International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 03 | Mar 2019 www.irjet.net p-ISSN: 2395-0072

ENGINE OIL COLOR MONITORING SYSTEM

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Abstract - *The Engine oil degrades in quality when it used for a period of time, so in order to find out its end period we have designed an instrument to find out. A turbidity sensor is used to determine the usage of the engine oil. A three-engine oil sample of 4T 10W30 is taken from starting of the engine oil and the second sample is taken at 2000 kms and third sample is taken at 3000 kms. An LED is used to indicate the condition of the engine oil like green color for fresh condition, blue color for medium condition and red color for heavily used condition which means that this engine oil cannot be used further. This makes this instrument a convenient to measure the condition of the engine oil. A microcontroller is used to control the LED and the signal from the turbidity is sent to PIC microcontroller. The power is received from the battery and is supplied to the sent to the power supply board to regulate the voltage.*

Key Words: **Turbidity sensor, LED, 4T 10W30, PIC microcontroller**, **Power supply board**.

1.INTRODUCTION

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 property monitoring system.

1.1 PROBLEM IDENTIFICATION

- During the service, the engine oil is changed by the technician. They didn't know whether the oil is fully utilized or not.
- Technician just simply replace the engine oil.
- To avoid the replacing the engine oil at the time of service.
- For that we are going to design an engine oil property monitoring system.

1.2 OBJECTIVE

- 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 a color code. Green means in excellent condition which means engine oil in normal condition, whereas blue means in good condition which means partially utilized, and red means in bad condition which means that the engine oil has been completely utilized.

2. LITERATURE REVIEW

A.Agoston, et al (2005): They monitored the thermal aging of lubricating oil. One of the investigated parameters is the viscosity of the lubricating oil, which can be efficiently measured using micro acoustic sensors. They have used micro-acoustic sensor and viscosity sensor. This specific behaviour is examined by Systematically investigating engine oils with and without additive packages, which were subjected to a defined artificial aging process.

Behnam Rahimi et al (2012): They tested the lubricating oil based on flash point, viscosity index, specific gravity and density. They have performed by inductively coupled plasma and some other techniques. They also monitored the contamination rate of the lubricating oil. The results are indicative of the decreasing trend in concentration of additive elements and increasing in concentration for wear elements. Different trends have been observed for various physical properties.

A.N. Farhanah, et al (2015): Commercial mineral lubrication oil SAE 10W-30 from three manufacturers was investigated to compare the lubrication performance at three different temperatures 40˚C, 70˚C and 100˚C in 60 minutes time duration by using four ball wear testers. They also tested the lubricating oil with different speed. The speed is varied from 1000 rpm to 2500 rpm. Their results show that all three lubricants have different lubricity performance; the smaller the wear scar, the better the lubricant since the lubricant can protect the moving surfaces from direct metal-to-metal contact occur.

Masuhiko kawamura, et al (2006): The lubricating properties of oil samples from four cars using either leaded or unleaded gasoline were examined using a cross-pin-type lubricant tester and a JIS four-ball tester. The load carrying condition were also tested. At running distances above 2000 km, the wear scar diameter decreased for oil from cars using unleaded gasoline but increased for oil from cars using leaded gasoline. Their results indicate that the differences in the lubricating properties of oils from cars using leaded and unleaded gasolene are due to the formation of pbdtp.

Yimin Moa, et al (2015): In this paper the lubricating oil co-relates to the friction of the engine and also viscosity grade, friction modifier, and viscosity index improver were tested in this paper. Their results showed that the engine friction loss was reduced and vehicle fuel economy was improved by lowering the viscosity of engine oil and adding high-performance friction modifier and new-type viscosity index improver. The effect of energy-conserving engine oils Dexos1 5W-20 adding 1% friction modifier and new type viscosity index improver was most significant with 12.45% engine friction reduction rate and 2.33% vehicle fuel economy improvement rate.

Devendra Singh et al (2011): Their experimental study was carried out on a 4-cylinder, Direct Injection off-highway, heavy-duty, diesel engine and 4- cylinder indirect injection, light duty diesel engine coupled with the appropriate eddy current dynamometers and instrumented with fuel consumption measurement unit, pressure sensor, angle encoder, speed sensor, temperature indicators, data acquisition system etc, to measure the fuel consumption, power/torque etc. They selected two engine oils for diesel engines SAE 20W-50 and SAE 10W-30.

Syarifah Yunusa, et al (2013): In this article they investigated and compared the viscosity index (VI) and wear elements of two different engine oil brands. The two engine oil brands used were Perodua Genuine (PG) Oil SAE5W-30 and Castrol Magnatec (CM) oil SAE5W-30. They obtained by comparing the kinematic viscosity value of engine oil at 40°C and 100°CThe Result revealed that VI value for both PG and CM oil increased as compared to the unused oil and the Lead (Pb) element. Exhibited higher value of wear elements (in parts per million unit) especially in the CM oil. They also tested it upon wear element and changes in temperature condition.

