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Temperature And Speed Monitoring On Google Sheet-Based Motorcycle Discs

ABSTRACT

The braking system for motor vehicles is very important which serves to slow down speed. So that the braking system is one that must be considered for driving safety. There are two types of braking systems on motorcycles based on the mechanism, namely braking using discs and drums. One of the causes of road accidents is because the brakes overheat so that failure of the braking system results in brake failure. Therefore, this research is about the design of temperature and speed monitoring on motorcycle brake discs based on google sheets. Which uses MLX90614 sensor as a temperature sensor and E18-D80NK sensor as a speed sensor and NodeMCU ESP8266 as a microcontroller. Both sensors are programmed to provide information so that the brake temperature does not overheat and turn on the buzzer when the temperature and speed reach / exceed predetermined values. The buzzer will turn on when the temperature on the disc brakes reaches >65°C and when the speed reaches 120rpm.

Keywords: Monitoring, Overheat, NodeMCU ESP8266, Sensor MLX90614, Sensor E18-D80NK, Google sheet

1. INTRODUCTION

The brakes of the vehicle are an important part. The car can slow down and stop thanks to the brake system(Prameswari & Yohanes, 2019). Therefore, system components must be able to reduce vehicle speed at all speed levels, loads, and road surfaces. The working temperature of the component has a significant influence on the level of braking when it occurs. Overheating, or excessive working temperature, can cause brake failure as brake performance decreases(Ida et al., 2022). Obstacles that often affect the brakes such as long brakes can be fatal and cause accidents. Efforts to reduce the number of accidents caused by brake failure. So it is necessary to have a device that functions to notify the driver if the brakes are overheated(M. Iman Wahyudi & Rifki Abdul Aziz, 2022). So that the driver can expect to stop for a moment to just cool the temperature on the brakes so that the temperature on the brakes does not overheat which can cause the brakes to become unable to function and brake failur occurs(Trinovat, 2018). The brake works on the basis of converting motion energy into thermal energy. In general, the combined pressure system that works against the rotating motion system is what makes the brakes work. The friction created between the two objects is what produces the braking action. Brake systems are classified into two categories based on their mechanism drum brakes and disc brakes(Rashid, 2018).

The percentage of accidents occurring on provincial roads is around 60% and 40% occur on district roads. Traffic accident cases that often occur on the Mojokerto regency route are in two black spots or accident-prone points, one of which is on the Sendi route, Pacet Village, Pacet District. It is recorded that every week there are those who experience brake accidents on the line(Zaini aryatama, 2022). Such as the case of vehicle accidents that often occur in the Sendi area of Pacet District, the main cause of which is brake failure(Eko, 2014). Riders going through the joint path are getting more and more every day. Because the route is an alternative route from Mojokerto to Batu Malang. So it is the choice of most people to shorten the trip and save time. However, the joint path can also be said to be quite an extreme path because the path is a path that passes through the mountains so that the condition of the path is up and down, especially for those with very many derivatives. So that the braking system is the main key to passing the lane, so the driver must be more vigilant so that the brakes do not overheat which causes the brakes to fail(Azdhar Baruddin, 2020).

Based on the background above, this study is about the design of a tool that uses a MLX90614 temperature sensor and an E18-D80NK speed sensor so that it serves to remind the motorcycle rider of the temperature on the motorcycle brake disc and the speed traveled by the motorcycle at that time(Sasmoko et al., 2021). And this tool is based on google sheet so that notifications of temperature and speed conditions are directly sent to the connected google sheet account(Kusuma et al., 2022). The initial purpose of this study is as prevention, so it is hoped that this will have a positive impact on motorists who will go through downhill paths such as those on the path in Sendi.

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2. LITERATURE REVIEW

In the research conducted by Edu Wardo Saragih, Muhammad Ridwan Lubis, Anjar Wanto, Solikhun, Jalaluddin, namely Design an Automatic Brake System in Vehicles Using Ultrasonic Sensors The result of this study is a tool that can operate an automatic braking system on a motorcycle. The research findings show that, based on the test results, the sensor can also identify objects up to 300 cm away, with the result being an automatic braking system powered by a servo motor(Saragih et al., 2021).

In the research conducted by Wildan Habiburrohman Azrie, M. Fariz Anjasmara, Yusuf Bronto Laras, Lolyta Prima Wardiana, and Sigit Setijo Budi, namely Braking Temperature Warning System Design Using ATmega 16 Microcontroller This system design uses ATMega 16 and LM35 sensors which, on a scale of 1:4, will function when the temperature reaches 50 °C, comparable to the temperature reaching 200 °C when braking. Early warning systems are designed to notify drivers as soon as possible using LCD screens, LED warnings, and buzzers in the car(Anjasmara et al., 2016).

