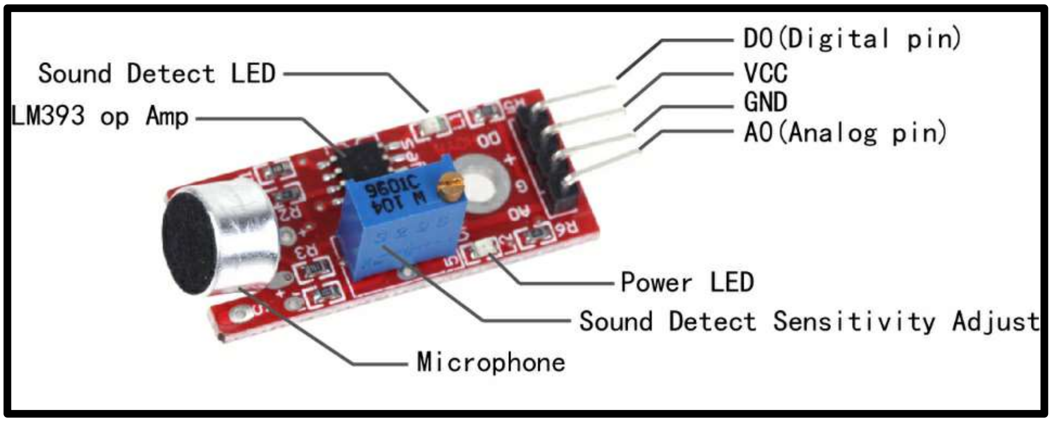


Fig 3.3: Sound sensor specification

Working Voltage - 3.3 - 6 V

Output - single channel Digital - (output remains HIGH (5v) until it's pulled LOW when sound is detected)

Note: Even though the output is digital, either HIGH or LOW, this little guy responds fast enough so that you can still use different voltage levels to make things happen in your sketch. What I'm trying to say here is that when the sensor picks up a sound vibration it will begin to bring its output low. But those sound vibrations move so fast and this guy responds so fast, that it may be in the process of pulling the output LOW when the vibration(s) stop and the sensor runs the output HIGH again. So, the voltage may have only dropped from HIGH (5v) to 3.5v before it was brought back to 5v again. And we can take advantage of that in our sketches.

Adjustable Sensitivity - via on-board POT (potentiometer) - This adjusts the

output voltage trigger point (how much sound is required before the sensor triggers the output pin. Adjusting this POT to high will cause the OUTPUT to remain HIGH, to low and output will remain LOW. Finding the "sweet spot" where the module responds as desired can be tricky.

Pins on Module - three (3), VCC / GND / OUT is On-Board LEDs - Red LED, power indicator Green LED, on when sound is detected

Dimensions: 1.73 x 0.63 x 0.35 (inches)

CHAPTER 4: LITERATURE SURVEY

Juniastel Rajagukguk , Nurdieni Eka Sari
Department of Physics Universitas Negeri Medan

Detection System of Sound Noise Level (SNL) Based on Condenser Microphone Sensor

- The research aims to know the noise level by using the Arduino Uno as data processing input from sensors and called as Sound Noise Level (SNL). The working principle of the instrument is as noise detector with the show notifications the noise level on the LCD indicator and in the audiovisual form. Noise detection using the sensor is a condenser microphone and LM 567 as IC op-amps, which are assembled so that it can detect the noise, which sounds are captured by the sensor will turn the tide of sinusoidal voice became sine wave energy electricity (altering sinusoidal electric current) that is able to responded to complaints by the Arduino Uno. The tool is equipped with a detector consists of a set indicator LED and sound well as the notification from the text on LCD 16*2. Work setting indicators on the condition that, if the measured noise > 75 dB then sound will beep, the red LED will light up indicating the status of the danger. If the measured value on the LCD is higher than 56 dB, sound indicator will be beep and yellow LED will be on indicating noisy. If the noise measured value will be beep and yellow LED will be on indicating noisy. If the noise measured on the LCD is higher than 56 dB, sound indicator will be beep and yellow LED will be on indicating noisy. If the noise measured value.

- **<u>Aggregating and analyzing usage data</u>**

- As Steve Hilton, guest author and lead analyst at Analyses Mason, describes it in his posts, we are transitioning from an M2M world to the Internet of Things (IoT), where the value lies in aggregating and analyzing usage data. In the context of machine maintenance, we will see the value of analyzing machine data to predict malfunctions. Being able to identify asset failures before they occur allows companies to take corrective action in advance and increase machine uptime. Since predictive maintenance solutions are based on the analysis of usage data, they become more powerful over a period of time as manufacturers gain more insights about anomalies in correlation with usage data.

- **<u>Predictive maintenance</u>**

- While predictive maintenance will help machine operators save costs by reducing unplanned downtimes, it will allow machine manufacturers to improve their business as well. For example, knowing about machine failures helps manufacturers plan and offer new maintenance services based on guaranteed uptime or optimize warehousing costs by having spare parts only on stock when they are actually needed. Moreover, it will help to increase product quality and shorten release cycles.

- Predictive maintenance is only one example in the manufacturing industry where the intelligent usage of data adds value to existing concepts. In the same way, the IoT will offer new possibilities in optimizing production or logistics processes.
- **https://blog.bosch-si.com/industry40/from-remote-to-predictive-maintenance-how-iot-refines-a-classic-m2m-concept/** (LINK FOR THE BELOW MENTIONED DATA).
- IoT predictive maintenance is enabled by a three major solution enhancement over a traditional maintenance schedule
- **Capturing Sensor Data** – There are sensors on the asset being monitored. These assets provide a constant flow of data – most of which are all within standard ranges of tolerance and trigger no alert or error. However, a very small percentage of those data falls outside standard ranges and trigger alerts that might indicate a reason to undertake maintenance.
- **Facilitating data communications** – The data flowing off these sensors are connected to a central processing facility using some WAN- or LAN-based connectivity platform. The choice of connectivity technology is dependent on several factors including security requirements, level of asset mobility and expected integrations with other assets.
- **Making predictions** – The captured data is continuously evaluated – for example, in a business intelligence system – based on expert knowledge or data from past events. The application relies on a series of rules that are based on expected and observed data associated with the assets being monitored. If the application can make better predictions, it can suggest a maintenance schedule which better matches the progressive deterioration of the asset. An enterprise need not over-invest in maintenance labor and parts. Predictive maintenance allows an enterprise to match its cash outlay with actual prevention of asset wear-and-tear.
- Data aggregation and analysis is a key piece of a predictive maintenance solution. We wrote about data aggregation and analysis in "M2M management software: supplier and product review." Predictive maintenance requires the collecting and systematic analyzing of large quantities of data to help predict faults and errors outside the normal tolerance range. These anomalies could be symptoms of larger problems with the asset and might trigger a maintenance response.
- As a result, predictive maintenance can:
- Lower maintenance costs by matching a maintenance activity with actual symptoms of future asset failures
- Save vital resources by reducing the need to purchase replacement parts for asset components before they fail
- Reduce out-of-service time for an asset by determining when maintenance must be completed in order to minimize asset failure
- IoT predictive maintenance allows for more services
- In addition, predictive maintenance allows enterprises to innovate through new revenue streams including enhanced warranty and maintenance services and also strengthen their competitive advantage through a differentiated offering. And last but not least, using predictive maintenance will help manufacturers to increase customer satisfaction from fewer warranty claims.

CHAPTER 5: PROBLEM DEFINITION

- With an annual production of more than 70 million units, the automobile sector is one of the biggest manufacturing industries in the world.

