

IMPLEMENTATION OF AUTOMATIC DOOR SYSTEM BASED ON BODY TEMPERATURE USING Arduino UNO AND NODEMCU V3

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Abstract-- So far, the spread of the corona virus disease is very difficult to prevent and reduce because transmission can occur through non-physical contact which can be easily done without being noticed by people when touching common items or objects that are often used, one of which is doorknobs. The design of the automatic door system on the sliding door was made based on body temperature. The purpose of this study is to reduce the occurrence of corona virus transmission through non-physical contact with objects that are often used in this case doorknobs. The infrared temperature sensor is used to measure the temperature when the user wants to enter the room. If the results of the body temperature measurement are normal (below 38°C), the door will open and then close automatically.

Keywords: body temperature, corona virus, Arduino Uno, Infrared Thermometer MLX90614.

I. INTRODUCTION

This automatic door system is made for daily use during the pandemic to avoid the spread of the corona virus disease which can be transmitted through direct contact with objects contaminated with the virus. So far, the spread of this disease is very difficult to prevent and reduce because transmission can occur through non-physical contact which can be easily done without being noticed by people when touching common items or objects that are often used, one of which is doorknobs.

Therefore, a design and implementation of an automatic door system was made. This system opens the door based on the user's temperature and every user who meets the normal body temperature requirements can be given access to enter the room and the measurement data has been recorded and entered into the database.[1]-[2]. This automatic door system uses an infrared temperature sensor MLX90614 with Arduino uno and NodeMCU ESP8266 for the connection of sending temperature measurement data to the database. The results of the

body temperature measurement will also be displayed on a 16x2 LCD.[3]-[5] The microcontroller can read the user's body temperature measurement, if the body temperature is normal, the automatic door will open without touching the doorknob. So that the spread of corona virus transmission can be minimized, because there is no touch with objects that people often use, namely doorknobs.

II. METHODE

To make an automatic door system, a sliding door is used by utilizing an unused DC power window motor as a driver when the door is open or closed. Then for temperature measurement used infrared temperature sensor MLX90614, communication and control system using Arduino Uno as a microcontroller to regulate system work. Meanwhile, NodeMCU ESP8266 is used for data communication. Ultrasonic Sensor HC-SR04 as an object reader when the user wants to leave the room, as well as a sliding door density reader when it is automatically closed.

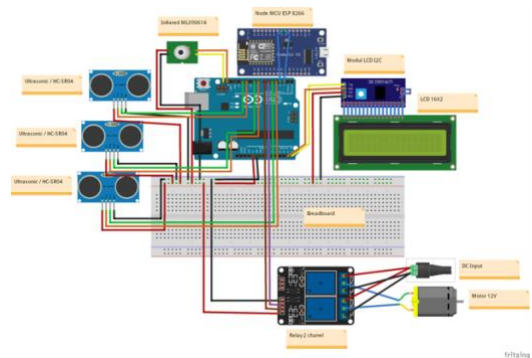


Figure 1 Automatic Door System Schematic Circuit

For this automatic door system, a schematic design of the electronic circuit is made as shown in Figure 1. This study uses Arduino Uno as a microcontroller and NodeMCU ESP8266 as data communication. For temperature measurement used infrared sensor MLX90614 and 3 ultrasonic sensors. Each has its own function, namely sensors that are outdoors and indoors. Then another ultrasonic sensor to determine the density of the sliding door when it closes automatically.

A. Body Temperature Measurement System

This temperature measurement consists of 1 infrared temperature sensor, a 16x2 LCD to display temperature measurements, an I2C LCD module to make it easier to use pins, because the pins on a 16x2 LCD have many pins and an ultrasonic sensor as a trigger to activate body temperature measurements. The results of this body temperature measurement will be sent to the database.

The distance measurement detected by the ultrasonic sensor can be calculated by equation 1.

$$d = t \times 0,034 \text{ cm/s} : 2 \quad (1)$$

where d is the distance, t is the round-trip time required when the sensor emits ultrasonic sound. So the distance can be calculated by multiplying the travel time by the speed of sound in the air divided into two, because the travel time is back and forth. If the ultrasonic sensor detects the presence of an object in front of the sensor at a distance of less than 5 cm, it will carry out temperature measurements with an infrared temperature sensor.

