# Engine Oil Quality Monitoring System

**Prof. V. B. Gundavade[1] P. D. Chougale[2] S. S. Jadhav[3] S. D. Jadhav[4]**
[1]Assistant Professor [2,3,4]UG Scholar
[1,2,3,4]Department of Electronics & Telecommunication Engineering
[1,2,3,4]KIT's College of Engineering, Kolhapur, Maharashtra, India

*Abstract*— In this project the main parameter under the consideration will be change in colour of oil. The change in colour of oil can be detected by using IR sensor. The bottom bolt of oil tank is replaced by threaded transparent tube. By virtue of which the IR sensor will check the transparency of oil. And temperature sensor is used to check the temperature of oil during working of our system. Also this temperature is displayed on LCD. If the oil quality degraded beyond the limit it will automatically give indication to user and message to owner of bike through GSM technology. A PIC microcontroller is used to control the output of the system. The signal from the IR sensor will send to PIC microcontroller and output will give by the controller as programmed. The power is received from the battery and is supplied to the power supply board to regulate the voltage of system.

***Keywords:*** Engine oil, PIC microcontroller, IR sensor, Temperature Sensor, GSM technology

## I. INTRODUCTION

In today's world all fields are updating and developing with the help of technology, if we consider automotive industries, it is presently dealing with greatest transformation using technology. Automobile industry is a growing industry which necessitates the importance of lubrication. Lubrication is mainly done for the proper functioning of machine and frictionless working of components of various parts such as engines, gearbox, differentials, etc. Maintenance of proper viscosity reduces the wear and tear of the component, it also increases the life of the component. During the maintenance of a vehicle the engine oil is drained even when the engine oil might be good condition. We do not have the proper system to monitor the engine oil. So, in order to eliminate such kind of draining of the engine oil, we are going to undertake this project to design an engine oil quality monitoring system for motorcycle.

## II. LITERATURE SURVEY

### A. *Problem Identification:*

- The problem is identified during the servicing of motorcycle, the engine oil is changed by the technician.
- They didn't know whether the oil is fully utilized or not.
- The manual process is used to check the quality of engine oil by using dipstick.
- For this process the vehicle must be in stop position.

### B. *Objectives:*

- To indicate the condition of engine oil.
- It helps the owner to change the engine oil when it has been fully utilized.
- It also eliminates the replacing of engine oil during maintenance whether it has been fully used or not.
- The oil condition is indicated by using transparency of engine oil.

### C. *Working of Engine of Motorcycle:*

A four-stroke engine is an internal combustion (IC) engine in which the piston completes four separate strokes while turning the crankshaft. A stroke refers to the full travel of the piston along the cylinder, in either direction. The four separate strokes are termed:

1) Intake: Also known as induction or suction. This stroke of the piston begins at top dead center (T.D.C.) and ends at bottom dead center (B.D.C.). In this stroke the intake valve must be in the open position while the piston pulls an air-fuel mixture into the cylinder by producing vacuum pressure into the cylinder through its downward motion. The piston is moving down as air is being sucked in by the downward motion against the piston.
2) Compression: This stroke begins at B.D.C, or just at the end of the suction stroke, and ends at T.D.C. In this stroke the piston compresses the air-fuel mixture in preparation for ignition during the power stroke (below). Both the intake and exhaust valves are closed during this stage.
3) Combustion: Also known as power or ignition. This is the start of the second revolution of the four stroke cycle. At this point the crankshaft has completed a full 360 degree revolution. While the piston is at T.D.C. (the end of the compression stroke) the compressed air-fuel mixture is ignited by a spark plug (in a gasoline engine) or by heat generated by high compression (diesel engines), forcefully returning the piston to B.D.C. This stroke produces mechanical work from the engine to turn the crankshaft.
4) Exhaust: Also known as outlet. During the exhaust stroke, the piston, once again, returns from B.D.C. to T.D.C. while the exhaust valve is open. This action expels the spent air-fuel mixture through the exhaust valve.