- The advent of IoT in automotive industry has opened new avenues for carmakers and buyers all across the world. With usage at both industrial and commercial level, IoT in automotive sector has become a prominent hotspot for variegated multi-purpose applications.

- From connected cars to automated transport systems, the applications of Internet of Things have made a deep dent in the global automotive market.

- Transportation of heavy loads from one place to another makes use of either SI or CI engines. Now due to heavy use of transportation system the load on engine is also increasing. This load is directly affecting various engine parts and one of them being piston rings.

- So, this makes necessary for us to have a monitoring system which helps us to get a thorough information regarding the present status and wear condition of the engine.

CHAPTER 6: METHODOLOGY

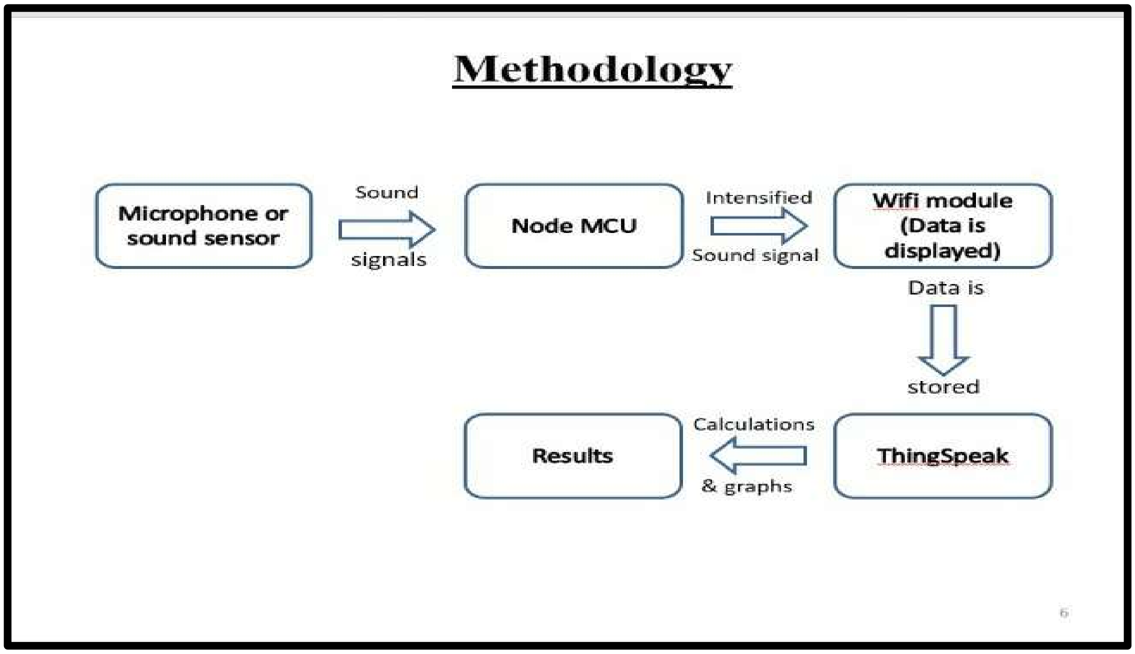


Fig 6.1: Flow Chart

- The components used in our experimentation are as follows **Sound Sensor, Engine, Node MCU, Thingspeak Platform, WIFI module**.

- **Sound detection sensor module** is used to detect the sound produced by the engine due to the wear and tear in it.

- The program (for Node Mcu) is uploaded on **Arduino IDE** platform which activates the sound sensor and noise/sounds signals are captured by the sensor.

- These sound signals are then captured and processed by Node MCU and then sent to Thingspeak via internet.

- Again, the program for **ThingSpeak** is uploaded on the platform to obtain the graph of **sound(db) vs time** for various engines.

- The **indicator** is also provided to know the wear status of the engine where, **RED** Indicates worn out engine and **Green** indicates good or intermediate condition of engine.

- Therefore, results are obtained by observing the graphs which will give **the range of sound intensities** telling us about the wear status of the engine.

CHAPTER 7: WORKING PRINCIPLE

Fig 7.1: Mind map of working

- Devices and objects with built in sensors are connected to an Internet of Things platform, which integrates data from the different devices and applies analytics to share the most valuable information with applications built to address specific needs.
- The engine used for this experiment was Honda **Activa** engine. To that engine the sound sensor was fixed such that only the engine sound was sensed. It was placed near the engine so that the maximum frequency of the sound produced by engine will be captured.
- To that sound sensor the Node MCU was fixed which converted all the sound frequencies into analog signals. The program was programmed in such manner that all the readings along with the graph were displayed on the screen.
- By using sound sensor, the standard sound of new engine is stored in the cloud, which is then used for comparing the sound checked from the worn-out engine.

CODE USED

- **NODE MCU**

```
#include "ESP8266WiFi.h"
#include "WiFiClient.h"
#include "ThingSpeak.h"
const char* ssid = "BuzzKiLL2G";
const char* password = "ombadagi";
int val;
int reading=1;
int pin = A0;
WiFiClient client;
unsigned long myChannelNumber = 1790650;
const char * myWriteAPIKey = "UICPJMFPL689BY3H";
void setup()
{
  Serial.begin(9600);
  delay(10);
  // Connect to WiFi network
  WiFi.begin(ssid, password);
  ThingSpeak.begin(client);
}
void loop()
{
  val = analogRead(pin)*0.322265;
  Serial.print("Signal= ");
  Serial.print(val);
  Serial.println("db");
  Serial.println(reading);
  delay(1000);
  ThingSpeak.writeField(myChannelNumber, 2,val, myWriteAPIKey);
  delay(100);
reading++;
}
```

- **THINGSPEAK**

```
% TODO - Replace the [] with channel ID to read data from:
readChannelID = [1790650];
% TODO - Replace the [] with the Field ID to read data from:
fieldID1 = [2];

% Channel Read API Key

readAPIKey = 'S49TP84TC0NBMC3Z';

%% Read Data %%

[data, time] = thingSpeakRead(readChannelID, 'Field', fieldID1, 'NumPoints', 30,
'ReadKey', readAPIKey);


%% Visualize Data %%

Plot (time, data);
```