For temperature measurement can be done with an infrared temperature sensor. The sensor will emit infrared light on an object, so that the light will bounce back towards the temperature detector module on the sensor called a thermopile. The thermopile module will measure the heat from infrared light and convert it into electrical energy. This electrical energy will be measured by the thermometer and read by the Arduino Uno microcontroller. Then the temperature measurement results are displayed on a 16x2 LCD via the I2C LCD module. Temperature measurement results are also sent to the database.

B. Automatic Door System

This part of the system requires a relay to turn on or off the DC power window motor whose function is to open and close the sliding door. To maintain only normal body temperature measurements (below 38°C) that can be controlled in running the DC power window motor to open the automatic sliding door, a program was made on Arduino Uno with the formulation of equation 2.

$$\text{Signal} = 0 : \text{temp} > 38 ; 1 : \text{temp} \leq 38. \quad (2)$$

The signal is worth 1 if the temperature sensor reads the temperature measurement less than 38°C, thus making the microcontroller run commands to the relay to rotate the DC power window motor which makes the sliding door open automatically. After the door is opened, there is a pause of 3 seconds for the user to pass through the door and enter the room. The DC motor will stop when the ultrasonic sensor detects the door is tightly closed. While the signal will be worth 0 if the temperature sensor reads a temperature measurement of 38°C.

Meanwhile, to open the sliding door automatically when the user leaves the room, it can be controlled with an ultrasonic sensor inside the room. If the ultrasonic sensor detects the presence of an object in front of the sensor at a distance of less than 5 cm, the sliding door will open and close automatically.

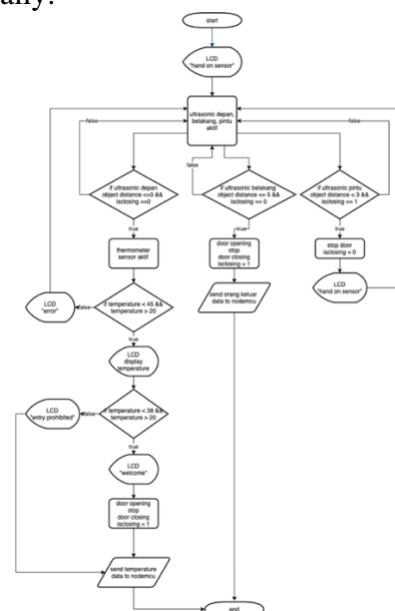


Figure 2 Automatic Door System Flowchart

C. Communication System

This part of the system functions for data communication from the temperature sensor through the Arduino Uno control system which is then sent with the NodeMCU ESP8266 then the data will be displayed in real time to the admin through a web-based monitoring system.

Figure 3 is a circuit used in transmitting sensor data in the form of temperature measurements and access status is accepted/rejected for each temperature measurement made. This transmission process is carried out in real time as long as the temperature sensor takes temperature measurements.

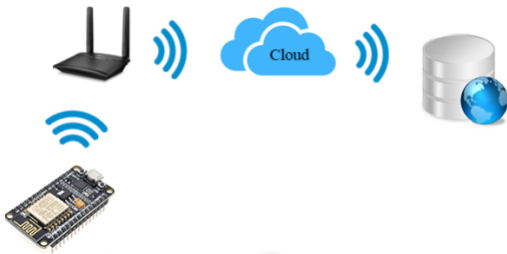


Figure 3 Communication System Circuit

D. Layer Monitoring System

Temperature measurement information obtained from the Communication System is displayed to the web-based admin using PHP programming. The information displayed is in the form of a table containing temperature measurements with id, date, time, temperature, and access. This information will be displayed in real time while the temperature sensor is taking temperature measurements.

✕ <https://pkliot.000webhostapp.com>
<https://pkliot.000webhostapp.com/>

Data Akses Ruangan

ID	Tanggal	Waktu	Suhu (Celcius)	Akses
0	08.12.2020	03:07:38	33.21	DITERIMA
0	08.12.2020	03:07:46	36.21	DITERIMA
0	08.12.2020	03:07:55	0.00	KELUAR
0	08.12.2020	03:07:57	0.00	KELUAR
0	08.12.2020	03:08:18	22.11	DITERIMA
0	08.12.2020	03:08:28	0.00	KELUAR
0	08.12.2020	03:11:47	0.00	KELUAR
0	08.12.2020	03:11:48	0.00	KELUAR
0	08.12.2020	03:19:52	33.21	DITERIMA
0	08.12.2020	03:20:02	35.21	DITERIMA
0	08.12.2020	03:20:52	38.21	DITOLAK
0	08.12.2020	03:21:19	39.21	DITOLAK
0	08.12.2020	03:21:26	0.00	KELUAR
0	08.12.2020	03:21:28	0.00	KELUAR
0	08.12.2020	11:30:19	32.11	DITERIMA
0	08.12.2020	11:30:30	35.11	DITERIMA
0	08.12.2020	11:30:38	38.11	DITOLAK