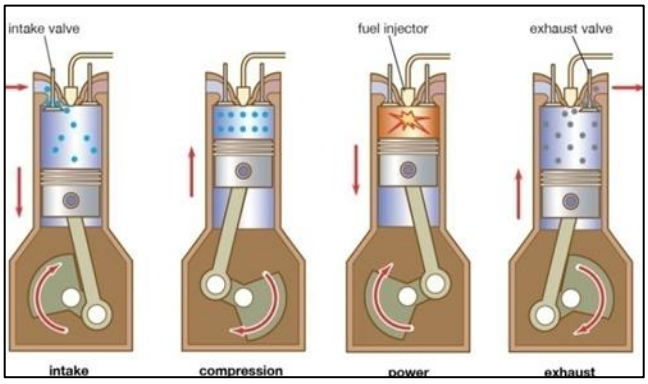

Fig. 1: Working of Engine

 

*D. Functions of Engine Oil*

1) Lubrication: The basic purpose of engine oil is to make sure that enough lubrication is provided to all engine parts so that friction and wear is reduced. Engine oil lubricates two moving parts by covering these parts with a slick film. The lubrication system must provide a continuous flow of oil to all the engine parts so that the oil film on each component is maintained to minimize wear. The correct oil viscosity is also essential for reducing friction.
2) Cooling: Synthetic engine oil carries the heat away from the lubricated parts. Once the engine is switched off, the oil returns to the oil pan. An efficient engine oil helps in cooling of the oil in the oil pan. The oil temperature should never go above the flash point of the oil under any circumstances. An engine oil with high heat resistance is recommended that keeps the carbon formation due to break down to a bare minimum.
3) Cleaning : All engine oils comprise of two basic ingredients: base oil and additives. While the base oil helps in lubrication, the additives provide additional engine protection by helping in its cleaning process. Engine oil cleans up all the engine components it comes in contact with. The additives present clean the carbon formation collected on the motor parts.

*E. Different Viscosity of Engine Oil:*

Viscosity is determined by the fluid's resistance to flow. The viscosity grade of an engine oil provides information on the oil's resistance to flow in your vehicle's engine.

An engine oil with a low viscosity grade will be more fluid and will flow easily. On the other hand, the engine oil with a higher grade is thicker and makes the flow slower which allows the formation of a protective layer on engine parts.

At low temperatures, an engine oil with a low viscosity grade is advised as it facilitates circulation of the lubricant in your vehicle during a cold engine start.

At high temperatures, an engine oil with a high viscosity grade is preferred as it will be more resistant in the crucial areas of the engine (hot areas). As it is thicker, it reduces wear and breakage and prevents friction between parts.

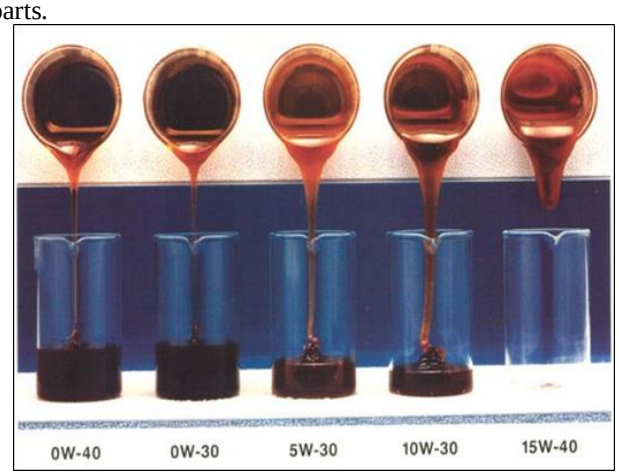


Fig. 2: A test of different engine oil viscosities

Here are the different engine oil grades are per viscosity:

1) MONOGRADE OIL: Monograde oils are used over a relatively small temperature range. They are generally designed for older vehicle types. This type of oil breaks down into two categories that depend on the season when you will be using your vehicle.

Monograde oils fall in two categories:

The low engine oil viscosity grades end with a "W" and are usually suited for winter use. For Eg: SAE 0W, 5W, 10W, 15W, 20W and 25W engine oils.

The high engine oil viscosity grades are not marked "W" and are suited for summer use. For Eg: SAE 8, 12, 16, 20, 30, 40, 50 or 60 engine oils.