WORKING MODEL

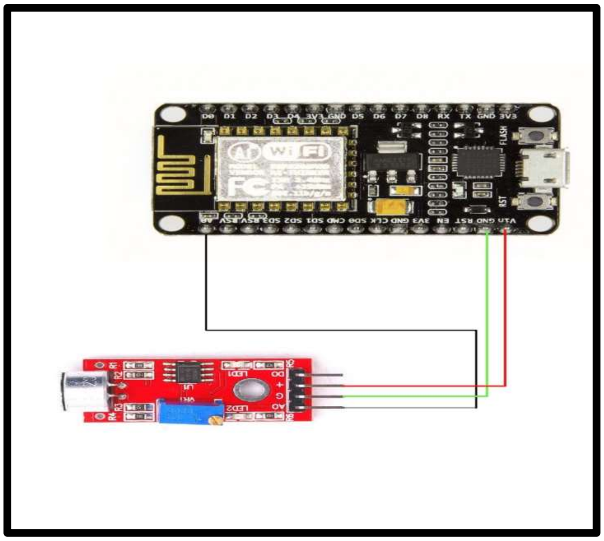


Fig 7.2: Circuit Connection

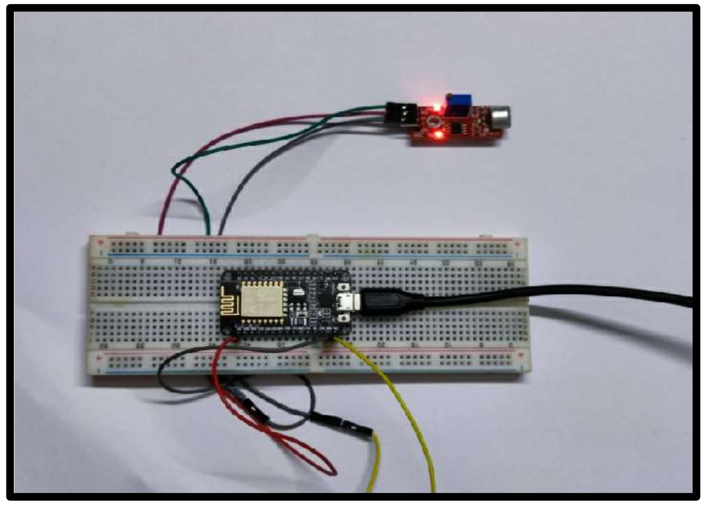


Fig 7.3: Working Model

COMPONENTS LIST

- Node MCU
- Esp 8266 Wifi Module
- Sound Sensor Module
- Jumper Cable
- Bread Board
- Honda Activa Engine (6G, 5G & 3G)
- Royal Enfield 350cc Engine

PLATFORM USED FOR GRAPH

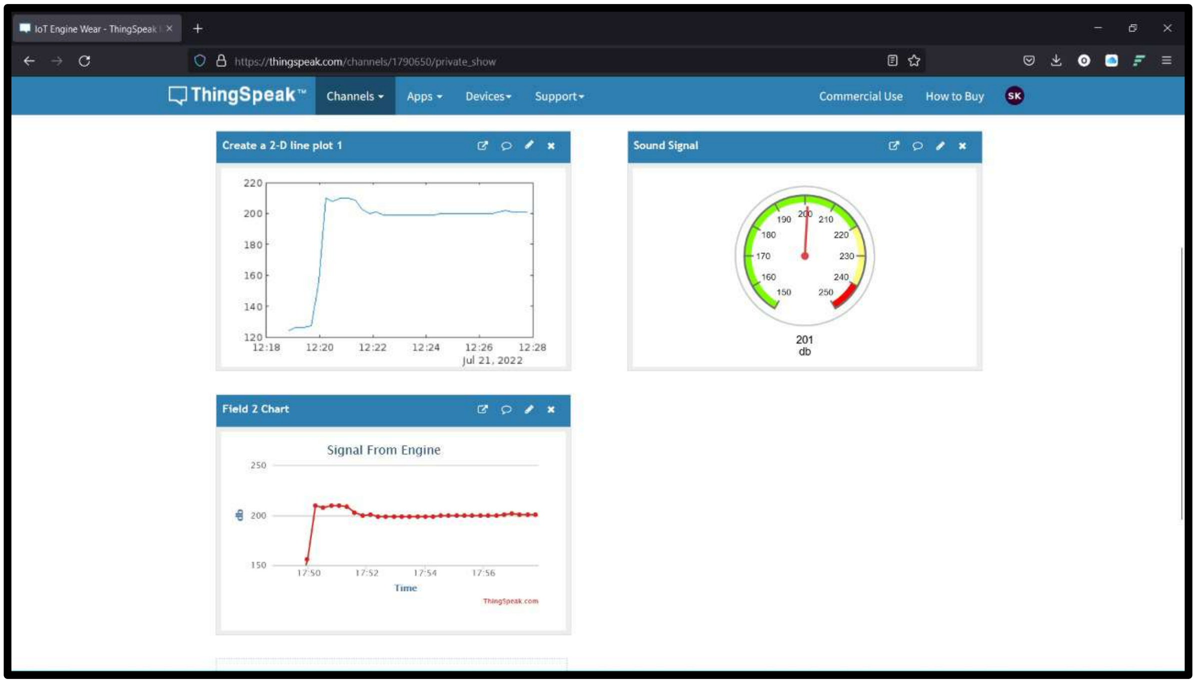


Fig 7.4: ThingSpeak Platform

What is ThingSpeak™?

- ThingSpeak™ is an IoT analytics platform service that allows you to aggregate, visualize and analyse live data streams in the cloud. ThingSpeak provides instant visualizations of data posted by your devices to ThingSpeak.

- The platform that we used for our project to get the graph (sound vs time) gives us the range of sound intensity where we get to know the condition of the engine whether it is good, intermediate or bad condition.

