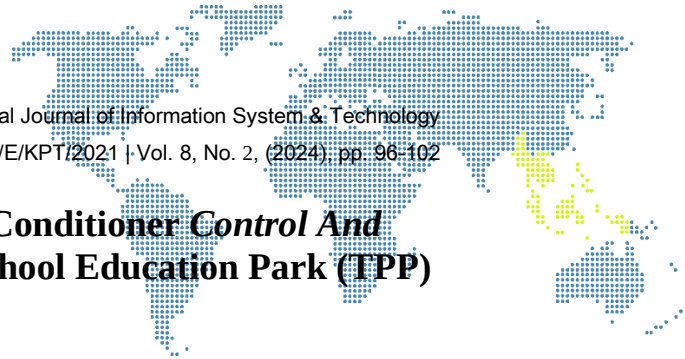




Internet of Things (Iot)-Based Air Conditioner Control And Monitoring System at Al Firdaus Preschool Education Park (TPP) Surakarta

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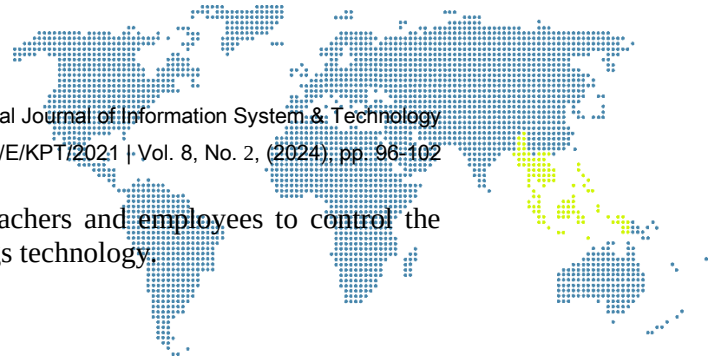
Abstract

The use of conventional air conditioners is often inefficient and energy-wasteful. Users usually set the temperature manually, which can result in excessive energy use. In addition, the lack of an effective monitoring system makes it difficult to monitor air conditioning conditions, such as room temperature and humidity. This research aims to create an Air Conditioner monitoring and control device that can work automatically to control the temperature in a room and can be controlled through IOT. A temperature monitoring system and remote air conditioning controller is a tool that can be used to monitor room temperature conditions and control the temperature in the room to match what we want. This tool uses proportional type control (P) with a monitoring system utilizing Internet of Things (IoT) technology. The ESP 32 microcontroller is used as a microcontroller-based control device that has been facilitated with a wifi module. To measure the room temperature, a DHT11 sensor and an infrared LED are assembled and connected to a microcontroller as a data transmitter to the air conditioning unit. This system uses the arduino IDE application which has features to monitor and control the temperature in the room. The way this tool works is as a remote that controls the Air Conditioner to get the desired temperature in the room and the temperature read on the device can be monitored on a smartphone remotely.

Keywords – monitoring, control, air conditioner, Internet of Things, automatic.

1. Introduction

System The system development method that will be used to build an internet of things (iot)-based air conditioner control and monitoring system is the *Prototyping method* [1]. The use of air conditioners in Indonesia is very much due to the very hot conditions in Indonesia [2]. Almost everywhere we will find air conditioners, such as in homes, schools, companies, factories, hotels and many other places. Along with the development of technology, the need for comfort in daily life is increasing. One highly desirable form of comfort is a cool and comfortable indoor environment, especially in areas with tropical climates or hot summers [4]. Air Conditioner (AC) is one of the most important electronic devices to create such a comfortable environment [5]. However, the conventional use of air conditioning is often inefficient and energy-wasteful. Users usually set the temperature manually, which can result in excessive energy use. In addition, the lack of an effective monitoring system makes it difficult to monitor air conditioning conditions, such as room temperature and humidity. With a total of 47 units of air conditioners in TPP Al Firdaus, here the author gets some of the problems that occur in TPP Al Firdaus, namely the use of air conditioners that cannot be monitored properly, the waste of electrical power so that it causes high financing expenses every month, and air conditioning devices that become not durable or often damaged. Therefore, the author feels that a tool is needed that is able to monitor and also control the temperature in the room that can be done remotely. Monitoring and control of air conditioners is useful for knowing the temperature



conditions in the room and making it easier for teachers and employees to control the desired temperature remotely using Internet of Things technology.

