ENGINE OIL MONITORING SYSTEM FOR AUTOMOBILES: A NOVEL APPROACH

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Abstract: *The deterioration rate of Lubricating oil in internal combustion engines is strongly dependent on the fuel quality, the ambient conditions and engine parameters like speed, distance travelled and Engine temperature etc. In order to avoid an unnecessary damage to the moving parts of internal combustion engines, the engine oil must be changed in regular intervals i.e. before it loses its protective properties like Viscosity, abrasives in suspension and water content etc. At the same time, an unnecessary oil change should be avoided for environmental and economic reasons as still active additives left in the oil may react with the environment and may cause harmful effect. Unexpected oil leaks have also shown to be disadvantageous in terms of efficiency in lubrication. Therefore, a device is in need to precisely measure the level of oil in the tank. In our work on bench experiment has been successfully conducted to verify the possibility of using sensors and controllers to check the quality of oil, quantity of the oil and temperature in automobiles.*

Keywords: **Color sensor, Oil quality, Oil level detector.**

1. INTRODUCTION

All automobile engines are subjected to continuous mechanical and thermal stresses leading to performance degradation of engines overtime. Often the engine performance is enhanced by the use of lubricants. For better operation of engine, frequent oil change is recommended. It is seen that, the life of lubricants greatly depends on the critical properties such as viscosity, Moisture content, co-efficient of thermal conductivity etc. Hence it is important to understand the parameters that affect the quality of the lubricants. Engine oils which are used for lubricating purpose in engine and gear box generally endures high temperature, pressure along with pollution of oxides, grease, sand, dust, metal particles, smoke etc., During the operation of engine these properties of lubricating oil are likely to be changed lowering the performance of the engine by varying critical properties of the lubricating oil [1].

Generally, we follow conventional methods observation to check the quality of the oil present in engine and gearbox. Otherwise we follow the method of periodical change with respect to time. The observation may include checking level of oil, oil color or depending on the wear and tear occurred in the moving parts like bearings etc. Observations in turn are dependent on the experience and may vary from person to person in terms of knowledge on the machine. The other way of checking oil quality may be send the oil sample to laboratory to check the quality of the oil to examine the quality of the oil and to decide whether it needs replacement of the oil. It is a time taking process. In laboratory the parameters were tested for their quality. But as result of long testing period with quite an amount of expenditure, this method does not turn out to be the efficient procedure for oil quality and quantity monitoring. In this paper a more efficient and precise method of oil quality and quantity monitoring is provided with added future scope and extensions by using light sensors and oil level monitoring system using ultrasonic sensor.

2. DESIGN PRINCIPLE

During the operation the quality of the oil depends on the ability of oil to blow-by gases of the combustion process, contamination of wear particle from metal surface lining of engine highly influences the degradation of lubricant, exceeding the saturation point, presence of moisture (oil to water ratio) etc. At the end of the duty cycle the oil is

completely degraded and one of its physical parameter color changes from the initial amber red color to dark black at the end of the degradation period.
As engine is used the color of the oil becomes darker, it can indicate high heat, presence of contaminants, and eliminating the required additives that cause the oil to darken during normal use. Transition of the engine oil color from amber red to dark black has been taken as an important parameter in determining the quality change of the oil. TCS230 RGB color sensor is being used to detect the amber red color during the beginning of the life cycle and dark black color at the end of its duty cycle. The output is calibrated to display information whether on the contained oil is of good quality or poor [2].