In the research conducted by Khairunnas, Unang Sunarya, S.T., M.T. , Atik Novianti, S.S.T., M.T. namely UIoT-based motorcycle lining detection system. Because brake pads are the cause of a vehicle's running speed slowing down, brake pads are very important to pay attention to. Modern technology is advancing, and the internet age is making it easier for people to perform daily tasks. Brake pads connected through internet technology can take advantage of this. To make it easier for riders to replace worn brake pads, this final project is to develop an IoT-based motorcycle brake lining detection tool(Sunarya & Novianti, 2019).

In the research conducted by Hanny Widura Septriana, Gunawan Dwi Haryadi, Mochammad Ariyanto, namely Manufacture and Testing of Temperature Gauges on Drum Brakes of Wheeled Vehicles Two with Remote Measuring System. From the results of this study it can be concluded that the RMS work system can be said to be quite effective and practical, because we can take measurements with sensors programmed by Arduino microcontrollers and connected to a GPRS modem to be sent to the Arduino web server. From this Arduino web server we just Requires hosting and domain that we create to display measurement charts on the website. Result Tests from the four brands of brake pads tested have fading temperature and friction coefficient values that varies(Septriana et al., 2017).

3. METHOD

A monitoring system that includes monitoring tools through smartphones based on google sheets. The MLX90614 temperature sensor serves as a temperature gauge on the motorcycle brake discs and the E18-D80NK sensor as an RPM counter(Harsoyo et al., 2019). Furthermore, the readings from both sensors will be forwarded to the ESP8266 microcontroller for processing(Sasmoko, 2021), if the temperature reaches 75° C then the buzzer will turn on and when the speed is above 120RPM the buzzer will also turn on. And the readings from both sensors will be sent to the connected google sheet(Journal, 2023).

System Design

As seen in figure 1 below is the design of the system to be made.

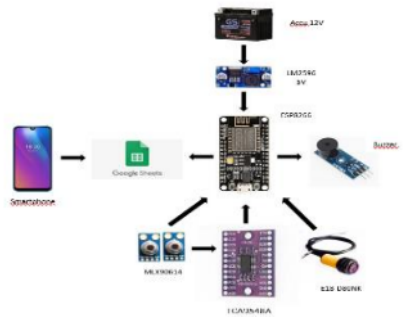

Fig. 1 System Design(Susilo & Maghfiroh, 2022)

Design the tools made in this study. Power comes from the accu which is then changed from 12v to 6v using the LM2596 stepdown and then connected to the ESP8266(Hutauruk, 2019). Then two temperature sensors for SDA and

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SCL pins are connected to the multiplexer TCA9548A while the Vin and GND pins are connected to the ESP8266. While the multiplexer TCA9548A(Nugraha et al., 2021), the E18-D80NK sensor and buzzer are directly connected to the ESP8266(Susilo & Maghfiroh, 2022). As well as the sensor readings are sent to the google sheet.

Wiring System

In this part of the wiring system, you can see in the wiring design drawing, from the drawing it can explain that all components are interconnected, starting from the input component TCA9548A connected to the sensor MLX90614 and The E18-D80NK sensor, then buzzer output, are all connected to the NodeMCU microcontroller ESP8266.

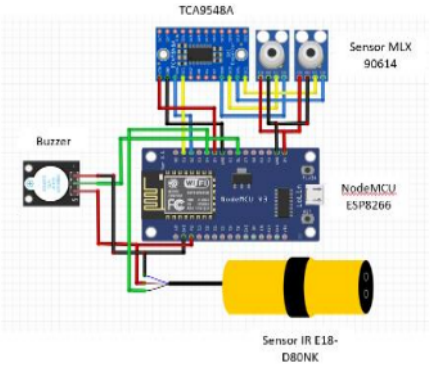

Fig. 2 Wiring System

Table 1.
Port ESP8266(Hutauruk, 2019)

Hardware	Pin Address Hardware	Pin Address TCA9548A	Pin Address ESP8266
-	-	Vin	3V
		GND	GND
		SDA	D2
		SCL	D1
MLX 90614 (1)	Vin	-	3V
	GND	-	GND
	SCL	SC0	-
	SDA	SD0	-
MLX 90614 (2)	Vin	-	3V
	GND	-	GND
	SCL	SC1	-
	SDA	SD1	-
E18-D80NK	VCC	-	5V
	GND	-	GND
	OUT	-	D4

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Buzzer	VCC	-	5V
	GND	-	GND
	OUT	-	D6

From table 1 above, it can be seen that the i2c pin addresses of the two temperature sensors are MLX90614 connected to the TCA9548A while the Vcc and Gnd pins of the temperature sensor and all pins on the TCA9548A are connected according to the pin addresses on the ESP8266. And for the E18-D80NK sensor the output is connected to pin D4 on the ESP8266, while the output from the buzzer is connected to pin D6.

