

## THE ADDITIONAL COOLING SYSTEM ON THE RADIATOR OF THE HONDA VARIO MOTORCYCLE USES AN EXTRA FAN BASED ON ARDUINO UNO

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### ABSTRACT:

In a component on a motorcycle, there is a tool called a radiator which is useful as a coolant on the vehicle's engine. The circulation of radiator water from the radiator to the engine and back again to the radiator must run properly so that the temperature in the motorcycle engine can be stable. This study discusses the design and simulation of additional coolant on Honda Vario motorcycle radiators using Arduino Uno-based extra fans. This design and simulation is very important to assess and evaluate the feasibility of the role of extra fans in helping cooling the motorcycle radiator so that the temperature of the motorcycle engine can be stable. This design and simulation will use the Honda Vario 125 motorcycle as a container for the development of cooling components on the motorcycle engine.

**Keywords:** Arduino One, Extra Fan, Honda Vario.

### INTRODUCTION

Motorcycles are one type of transportation mode that is often found on the highway (Olubomehin, 2012). People in Southeast Asia, especially Indonesia, motorcycles have become a necessity that must be owned today, ranging from the lower middle class to the upper middle class. The public also recognizes that motorcycles are the most practical and easy to drive transportation, because travel time is more efficient when facing congestion on the highway, especially in large cities (Lee et al., 2020). In addition to being a private

mode of transportation, motorcycles are currently public transportation with the existence of online motorcycle taxi services (Suatmadi et al., 2019).

A problem arises, where motorcycles that are a mode of public transportation, use more time than private transportation motorcycles (Jou & Chen, 2014). From some communities, many do not check the condition before and after the motorcycle is used, such as checking the radiator water on a motorcycle that has a radiator as engine coolant, then checking the distance (kilometers) that has been traveled by the

motorcycle on the speedometer which is a reference for changing engine oil (Gu et al., 2013). Lack of attention And maintenance can result in fatal damage to motorcycle components, damage that can be caused if the radiator water runs out or engine oil that is too thin in viscosity can cause damage to the motorcycle engine, other supporting components also have the risk of being affected by damage. Motorcycles can also experience overheating or excessive heat caused by the motorcycle engine.

## **Theoretical Foundation**

### **2.1. Control System**

The control system is part of a system that functions to control or regulate a work system so that it always works as designed (Malmi & Brown, 2008). If there is a failure in a system, the system will correct it, so that if there is a failure in the system, it can be easily resolved (Kotsovolos et al., 2006).

### **2.2. Arduino Uno**

Arduino is an open source electronic kit or electronic circuit board in which there is a main component that is the brain of programming, namely a microcontroller chip (Rahayu & Sumarni, 2021). The microcontroller itself has an Integrated Circuit (IC) that can be programmed through a laptop or user's computer (Hudedmani et al., 2017). The purpose of embedding the program in the microcontroller so that the electronic circuit can read input, process input, and then produce output as desired (Latif et al., 2020).

In this study, the design of the tool used an Arduino Uno microcontroller. The Arduino Uno is an ATmega328P-based microcontroller board (Rahman & Jambek, 2019). The Arduino Uno has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, 16 MHz

quartz crystal, Universal Serial Bus (USB) connection, power plug, ICSP header and reset button. It contains everything needed to support a microcontroller (Baba Lawan et al., 2018).

### **2.3. Accu**

Accu is a storage device, provider, supplier of electric voltage that does not require an electric parent as a voltage source and has the main constituent component, sulfuric acid (H<sub>2</sub>SO<sub>4</sub>). The chemical reaction of sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) will cause an electric current. In this case, the design of the tool uses a battery with a capacity of 12 VDC which functions as a source.

### **2.4. Stepdown DC 12 V to 5 V.**

Stepdown is an electronic component that has a function as a high voltage converter into low voltage. The DC stepdown module has a voltage input from a voltage source for example 12 VDC to 24 VDC, the voltage is then processed by electronic components contained in the stepdown module, then the output from the stepdown module outputs a lower voltage than the input, the amount of the output voltage ranges from 3 VDC to 5 VDC.