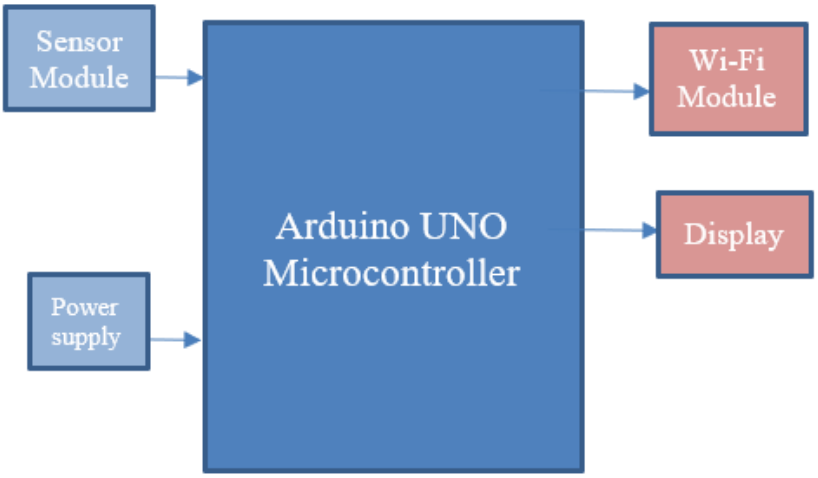

Figure.1 Block Diagram

3. SENSORS USED

3.1. TCS230 RGB LIGHT SENSOR

TCS230 is a programmable color sensor which is used to identify the color of the object using light to frequency converter. It uses a silicon based configurable ohotodiodes and a current to frequency convorter with a CMOS integrated circuit. The output of this sensor is a aquare wavw with its frequency directly proportional to light intensity. It contains 8×8 array of photodiodes. This RGB light sensor uses 16 photodiodes having blue filters, 16 photodiodes with green filters, 16 photodiodes with red filters and 16 photodiodes with no filter. These four types of photodiodes are integrated together to reduce non uniformity of incidence irradiance. Output enable (OE) places the output in the high-impedance state for multiple-unit sharing of a micro-controller input line.

Figure 2. TCS230 RGB Color Sensor Module

3.2. HC-SR04 ULTRASONIC SENSOR

Ultrasonic sensor works on the principle Ultrasonic distance measurement, In which time taken for ultrasonic wave to travel a given distance is measured. From that the distance between the objects were calculated. In this sensor an ultrasonic wave is emitted from the emitter during emission the timer starts. When this ultrasonic sensor encounters obstacle it rebounds, and the reflected ultrasonic wave is detected by the receiver during receiving the timer stops, and records the time interval between the emitted and receiving the sound wave. As the speed of ultrasonic wave in sir is 340 m/s, and by using the time (t) recorded between the emitting and receiving ultrasonic wave distance (s) between the emitter and the object is calculated using the equation.

$$S=340t/2$$

This principle is similar to that of RADAR ranging sensor. Which gives information of distance between the object and the obstacle according to the time and the velocity if the radio signal.

Figure 3. HC-SR04 Ultrasonic Module

4. EXPERIMENTATION

In this project we have used Arduino UNO micro-controller board which employs the ATmega328P Microchip to do the necessary data collection and calculations required for this project. We have implemented a setup to identify the colour of the engine oil using the color sensor (TCS230 RGB LIGHT SENSOR) and to detect the level of oil present in the tank we are using an ultrasonic proximity sensor (HC-SR04 ULTRASONIC SENSOR).

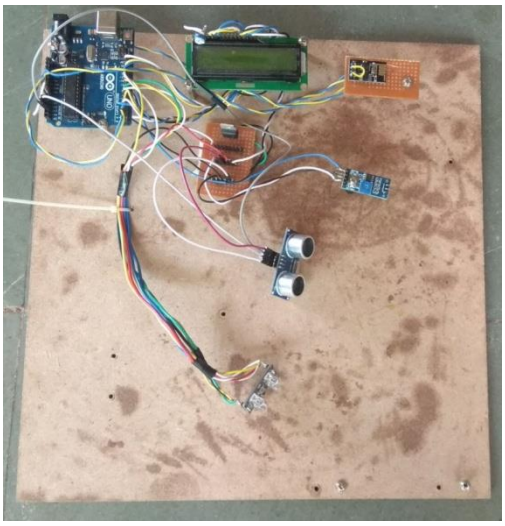

Figure 4. Circuit Implementation

Usually the when the oil deteriorates the color of the oil changes from amber red to dark black due to additives, combustion bi-product and debris. The change in color indicates the particles added to the pure oil, hence we are monitoring the oil color which changes from amber red to dark black. When the red filtered photodiode detects the red color, the current through the photodiode increases and the frequency from the current to frequency converter also increases.