Block Diagrams

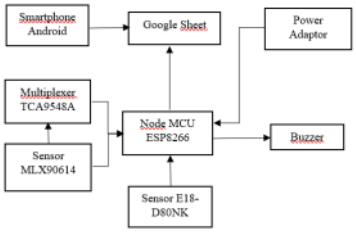

Fig. 3 System Block Diagrams

There are three parts to this diagram: input, process and output. In the input section there is a multiplexer TCA9548A so that it can use two I2C addresses from two MLX90614 sensors used as temperature sensors, and also the E10-D80NK sensor as an rpm counter. Then in the process section there is a NodeMCU ESP8266 as a data processor resulting from temperature and rpm sensor readings. And in the output section there is a buzzer as a notification if the temperature and speed have exceeded the predetermined number and google sheet as a temperature and speed data logger.

System Flowcharts

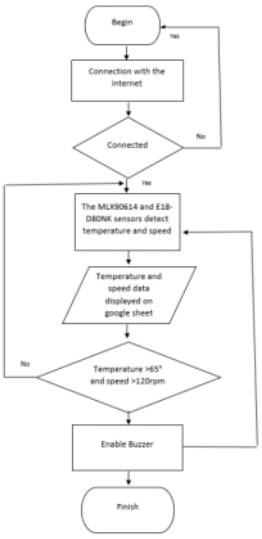

Fig. 4 System Flowcharts

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The beginning of the running stage of this tool is to start as a symbol starting then the process of connecting to the internet wifi network that has been determined, if it is connected to a wifi network, then the MLX90614 temperature sensor and speed sensor E18-D80NK will read the temperature and speed on the motorcycle disc, which is then collected and displays the reading data and then sent to the Google sheets Web as a data logger and cloud storage of the reading results. If the disc temperature is detected >65°C and if the speed of the motorcycle reaches 120rpm the buzzer will activate.

4. RESULT

This tool consists of two non-contact temperature sensors, namely the MLX 90614 temperature sensor which functions as a temperature detector on the front and rear brake discs and there is also an E18-D80NK sensor which functions to calculate speed (RPM). And as a reminder / alarm that functions when the temperature and speed have reached the maximum limit that has been determined, namely using the buzzer.

Fig. 5 Result of tool realization

Google Sheet implementation results of the experiment on google sheet view as shown below.

	A	B	C	D	E
14	Tanggal	Jam	Suhu Depan	Suhu Belakang	Kecepatan
15	29/08/2023	13.41.58	41.25	45.29	73
16	29/08/2023	13.42.09	43.15	47.13	68
17	29/08/2023	13.42.50	46.39	50.39	63
18	29/08/2023	13.43.10	47.11	53.19	60
19	29/08/2023	13.43.21	47.58	54.56	60
20	29/08/2023	13.43.32	48.19	55.11	57
21	29/08/2023	13.43.43	48.43	56.53	57
22	29/08/2023	13.43.54	49.34	57.76	45
23	29/08/2023	13.44.05	50.23	59.25	38
24	29/08/2023	13.44.15	51.15	61.64	35
25	29/08/2023	13.44.26	54.21	64.87	30
26	29/08/2023	13.44.37	57.35	**65.25**	30
27	29/08/2023	13.44.48	60.23	63.64	27
28	29/08/2023	13.44.59	62.76	61.43	27
29	29/08/2023	13.45.10	**65.19**	58.19	25
30	29/08/2023	13.45.21	63.76	57.85	20
31	29/08/2023	13.45.32	60.29	56.19	0

Fig. 6 Google sheet value

Figure 6. is the display design of the google sheet. The first line displays the date, the second line displays the clock, the third row displays the front brake temperature, the fourth row displays the rear brake temperature, and the fifth displays the speed reading. This Google sheet will automatically save data from sensor readings along with the time.