### **2.5. Temperature Sensor DS18B20**

The sensor used in the design of this tool is the DS18B20 temperature sensor. This sensor is a digital temperature sensor that requires 1 pin of the data line for communication, and has a temperature measurement range from -55OC to more than 125OC with an accuracy of approximately 0.5 degrees Celsius from -100C to 850C.

### **2.6. Relay 5 VDC 1 Channel**

Relay is a component that has an electromagnetic principle that works like a switch, can disconnect or connect electric current. Although it has the same way of working as a switch, the advantage of the

relay is that when moving the position on to off and vice versa is automatically with an electric current.

**2.7.Liquid Crystal Display (LCD)**

The design of this study uses a liquid crystal viewer or what we commonly know as Liquid Crystal Display (LCD), LCD measuring 16 cm x 2 cm, the size of the LCD was chosen because it does not take up too much space on the tool that will be made. The design using LCD aims to display a data obtained from the DS18B20 temperature sensor, then the data is sent to Arduino Uno, which then displays motorcycle engine temperature data to the LCD. To facilitate the use of the 16 x 02 LCD to look neat wiring, the design uses I2C as an additional component placed behind the LCD.

**2.8.Extra Fan**

The next component that will be used is the extra fan. This tool functions as a supplier of wind or air from outside to the radiator grille. This tool serves to help the cooling process on the motorcycle radiator become faster and make the motorcycle engine more stable temperature. With the extra fan, it is hoped that various problems that often arise due to motorcycle engines that experience overheating can be reduced.

**2.9.Light Emitting Diode (LED)**

In the design of this tool uses Light Emitting Diode (LED) lights as a notification of extra fans starting to work or when extra fans stop working.

**2.10.Buzzer**

In the design of this study, the alarm notification used was the Active 5 VDC Buzzer. This type of active buzzer is simply given a voltage of 5 VDC from the microcontroller. The buzzer will work when the temperature of the motorcycle engine has reached a point that requires the extra fan to start working.

**Design**

**3.1.Block Diagram**

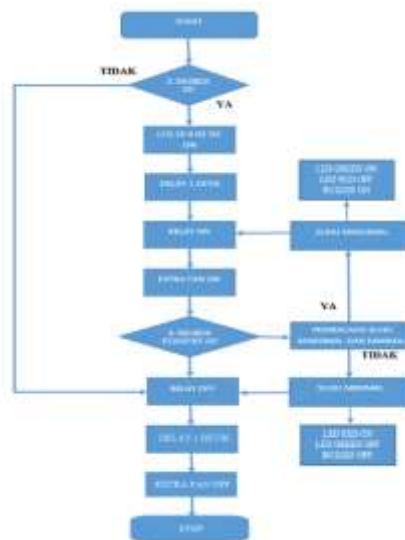
To illustrate the whole system to be created, on the block The diagram below will describe the components composed of the working system of the tool to be designed, along with the arrangement:



Gambar 1. Diagram Blok *Extra Fan* Berbasis Arduino Uno.

**3.2. Flowchart**

The flowchart below describes the stages of the work system process of the extra fan consisting of several processes, namely:



Gambar 2. Flowchart extra fan.

### 3.3. Electrical System Installation Design

In the design of the electrical system includes a 12 VDC power supply from the accu, a 5 VDC power supply from the stepdown module for Arduino Uno, a DS18B20 sensor circuit with a 4.7k $\Omega$  resistor, a relay circuit, an extra fan circuit, an LED light circuit, a buzzer circuit, and an LCD circuit.

### 3.4. Program Design in Arduino IDE

Software program design is carried out on a computer in the Arduino IDE application, later the program will be inserted into the Arduino Uno microcontroller, then Arduino Uno will run the process of controlling other components automatically. Here the author will make a sketch program in the Arduino Uno software on the computer, in designing the program there are several procedures, starting with making a sketch program, downloading libraries for component programs, selecting component communication lines, verifying the program, finally uploading the program that has been made to Arduino Uno.

## RESEARCH METHODS

This research uses qualitative methods with a literature review approach. Literature review is a systematic, explicit and reproducible method for identifying, evaluating and synthesizing research works and thoughts that have been produced by researchers and practitioners. The step in writing this review literature begins with the selection of topics. Perform a library or

source search to gather relevant information from Google Scholar, CINAHL, Proquest, Ebsco, or National Library databases. Determine keywords or keywords for journal searches. After the data is collected, it is processed, analyzed and conclusions drawn.