ID | jumlah orang
0 | 0

Figure 4 Body Temperature Monitoring Website Database Display

III. RESULT AND DISCUSSION

This automatic door system research was carried out in 2 stages of testing, namely a single test on each component of the tool and a system test in measuring temperature and performing the performance of opening or closing the sliding door automatically.

A. Single Test On Each Component

At this stage, testing is carried out on each component of the tool such as the HC-SR04 ultrasonic sensor, infrared temperature sensor, relay, and DC power window motor. Sensor testing is done by using Arduino IDE via a serial monitor. While relays and DC power window motors are carried out with a scenario when the user wants to enter the room or leave the room by taking the previous temperature measurement.

Ultrasonic sensor testing runs according to the code that has been configured via Arduino Uno. The infrared temperature sensor also runs according to the preconfigured code via the Arduino Uno.



Figure 5 Implemented circuit



Figure 6 Outdoor Visual Automatic Door System

B. Automatic Door System Testing

At the stage of testing the automatic door system, it is carried out with scenarios of users who want to enter the room and leave the room, namely conditions when the body temperature is normal 12 times, the condition when the body temperature is high 8 times and the condition when the user leaves the room 5 times, so the total experiment is 25 times.

TABLE 1
Automatic Door System Testing

No	Date/Time	Temperature (Celcius)	Access
1	09-12-2020/15.07	35.21	accept
2	09-12-2020/15.20	37.04	accept
3	09-12-2020/15.38	0.00	out
4	09-12-2020/15.45	36.21	accept
5	09-12-2020/16.20	38.56	deny
6	09-12-2020/16.35	35.47	accept
7	09-12-2020/16.48	37.45	accept
8	09-12-2020/16.59	36.51	accept
9	09-12-2020/17.10	39.21	deny
10	09-12-2020/17.31	38.11	deny
11	09-12-2020/17.47	35.21	accept
12	09-12-2020/17.58	0.00	out
13	09-12-2020/18.40	36.33	accept
14	09-12-2020/18.54	39.34	deny
15	09-12-2020/19.15	38.11	deny
16	09-12-2020/19.27	0.00	out
17	09-12-2020/19.38	38.41	deny
18	09-12-2020/19.47	38.21	deny
19	09-12-2020/19.55	36.04	accept
20	09-12-2020/20.07	35.24	accept
21	09-12-2020/20.15	0.00	out
22	09-12-2020/20.34	35.31	accept
23	09-12-2020/20.42	34.33	accept
24	09-12-2020/20.48	0.00	out
25	09-12-2020/20.57	35.41	accept

Table I is the result of the experimental scenario of the user entering a room with normal body temperature and high body temperature, and when the user wants to leave the room. When the user leaves the room, no body temperature measurement is taken, so the dawn measurement is 0.

C. Analysis of Trial Results

The analysis was carried out by looking at the results of testing the automatic door system, where based on Table I, no inappropriate mechanism was found. All experiments went well. When the body temperature measurement results are normal (below 38°C), the door mechanism will open and then close automatically. Meanwhile, for high body temperature (above 38°C), the door mechanism is not opened or closed, but the measurement results are still recorded and sent to the database. Then access to enter the room is denied.

When the sliding door mechanism opens, the DC power window motor will rotate counterclockwise, and vice versa when the sliding door mechanism is closed, the DC power window motor will rotate clockwise. This can happen because the relay is able to change the direction of the running electric current.

IV. CONCLUSION

This research focused on automatic door systems for office spaces with sliding doors based on body temperature. Measurement of body temperature of people who enter the room can be monitored. The results prove that when the body temperature is below 38°C, the door will open, while if the person wants to leave the room, the door will also open by bringing the object in front of the ultrasonic sensor with a maximum distance of 5 cm. So that people do not need to make physical contact with the sliding door.

In this automatic door system innovation, there are still many shortcomings. It is necessary to develop the tool by adding direct interaction features using a keypad or through an IoT-free platform as a User Interface medium to set the temperature conditions you want to configured.

V. ACKNOWLEDGMENT

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