DESIGN OF CENTRALIZED CONTROL AND MONITORING OF AIR CONDITIONER TEMPERATURE USING MICROCONTROLLER BASED ON INTERNET OF THINGS

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ABSTRACT

Air conditioner or with the abbreviation AC is a device or machine that can help regulate the temperature in the room, regulate humidity and air quality in the room. The purpose of this research is to be able to turn off the AC (Air Conditioner) centrally and can be monitored remotely using a Smartphone with the Blynk application. In addition, it is also able to automatically adjust the temperature of a room. In this testing technique, researchers conducted tests by looking at measurements from the DHT22 temperature sensor, PIR sensor and fan performance when there was an increase in temperature. If the PIR sensor detects movement and the temperature shows> 30 ° C then 1 Fan turns on, if the temperature is> 33 ° C then 2 Fans will turn on, if the temperature is> 35 ° C then 3 Fans turn on. If the PIR sensor detects no movement in the room then the Fan will not turn on.

Keywords: *AC (Air Conditioner), Blynk, DHT22, PIR Sensor*

1. INTRODUCTION

Air conditioner or with the abbreviation AC is a device or machine that can help regulate the temperature in the room, regulate humidity and air quality in the room. In addition to being a room air conditioner, it turns out that air conditioners or air conditioners can also function as room heaters. This depends on the conditions and needs in the room. (putra, 2020)

With these conditions, the need for air conditioners or air conditioners (AC) in Indonesia is needed to support comfort in doing activities indoors in accordance with the Indonesian National Standard (SNI) that comfortable temperatures are not specified in the standard, in general, planning conditions should be used with a dry bulb temperature of 25 ° C ± 1 ° C and relative humidity of 60% ± 10% for occupant comfort.

You can use this air conditioner on a small scale - such as home air conditioners in housing or small-scale restaurants. Large-scale use such as in restaurants, hotels, hospitals, to shopping centers or malls.

The use of air conditioning in public facilities aims to increase the sense of comfort and security of visitors. So that it feels comfortable to spend time in the room. In addition, AC is also widely used in office buildings. Office buildings in which there are many people and electronic devices that are easily heated such as computers, laptops, and so on so that air conditioning can also make electronic devices work better with temperatures that are always stable without the need to become hot and vulnerable to various damage.

At this time there are still many AC (Air Conditioner) operations that are still manual or use remote control where this use is still less efficient because there are still many people who forget to turn off the AC when leaving a room, causing waste of electricity.

In addition, there are still many air conditioners (Air Conditioner) that have not been able to adjust the temperature automatically in the room, where if there are many people in a room the room temperature will rise and we need to lower the temperature of the air conditioner using the remote or done manually.

To overcome these problems, a system is needed that can turn off the AC (Air Conditioner) centrally and can be monitored remotely. It is also able to automatically adjust the temperature of a room. Therefore the author raises the title "Design of Centralized Air Conditioner Temperature Control and Monitoring Using an Internet Of Things-Based Microcontroller".

2. METHOD

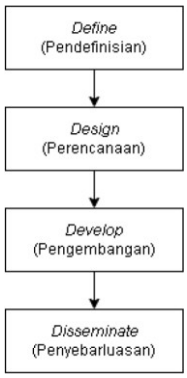

Figure 1. Research design

The research design is a strategy for achieving predetermined research objectives and serves as a guide for researchers during the research process. This research is a type of research and development (R&D). According to Gay (1990), it is an effort or activity to develop an effective product for school use, and not to test a theory.

This research design uses the 4D Model, which is one of the research and development methods. The 4D model is used to develop learning devices. The 4D model was developed by S. Thiagarajan, Dorothy S. Semmel, and Melvyn I. Semmel in 1974.

The temperature in the room is additive related to the number of people in the room which will be detected by the Passive Infrared Receiver (PIR) sensor and the temperature sensor will show how many degrees of temperature in the room.

