Design of Motorcycle Oil Performance Detector

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Abstract

IOT development currently leads in all fields of science, one of which is the area of the vehicle. 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.

Keywords
IOT, Oil Performance, Turbidity Sensor.

1. Introduction
Currently, the increase in the number of motorbikes each year is increasing very rapidly. According to data from the Central Statistics Agency (BPS), the number of motorcycles in Indonesia in 2019 reached 112 771 136 (BPS 2019). With the increase in the vehicle resulting in an accident. The number of events in Indonesia reached 116 441 accident victims, according to BPS data related accidents in 2019 (BPS 2019). There are several factors of accidents that occur either from the driver's negligence or from the condition / damage to the vehicle itself. The cause of damage to a motorcycle can vary from the state of the components, lubricants and other parts of the motorbike.

Prevention of accidents caused by damage to the motorcycle can be done with the treatment of internal and external components of the motorcycle regularly, either by replacing the regular lubricants (Antonius et al. 2019). Lubricants can serve as a coolant, vibration dampeners, and transporting the dirt in the operation of the machine, as well as for the prevention of wear and tear on the components (Mitan et al. 2018, Singh et al. 2021). Conditions need to be considered and the lubrication system is done routinely turn to optimize its performance. How to determine the optimal lubrication system performance is affected by the quality level of viscosity with units SAE (Society of Automotive Engineers), the quality of Oil Services API (American Petroleum Institute), and the lubricant in the engine capacity (Suyitno 2019).

Figure 1. Dipstick

The conventional method used to check the condition of the oil that has been used is to use a dipstick in Figure 1, this serves as a way to determine the volume and color of the lubricant. However, the dipstick has limitations in checking the color of the lubricant, where each individual has their own understanding of the exact color of the lubricant (Randis et al. 2019, Sharma et al. 2019, Syafitri et al. 2019). So that another technology is needed that can be used as the right tool to check the condition of the oil regularly with better results.

Figure 2. Viscometer NDJ-8S

Mechanics can find out and check the quality of oil can be done regularly with a tool called the NDJ-8S viscometer in Figure 2 (Yanwar 2019), this tool adopts sophisticated mechanical design technology, so this tool can be used to check the results of oil quality accurately, but lacks in use these tools cannot be directly installed on the machine. So that the results of these checks will be applied using a microcomputer-based rotor drive, to display the results of computing the viscosity of the oil on the LCD, and enables users to read the results.

Based on the background, the solution to this problem is by applying Artificial intelligence (AI) and IOT in one of the scientific fields (Setiawan et al. 2020), one of which is in the transportation model, this article will optimize the use of oil quality checking tools, namely by presenting the concept of a tool to detect oil quality performance based on viscosity at motorcycles to reduce engine component damage, as a marker or reminder of regular motorcycle maintenance, and the results will be displayed on the LCD.

2. Materials and Methods

This study uses several tools that will be applied as a step in solving the problem of checking the quality of the oil on a motorcycle. This tool is in the form of a microcontroller and sensor, which includes Arduino, LCD and I2C, Batteries, Turbidity Sensors, RTD Sensors, and Selenoid Valves. Problem-solving method in this study to create a design and concept to check the quality of oil that can be utilized by the user.

2.1 Arduino

The Arduino used is the Arduino UNO ATmega328P, with 7-12V Input Voltage and 32 KB Flash Memory (ATmega328P) where 0.5 KB is used by the bootloader. The board of the Arduino UNO ATmega328P has 14 digital inputs / outputs, 6 outputs for PWM (Pulse Width Modulation), 6 analog inputs, a 16 MHz ceramic digital resonator, USB connection, socket adapter, ICSP (In Circuit Serial Programming) pin header, and a reset button. as shown in Figure 3.