2) MULTIGRADE OIL: Multigrade oils must fulfill two viscosity specifications, their viscosity grades consist of two numbers. For Eg: 10W30. 10W is the low-temperature viscosity (winter) whereas 30 is the high-temperature viscosity oil (summer). Multigrade oils are less affected by temperature variations than monograde oils. It is due to this that multigrade oil containers have a number on either side of the "W". On the most frequently purchased engine oils, you will see values such as 5W40, 20W40, or 10W30.

*F. Understanding of Engine oil colour:*

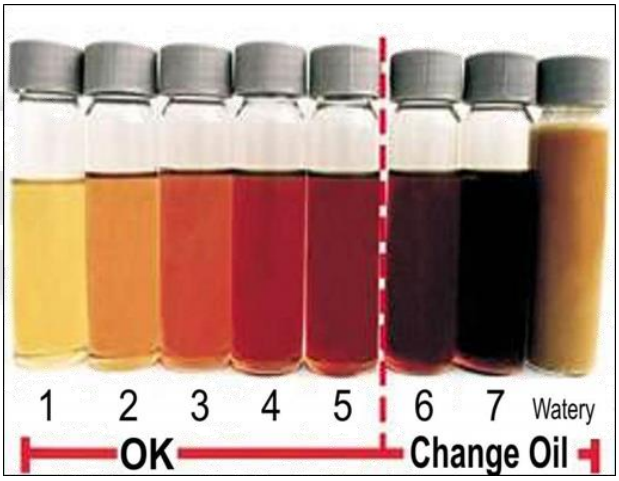


Fig. 3: changes in colour of engine oil

The color of lubricating oils can range from transparent to opaque. The color is based on the crude from which it is made, its viscosity, method and degree of treatment during refining, and the amount and types of additives included.

A change in oil color signifies a change in the chemistry of the oil or the presence of contaminants. For example, oil oxidation, mixing two dissimilar types of oil, and carbon insoluble's from thermal failure can all darken oil. There is also a possibility that the oil darkening is due to a photochemical reaction from sunlight exposure.

Measuring color is based on a visual comparison of the amount of light transmitted through a defined depth of oil. This can be done with a predefined test method and instrumentation or a subjective view of the oil with reference to a color gauge. In either case, there may be a number of variables to monitor for quality results.

## III. COMPONENTS USED

### *A. IR Sensor:*

An IR sensor consists of an IR LED and an IR Photodiode; together they are called as Photo – Coupler or Opto-Coupler.

When the IR transmitter emits radiation, it reaches the object and some of the radiation reflects back to the IR receiver. Based on the intensity of the reception by the IR receiver, the output of the sensor is defined.

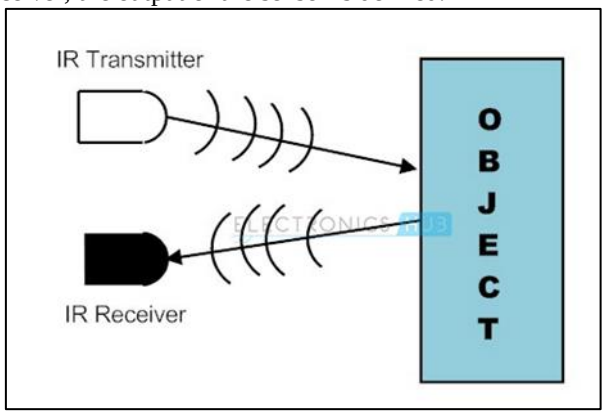


Fig. 4: IR Sensor working principle

The positioning of the IR LED and the IR Receiver is an important factor. When the IR LED is held directly in front of the IR receiver, this setup is called Direct Incidence. In this case, almost the entire radiation from the IR LED will fall on the IR receiver.

Hence there is a line of sight communication between the infrared transmitter and the receiver. If an object falls in this line, it obstructs the radiation from reaching the receiver either by reflecting the radiation or absorbing the radiation.

### *B. Temperature Sensor (PT100):*

The principle of operation is to measure the resistance of a platinum element. The most common type (PT100) has a resistance of 100 ohms at 0 °C and 138.4 ohms at 100 °C.