## RESULTS AND DISCUSSION

### 4.1. System Testing

#### 4.1.1. DS18B20 Temperature Sensor Testing and Notifications

At the testing stage of this system, the author tested the DS18B20 sensor using a motorcycle that was being turned on, namely by placing the DS18B20 sensor in the motorcycle engine area.



Figure 3. Placement of DS18B20 Temperature Sensor on Motorcycle Engine Block.

In designing this Arduino Uno program, the author has set the standard temperature on the motorcycle engine at 70°C. The DS18B20 temperature sensor will send temperature data to the Arduino Uno which can be displayed via LCD. Electronic components that function as marker notifications are LED lights and Buzzers. The Red LED Light will light up which means that the position of the motorcycle engine temperature is below 70°C, while the Green LED Light and Buzzer will turn on indicating

that the temperature of the motorcycle engine has reached a temperature above 70°C.

Table 1. DS18B20 Temperature Sensor Testing with LCD and Notifications

No	Titik Ukur	Relay		Extra Fan	
	Suhu	NC	NO	OFF	ON
1.	32°C	✓	-	✓	-
2.	51°C	✓	-	✓	-
3.	65°C	✓	-	✓	-
4.	70,50°C	✓	✓	✓	✓
5.	80,00°C	✓	✓	✓	✓

In Table 1. there is temperature data from the LCD of 32°C, 51°C, and 65°C with notification The Red LED light is on because in this design the standard temperature is set at 70°C. Next, at 70.50 and 80.00°C notifications Red LED Light off, Green LED Light and Buzzer On.

**4.1.2.DS18B20 Temperature Sensor Testing with Relay and Extra Fan**

Relay and Extra Fan tests are carried out using the DS18B20 temperature sensor as a temperature detector installed on the motorcycle in live conditions. In the Arduino Uno program, the temperature set as the working temperature point is above 70°C. If the temperature obtained from the DS18B20 sensor has not reached the temperature point of 70°C then the Relay and Extra Fan are not active, if the temperature has reached a temperature point above 70°C then the Relay and Extra Fan will be active. The following is a presentation of these tests in Table 2.

Table 2. DS18B20 Temperature Sensor Testing with Relay and Extra Fan.

No	Titik Ukur	LED	LED	Buzzer
	Suhu	Merah	Hijau	
1.	32°C	✓	-	-
2.	51°C	✓	-	-
3.	65°C	✓	-	-
4.	70,50°C	-	✓	✓

In Table 2. there is temperature data from the LCD of 32°C, 51°C, and 65°C there is a red light notification on the Relay which means it is in a Normally Close (NC) state so that the Extra Fan is not active. Next, at temperatures of 70.50°C and 80.00°C there are red and green light notifications on the Relay which means it is in a Normally Open (NO) state so that Extra Fan will be active.

**4.1.3.Engine Temperature Comparison Testing on Motorcycles**

The comparison test was applied to motorcycles that use Extra fans as additional coolant on motorcycle radiators with those that do not use Extra fans. The motorcycles used for comparison use the same specifications in the volume of the combustion chamber in the motorcycle engine, namely the Honda Vario 125 CC in 2015 using Extra Fan as an additional coolant in the motorcycle radiator and the Honda Vario in 2018. Both motorcycles use radiator water specifications using the same, namely Pre-Mix Coolant Honda AHM, and also change oil with the same specifications, namely Motul Scooter LE 4T 10W-30 0.8 L oil.