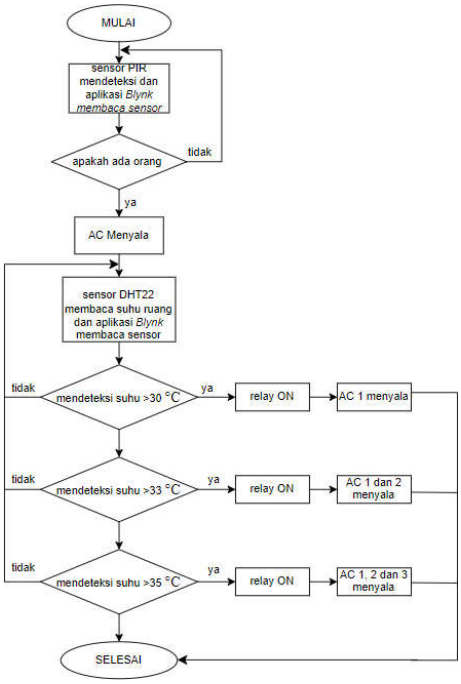

Figure 2. Tool Design

In this design, the author uses an AC fan as a substitute for AC (Air Conditioning). Here using 3 AC fans, with temperature sensors that have been set with temperatures between 30 degrees Celsius to 35 degrees Celsius. The author also uses a PIR sensor (Passive Infrared Receiver) which is used as an automatic ON / OFF when there is movement or there are people in the room. The temperature sensor is set if the temperature sensor gets a value that is at a temperature above 30 degrees Celsius then the relay will turn on one AC Fan and when the temperature is above 33 degrees Celsius then the relay will turn on 2 AC Fans, and if the temperature is above 35 degrees Celsius then the relay will turn on 3 AC Fans.

The capacity of a 3 PK air conditioner is equivalent to 27,000 Btu/hr. The author makes a miniature room for the tool with a size of 30cm x 20cm x 30cm.

In addition, the results of sensor readings will enter and be processed by NodeMCU which will send data to the server with the help of internet signals obtained from smartphones, then the data can be accessed and monitored through the Blynk application.

Device testing aims to determine whether the hardware has functioned and in accordance with the design that has been made. Testing is first carried out separately on each circuit unit, then proceed to testing the integrated system as a whole.

3. RESULT AND DISCUSSION

In this section the author wants to test every component in the final project made, with the aim of this project running with what the author wants, the following is testing hardware and software components:

4.2.1 Hardware Testing

4.2.1.1 NodeMCU ESP32

Testing on the NodeMCU ESP32 aims to find out whether the NodeMCU ESP32 used can work properly or not.

Testing steps:

1. Prepare the NodeMCU to be tested.
2. Connect the NodeMCU to the voltage source.
3. Measure the voltage on the NodeMCU.
4. If the indicator light on the Arduino lights up then the Arduino can work.

Pengujian	Tegangan
1	5,1 VDC
2	5,1 VDC
3	5,1 VDC
4	5,1 VDC
5	5,1 VDC

Table 1. NodeMCU Testing

After testing the NodeMCU by measuring the flowing voltage, it is obtained that the voltage flowing is 5.1V DC.

4.2.1.2 LCD

LCD testing is carried out with the aim of knowing whether the LCD can display the results of the temperature sensor measurements.

Testing Steps:

1. Prepare the LCD under test.
2. Connect the LCD to a voltage source.
3. Measure the output voltage on the LCD.
4. Connect the LCD with the sensor and NodeMCU.
5. See if the LCD can display the data text on the screen.

Figure 3. LCD Testing

After testing this LCD, it is found that the LCD can work properly by displaying data results from the temperature sensor and for an output voltage of 5.1 VDC.

4.2.1.3 PIR Sensor

This sensor test aims to find out how far the PIR sensor works to detect an object so that it can turn on the 220V AC Fan.

Testing steps:

1. Prepare the PIR sensor to be used.
2. Connect the PIR sensor with the NodeMCU.
3. Connect the sensor to the voltage source.
4. Measure the voltage output on the PIR sensor.
5. Measure how long it takes for the PIR sensor to respond to motion when it starts to turn on and turns off with a time range between 1 second and 20 seconds.
6. See how the PIR sensor responds to motion.

