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Design of a Human Body Temperature Measuring Instrument with a Contactless Based System *Internet of Things*

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ABSTRACT: Measuring body temperature is one way of physical assessment that is used to determine the state of human health or to test human responses. This factor is the most important to detect whether a person is experiencing symptoms of disease or not.A human body temperature measuring system with a contactless system will help health agencies in determining a visitor or patient in knowing whether they are healthy or sick. The results of this research show that the body temperature measuring device with a contactless system using the mlx90614 temperature sensor can work well in accordance with the design with a large accuracy of 98.44% with the ratio of conventional body temperature measuring devices.

KEYWORDS: body temperature, contactless, mlx90614

I. INTRODUCTION

Measuring body temperature is one of the physical assessment methods used to determine the state of human health or to test human responses. Thermometers that can be used to measure human body temperature are usually divided into several types of thermometers, including mercury, electronic thermometers, digital thermometers, thermometers. disposable, glass thermometer. [1].

The contact and non-contact body temperature thermometer test equipment made using the MLX90614 sensor has been successfully manufactured and tested. Based on the test results, it can be seen that the MLX90614 sensor can work well because the error is less than 5% [2]. Further research using the MLX90614 sensor was also carried out by Gusti Arya Nata. The research results show that the measurement distance greatly influences the error value of the measuring instrument [3].

Based on previous research, it has been shown that the MLX90614 sensor can be used as a replacement for standard body temperature measuring instruments. In this research, a body temperature measurement tool will also be created using the MLX90614 sensor. The measuring instrument that will be made will use an ESP8266 based nodemcu which will connect the system with an online and offline database.

The aim of this research is to create a system for measuring human body temperature with a contactless system to avoid encounters between equipment operators and visitors to a public place and produce an effective and efficient tool.

2. METHODOLOGY

2.1 Tools and materials

1. Tool

Several equipment are needed that will be used to support this research, including the following:

1. Laptops.
2. Digital multimeter.
3. Soldering.
4. Electric drill.
5. Cutting pliers.
6. Needle-nose pliers.
7. Thermogun.

2. Material

Some of the ingredients needed for the success of this research are as follows:

2.2 MLX90614 temperature sensor

The MLX90614 sensor isnon-contact or contactless temperature sensor that measures temperature based on infrared radiation emitted by an object.

Figure 1. Temperature sensor

specifications as follows:

1.The temperature reading range is -40 to 125°C, and for object temperature measurements -70 to 380°C

2. Has a measurement accuracy of 0.5°C over a range of 0-50°C
3. Measurement resolution 0.02°C
4. Power saving mode
5. Has two voltage versions 3V and 5V
6. TO-93 package type

2.3 Proximity sensors

The E18-D80NK type proximity sensor is a sensor for detecting the presence or absence of an object. If the object is in front of the sensor and can be reached by the sensor, the sensor circuit output will be logic "1" or "high" which means the object is "there".

Figure 2. Proximity sensor

This sensor has a long detection distance and has high sensitivity to light that blocks it, and has a detection distance control. The implementation of a modulated IR (Infra Red) signal makes the sensor immune to interference caused by normal light from a light bulb or sunlight.

2.4 NodeMCU Module

NodeMCU is basically a development of the ESP 8266 with e-lua based firmware. The NodeMcu is equipped with a micro USB (Universal Serial Bus) port which functions for programming and power supply. Apart from that, the NodeMCU is also equipped with push buttons, namely the reset and flash buttons. NodeMCU uses the Lua programming language which is a package from esp8266. The Lua language has the same logic and programming structure as C, only the syntax is different. If you use the Lua language, you can use the Lua loader or Lua uploder tools.

Figure 3.nodeMCU board

2.5 DFPlayer Module

DFPlayer mini is an MP3 module (*MPEG-1 Layer-3 audio*) whose output is simple, can be directly applied to loudspeakers. DFPlayer mini can be used as a single stand using a battery, speaker and push button, it can also be used on an Arduino Uno or with other devices that use UART communication (*Universal Asynchronous Receiver-Transmitter*) by utilizing RX (Receiver) and TX (Transmitter).

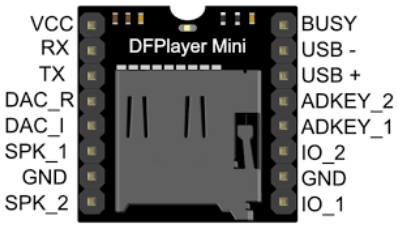

Figure 4. DFPlayer module

2.6 SD card reader module

The SD (Secure Digital) card reader module is a module that functions as communication between the SD Card and the microcontroller asData storage is used to store all sensor data generated from monitoring toolsby using SPI communication with the MISO pin (*Master In Slave Out*), MOTION (*Master Out Slave In*), SCK/CLK (Serial Clock) and CS (Chip Select).

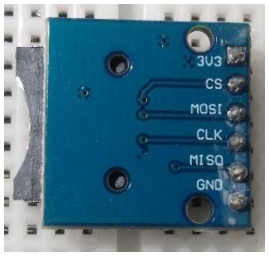

Figure 5. SD card reader

LCD basically consists of two main parts, namely the Backlight part and the Liquid Crystal part. As mentioned earlier, LCDs do not emit any lighting, they only reflect and transmit the light that passes through them. Therefore, LCD requires backlight or background light as its light source. The backlight light is generally white. Meanwhile, liquid crystal itself is an organic liquid that is between two sheets of glass that have a transparent, conductive surface.

