http://infor.seaninstitute.org/index.php/infokum/index
JURNAL INFOKUM, Volume 9, No. 2, Juni 2021 ISSN : 2302-9706

HEALTHY SMART DOOR BASED ON BODY TEMPERATURE USING ARDUINO UNO AND FUZZY LOGIC

Fadhillah Azmi[1], Gopas Pasaribu[2] & Rizki Imanuel[3]
[1,2,3] Universitas Prima Indonesia
azmi.fadhillah007@gmail.com

Article Info
Received 10 May 2021
Revised 29 May 2021
Accepted 29 June 2021

Abstract

Since the end of 2019, the spread of Corona Virus Disease (COVID-19) has always shown an increase from time to time, this is due to the rise of physical contact, both directly between humans and through contact with equipment or public facilities. Automated public facilities and early detection of humans who have the potential to spread disease are effective ways to prevent physical contact between the spreader and other humans. Body temperature is one indicator that shows how the human body is and its ability to generate or reduce heat in the body. Based on the information obtained, the normal human temperature is in the range of 36.5-37.20C, whereas if it is above that temperature a person can be said to have a fever, where fever is a symptom of COVID-19. However, the human body temperature is also relatively fluctuating depending on activities and environmental conditions. For this reason, a method that makes it easier to analyze body temperature based on grouping is used, namely the fuzzy logic method which is implemented into the Arduino Uno microcontroller as an automatic control tool.

Keywords: Covid-19, fuzzy logic, smart door

1. Introduction

Since the end of 2019, the spread of the corona virus disease (COVID-19) has always shown an increase from time to time, this is due to the rise of physical contact, both directly between humans and through contact with equipment or public facilities. Automation of public facilities and early detection of human potential as disease spreaders are effective ways to prevent physical contact between the spreader and other humans. After the outbreak of the COVID-19 disease, efforts have recently been implemented to reduce its spread by carrying out early detection through manual body temperature checks at the doors of places where there are usually crowds, but it seems that this manual early detection has several obstacles that make it less effective in preventing the spread of COVID-19, so an innovation is needed to make a smart door design that automatically opens or closes based on the temperature sensor readings. Body temperature is one indicator that shows how the human body is and its ability to produce or reduce heat in the body. Based on the information obtained, the normal human temperature is in the range of 36.5-37.2 degrees Celsius, while if it is above that temperature, a person can be said to have a fever, where fever is one of the symptoms of COVID-19. However, the human body temperature is also relatively fluctuating depending on activities and environmental conditions.

2. Materials and Methods

The system built in this study is a Design for Early Detection of COVID-19 Healthy Smart Door Based on Body Temperature Based on Arduino Uno With Fuzzy Logic. Healthy Smart Door control uses a DC Motor and is carried out based on the readings of the MLX90614 temperature sensor and Ultrasonic

INFOKUM is licensed under a Creative Commons Attribution-Non Commercial 4.0 International License (CC BY-NC 4.0)

sensor. The results of the MLX90614 temperature sensor readings and Ultrasonic sensors are used as input in the logic control process using fuzzy logic.

2.1. Arduino Uno

Arduino Uno is a circuit board based on the ATmega328 microcontroller. The IC (integrated circuit) ATmega328 has 14 digital inputs/outputs (6 outputs for PWM), 6 analog inputs, a USB connection, an adapter socket, an ICSP pin header, and a reset button. This is what is needed to support the microcontroller so that it is easily connected with a USB power cable or AC to DC adapter power supply cable or also to the battery (Suhendri, 2015). Arduino software or Arduino IDE (integrated development environment) is a software that produces a hex format file that will be uploaded to the Arduino circuit board. Arduino software generates hex files from lines of code called sketch.

2.2. Ultrasonic Sensor HC-SR04

Ultrasonic Sensor HC-SR04 is an electronic module that detects an object using sound waves. The ultrasonic sensor consists of a transmitter (transmitter) and a receiver (receiver). The ultrasonic sensor HC-SR04 works when the trigger pulse is received by the sensor, the transmitter will emit ultrasonic waves and the reflected ultrasonic waves will be received by the receiver, based on the travel time of ultrasonic waves from the transmitter to the receiver, the object distance can be calculated based on the formula:

S = t . 340 M/S:2 (1)

Where: S = Distance between sensor and object (m)
t = WUltrasonic wave travel time from transmitter to receiver (s)

2.3. MLX90614 Suhu Temperature Sensor

The MLX90614 sensor is a non-contact temperature sensor that measures temperature based on infrared radiation emitted by an object. This sensor can sense electromagnetic waves in the 700nm to 14000nm range and can measure human body temperature accurately at a distance of 5cm. The MLX90614 sensor can measure object temperatures in the measuring range of -70 degrees Celsius to 380 degrees Celsius (Zhang, 2015).