No.	Pergerakan	Waktu Respon Sensor tidak mendeteksi gerakan
1.	Selama 1 detik	28 detik
2.	Selama 5 detik	22 detik
3.	Selama 10 detik	15 detik
4.	Selama 15 detik	11 detik
5.	Selama 20 detik	6 detik

Table 2. PIR ON-OFF Testing Cable

Figure 4. PIR Testing

After conducting 5 tests on this PIR sensor by looking at the response when the PIR sensor starts to turn on and turns off, the PIR sensor turns on with an average time of 16.4 seconds. The PIR sensor outputs a voltage of 5.1 VDC.

4.2.1.4 DHT22 Temperature Sensor

This sensor test aims to determine whether the temperature sensor can detect the temperature and humidity commanded by NodeMcu.

Testing Steps:

1. Prepare the DHT22 sensor to be tested.
2. Prepare a temperature measuring instrument such as a thermometer for comparison.
3. Connecting the DHT22 sensor to the NodeMCU.
4. Provide voltage input.
5. Measure the output voltageon the DHT22 sensor.
6. Connect the DHT22 sensor with the LCD to display the results.
7. Test the DHT22 sensor by taking 5 temperature samples between <30° and >35°.
8. If the values generated by the temperature sensor and thermometer.

No.	Termometer Digital °C	LCD DHT22 °C	Selisih °C
1.	Suhu 27°C	Suhu 27,7°C	0,7°C
2.	Suhu 30,2°C	Suhu 30,9°C	0,7°C
3.	Suhu 33,9°C	Suhu 33,2°C	0,7°C
4.	Suhu 35,7°C	Suhu 35,1°C	0,6°C
5.	Suhu 40,4°C	Suhu 40,5°C	0,1°C

Table 3. DHT22 Testing

After testing the DHT22 sensor with a comparison thermometer, the results obtained between the thermometer and the sensor are not much different, namely with an average difference of 0.5°C.

4.2.1.5 AC 220V fan

AC 220V fan is used as a component that replaces AC (*Air Conditioner*) which will be controlled using NodeMCU.

Testing Steps:

1. Prepare the AC Fan for testing.
2. Connect the device to a voltage source.
3. Connect the Fan with the relay and sensor.
4. Set the on-off on the *Blynk* app.

Suhu	Keterangan Fan
Suhu 30° C - 33° C	1 Fan menyala
Suhu 33° C - 35° C	2 Fan menyala
Suhu >35° C	3 Fan menyala

Table 4. Fan Testing

Pros and Cons of Tools

In the design of centralized control and monitoring of air conditioners using iot-based microcontrollers that have been made by the author, there are several advantages and disadvantages possessed in the tool.

Tool Advantages:

1. Can control the Fan automatically and manually.
2. Remotely monitor the temperature using a smartphone.
3. This plan is already IOT-based.
4. Can turn off the AC when the set temperature has been reached.
5. Uses a PIR sensor to detect movement in the room.
6. Using NodeMCU which does not need additional devices to connect to a wifi network.

Tool Shortages:

1. Depends on internet connection to monitor and control via smartphone.
2. The PIR sensor does not detect if the object is too far away from the sensor.

4. CLOSING

Conclusion

Based on the results of testing the components in the previous chapter, conclusions can be drawn, among others:

1. The whole series of tools can work well, using NodeMCU ESP32 to monitor and control the turning on and off of the Fan. And the reading results of the DHT22 sensor and PIR sensor are displayed on the LCD and smartphone on the Blynk application which can help technicians monitor and control remotely.
2. In the AC prototype tool, it is replaced by a 220V AC fan. There is movement or a temperature of more than 30 ° C then 1 Fan turns on, there is movement or a temperature of more than 33 ° C then 2 Fans will turn on, there is movement or a temperature of more than 35 ° C then 3 Fans turn on. Does not detect any movement in the room then the Fan will not turn on.

Advice

The suggestions from the author for the development of this final project for the future are better, among others:

1. The design of this tool is still limited to the Blynk application because it must be accessed via a smartphone whose weaknesses require good internet connectivity to work. Therefore, it is expected that the monitoring display is made so that it can be accessed using a smartphone and PC that is always connected to wifi.
2. Suggests that further development can add some additional indicators.