The comparison is in the form of testing the vehicle's mileage from the starting point of departure to the last point

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of destination as far as 25 Km. The test was carried out 5 times with the distance of each point is 5 Km with an average speed of 20 – 60 km / hour, this stop aims to see the temperature comparison of the two motorcycles. From the test results, the author has made a table and graph comparing the engine temperature of the two motorcycles. The results of the test of engine temperature comparison of the two motorcycles obtained temperature data that is quite far. The test results in the form of temperature data are shown in **Table 3** and **Table 4** below:

**Table 3. Results from Motorcycle Testing using Extra Fan.**

Jarak Tempuh	Waktu Tempuh	Kecepatan Sepeda Motor	Suhu Mesin Sepeda Motor
0 Km	5 Menit	0 Km/Jam	48,44°C
5 Km	10 Menit	40 – 60 Km/Jam	89,87°C
10 Km	10 Menit	40 – 60 Km/Jam	96,69°C
15 Km	15 Menit	40 – 60 Km/Jam	97,17°C
20 Km	15 Menit	40 – 60 Km/Jam	98,37°C
25 Km	20 Menit	10 – 40 Km/Jam	99,31°C

**Table 4. Results from Motorcycle Testing that does not use Extra Fan.**



From the results of comparison testing that can be seen the comparison of motorcycle engine temperature in Table 3 motorcycle engine temperature data using Extra Fan and in Table 4 motorcycle engine temperature data that does not use Extra Fan. At the starting point of 0 Km, both motorcycles are heated for 5 minutes. At the distance of the first 5 Km to the last 5 Km mileage, which is at the point of 25 Km, a comparison of engine temperature data from the two motorcycles that differ far can be seen. After traveling from the starting point to the end point with a total distance of 25 Km and a total travel time of 1 hour 10 minutes.

In Figure 4., the engine temperature comparison of motorcycles that use Extra Fan with those that do not use Extra Fan is quite far from the temperature comparison distance. Motorcycles that use Extra Fan have a fairly stable engine temperature at 70°C to 80°C when traveling as far as 25 Km, while motorcycles that do not use Extra Fan the temperature data obtained reaches 80°C to 100°C when traveling as far as 25 Km.

Jarak Tempuh	Waktu Tempuh	Kecepatan Sepeda Motor	Suhu Mesin Sepeda Motor
0 Km	5 Menit	0 Km/Jam	45,50°C
5 Km	10 Menit	40 – 60 Km/Jam	71,50°C
10 Km	10 Menit	40 – 60 Km/Jam	72,00°C
15 Km	15 Menit	40 – 60 Km/Jam	73,50°C
20 Km	15 Menit	40 – 60 Km/Jam	74,00°C
25 Km	20 Menit	10 – 40 Km/Jam	75,50°C

Figure 4. Graph of temperature comparison of motorcycle engines that use extra fans with those that do not use extra fans.

After testing both motorcycle vehicles, from this design obtained positive results. The positive result is in the form of a motorcycle that uses an extra fan as an additional coolant on the motorcycle radiator can stabilize the temperature on the motorcycle engine compared to motorcycles that do not use it. In addition, the pull on the motorcycle gas is more responsive, which means there is no reduction in power from the motorcycle. The performance of the motorcycle radiator is quite helped by the performance of the extra fan, by cooling the radiator which later the radiator water when circulating to the motorcycle engine is cooler than before. With the ideal temperature of the motorcycle engine at 70°C to 80°C it can maintain the performance of the engine.

## **CONCLUSION**

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After the author finishes testing from the initial stage to the testing stage, the author gets a conclusion obtained from the suitability between the initial specifications and the tools that have been realized, namely:

From the results of the design test, the author obtained results, that the use of extra fans as additional coolant on motorcycle radiators has an optimal function to help cool the radiator which later the radiator water when circulating to the motorcycle engine is lower temperature than before.

b. Extra fan test results can stabilize the temperature on the motorcycle engine which makes the power of the motorcycle more responsive.

c. The results of this test, found a significant difference in temperature data between motorcycles that use extra fans that get a fairly stable engine temperature of 70°C to 80°C while motorcycles that do not use extra fans get fairly high temperature data results, which are 85°C to 100°C. If a motorcycle that does not use an extra fan continuously at high temperatures ranges from 85°C to 100°C with use Motorcycle unnaturally, it is quite risky to overheat the motorcycle engine, because the spare tube containing radiator water runs out and also the radiator water in the circulation line is easy to evaporate because the engine temperature is so high.

d. From the results of the design that has been tested, and from factors that can cause the risk of damage to the motorcycle engine such as overheating of the motorcycle engine can be minimized and also maintain the life-time of the components contained in the motorcycle engine.

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