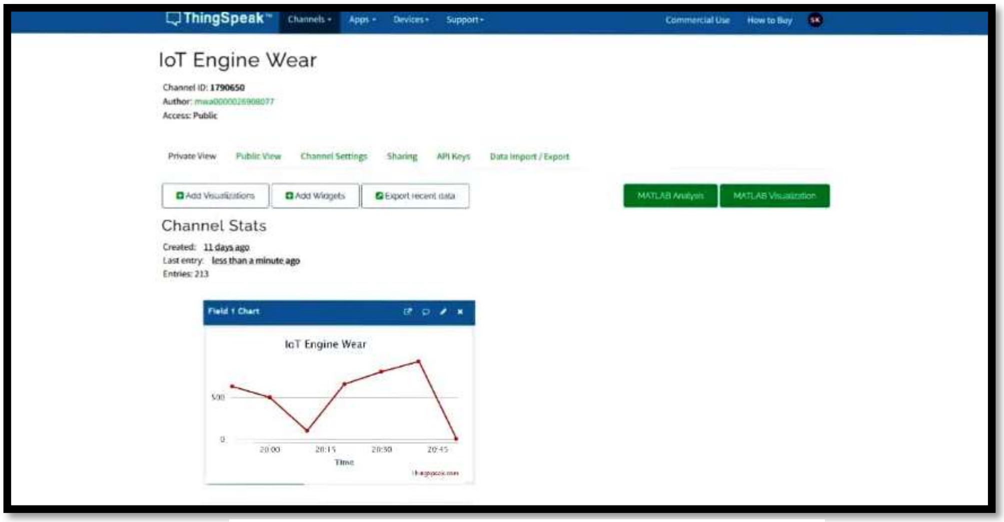


Fig 7.5: ThingSpeak Dashboard

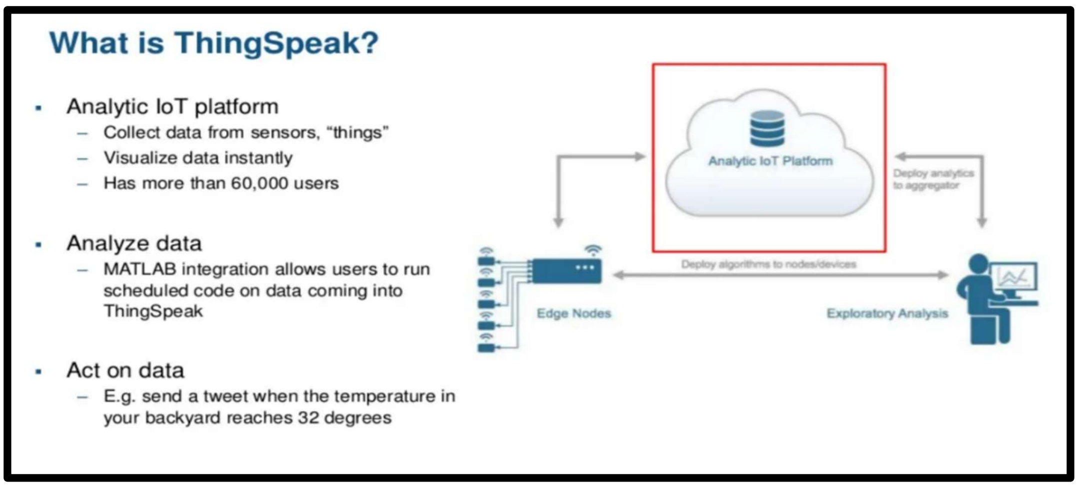


Fig 7.6: ThingSpeak Analysis

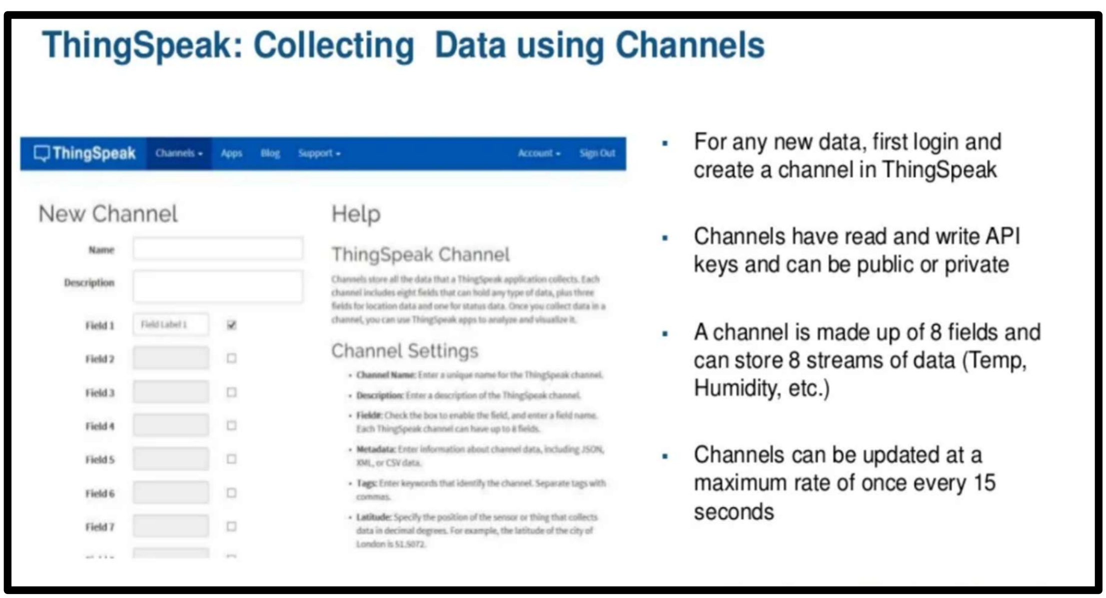


Fig 7.7: ThingSpeak Data Collection

CHAPTER 8: COST ESTIMATION

SL NO	COMPONENTS	COST
1	NODE MCU	350
2	ESP 8266 WIFI MODULE	300
3	SOUND SENSOR MODULE	80
4	JUMPER CABLE	100
5	BREAD BOARD	220
6	TOTAL	1050

CHAPTER 9: CONCLUSION

- According to the engine we tested i.e., Honda Activa 6G ,5G & 3G engine, the result was concluded that the intensity ranging from **150db to 210db.** was the **intensity of a good working engine**. The intensity ranging from **210dB to 230dB** was the intensity of the **intermediate engine**. The intensity **above 230dB** was the intensity of the engine which was totally in a **bad condition**.

- The above tested intensity is for one particular engine. There will be different intensities for different engines. The main disadvantage of using this sound sensor is the temperature. We can overcome the problem by using the acoustic sensor which are greatly helpful in the high temperatures.

- By this type of technology, we can easily predict the wear status of engine, and if the problem exists, we can easily service without causing any damage to the engine further causing accidents.

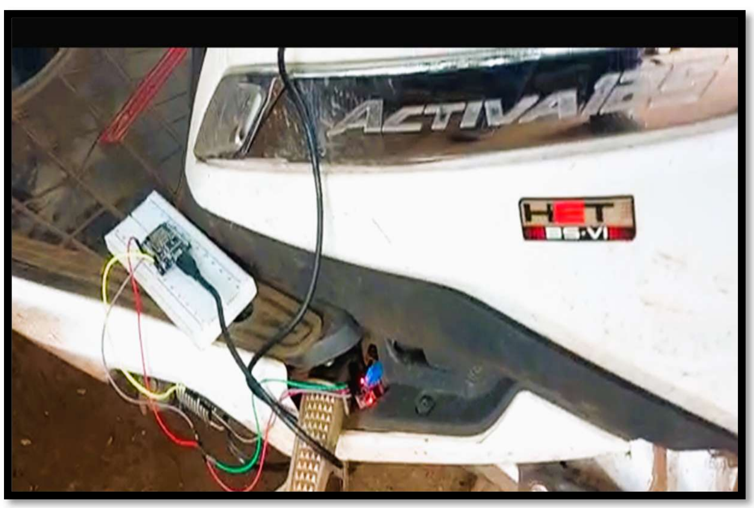


Fig 8.1: Testing on Honda Activa Engine

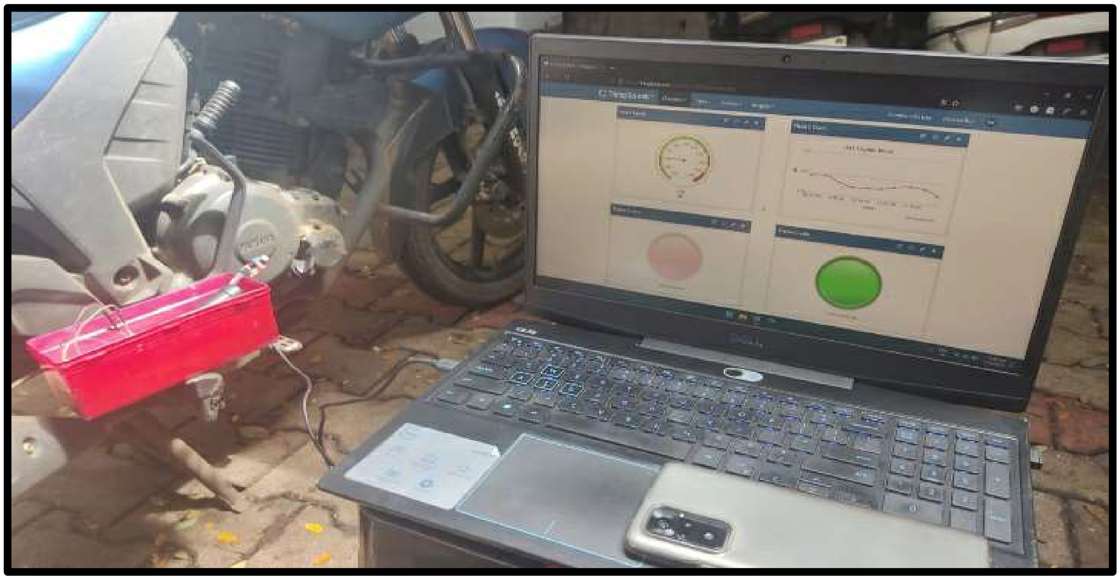


Fig A: testing on Bajaj Pulsar 220cc 35000km

Fig B: testing on Bajaj Pulsar 220cc 97000km

The below graph of sound vs time shows the engine condition of Bajaj Pulsar 220cc with running 35000 km