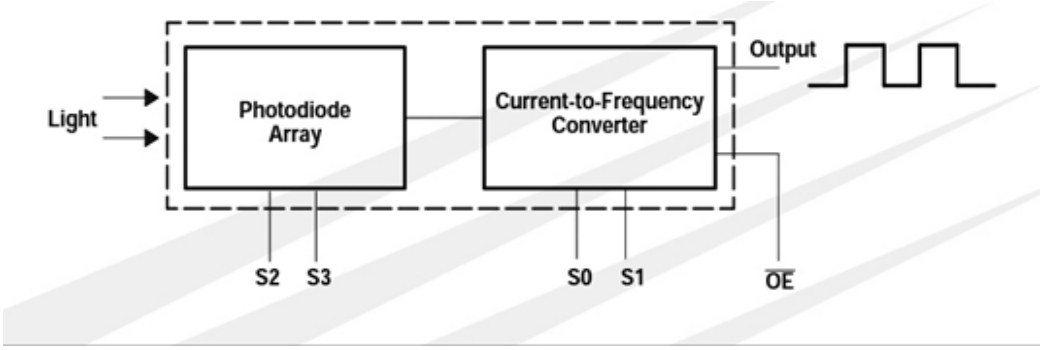

Figure 5. Block Diagram of TCS230 Color sensor

The Arduino UNO micro-controller board reads the time period of the input frequency signal and gives out a number accordingly, this number represents the number of pulses. When the color sensor detects red color that number is low, when the sensor dose not detect red color the number is high. We are now taking this number with lower value as reference for pure oil and the higher valued number as reference for Impure oil.
As shown above the HC-SR04 Ultrasonic sensor is a 4-pin module, whose pin names are V_{cc}, Trigger, Echo and Ground respectively. The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver. We are using this sensor to measure the level of the oil in the tank. The level of the oil is then displayed as full, three forth, half and quarter of the tank.

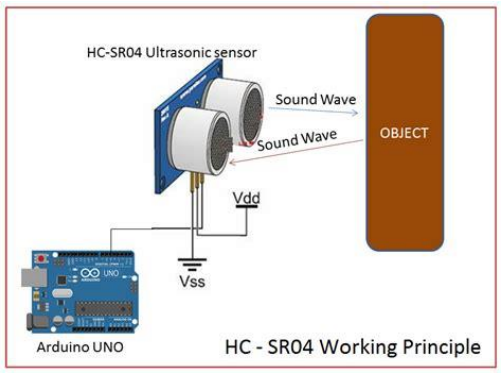

Figure 6. Working Principle of HC-SR04

All the processed information is then displayed on an LCD display to the user, also this information is sent wireless through a WIFI module to the user.

5. CONCLUSION

In the current work the successful integration of sensors and Arduino controller has been done on table to detect the oil quality. In this system the sensor inputs are the only variables which decides the quality of the lubricating engine oil. The effect of engine runtime on temperature of the engine has not considered in the present work. The Arduino Uno controller which gives a better advantage over other controller has been used in this work for its compactness and economic point of view. This shows that the same procedure can be followed in the automobiles to automatically check the oil quality and inform the driver regarding the service requirements. If a separate database is used

along with oil replacement reminder it can be used to find the nearest service station and cost for replacing the oil.

Already existing techniques uses manual identification of the oil and replacing them, our model uses real time monitoring of the engine oil and inform the user about the quality and level of the oil. This work has implemented WIFI based communication system to inform the user about the quality and quantity of the oil.
In future implementation the database can be created to upload and store the information, which can then be accessed by the owner of the vehicle and the workshop or the service center to book the appointment. The effect of engine run time can also be considered as a variable to check the temperature developed inside the engine and the effect of temperature on engine oil quality can be considered in future works.

6. REFERENCE

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