Martin Skjoedt, et al (2008): They tested the lubricating oil in the bases of friction, oil and viscosity grade-based engine friction. Results show that replacing conventional oil with synthetic oil of the same viscosity grade reduces friction, especially at high boundary friction conditions. Molybdenum dithiocarbonate (modtc), and to a lesser extent organic FM, also reduce friction, especially at high boundary friction conditions. They also analyzed the difference in the synthetic and conventional oil based on viscosity grade. The effects of base oil, friction modifier (FM) and viscosity grade on firing engine friction are investigated in an automotive gasoline engine.

3. ENGINE OIL CHARACTERISTIC

The quality of a lubricating oil is tested for the following various properties to evaluate its suitability and merits for certain service conditions.

- **Viscosity:** Viscosity is a measure of the flow ability of an oil under a particular temperature and pressure.
- **Flash Point or Fire Point:** The lowest temperatures at which the oil flashes and fires, known as flash and fire points. These two temperatures must be sufficiently high for any lubricating oil to avoid flash or burn during use.
- **Cloud:** The low temperature at which the lubricant changes from liquid state to a plastic or solid state is called cloud point. In some cases, the oil appears to be cloudy at the start of solidification.
- **Carbon Residue:** Lubricating oils being the chemical compounds of carbon and hydrogen, when burnt deposit carbon on the engine parts. This should be as low as possible for lubricating oil.
- **Corrosion:** A lubricant should not corrode the working parts.
- **Pour Point:** The lowest temperature at which the oil pours is called its pour point. Below this temperature the oil becomes plastic, so it does not produce hydrodynamic lubrication and therefore cannot be used below this temperature.
- **Color:** This test is not so important except for checking the uniformity of any given grade of oil.
- **Dilution of Crankcase Oil:** Petrol vapour may escape past the piston rings during the compression stroke, which mixes with oil and affects its lubricating property. The test, which determines the amount of dilution in crankcase oil, indicates the suitability of such oil.
- **Emulsification:** A lubricant when mixed with water tends to separate. The emulsification number is an index of the tendency of any oil to emulsify with water.
- **Oxidation at High Temperature:** Lubricating oils may break down at high tempera¬ture due to oxidation producing hard carbon and varnish, which deposits on the engine parts. Therefore, lubricants must resist oxidation.
- **Evaporation:** Evaporation test is conducted to find the quantity of oil that may evaporate at high temperatures. Lubricating oil should have a low evaporation characteristic.
- **Sulphur Content:** Sulphur in a corrosive form is detrimental in lubricating oil. Thus, its presence should be avoided.

- **Specific Gravity:** Specific gravity of lubricating oil varies considerably and hence should not be regarded as the main indication of its lubricating property.
- **Neutralization Number:** Oil may contain impurities, if not removed during refining, which have deleterious effect on the properties of the oil.

Among those properties the color of the engine oil characteristic is taken.

3.1 COLOR

As a general rule of thumb, new, clean oil is amber in color. It should also be clear when you pull out the dipstick.

Brown Colored Oil

If the oil is milky or creamy colored, it could be indicative of a head gasket leak. Another good way to pick up on this, is if your exhaust is blowing white smoke and the vehicle is losing coolant.

Frothy and cream-colored oil could reveal water contamination. If you're not seeing white smoke and low coolant levels in your vehicle, then water contamination is the next culprit.

Dark Colored Oil

Dark oil can mean multiple things as well. It could simply just be darkened because of the additives. Or, the darker shade could result if the oil has also been cycled through one time too many, and it's time for a change.

If the oil is thick and dark, it could indicate dirt or contaminants, especially if it's an off-road rig. Furthermore, it could also indicate that it has been experiencing high heat. Typically, that's coupled with a burning smell when you take a whiff of the sample on the dip stick.

Dark brown is okay, and typically just a result of time. Black is cause for more concern and deeper investigation.

3.2 Engine Oil Selection

The Engine oil that is selected for testing is Mobil 4T 10W-30. Here are the following lubrication properties.

Table -1: Engine Oil Specification

Mobil Super 4T	10W-30
SAE Grade	10W-30
Viscosity, ASTM D445 cSt @ 40ºC	70
Viscosity, ASTM D445 cSt @ 100ºC	10.8
Sulpfated Ash, wt%, ASTM D874	0.96
Pour Point, ºC, ASTM D97	-30
Flash Point, ºC, ASTM D92	226
Density @15.6ºC g/ml, ASTM D4052	0.87

3.3 SAMPLE OIL COLLECTION

The Engine oil is collected in three stages. The first engine oil is collected when it is fresh. The second sample is collected when the vehicle is driven for about 2000 kms, where the engine oil is used to some extent. This engine oil is considered as an mediumly used oil. The third sample is collected when the vehicle is driven for about 3000 kms, where this engine is considered as a heavily used engine oil. The third sample is the final face of the engine oil where it cannot be used further because it has lost all its lubrication properties.

