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Body Temperature Monitoring System For Covid-19 Prevention Using Amg8833 Thermal Sensor Based On Internet Of Things

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ABSTRACT

The spread of the Covid-19 virus which continues to grow and is worrying to date with its increasing number of victims, encourages the Government to continue to take measures to prevent the spread of the Corona virus. One of the government's efforts to prevent COVID-19 is to monitor the health condition of the human body. One of them is detecting the human body temperature, because body temperature with a temperature above a certain limit is one of the symptoms of covid-19. The normal human body temperature ranges from 36 degrees to 37 degrees. However, for the current situation related to the corona virus pandemic, temperatures above 37 degrees have become temperatures that must be watched out for. This study aims to make a prototype of a body temperature monitoring system for the prevention of Covid-19 based on Internet of Things (IoT) The prototype designed uses an AMG8833 thermal sensor which will measure a person's body temperature with infrared which can identify a person's health through his body heat and also uses an ultrasonic sensor to measure a person's distance with the thermal sensor. The results of body temperature monitoring can be accessed on the cellphone through the blink application. From the results of the discussion, it was found that the body temperature monitoring system for the prevention of Covid-19 using AMG8833 thermal sensor the based on IoT was successfully designed and implemented in a prototype form. AMG 8833 thermal sensor works well in measuring human body temperature up to a distance of 20 with an average error of 1.18%. The level of accuracy of the body temperature monitoring system using the AMG 8833 thermal sensor is 98.82%.

1. Introduction

The spread of the Covid-19 virus which continues to grow and is worrying to date with its increasing number of victims, encourages the Government to continue to take measures to prevent the spread of the Corona virus. One of the efforts tried by the government in preventing COVID-19 is to monitor the state of the health of the human body. Monitoring the state of health of the human body is carried out by knowing the temperature of the human body because body temperature with a temperature above a certain limit is one indication of covid-19. Many studies state that a normal human body temperature ranges from 36.5 oC to 37.5 ^{o}C [1]. However, for the current situation related to the corona virus pandemic, temperatures above 37 degrees have become temperatures that must be watched out for.

Research related to the design of a body temperature monitoring system for the prevention of Covid-19 that has been carried out are: Research that discusses body temperature monitoring is carried out using the AMG8833 thermal camera and face detection. The AMG8833 thermal camera is used to measure body temperature, while the Haarcascade Classifier is used to detect faces [2]. The development of a thermal camera detector in Kepuharjo Village, Karangploso District shows that Covid-19 control is carried out by checking the body temperature of each alternative road user automatically. All road users detected body temperature in the

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normal category as much as 92% and not detected because the vehicle was traveling at high speed as much as 8% [3]. The process of measuring human body temperature using a microcontroller-based temperature sensor. After obtaining the results of temperature measurements using different temperature sensors, the results of these measurements are analyzed and compared to obtain an effective and efficient temperature sensor. Based on the analysis, the results of measuring human body temperature using a thermal camera are an effective and efficient sensor [1]. Research that designed the prototype was carried out in collaboration with computer vision, Location Based Services (LBS), and body temperature sensors placed on smart cameras. The prototype will then be analyzed regarding the feasibility and impact that can be caused by the implementation of the prototype in the community. The prototype is used by the government to quickly monitor community activities so that the spread of COVID-19 can be well controlled [4].

In previous studies, there was no analysis of the accuracy of the system made and in general it was not based on the Internet of Things (IoT). This study aims to make a prototype of a body temperature monitoring system for the prevention of Covid-19 based on IoT (Internet Of Things). The prototype designed uses the AMG8833 thermal sensor which will measure a person's body temperature with infrared which can identify a person's health through his body heat and also uses the US-015 ultrasonic sensor to determine the distance between a person and the thermal sensor. In addition, the designed prototype is equipped with GPS so that the location can be known in real time and the results of body temperature measurements can be accessed on mobile phones through the blink application.The manuscript is written with Times New Roman font size 10, single-spaced, left and right alligned, one one-sided pages and on A4 paper (210 mm x 297 mm) with the Top of 5 CM, Button margin 2,5 cm, inside margin 3,5, outsice margin 2 cm. The width of column when using one-column the space should be singel space.