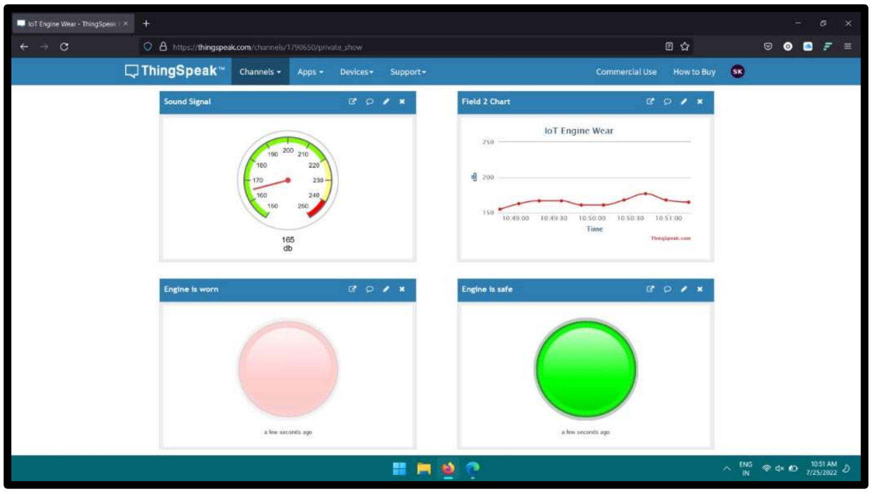


Fig A.1: In neutral mode

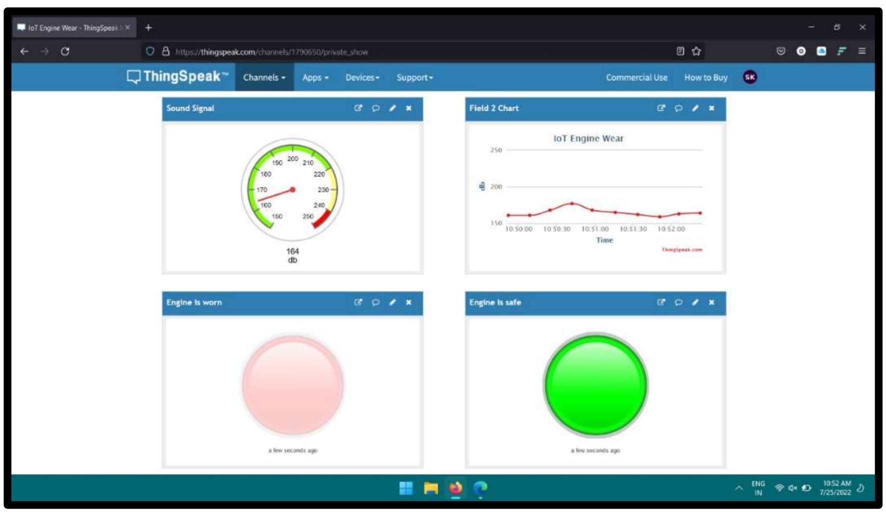


Fig A.2: In First gear

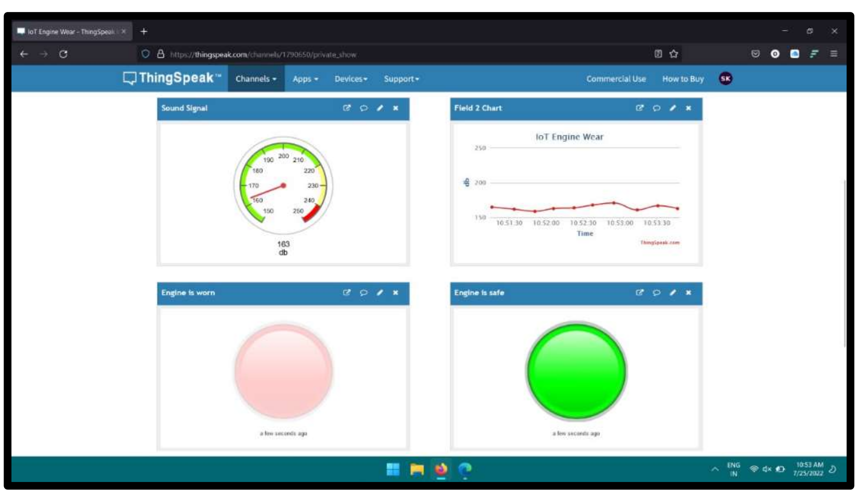


Fig A.3: In Second gear

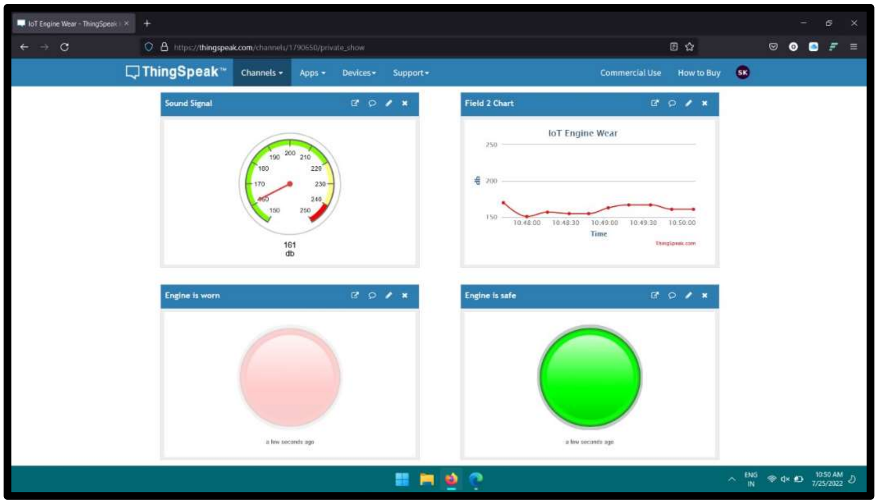


Fig A.4: In Third gear

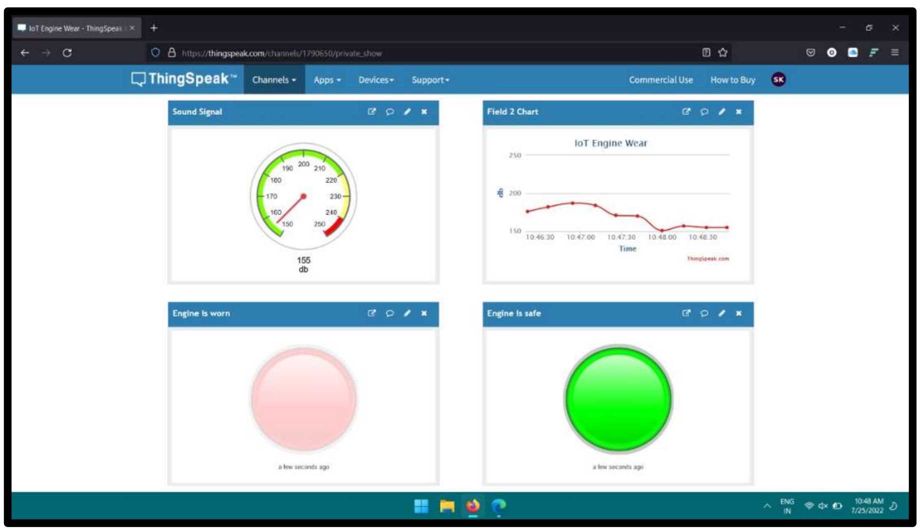


Fig A.5: In Fourth gear

1. From the above graphs that is Fig A.1, Fig A.2, Fig A.3, Fig A.4, Fig A.5 we conclude that the engine of Bajaj Pulsar 220cc with 35000km running is in the **good condition**.
2. Also sound intensity range for this engine is **150db to 180db** for the engine to be in good working condition.

