Design Of Non-Contact Human Body Temperature Detection Based On Internet Of Things (Iot) To Open The Door Automatically

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Abstract
Covid-19 has hit Indonesia since March 2020; as a policymaker, the government has imposed new regulations so that everyone can leave the house and do work without worrying about being exposed to the Covid-19 virus. Measurement of body temperature is the fundamental way to determine the condition of body temperature. However, the problem is that when a thermometer is used to check the temperature of the human body, it is still carried out in direct physical contact between humans so that the risk of transmission of the covid-19 virus can occur. Based on these problems, a thermometer was made, which can be used to check human body temperature without making physical contact. Using the prototype method and system design with UML diagrams, the temperature sensor GY-906 MLX90614 (Temperature detection sensor) was used to build a prototype non-contact human body temperature detection monitoring system based on the Internet of Things (IoT) to open doors automatically.). body), LCD (Liquid Crystal Display) displays the results of the human body temperature, servo motor as an action system in the form of a sliding door controller, ESP8266 Wifi Module, which is used as a microcontroller that processes sensor data and sends sensors through a wireless network. The data sent by the ESP8266 Wifi Module can be monitored via a Web application.

Keywords: *Thermometer,IoT,Infrared MLX90614,ESP8266 ,Body Temperature.*

I. INTRODUCTION

Covid-19 has hit Indonesia since March 2020, so the cases exposed to the Covid-19 virus in Indonesia as of August 19, 2021, reached 3,930,300 cases exposed to the Covid-19 virus, 122.633 cases of death, and 3,472,915 people who recovered. Cases of people who were declared cured [1]. As a policymaker, the government has imposed new regulations so that everyone can leave the house and do work without worrying about being exposed to the Covid-19 virus. Everyone must be tested for body temperature when they want to enter work or housing and practice Social Distancing to avoid the spread of the Covid-19 virus [2]. Measurement of body temperature is a fundamental way of knowing the body's heat. Using a thermometer is very practical and accessible. However, The thermometer is used to measure body temperature, humans are still in direct physical contact, so the risk of transmission of the covid-19 virus exists. The new way to monitor temperature is by using an infrared sensor.

Using the infrared sensor MLX90614, users can monitor an object without having physical contact. The problem of measuring with a thermometer in direct physical contact with humans can be avoided.Based on these problems, a thermometer was made that can be used to check the temperature of the human body without having to make physical contact. The thermometer is designed to detect the temperature of an object (Human) in seconds and without having to make physical contact.The risk of possible transmission of COVID-19 can be avoided with a faster temperature measurement time. With the MLX90614 infrared sensor, the data read by the sensor is analog data processed by the esp8266; the data will be displayed on the LCD in degrees Celsius directly.The design of an object's temperature system indirectly with the object being measured is not a new thing related to the research to be carried out, how different tools work. The following are some of the studies carried out with future research, such as Detecting Body Temperature Using Infrared and Arduino [3]. Portable Body Temperature and Heart Rate Measuring Device [4] [13]. Detection of Healthy Cows Based on Body Temperature Based on the MLX90614 Sensor and Microcontroller [5][14].

II. METHODS

This study was designed and built using the following research methods:

A. Data Collection

The data collection technique has several activities carried out as follows:

1. Observation Method

The method of observation, conducting direct observations to the location of the Bumi Asri housing using the gate and checking the temperature, is still done by physical contact between guards at the security post and people who will enter the housing, and the proposed system does not yet exist. In the Bumi Asri housing estate in Pasar Kemis district, around 20 people tested positive for COVID-19; none of them were declared dead. The cause of the coronavirus entering homes was because previously, there was a lack of monitoring at the security post, so there were residents who came in and out without monitoring and checking body temperature.

2. Literature Study Method

Perform data searches and collect information from sources, journals, and articles. Obtaining relevant data and information is also done by searching the internet for literature studies. Various references to scientific papers, with different points of view from all forms of data and information, will later be used as reference material for research.

B. PIECES Analysis

Data were collected and analyzed using PIECES analysis to discover the existing problems. The results of the problem analysis obtained will be described using PIECES analysis. Next, a problem-solving solution was made: making a prototype of non-contact human body temperature detection based on the Internet of Things (IoT). Those who can monitor when there are temperature checks without having to make physical contact with the guard at the security post at the entrance to the housing. The tool is designed to detect people who have a temperature above 37^0C. Then, the automatic door will not open. The built system can count the number of people per week or month who enter the housing. The proposed system has a database as temperature data storage and a Web-based application to display temperature data in real-time. The proposed solution is to create a prototype design for non-contact human body temperature detection based on the Internet of Things (IoT) to open the door automatically.

C. Prototype Method

The development method used is a prototype with several stages: system requirements analysis, planning, prototype design, assembling and coding tools, and building web applications for monitoring and testing systems [6][12].