2. Research Method

The block diagram of a prototype body temperature monitoring system for Covid-19 prevention using the IoT-based AMG8833 thermal sensor can be seen in Figure 1.

The relationship between the input and output of the system created is:

a. Inputs to the system are the AMG 8833 thermal sensor, the US-015 ultrasonic sensor, and the GPS module. AMG 8833 thermal sensor which functions to measure the temperature of a person's object, the US-015 ultrasonic sensor serves to measure the distance of a person object to the sensor, the GPS module functions to detect the location point where the body temperature monitoring system is carried out.
b. The transmission medium used is wireless via SIM800L which is connected to Cloud IoT to connect the microcontroller system with the user.
c. The outputs of the system are LCD, Buzzer, and Mobile. The LCD will display the body temperature of the object person. The buzzer will sound when the object's body temperature over 37 oC is detected. Monitoring result data is displayed on the cellphone through the blink application which can be accessed in real-time.

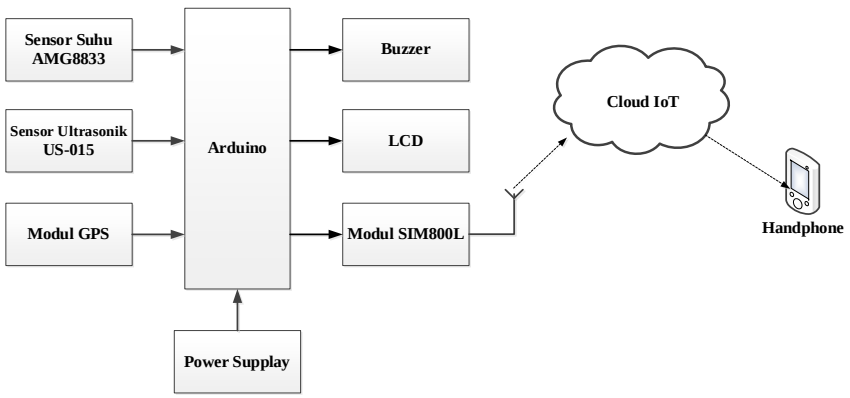

Fig 1. System Block Diagram

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The data analysis carried out in this study is to calculate the accuracy of the system in measuring the body temperature of a person object by the AMG8833 thermal sensor. The level of system accuracy is obtained by calculating the percentage of measurement error from the AMG8833 thermal sensor reading to the digital thermometer reading.
The percentage of measurement error is calculated using the formula:

$$\%\ error = \frac{|true\ value - measured\ value\ of\ sensor|}{true\ value}\ x\ 100\% \quad (1)$$

While the accuracy of the system can be calculated using the formula:

$$system\ accuracy = 100\ \% - \%\ error \quad (2)$$

3. Results and Discussion

The prototype of the design of the body temperature monitoring system for covid-19 prevention using AMG8833 thermal sensor Based on IoT (Internet of Things) in figure 2. The input from the system is the AMG 8833 thermal sensor which functions to measure the temperature of a person object, the ultrasonic sensor measures the distance of a person object with the thermal sensor, GPS detects the location point where the body temperature monitoring system is carried out. The transmission medium used is wireless via SIM800L which is connected to Cloud IoT to connect the microcontroller system with the user. The outputs of the system are LCD, buzzer, and handphone. The LCD will display the body temperature of the object person. The buzzer will sound when the object's body temperature over 37 oC is detected. Monitoring result data is displayed on the cellphone through the blink application which can be accessed in real-time as shown in Figure 3.

Testing the AMG 8833 thermal sensor to determine the sensor's ability to read human body temperature at a distance of 10 cm to 50 cm. The results of testing the temperature of the AMG 8833 thermal sensor were carried out 10 times for different objects of people and compared with the results of distance measurements with a thermometer and recorded the results in Table 1. The test is carried out on the same person object with different distances as shown in Figure 4.