The below graph of sound vs time shows the engine condition of Bajaj Pulsar 220cc with running 97000 km

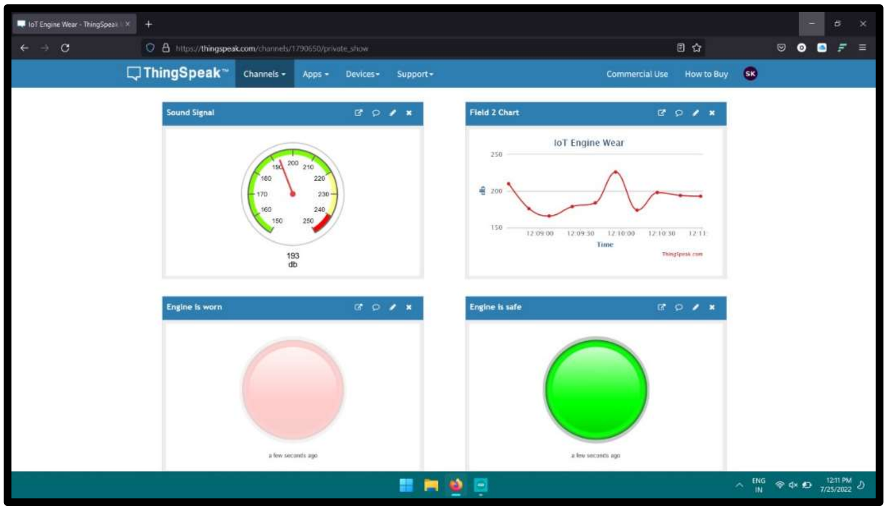


Fig B.1: In First gear

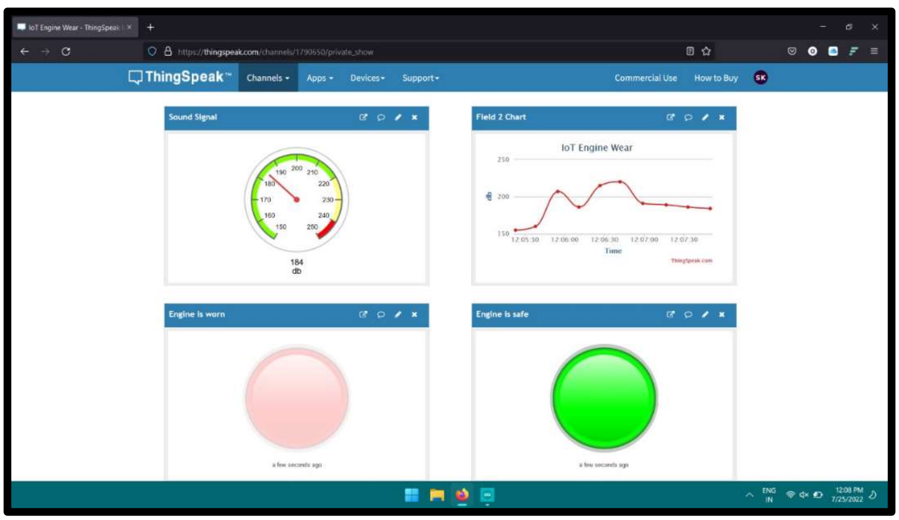


Fig B.2: In Second gear

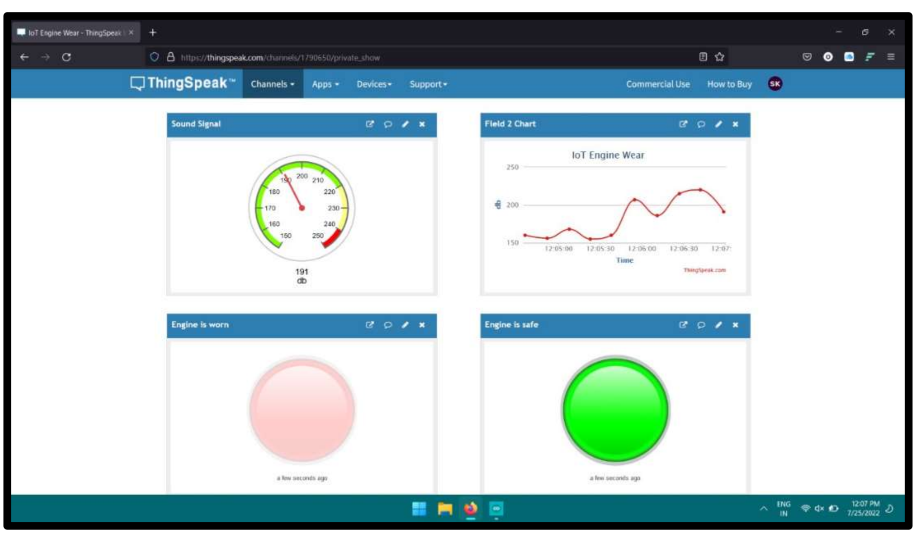


Fig B.3: In Third gear

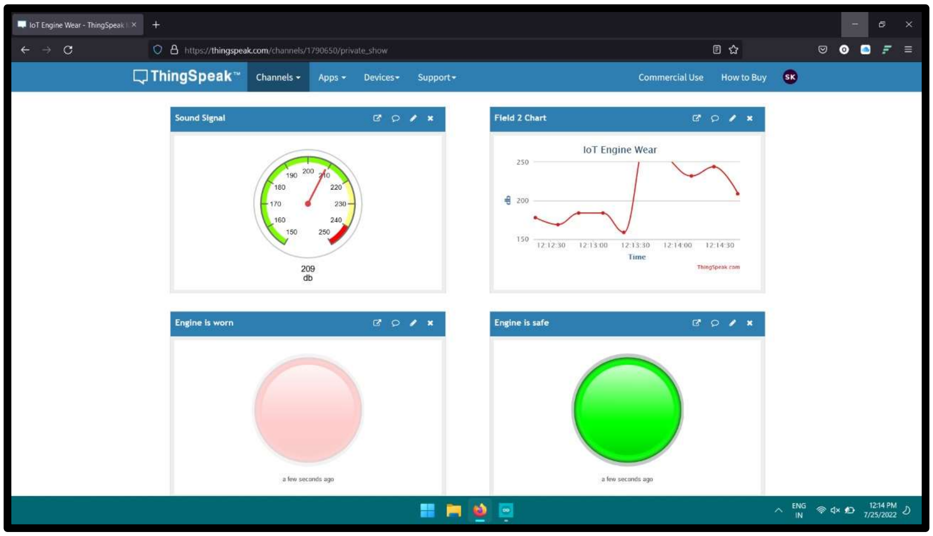


Fig B.4: In Fourth gear

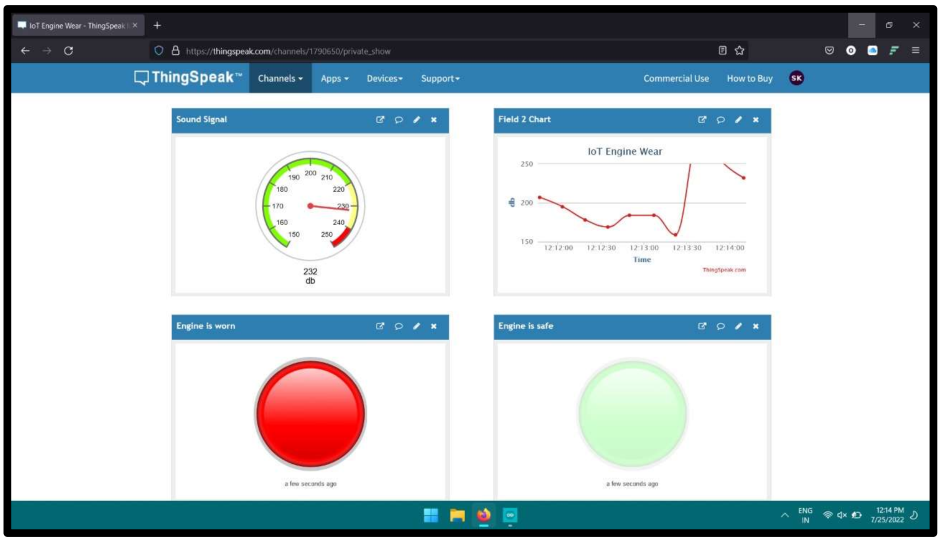


Fig B.5: In Fifth gear

3. From the above graphs that is Fig B.1, Fig B.2, Fig B.3, Fig B.4, Fig B.5 we conclude that the engine of Bajaj Pulsar 220cc with 97000km running is in the **intermediate condition**.
4. Also sound intensity range for this engine is **180db to 210db** for the engine to be in intermediate condition.