4.COMPONETS

The following components has been used to monitor the engine oi.

4.1TURBIDITY SENSOR

Turbidity sensors measure the amount of light that is scattered by the suspended solids in water. As the amount of total suspended solids (TSS) in water increases, the water's turbidity level (and cloudiness or haziness) increases. Turbidity sensors are used in river and stream gaging, wastewater and effluent measurements, control instrumentation for settling ponds, sediment transport research, and laboratory measurements.

Fig -1 Turbidity sensor

4.2 Microcontroller

Microcontrollers give you a fantastic way of creating projects. A PIC microcontroller is a processor with built in memory and RAM and you can use it to control your projects (or build projects around it). The circuit has separate external RAM, ROM and peripheral chips. Frequency counter using the internal timers and reporting through UART (RS232) or output to LCD. Capacitance meter analogue comparator oscillator. Event timer using

internal timers. Event data logger capturing analogue data using an internal ADC and using the internal EEPROM for storing data (using an external I2C for high data storage capacity. Servo controller (Control through UART) using the internal PWM module or using a software created PWM.

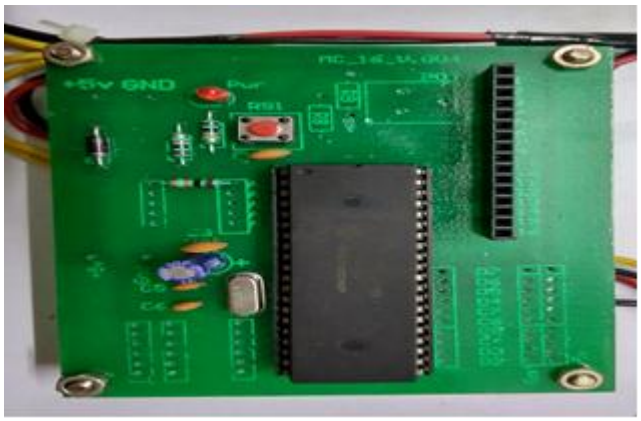

Fig -2: Microcontroller

4.3.LED

A light-emitting diode (LED) is a two-lead semiconductor light source. It is a p–n junction diode, which emits light when activated. When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the color of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor. This contains red, blue and green lights.

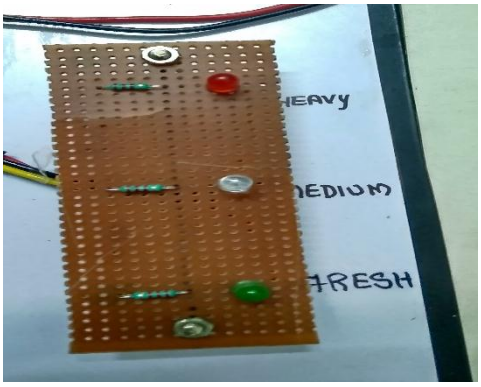

Fig -3:LED

4.4POWER SUPPLY BOARD

A power supply is an electronic device that supplies electric energy to an electrical load. The primary function of a power supply is to convert one form of electrical energy to another. Transformer steps down high voltage AC mains to low voltage AC. A rectifier is used to convert the transformer output voltage to a varying DC voltage. An electronic filter to convert it to an unregulated DC voltage. The filter removes most, but not all of the AC voltage variations; the remaining voltage variations are known as ripple. The function of a linear voltage regulator is to convert a varying DC voltage to a constant, often specific, lower DC voltage. In addition, they often provide a current limiting function to protect the power supply and load from over current.

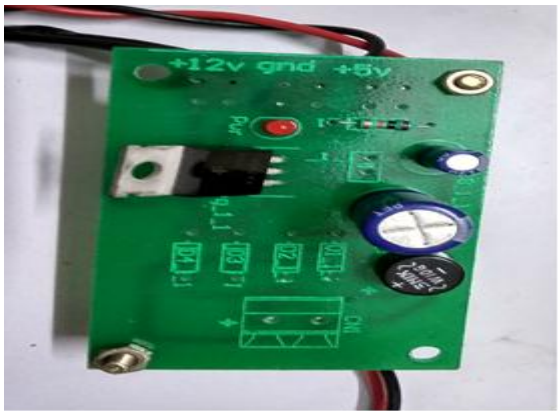

Fig -4: Power Supply Board

5. CONCLUSIONS

By using this device, we can find the engine oil condition with the help of the turbidity sensor and with the help of an LED indicating its condition.

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