2. Research Methodology

2.1. Data Collection Techniques

- a) Direct observation is a way of collecting data using the eye without the help of other standard tools for this purpose. In this case, direct observation of how the conditions that occur in the field is very useful to support the running of this research. So that an *IoT-based* AC control and *monitoring* system can be realized. Observation was carried out at TPP Al Firdaus, which is one of the places where the author works.
- b) Interview, is the process of obtaining information for research purposes by means of questions and answers, while face-to-face between the researcher and the resource person using a tool called *an interview guide*. In this case, interviews were conducted together with teachers and employees in the TPP Al Firdaus environment.
- c) Documentation, is written material in the form of essays, memos, announcements, data collection, instructions, magazines, newsletters, statements, rules of an institution and news broadcast to the media. The data taken and documented became a reference for research and problem solving.

2.2. System Development Methods

The system development method that will be used to build an *IoT-based* AC control and *monitoring* system is the *Prototyping method* [6]-[8]. It has four stages as follows:

1. Communication

The first step in this method is for the Developer to determine what needs are used to create this system starting from hardware and software and how this system will be integrated with the machine.

2. Quick Plan

At this stage, it is the process of building a prototype, namely by making a design plan of the system to be built. How the system will work and provide information in real time.

3. Modeling Quick Design

At this stage, focusing on the software and hardware aspects, it is carried out by creating a design of a temperature monitoring circuit and Auto Auto on/off. Determine what application web system will be used as a dashboard to display the information needed.

4. Construction of Prototype

At this stage, build a prototype design that will be built by assembling hardware components, then the series of hardware components is connected with the coding that has been made by compiling the coding and uploading it to the ESP32 Board using Arduino IDE software.

5. Deployment Delivery & Feedback

At this stage, tests are carried out on the prototype of the designed tool, then an evaluation is carried out whether the designed system is in accordance with the needs or not.

3. Results and Discussion

3.1. Minimum Hardware and Software Specification Requirements

The need scheme for the *IoT-based* AC control and *monitoring* system tool using the notification *output* on the *arduino IDE dashboard application and telegram* is the ESP 32 microcontroller, relay, power supply, breadboard, smartphone fan processor and also DHT 11 as a temperature detection tool.

3.2. Troubleshooting In IOT-based air conditioner control and monitoring systems

- Design and manufacture of the system *Hardware* and *software* are precisely integrated into the machine to facilitate the on/off process when the air conditioner is turned on and used.
- Microcontrollers* that are integrated with *web hosting* and telegram applications that are able to provide notifications via telegram groups with *admin* members to facilitate the *maintenance process*.
- The use of *microcontroller hardware* and the application of *IoT* so that a temperature sensor device can be added as a data *input* to detect the *temperature* in the air conditioner.

3.3. System Design and Manufacturing

a) Research Flow Diagram

A flowchart is a type of diagram that represents an *algorithm*, workflow or process, which displays the steps in the form of graphical symbols, and their sequence is connected by arrows. Flowcharts are used to analyze, design, document or manage a process or program in various fields.