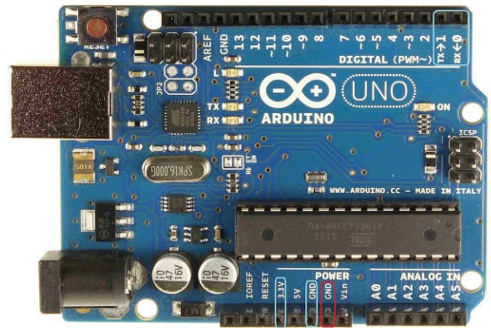

Figure 3. Arduino UNO ATmega328P

2.2 LCD dan I2C

LCD (Liquid Crystal Display) which is used to display 16x2 type of results. This LCD is an electronic display made using CMOS Logic technology by reflecting the surrounding light against the front-lit or transmitting back-lit light. 16x2 LCD uses 16 pins as control, to reduce pin usage a special LCD module is used, namely I2C (Inter Integrated Circuit). Through I2C, the LCD can be controlled using only 2 pins to send and receive data, LCD and I2C are shown in Figure 4.

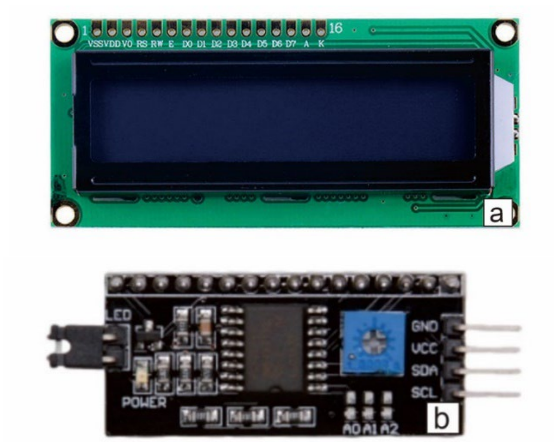

Figure 4. (a) LCD (b) LCD I2C module

2.3 Battery

Battery is used as a voltage source, with a voltage of 12V which utilizes a motorcycle battery. A battery or a motorcycle called an accumulator is an important component that stores electrical power. As shown in Figure 5.


Figure 5. Battery (ACCU)

2.4 Turbidity Sensor

The Turbidity sensor used is the TS-300B to measure the turbidity of a liquid which consists of a Turbidity Sensor Probe, a Turbidity Detection Module and the two tools are combined using a Cable Sensor Probe. As shown in Figure 6.

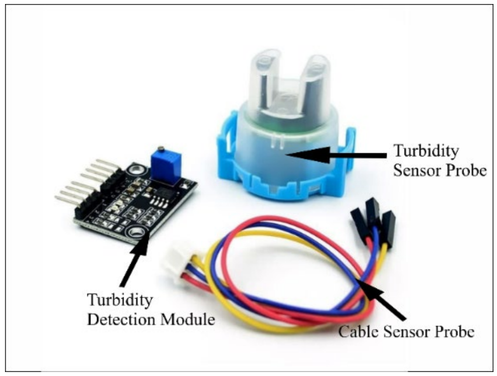

Figure 6. Sensor turbidity TS-300B

2.5 RTD Sensor

RTD (Resistance Temperature Detector) Sensor is a temperature sensor used to measure temperature. This temperature measuring sensor works on the basis of changes in the value of metal resistance. The RTD sensor used is PT100 which can withstand temperatures of 50-400 Celsius. As shown in Figure 7.

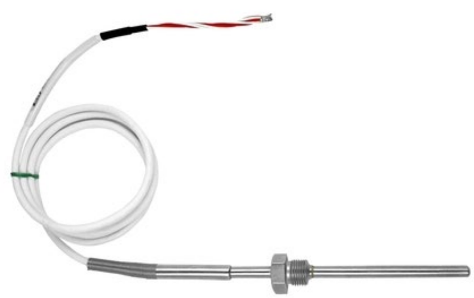

Figure 7. RTD sensor PT 100

2.6 Solenoid Valve

The solenoid valve is driven by electrical energy which has a coil as a drive that functions to move the piston in it. Solenoid Valve has 3 holes, namely output, input, and exhaust holes (channels for trapped fluids). The way this tool works, namely the electric voltage that provides supply to the coil will be converted into a magnetic field to move the piston. As shown in Figure 8.

Figure 8. Solenoid valve

2.7 Oil Performance Check Assembly Scheme

The schematic of the series of oil performance check tools to remind about oil changes with a high percentage of quality accuracy, the assembly scheme is presented in Figure 9 as follows.