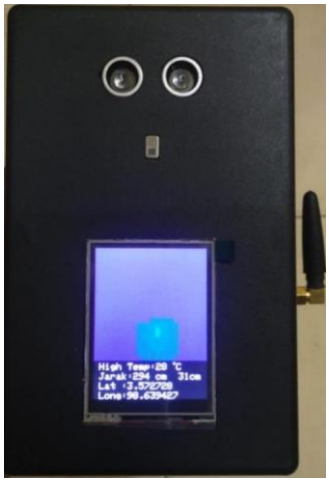

Fig 2. Prototype of Body Temperature Monitoring System

Fig 3. Display of Monitoring Results Through the Blink Application

Fig 4. Testing the AMG 8833 Thermal Sensor on individual objects

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Table 1
AMG8833 Thermal Sensor Test Result

Individual Object Sample	Thermometer Reading Results (ºC)	Thermal Sensor Measurement Results				
		Distance of 10 m (ºC)	Distance of 20 m (ºC)	Distance of 30 m (ºC)	Distance of 40 m(ºC)	Distance of 50 m (ºC)
Sampel 1	36,6	36	36	35	34	34
Sampel 2	36,5	36	36	35	34	34
Sampel 3	36,3	36	36	35	34	34
Sampel 4	36,3	36	36	34	34	33
Sampel 5	36,4	36	36	35	34	34
Sampel 6	36,5	36	36	35	35	34
Sampel 7	36,6	37	36	35	35	34
Sampel 8	36,3	36	36	35	35	35
Sampel 9	36,2	36	36	36	35	35
Sampel 10	36,6	36	36	35	34	34

From the test results of the AMG 8833 thermal sensor in table 5.1. above it can be calculated the error percentage of the thermal sensor reading by comparing the thermometer readings using equation (1). The error percentage of thermal sensor readings is calculated for a distance of 10 cm to 50 cm and the results can be seen in graphs 5, 6, 7, 8, and 9.