III. RESULTS AND DISCUSSION

In developing an Internet of Things (IoT) based non-contact human body temperature monitoring and detection system, some requirements for software and hardware specifications are as follows:

1. The Printed Circuit Board (PCB) will function as a container or place for compiling electronic components.
2. The infrared sensor MLX90614.
3. The I2C LCDs information about human body temperature.
4. The servo motor that functions as a sliding door driver.
5. The esp8266 functions as a microcontroller.
6. A web application displays the number of temperatures detected and real-time monitoring.
7. Arduino IDE is used as a programming tool.
8. A database that functions as a data storage medium for human body temperature.

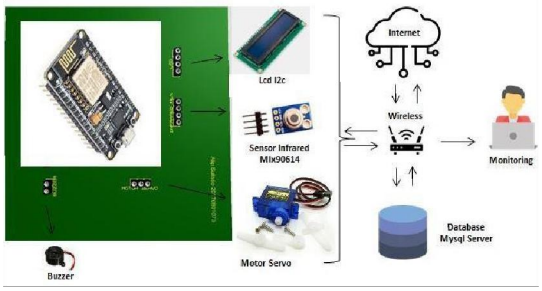


Fig 1. Schematic of Monitoring System and Body Temperature Detection Device,Non-Contact Human Based on Internet of Things (IoT) To Open Doors Automatically.

In Figure 1. Schematic of Monitoring System and Non-Contact Human Body Temperature Detection Device Based on Internet of Things (IoT) To Open Doors Automatically. Based on the temperature indicator from Infrared MLX90614. The tool will send the temperature detection results to the database. A web application displays data that has been processed in the database. It works like real-time monitoring that users can access with a computer or mobile phone. The following components make up the system:

1. MLX90614 Infrared Sensor (Temperature detection sensor)

This sensor serves to detect the temperature of the human body, and the NodeMCUesp8266 microcontroller will process the sensor data [7].

2. LCD I2C 16x2

Inter-Integrated Circuit (I2C) is a two-way serial communication standard because it uses two channels designed to send or receive data, an LCD that displays temperature data in real-time [8].

3. Micro Servo

The micro servo will be informed back to the control circuit in the micro servo. Serves to move the door based on the human body temperature indikator [9].

4. Buzzer

It serves as a warning if there is a temperature that exceeds the temperature above 37^{0}C [9].The information system functions to store temperature data used by the user for monitoring.

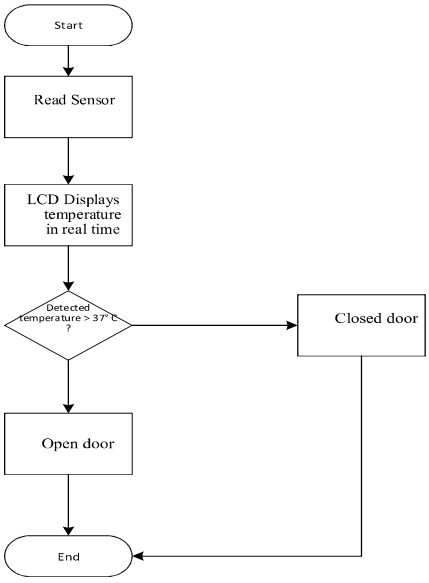
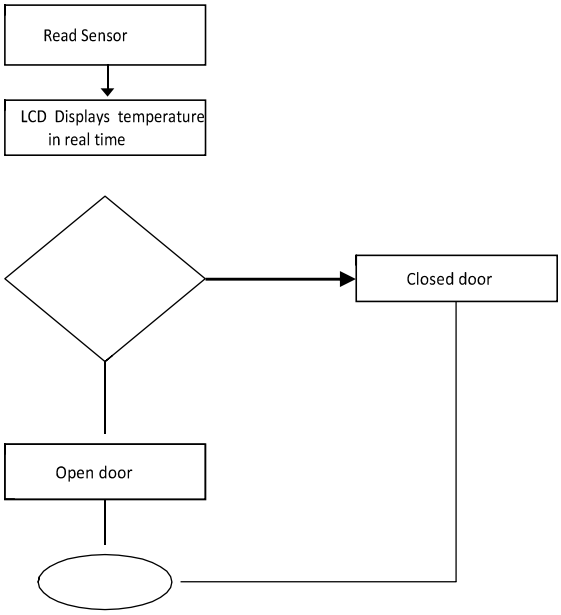


Fig 2. The system flow diagram.

The workings of the non-contact human body temperature detector system start with reading the sensor. LCD temperature directly; if someone is detected at a temperature above 37*C, the system will close the door automatically. If the temperature is below 37*C, the door will open automatically, As shown in figure 2.



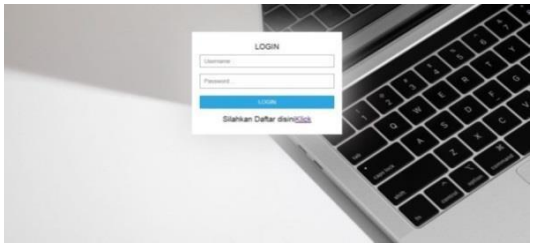


Fig 3. Login Page Display.