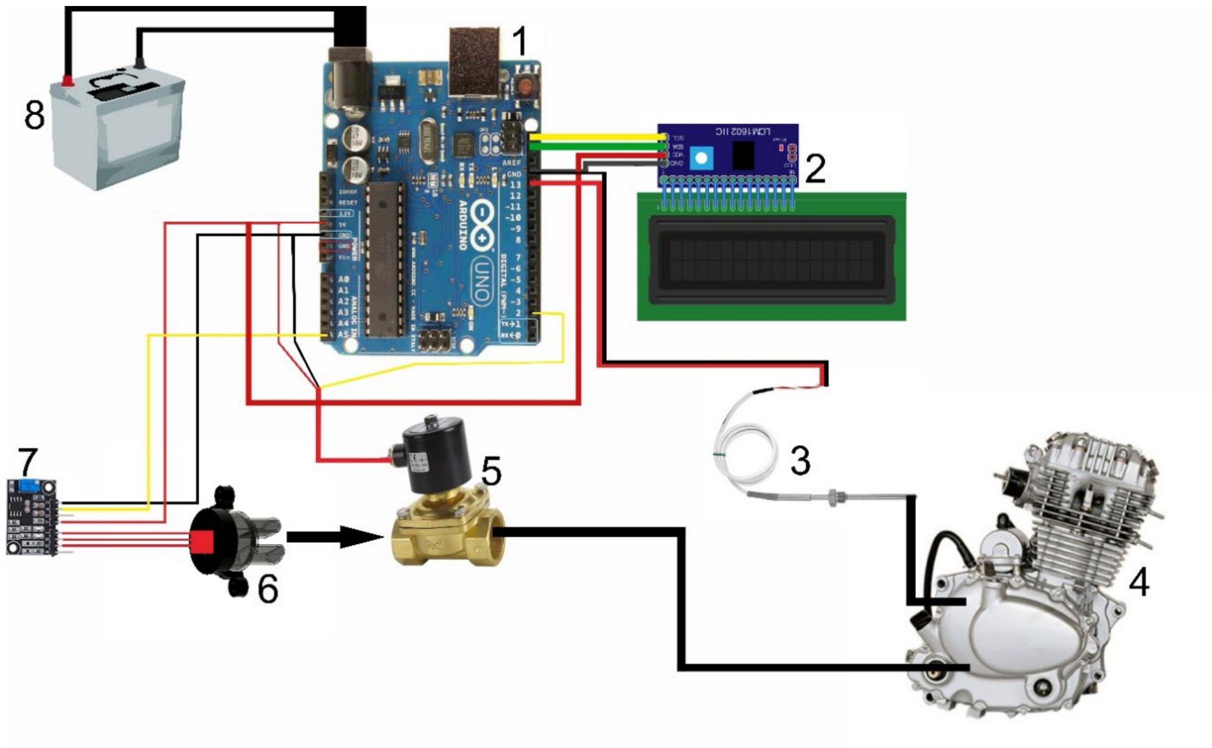

Figure 9. Oil performance check assembly scheme (1. Arduino UNO, 2. LCD and I2C, 3. RTD sensor PT100, 4. Motorcycle engine, 5. Solenoid valve, 6. Turbidity sensor, 7. Turbidity detection module, 8. Battery)

Figure 9 describes the assembly of the oil performance check tool. Assembly begins with assembling the components including the Arduino which is assembled with LCD, I2C, Turbidity Sensor, Turbidity Detection Module, Solenoid Valve, and RTD Sensor components. The next step after assembly is then the tool is applied to a motorcycle engine, and the components that are directly connected to the engine are the solenoid valve and the RTD sensor. For the power source, this tool uses a battery that is connected to the Arduino.

3. Results and Discussion

The author makes a design concept to model the tools to be made. The designs discussed include the installation of tools and how the tools work.

3.1 Tool Installation Design

The tool design process uses the SolidWorks application. This tool will be attached to the engine and will be connected directly to the oil pan. As shown in Figure 10.