- **The below shown graph shows the condition of the (Honda Activa) engine by plotting graph of various intensities of sound vs time.**

HONDA ACTIVE 6G 125 cc (6000km running):

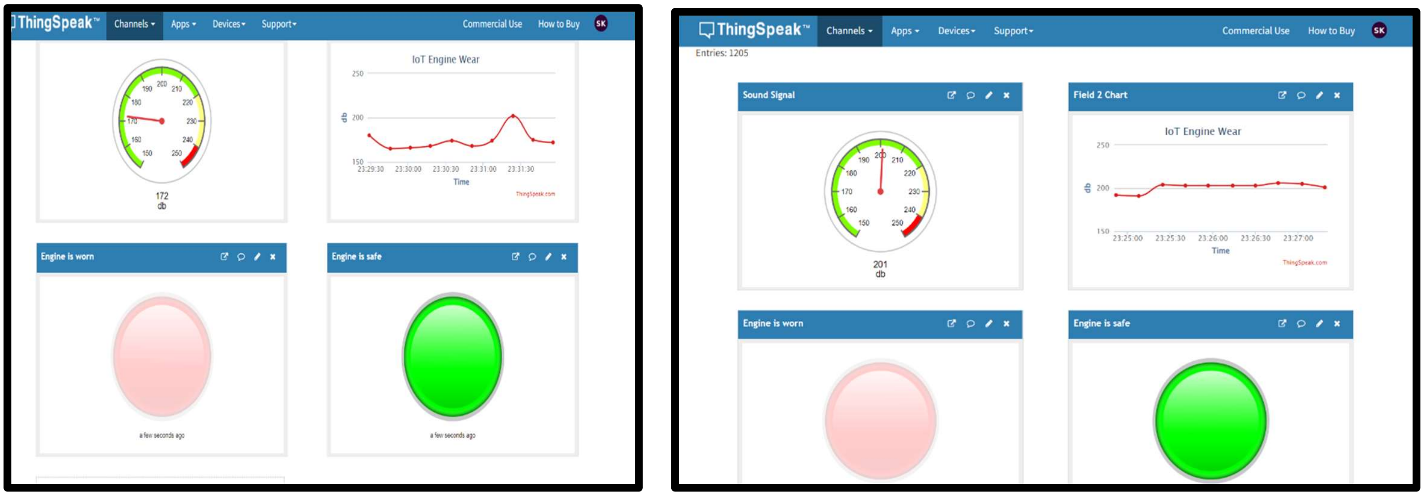


Fig 8.2: Graph of sound vs time (Good Condition)

- The above Fig 8.2 tells us that the engine is in **good condition** also the intensity of sound for engine in good condition ranges from **150db to 210db.**

- ## HONDA ACTIVE 5G 125 cc (25000km running):

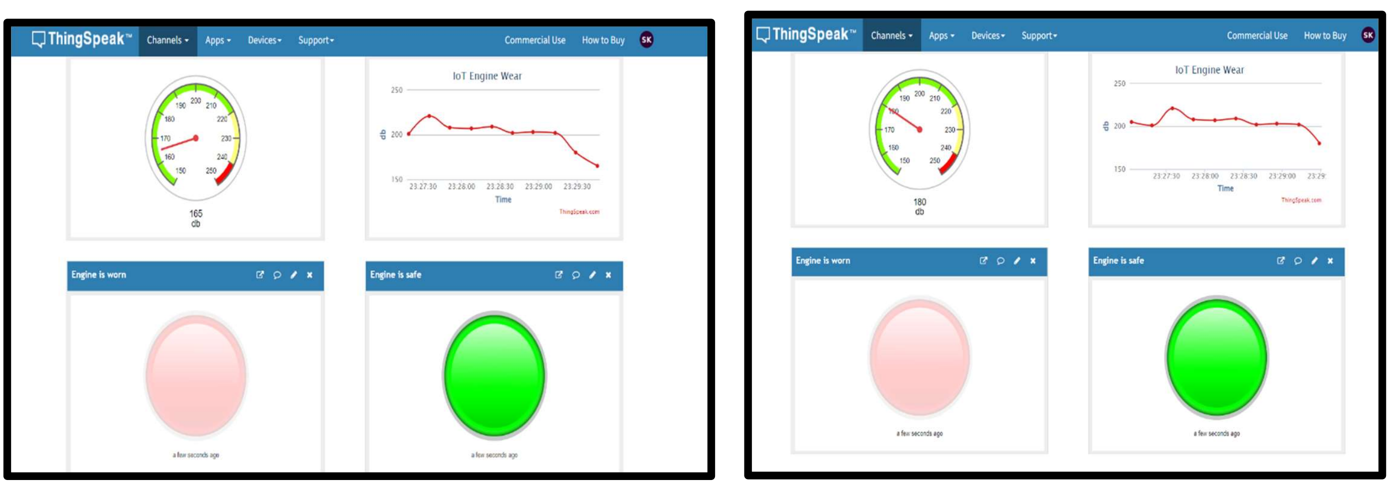


Fig 8.3: Graph of sound vs time (Intermediate Condition)

- The above Fig 8.3 tells us that the engine is in **intermediate condition** also the intensity of sound for engine in intermediate condition ranges from **210db to 230db.**

HONDA ACTIVE 3G 110 cc (500000km running):