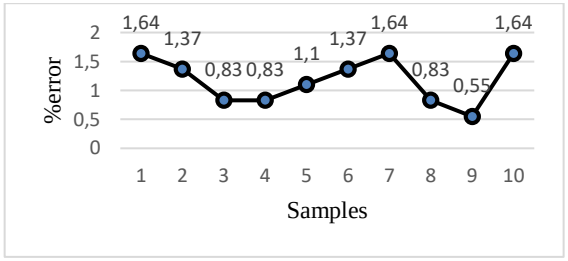

Fig 5. Errors Percentage of Thermal Sensor Reading at a Distance of 10 cm

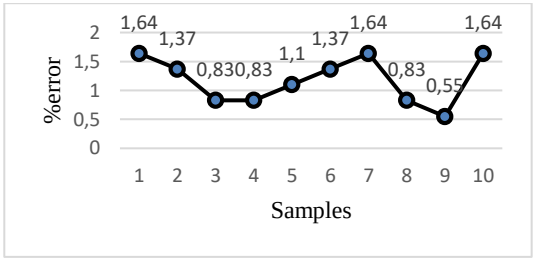

Fig 6. Errors Percentage of Thermal Sensor Reading at a Distance of 20 cm

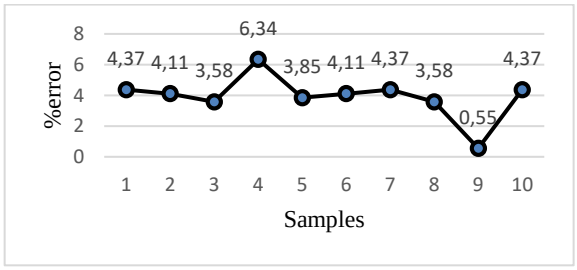

Fig 7. Errors Percentage of Thermal Sensor Reading at a Distance of 30 cm

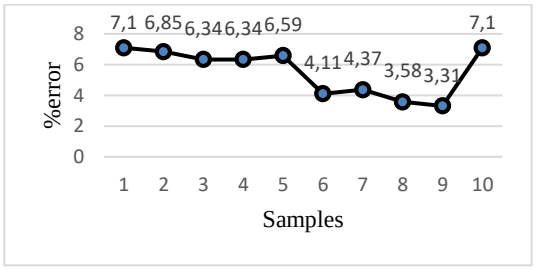

Fig 8. Errors Percentage of Thermal Sensor Reading at a Distance of 40 cm

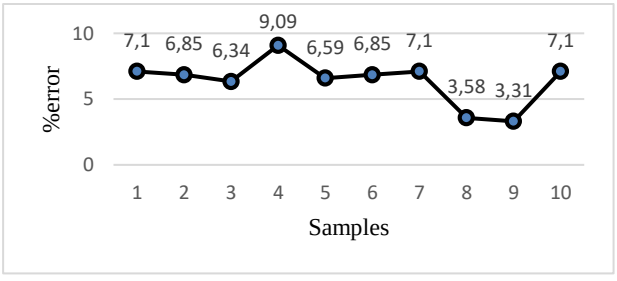

Fig 9. Errors Percentage of Thermal Sensor Reading at a Distance of 50 cm

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From graphs 5, 6, 7, 8, and 9 it can be calculated the error percentage of the average thermal camera reading at a distance of 10 cm, 20 cm, 30 cm, 40 cm, and 50 m, namely:

$$\%\ average\ error\ at\ a\ distance\ of\ 10\ cm = \frac{1{,}64 + 1{,}37 + 0{,}83 + 0{,}83 + 1{,}1 + 1{,}37 + 1{,}64 + 0{,}83 + 0{,}55 + 1{,}64}{10} = 1{,}18\%$$

$$\%\ average\ error\ at\ a\ distance\ of\ 20\ cm = \frac{1{,}64 + 1{,}37 + 0{,}83 + 0{,}83 + 1{,}1 + 1{,}37 + 1{,}64 + 0{,}83 + 0{,}55 + 1{,}64}{10} = 1{,}18\%$$

$$\%\ average\ error\ at\ a\ distance\ of\ 30\ cm = \frac{4{,}37 + 4{,}11 + 3{,}58 + 6{,}34 + 3{,}85 + 4{,}11 + 4{,}37 + 3{,}58 + 0{,}55 + 4{,}37}{10} = 3{,}92\%$$

$$\%\ average\ error\ at\ a\ distance\ of\ 40\ cm = \frac{7{,}10 + 6{,}85 + 6{,}34 + 6{,}34 + 6{,}59 + 4{,}11 + 4{,}37 + 3{,}58 + 3{,}31 + 7{,}1}{10} = 5{,}57\%$$

$$\%\ average\ error\ at\ a\ distance\ of\ 50\ cm = \frac{7{,}10 + 6{,}85 + 6{,}34 + 9{,}09 + 6{,}59 + 6{,}85 + 7{,}10 + 3{,}58 + 3{,}31 + 7{,}1}{10} = 6{,}39\%$$

From the calculation of the average percentage error, it can be seen that the effective distance of an individual object with a thermal sensor is up to 20 cm and the farther the distance of an individual object with the AMG8833 thermal sensor, the greater the percentage of error.
The average percentage error of thermal sensor readings for a distance of 10 cm and 20 cm is:

$$\%\ thermal\ sensor\ average\ error = \frac{1{,}18 + 1{,}18}{2} = 1{,}18\%$$

The level of accuracy of thermal sensor readings for distances up to 20 cm is calculated using equation (2), namely:

$$system\ accuracy = 100\% - \%\ thermal\ sensor\ average\ error = 100\% - 1{,}18\% = 98{,}82\%$$

4. Conclusions

From the results of the discussion, it can be concluded that: The body temperature monitoring system for the prevention of Covid-19 using the IoT (Internet of Things)-based AMG8833 thermal sensor has been successfully designed and implemented in the form of a prototype and works well. The AMG8833 thermal sensor works well in measuring human body temperature with a distance of up to 20 cm. The percentage error of the average thermal sensor reading at a distance of up to 20 cm is 1.18%. The level of accuracy of the body temperature monitoring system using the AMG8833 thermal sensor is 98.82%.

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