For testing temperature sensors a comparison / calibration tool is required. The tool used as a comparison of temperature sensors is a thermometer gun. and for comparison of speed sensors using the speedo meter on the motor

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To find out how accurate the sensor used, a comparison tool is needed and the calculation of errors is carried out using the formula, namely:

$$error = \frac{(Sensor\ Value - Original\ Value)}{Original\ Value} \times 100 \quad (1)$$

Table 2.
Front Temperature Sensor Testing

No.	Front Temperature Sensor Value(°C)	Thermometer Gun (°C)	Buzzer	Error (%)
1	49.34	48.3	Off	2.15
2	50.23	49.8	Off	0.86
3	51.15	50.4	Off	1.48
4	54.21	53.8	Off	0.76
5	57.35	56.3	Off	1.86
6	60.23	59.9	Off	0.55
7	62.76	61.8	Off	1.55
8	65.19	64.9	On	0.44
9	63.76	62.6	Off	1.85
10	60.29	59.7	Off	0.98
Average error				1.24

The above are the test results of the speed sensor in table 2, which has been carried out 10 times. From the results of these experiments, it can be seen how accurate the tools made. Based on the table above, it is found that the smallest error value is 0.44% while the largest error value is 2.15%. And the average error result from 10 attempts is 1.24%. And when the google sheet is recorded at 65.19°C, the buzzer will turn on.

Table 3.
Rear Temperature Sensor Testing

No.	Rear Temperature Sensor Value(°C)	Thermometer Gun (°C)	Buzzer	Error (%)
1	57.76	56.2	Off	2.77
2	59.25	58.7	Off	0.93
3	61.64	60.4	Off	2.05
4	64.87	63.1	Off	2.80
5	65.25	64.7	On	0.85
6	63.64	62.4	Off	1.98
7	61.43	60.6	Off	1.36
8	58.19	57.8	Off	0.67
9	57.85	56.1	Off	3.11
10	56.19	55.2	Off	1.79
Average error				1.83

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The above are the test results of the speed sensor in table 3, which has been carried out 10 times. From the results of these experiments, it can be seen how accurate the tools made. Based on the table above, it is found that the smallest error value is 0.67% while the largest error value is 3.11%. As well as the average error result from 10 attempts is 1.83%. And when the google sheet is recorded at 65.25°C, the buzzer will light up.

Table 4.
Speed Sensor Testing

No.	Speed Sensor (RPM)	Speedo Meter	Buzzer	Error
1	65	62	Off	4.8
2	80	77	Off	3.8
3	95	92	Off	3.2
4	115	110	Off	4.5
5	120	116	On	3.4
6	110	107	Off	2.8
7	95	91	Off	4.3
8	80	77	Off	3.8
9	65	63	Off	3.1
10	55	53	Off	3.7
Average error				3.74

The above are the test results of the speed sensor in table 4, which has been carried out 10 times. From the results of these experiments, it can be seen how accurate the tools made. Based on the table above, it is found that the smallest error value is 2.8% while the largest error value is 4.8%. And the average error result from 10 attempts is 3.74%. And when the google sheet is recorded at 120rpm, the buzzer will turn on.

5. DISCUSSIONS

The temperature sensor on the front brake detects temperatures close to the comparison tool, with an average error result of 1.48%. Likewise, the temperature censorship on the rear brake has an average error of 1.52%. And for the speed sensor itself has an error rate of 3.74%. The overall results of all sensors can also be connected / displayed on the google sheet smoothly depending on the internet connection at the time of conducting the experiment. As well as buzzers that run according to the programming that has been done.

6. CONCLUSION

Based on the results that have been obtained from the above experiments applied to the CB 150 R motorcycle, it can be concluded that the temperature and speed monitoring tool on Google Sheet-based motorcycle disc brakes can work as expected. Proven by sensor testing that has been done on this tool runs quite well. Starting from testing the temperature sensor on the front disc brakes, the temperature sensor on the rear disc brakes and also the speed sensor has a fairly small difference from the comparison tool (calibration), as well as the condition of the buzzer that runs / sounds according to the program. And the google sheet can also connect well when sending reading data from sensors, making it easier for motorists to monitor the temperature on the vehicle's disc brakes. The buzzer will activate when the temperature on the brake disc shows >65°C and at a speed of 120rpm.

Expected from this study can be beneficial for motorists who will pass on roads that have very steep descents to avoid brake failure. Suggestions in future research to be able to make a tool like this but which is waterproof so that it can be used during the rainy season.

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