2.4. LCD 16X2 I2C and L298N Motor Driver

LCD 16X2 (liquid crystal display) is a display media that produces a good display of characters and quite a lot. On the 16x2 LCD can be displayed 32 characters, 16 characters on the top line and 16 characters on the bottom line. 16x2 LCD generally uses 16pin as the control. With the special I2C driver, the LCD can be controlled with only 2 pins, namely SDA and SCL. L298N motor driver is a driver module that uses IC L298, which is an H-bridge type IC that is capable of controlling inductive loads such as dc solenoid motors and relays. In ICL298 there are transistor-transistor logic (TTL) with NAND gates that function to make it easier to determine the direction of rotation of a DC motor.

2.5. DC motor gearbox

A DC motor is a motor that can rotate in both directions alternately with a dc voltage as its input. There are two main parts in a dc motor, namely the stator and rotor, the stator is the part of the motor that does not rotate, this part consists of the frame and the field coil. While the rotor is a rotating part, part of the rotor consists of anchor coils. In this study, the dc motor used is a dc gearbox motor. This motor is suitable for use as a gear drive actuator because it has a gear ratio, so the smartdoor has a stable speed and high stopping ability when the command is LOW.

2.6. Fuzzy logic

Fuzzy logic according to Prof. Zade is an approach using mathematical forms to see how ambiguity is then expressed in human language (Pandjaitan, 2007). Fuzzy set theory was developed by

INFOKUM is licensed under a Creative Commons Attribution-Non Commercial 4.0 International License (CC BY-NC 4.0)

Prof. Dr. Lotfizade in 1960. Zade theorizes that true or false logic from Booleann logic cannot solve problems in gradation on problems in the real world. To overcome this, Zade developed a fuzzy set. The fuzzy inference system used in this smartdoor is the Mamdani method, because the program on this system is made using the help of a library that has been provided from the Arduino company so that in completing this smartdoor program some adapt from the example and library. The following are the parameters used in fuzzy logic:

Table 1. Member function of temperature level

No	*Temperature*	*Member function*	*Logic*	*Category*
1	< 35°C	0 – 0.25	1	Hipotermia
2	36,1 - 37,0°C	0.26 – 0.50	1	Normal
3	37,1 - 38,0°C	0.51 – 0.75	0	Hipertermia
4	>40°C	0.76 – 1.00	0	Hiperpireksia

Tabel 2. Derajat Keanggotaan Level Handsanitizer

No	*Destination (cm)*	*Member function*	*Logic*	*Category*
1	0.00 – 2.50	0 – 0.25	1	Keluar sesuai ukuran
2	2.60 – 5.00	0.26 – 0.50	1	Agak keluar
3	5.10 – 0.75	0.51 – 0.75	0	Tidak keluar
4	0.76 – 1.00	0.76 – 1.00	0	Alarm berbunyi

Based on the objectives to be achieved, the research methods used in the preparation of this final project are:

1. **Preparation phase**, namely by obtaining books and journals related to the problems discussed in this final project, as reference material for reference data and method selection.
2. **Design stage**, namely the selection of tools and materials used for the hardware design process and applying the selected method, namely fuzzy logic.
3. **Test stage**At this stage, hardware testing and fuzzy logic methods are carried out by paying attention to the parameters to be tested.
4. **Evaluation stage**At this stage, the results obtained from the testing stage are the results obtained are discussed from the rules applied using the fuzzy logic method.

INFOKUM is licensed under a Creative Commons Attribution-Non Commercial 4.0 International License (CC BY-NC 4.0)

Figure 1. Research Methodology

3. Results and Discussion

3.1. Result

System Prototype Testing is carried out to determine whether the system that has been designed is running well and in accordance with the fuzzy rules that have been created. This test is carried out with different distances and temperatures of objects at random to prove whether the automatic door is working properly. The results of the system prototype test are shown in Table 3.

Table 3. Implementation using fuzzy logic

No	*Temperature*	*Logic*	*Destination (cm)*	*Logic*	*Output Handsanistizer*	*Output Alarm*
1	< 35°C	1	0.00 – 2.50	1	1	0
2	36,1 - 37,0°C	1	2.60 – 5.00	1	1	0
3	37,1 - 38,0°C	0	5.10 – 0.75	0	0	1
4	>40°C	0	0.76 – 1.00	0	0	1

3.2. System Prototype Testing

In this study, the prototype design consisted of a rectangular box that was used to place an electrical circuit and two rails placed above and below as a wheel holder from the door leaf. The mechanics used to move the sliding door are made of acrylic board which is shaped in such a way that it resembles a set of rack and pinion gear. This rack and pinion gear is driven by a DC Motor actuator. The working principle of this sliding door is that the sliding door will open automatically if the ultrasonic sensor detects an object and the MLX90614 sensor will measure the object's temperature. Then Arduino will send a signal to the driver to drive the DC Motor. This miniature sliding door has two doors that will open each to the left and right and close again.