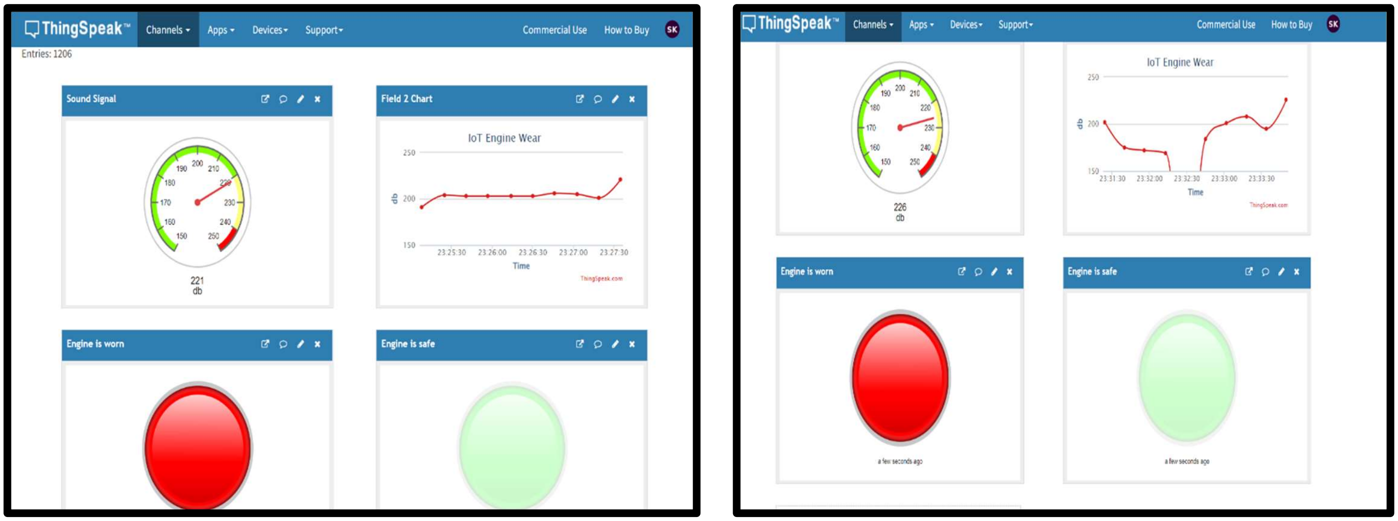


Fig 8.4: Graph of sound vs time (Bad Condition)

- The above Fig 8.4 tells us that the engine is in **bad condition** also the intensity of sound for engine in bad condition is found **above 230db.**

ROYAL ENFIELD 350CC

- We also tested our technology on Royal Enfield and the result was concluded that the intensity ranging from **180db to 220db**.was the **intensity of an intermediate working engine.**
- **Therefore, we conclude that the engine of all the three Royal Enfield is in intermediate condition.**

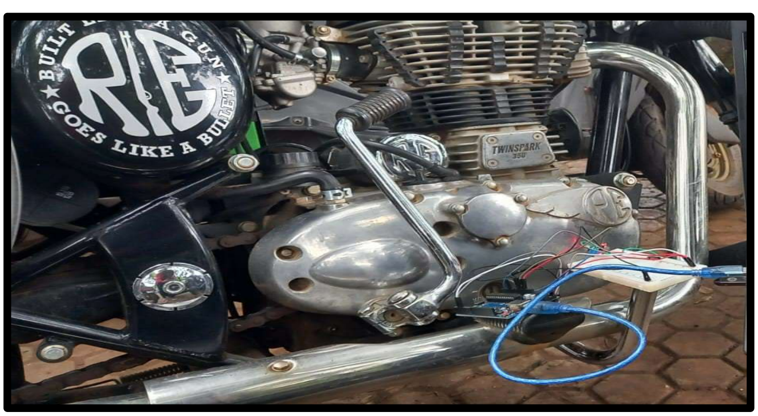


Fig 8.5: Testing on Royal Enfield Engine

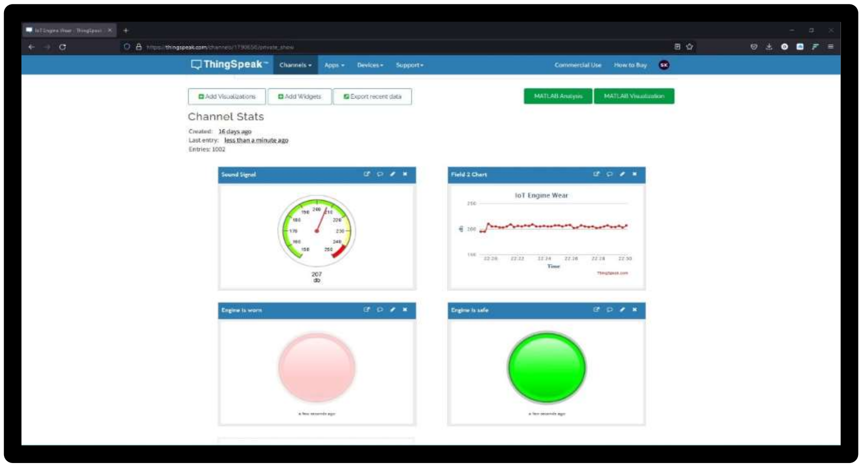
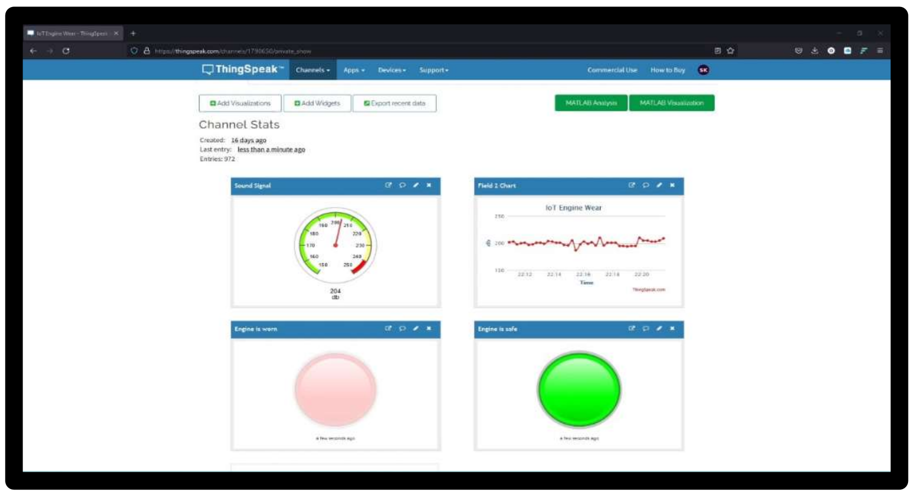
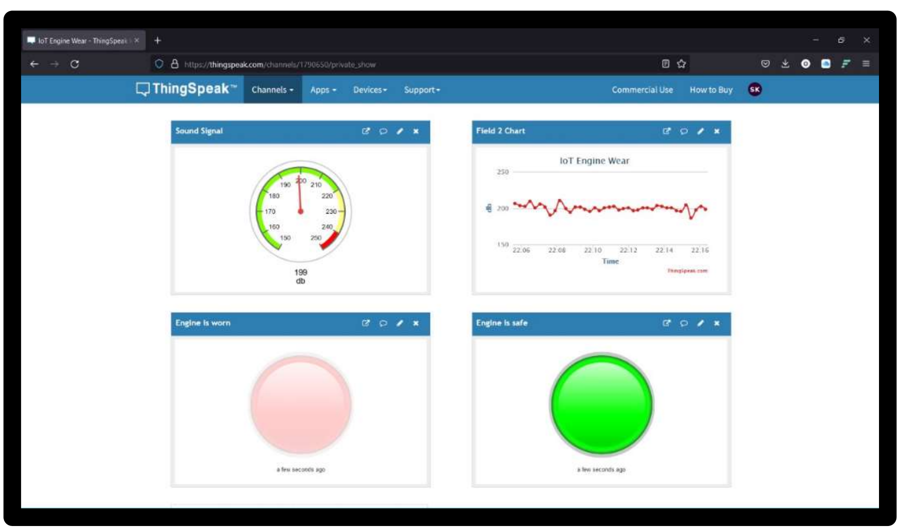


Fig 8.6: GRAPH OF ROYALENFILED WITH 50,000 KM.

Fig 8.7: GRAPH OF ROYAL ENFILED WITH 40,000 KM





8.8: GRAPH OF ROYALENFILED WITH 80,000 KM

CHAPTER 9: REFERENCES

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