REFERENCES

[1] Abizar Rachman, Z. A. (2020). Sistem Pengendali Suhu Ruangan Berbasis Internet of Things (IoT) Menggunakan Air Conditioner (AC) Dan NodeMCU V3 ESP82. Samarinda: Universitas Mulawarman.

[2] Airtech Tutorial. (2019, November 8). tips mengetahui dan menentukan CRS pada kompresor ac. Retrieved from https://www.airtechteknik.tech/2019/11/tips-mengetahui-dan-menentukan-crs-pada.html

[3] angel. (2018, januari 11). Humidity Guide. Retrieved from Higienis Indonesia: https://www.higienis.com/blog/humidity-guide/

[4] Badan Standardisasi Nasional. (2011). Konservasi Energi Sistem Tata Udara Bangunan Gedung. Jakarta: BSN.

[5] dharma, r. (2021, agustus 3). Retrieved from Internet of Things (IoT): Pengertian dan Beberapa Industri yang Bisa Menggunakannya: https://accurate.id/teknologi/internet-of-things/

[6] Goyal, A. (2022, january 11). https://www.ardutech.com/mengenal-esp32-development-kit-untuk-iot-internet-of-things/. Retrieved from https://www- hnhcart-com.translate.goog/blogs/iot-rf/difference-between-esp8266-and- esp32

[7] Handoko, J. (2007). Merawat & Memperbaiki AC. Panduan Menjadi Teknisi, 19.

[8] Iqbal, M. (2022, maret 11). Mikrokontroler ESP32. Retrieved from telkomuniversity:https://miqbal.staff.telkomuniversity.ac.id/mikrokontroler-esp32/

[9] Kho, D. (2022, september 3). Pengertian Relay dan Fungsinya. Retrieved from Teknik

Elektronika: https://teknikelektronika.com/pengertian-relay-fungsi- relay/

[10] Prayoga, B. (2020, november 25). cara kerja sensor passive infra red. Retrieved from electrical engineering : https://te.umtas.ac.id/2020/11/25/pyroelectric-infrared-bte16-19/

[11] putra. (2020, februari 5). PENGERTIAN AC: Fungsi, Jenis, Cara Kerja & Komponen Air Conditioner. Retrieved from SALAMADIAN: https://salamadian.com/pengertian-ac-air-conditioner/

[12] Rahmawati, D. C. (2021). Prototype Sistem Pengaturan Suhu Ac Otomatis Terhadap Kapasitas Orang Masuk Dan Keluar Berbasis Arduino. Surabaya : Poltekbang Surabaya.

[13] Rasyid, A. (2020, desember 06). Retrieved from pengertian sensor PIR: https://www.samrasyid.com/2020/12/pengertian-sensor-pir.html

[14] Renanda, R. N. (2018). Rancang Bangun Kontrol dan Monitoring Jarak Jauh Secara Terpusat Pada Air Conditioning Floor Standing Berbasis Mikrokontroler Via Android di Bandar Udara Tjilik Riwut Palangkaraya. Surabaya: Poltekbang Surabaya.

[15] Saini, M. K. (2021, juli 5). Relai Elektromekanis – Jenis dan Prinsip Kerja. Retrieved from tutorialspoint: https://www.tutorialspoint.com/electromechanical-relays-types-and- working-principle

[16] Setiawan, R. (2021, september 8). Memahami Apa Itu Internet of Things. Retrieved from Dicoding Indonesia: https://www.dicoding.com/blog/apa-itu-internet- of-things/

[17] Topan, M. A. (2020, may 4). Mengukur Suhu Ruangan dengan Sensor DHT22. Retrieved from medium: https://medium.com/@helloaltop/mengukur-suhu- ruangan-dengan-sensor-dht22-c4c0b3fce532

[18] Yolnasdi, A. D. (2020). Rancang Bangun Pengontrol Suhu Ruangan Berbasis Mikrokontroler Arduino Uno. Information Technology and Computer Science.