2.7 XL6009 voltage boost module

The XL6009E1 IC module is a switching regulator which includes a boost converter type of operation, namely providing an output voltage that is higher than the input. With a minimum number of external components, use is easier and more cost effective. This type of regulator has a large input voltage range and the output voltage can be adjusted.

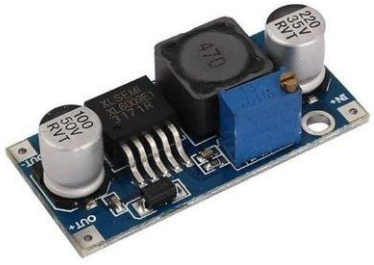

Figure 6 XL6009 stepup module

2.8 System planning

In system design, there are two processes that must be carried out, namely creating hardware and creating a database server. In general, the system design for temperature monitoring can be seen in Figure 3.2.

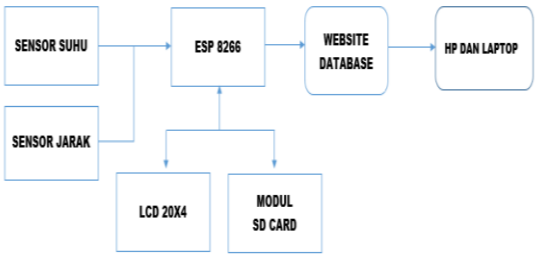

Figure 7. Block diagram of system design

The measuring instrument that will be made uses 2 sensors, namely the MLX90614 temperature sensor to read human body temperature directly.*contactless*,and the E18-D80NK distance sensor to detect whether there are humans or not. The results of this sensor reading have output in the form of digital data using communication*inter-integrated circuit* which is then processed by the ESP8266 microcontroller which in the program section produces float values which are processed by the Arduino library. Data from temperature readings becomes a reference for whether visitors can enter or not according to WHO (World Health Organization) standards for temperatures below 37.5˚C, then the measurement results will be saved on micro SD and the Google Firebase server.

3. RESULTS AND DISCUSSION

This research was tested in Sutodirjan village, Pringgokusuman Gedongtengen sub-district, Yogyakarta city. The objects observed were residents by checking their body temperature.

2.7 Current consumption testing

Connecting speed testing is needed to find out how fast the system connects to the internet.

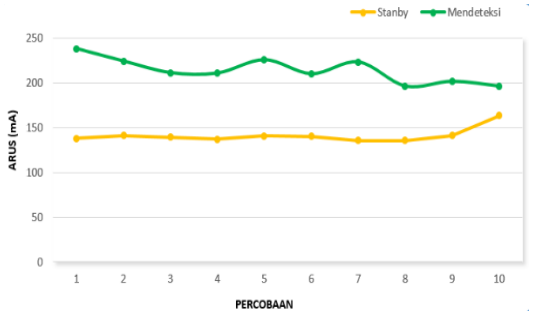

Figure 8. Comparison of current consumption

The current consumption between the device when it is on standby and the device when it is detecting an object has a difference in current magnitude with an average of 75.13 mA. With the results of the average current consumption when the device is on standby is 138.54 mA and the device is detecting an object is 213. The 67 mA comparison above is obtained because the current consumption when standby components only requires relatively small current, whereas when detecting objects it is greater because all components operate according to their respective functions according to the hardware design.

2.8 Tool testing results

This measurement trial was carried out in Sutodirjan Village, Pringgokusuman Village, Gedongtengen District, Yogyakarta City. The object observed was checking residents' body temperatures, along with the measurement results.

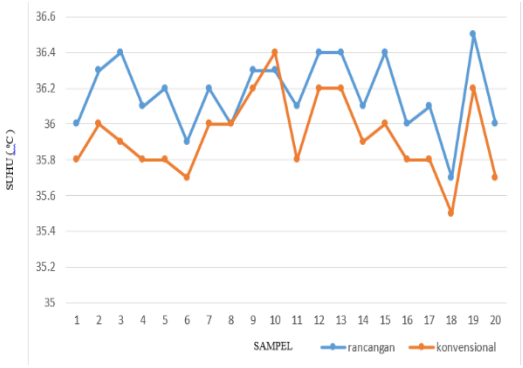

Figure 9. Results of body temperature measurements

The results from Figure 9 show that the results of measuring body temperature using the measuring instrument made in this study with conventional measuring instruments have measurement results that are not much different. Based on the results of 20 samples measuring the average value of body temperature using a measuring instrument, the results of this study were 36.1º C and the average result of measuring body temperature using a conventional measuring instrument in the form of a thermogun was 35.9º C. These results show that the instrument has an error of 1, 55% accuracy of the temperature sensor in this study is quite good with an accuracy of 98.44%. Thus, the measuring instrument in this study can be used as a substitute for conventional body temperature measuring instruments.

4. CONCLUSION

1. The system can work well according to design with a temperature sensor accuracy level of 98.44%.
2. The body temperature measuring instrument with a contactless system detects an object, the LCD will activate and display the MLX90614 temperature sensor reading data and activate multimedia in the form of sound, consuming an average current of 213.67 mA.
3. Factors that influence sensor readings are the distance between the object and the sensor of 10 cm with an accuracy level of 98.44%, as well as the temperature around the sensor itself.

5. THANK-YOU NOTE

Praise be to the presence of Almighty God who has bestowed His grace and blessings so that the author can complete this journal. The writing of this journal could not have been completed without the support of the supervisor, head of the department. The author is fully aware that this journal is still far from perfect, for this reason, all types of suggestions, criticism and constructive input are highly expected by the author. Finally, I hope this article can provide benefits and provide additional insight for readers and especially for the author himself.

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