For a PT100 sensor, a 1 °C temperature change will cause a 0.384 ohm change in resistance, so even a small error in measurement of the resistance (for example, the resistance of the wires leading to the sensor) can cause a large error in the measurement of the temperature. For precision work, sensors have four wires- two to carry the sense current, and two to measure the voltage across the sensor element.

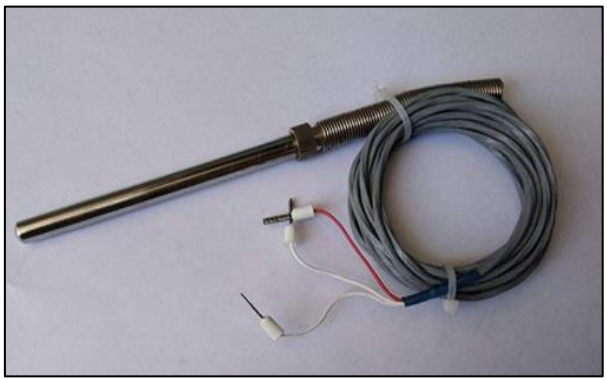

Fig. 5: PT100 sensor (3 wire)

The influence of the lead resistance is compensated to the greatest possible extent with a 3-wire connection. The requirement for this is that the lead resistances are the same, as can be assumed with a 3-wire connection. The maximum length of the connection lead depends on the conductor cross-section and the compensation options of the evaluation electronics (transmitter, display, controller or process control system).

### *C. PIC 16f877A:*

- Operating frequency 0-20 MHz
- Precision internal oscillator: Software selectable frequency range of 8MHz to 31 KHz
- Power supply voltage 2.0-5.5V: Consumption: 220uA (2.0V, 4MHz), 11uA (2.0 V, 32 KHz) 50nA (stand-by mode)
- High current source/sink for direct LED drive
- Software and individually programmable pull-up resistor
- 8K ROM memory in FLASH technology
- In-Circuit Serial Programming Option: Chip can be programmed even embedded in the target device
- 256 bytes EEPROM memory: Data can be written more than 1.000.000 times
- 368 bytes RAM memory
- A/D converter: 14-channels, 10-bit resolution
- 3 independent timers/counters
- Enhanced USART Module: Supports RS-485, RS-232 and LIN2.0, Auto-Baud Detect

### *D. GSM Module:*

- Quad-band 850/900/1800/1900MHz.
- GPRS class 2/10.
- Control via AT commands (3GPP TS 27.007, 27.005 and SIMCOM enhanced AT command set).
- High-Quality Product (Not hobby grade).
- 5V interface for direct communication with MCU kit.
- Configurable baud rate.
- Built-in SIM Card holder.
- Built-in Network Status LED.
- Inbuilt Powerful TCP/IP protocol stack for internet data transfer over GPRS.
- Low power.

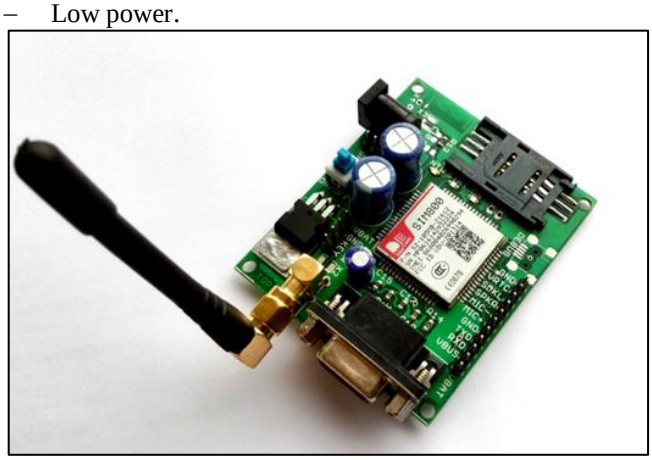

Fig. 6: GSM Module(SIM800A)

## IV. CONCLUSION

The system provides a voltage output related to the transparency factor and therefore, it provides an indication of the oil condition as the transparency factor tends to decrease with the increasing presence of contaminants in lubrication oil. The proposed system shows two important features: it is a very low cost design and it provides effective oil quality detection. By using this system, we can find the engine oil condition with the help of the IR sensor, an LCD and GSM module indicating its condition.

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