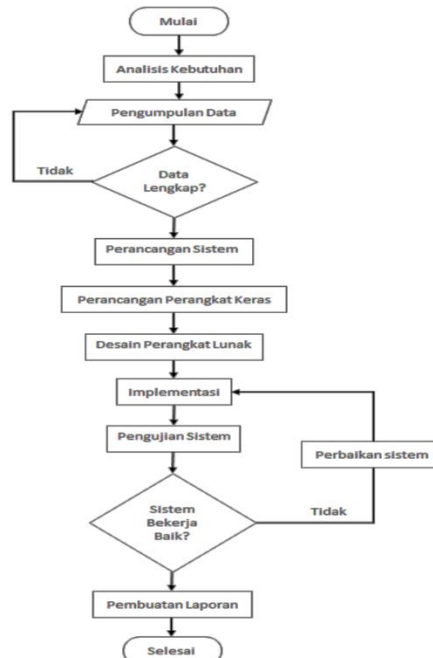


Figure 1. Research Flow Diagram

b) System Flow Design

System design is the process of developing new system specifications based on the recommendations of the results of system analysis. In this stage, design in various working papers regarding the specifications in question. The working paper contains various descriptions of the *inputs*, processes, and *outputs* of the proposed system.

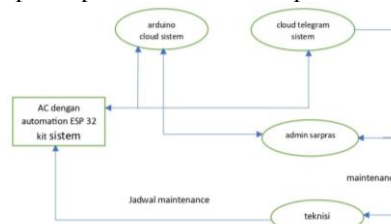


Figure 2. System flow design

c) System Diagram Block

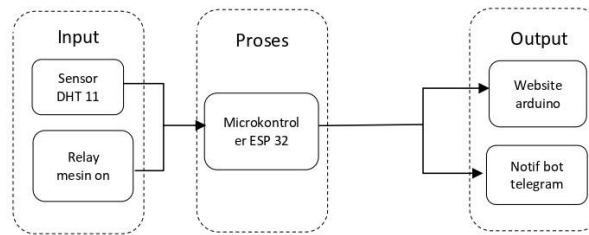


Figure 3. System diagram blocks

Based on the illustration from figure 3 which explains that the tool uses several physical and software components that have the following uses:

1. *ESP32 Microcontroller* As the heart of the system. Functions to receive, process data and pass on data.
2. *DHT11* which acts as a *sensor* to monitor temperature and humidity.
3. *Web* is used to display temperature and humidity values.
4. *The Arduino cloud database* acts as a data logger for *temperature and humidity values*.
5. *Telegram* bots serve as message senders to provide on/off commands on the air conditioner and notifications about the condition of the air conditioner machine.

The operation of the instrument, including the role played by the instrument's *main sensor*, the *DHT11*, is depicted in the block diagram that can be found above. *DHT11* is useful for monitoring temperature and humidity values, and was used in this study.

The ESP32 NodeMCU microcontroller, which is the heart of the tool, performs data processing and processing in addition to transmitting data online wirelessly. More specifically, this data is transmitted to the *Arduino cloud database*, and if the *Telegram bot* is asked to show the user temperature and humidity readings, the readings will be displayed to the user. Temperature and humidity readings can be found on the *web*.