INFOKUM is licensed under a Creative Commons Attribution-Non Commercial 4.0 International License (CC BY-NC 4.0)

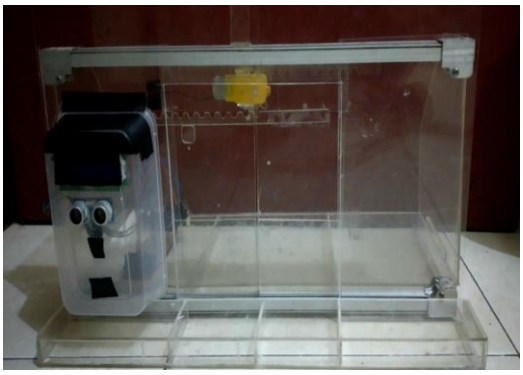

Figure 2. Front Prototype

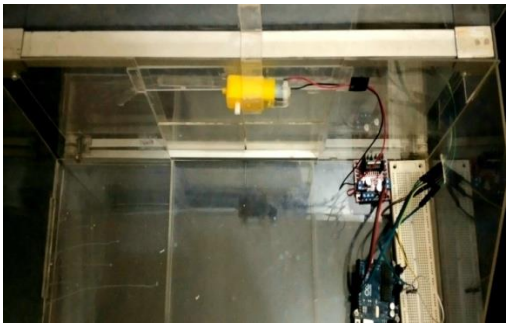

Figure 3. Behind Prototye

3.3. Discussion

From the results of the research that has been done, it can be concluded that the testing of each component used, including:

1. Testing on Ultrasonic Sensors In general, ultrasonic sensors can work well. The way this tool works is to detect the presence of a certain object in front of it, if the sensor detects an object, the sensor will send a signal to the microcontroller for processing.
2. MLX90614 Temperature Sensor Testing In general, the MLX90614 temperature sensor can work well. This tool will work if the sensor detects an object and measures its temperature, then the sensor will send a signal to the microcontroller to provide output in the form of HIGH and LOW logic to the door driving motor.
3. Application of Fuzzy Logic Fuzzy Logic is a method used to help group variables in this study so that the measurement results are in several levels. In addition, the Fuzzy method is easy to understand and easy to apply.

4. Conclusions

Based on the results of the tests and discussions that have been carried out, the distance readings carried out by ultrasonic sensors and body temperature calculations using fuzzy logic, can open the door automatically according to what is read by the ultrasonic sensor, and have the same accuracy as the results of calculations or analyzes that have been carried out.

INFOKUM is licensed under a Creative Commons Attribution-Non Commercial 4.0 International License (CC BY-NC 4.0)

Reference

[1] Alfith, Bacthiar, A.,& Algizan A.A (2019). Perancangan Pengendali pada Bak Mandi Menggunakan Fuzzy Logic Controller, Jurnal Teknik Elektro ITP. 8 (2) : 111-112. Anda, M.F. (2020) , Penerapan Logika Fuzzy Sebagai Alat Deteksi Hipotermia dan Hipertermia Berdasarkan Suhu Tubuh dan Detak Jantung Manusia pada Masa Remaja Akhir Sampai Dewasa Awal Berbasis Internet Of Thing (IOT) , Skripsi Universitas Jember.

[2] Azmi, F., Louise, J., Sitompul, Z.R., Kumar, S. & Surya, J. (2020). Design of Smart Garden Sprinklers Based On Fuzzy Logic. JITE (Journal Of Informatic And Telecommunication Engineering). 4 (1): 217-219.

[3] Faudin, Agus, (2017). Tutorial Arduino Mengakses Sensor Ultrasonik HC-SR04. Diunduh di https://www.nyebarilmu.com/tutorial-arduino-mengakses-sensor-ultrasonik-hc-sr04/29mei2021

[4] Kurniawan. E ., (2017), STERILISATOR Basah Menggunakan Atmega8535, Tugas Akhir, Universitas Sanata Dharma Yogyakarta.

[5] Marx.J (2006). Rosens's Emergency Medicine, Conceps and Clinical Practice. Mosby/Elsevier. p 2239. ISBN978-0-323-02845-5.

[6] Pranata ,A.,Jaka ,P. & Teja Sandika (2017). Rancang Bangun Alat Pendeteksi Dehidrasi Dengan Metode Fuzzy Logic Berbasis Arduino, Jurnal SAINTIKOM 6(2)

[7] Ramadhan, F.A., Maulana,R., Kurniawan,W. (2018) Rancang Bangun Pengontrolan Suhu Pada *Sleepingbag* Sebagai Tindakan Pencegahan Pada Penderita Hipotermia.

[8] Safitri, Meilia (2019). Non-Contact thermometer Berbasis Infra Merah, jurnal SIMETRIS 10 (2)

[9] Saputra, A.J.A., Erfianto, B., Saputra, M.A. (2019) Implementasi Fuzzy Logic Control Pada Pelacakan Panel Surya, Jurnal Teknologi Bahan dan Barang Teknik. 9(1) : 28-30

[10] Urbach, T.U., Wildian. (2019). Rancang Bangun Sistem Monitoring dan Kontrol Temperatur Pemanasan Zat Cair Menggunakan Sensor Infrared MLX90614 8 (3) : 274-277

INFOKUM is licensed under a Creative Commons Attribution-Non Commercial 4.0 International License (CC BY-NC 4.0)