The application login page is displayed as a start when accessing the information system; after the user enters, it will be directed to the homepage display, namely the temperature data menu, as shown in figure 3.

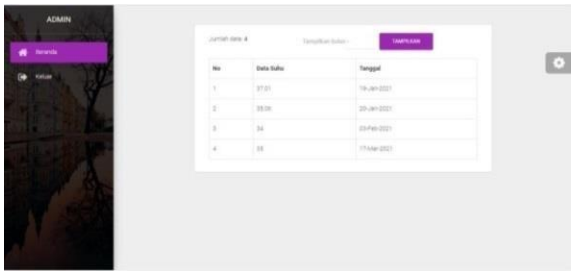


Fig 4. Home Page Display.

This home page displays temperature data that is used to report data on people entering the housing, as shown in figure 4.

Fig 5. Realtime Monitoring Page Display.

Figure 5. is an example of displaying body temperature data in real-time, from a non-contact human body temperature detection design tool based on the Internet of Things (IoT), based on body temperature indicators from humans.

IV. IMPLEMENTATION AND TESTING

Perform the test by directing the human body to the MLX90614 infrared sensor, an LCD that can display the sensor value output read from the infrared sensor.

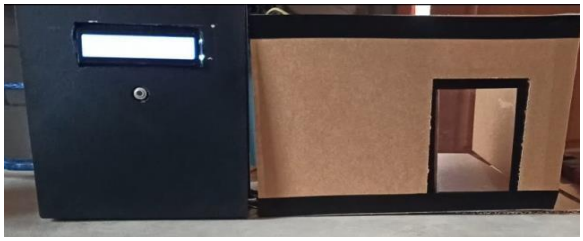


Fig 6. Testing of Non-Contact Body Temperature Detection Equipment

In Figure 6. the test is carried out to determine how fast the MLX90614 infrared sensor responds in detecting body temperature. The servo motor moves; if the temperature is detected above 37^0 C, the servo motor will move, and the LCDs body temperature data in real-time.

Table 1. Testing of Body Temperature Detection Equipment

Experiment	Experiment Distance	Temperature	Result
1	4 Cm	35,56	Buzzer OFF, Servo ON, LCD ON
2	4 Cm	35,20	Buzzer OFF, Servo ON, LCD ON
3	4 Cm	35,79	Buzzer OFF, Servo ON,LCD ON
4	4 Cm	39,49	Buzzer ON, Servo ON, LCD ON
5	4 Cm	40,35	Buzzer ON, Servo ON, LCD ON

Table 1 is the result of testing the infrared sensor MLX90614, tested five times with the first data within a distance of 4 Cm with a temperature value below 37□C and the Servo Motor moving towards 180^0 (Open Door Position), buzzer OFF, LCD ON. Furthermore, in the fourth and fifth experiments within a distance of 4 Cm, the temperature value is above 37^0 C. This test is carried out using warm water to determine the Buzzer and Servo Motor response. The temperature value shows above 37^0 C, the servo motor will move towards 0^0 (Door Position closed), then the door will be closed, and the buzzer will turn on automatically.Perform a temperature test by comparing the Non-Contact MLX90614 infrared sensor with a digital thermometer. Calculations to find the Error value use the formula: *Error = X-Xi* (Alhabba and Kholis 2019). looking for the %Error value will be calculated by the formula: *% Error = X− Xi x100%* [10] [11]. Table 2 shows the test results.

Table 2. Infrared Temperature Sensor Testing MLX90614

Test Distance	MLX90 6 Sensor Value 14	Thermometer Sensor Value	Deviation	*Error*
4 Cm	35,09	35,14	0,05	0,14
4 Cm	35,62	35,50	0,12	0,33
4 Cm	35,37	35,89	0,52	1,14
4 Cm	35,20	35,37	0,17	0,48
4 Cm	3547	35,78	0,31	0,86
4 Cm	35,95	36,04	0,09	0,24
Average Value Difference and%Error			0,21	0,53

Based on Table 2, the most significant error limit value for non-contact MLX90614 infrared temperature measurements compared to a body temperature thermometer is 1.14^0C. The slightest error limit value is 0.14^0C.

V. CONCLUSION

Based on the results of making, data collection, and testing that have been carried out, the following conclusions. Can obtain a non-contact human body temperature detection design based on the Internet of Things (IoT). This system can detect human body temperature without having direct physical contact with objects (humans) using an Infrared sensor as input. At the same time, the output consists of an LCD to display temperature data in real-time, with a servo motor acting as a door driver; if body temperature is detected above 37^0 C, the door will be closed. The buzzer will light up; if the temperature is below 37^0 C, the door will open. In the MLX90614 infrared sensor test, where a comparison test was carried out, as many as six tests got the most significant class limit value. In the MLX90614 Non-contact infrared temperature test, compared to a body temperature thermometer, the value was 1.14^0 C, and the slightest error limit value was obtained. Of 0.14^0 C. Can obtain a monitoring system to see how many people enter the housing because it has a web application that can display temperature data in real-time, storing temperature data that has been detected.

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