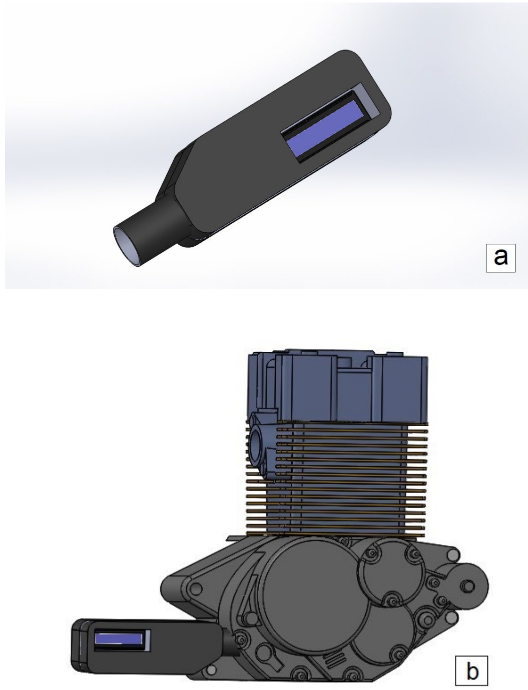

Figure 10. (a) Design tool and (b) Tool installation design

3.2 Tool Performance

The turbidity sensor is a module that works to detect quality based on the scattering of light hitting oil particles (Zang et al. 2020). Number 3 in Figure 11 shows the Turbidity Sensor used in this research. Turbidity in liquids depends on particles that can block light into the liquid. So the fewer particles that can cover the light, the higher the quality of the liquid is also the opposite (Rahmat et al. 2018).

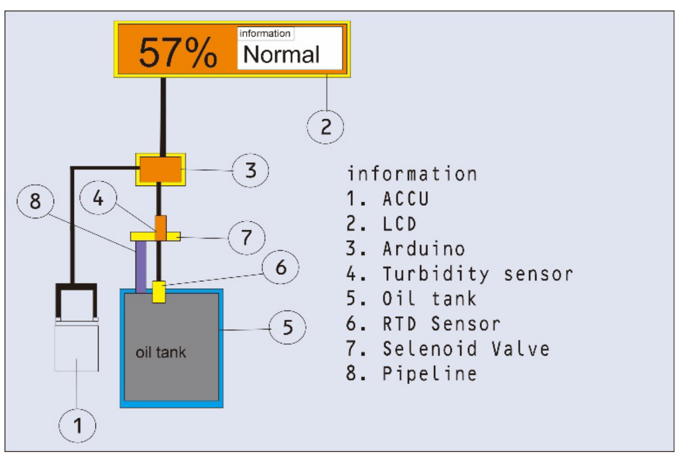

Figure 11. The concept of how the tool works

The temperature sensor (RTD) will read the oil temperature, when the oil temperature reaches around 0-50 degrees it will open the solenoid valve and flow oil into the tool, then the oil flows directly to the turbidity sensor which is connected to the Arduino Uno ATmega328P Microcontroller as a data processor. Output data from the quality of the liquid will be read by Arduino using the Arduino IDE software programmed using a computer. Then connected to the LCD display to be converted into a percentage of the liquid. If the engine starts to turn on or the oil is hot again with the temperature read by the RTD sensor reaching above 50 degrees, the solenoid valve will close.

All of these tools are combined into an oil performance detection tool and inserted into the motor oil tank. For its own power source, this tool uses a 12-volt voltage coming from the motorcycle battery.

4. Conclusion

The result of this research is the concept of an automatic oil performance check tool by showing the percentage of oil condition to avoid the driver's negligence in replacing it. Where the concept in this study uses several sensors namely, Turbidity Sensor which functions to read the quality of the oil and then is converted into a percent by Arduino. The RTD Sensor which functions to read the oil temperature will then give a signal to Arduino in operating the solenoid valve to open the valve and flow the oil to the Turbidity Sensor.

Acknowledgements

Researchers are grateful to KEMENRISTEK DIKTI which has organized PKM (Pekan Kreativitas Mahasiswa) and passed the researcher's idea entitled “Alat Deteksi Persentase Performa Oli Untuk Pengingat Penggantiannya” and therefore researchers can make this paper.

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