d) Flowchart Sistem Monitoring

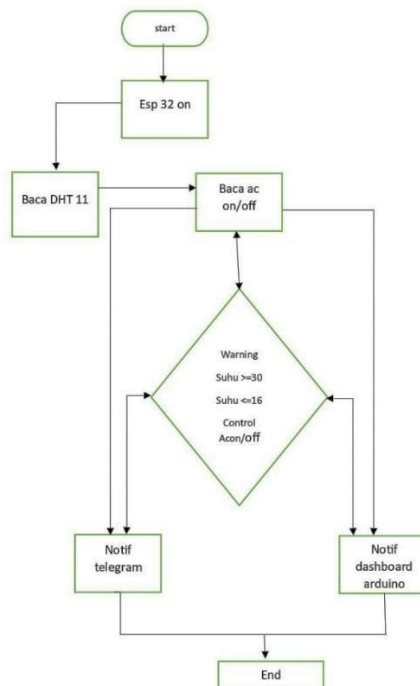


Figure 4. Flowchart system monitoring

System Workflow Explained

1. *ESP32* connects with *wifi internet*
2. When the air conditioner is turned on, it will activate the *DHT 11* sensor to provide a *signal temperature* at *esp 32*
3. Then on *esp 32* the *signal* is processed and sent to the telegram bot and *Arduino cloud*.
4. When the air conditioner is turned on, it will activate the NO 1 switch which provides a *signal run* on the *ESP32*.
5. The *signal run* on the *esp 32* is processed and forwarded to the *Arduino cloud* and telegram bot as an *AC signal* in the *ON* condition.
6. If the temperature reaches ≥ 30 or ≤ 16 , it will provide notifications to the arduino cloud and telegram bot.
7. The arduino dashboard control and telegram bot signal on the *esp 32* to turn the air conditioner on and off via relay.

e) The entire range of tools

Figure 5 above is a schematic of the set of tools in the IoT-based AC control and monitoring system tool series using the *notification output* on the *arduino IDE dashboard application* and *telegram* in the form of notifications, the image is a visual result of the relationship between the connections of several components in a system. a set of components.



Figure 5. The entire range of tools

f) Arduino IoT Cloud Dashboard Display

Figure 6 above is the display of the *arduino IDE dashboard*. On the dashboard, it reads that the air conditioner has turned on at a temperature of 30 degrees and the air conditioner is in an overheated condition and must be immediately reported to the technician for immediate *maintenance*.

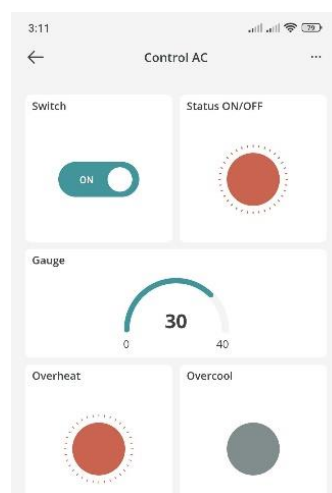


Figure 6. Display Arduino IOT cloud dashboard

g) View On Telegram Group Chat bot

In Figure 7 above is the display of the telegram group. The telegram group informs that air conditioners can be turned on and off via telegram.

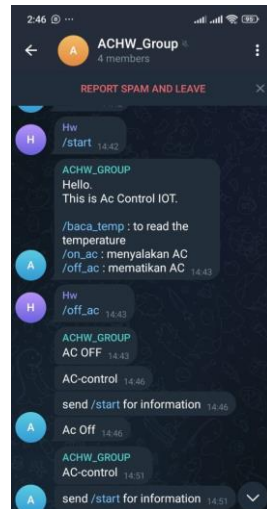


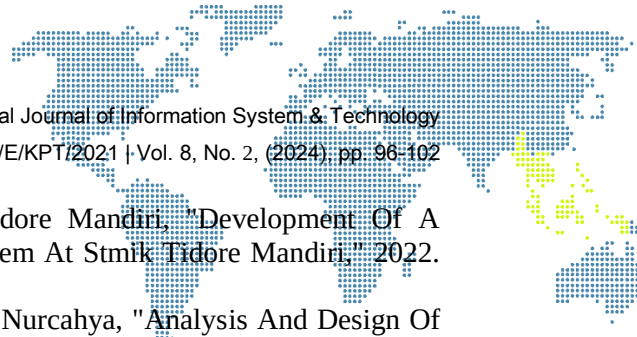
Figure 7. Display on group telegram *Powders*

4. Conclusion

The conclusion that can be conveyed from this study is, the system that is currently running admin is able to turn on/off through the web dashboard application or via Telegram, so that the efficiency of electricity use can be done properly. The creation of this device functions to detect *the temperature of* the area and provide air conditioning temperature information when turned on or off, from this information is then forwarded to *the Arduino IOT cloud* and *telegram bot*, which is integrated with the Admin. Then for the maintenance process can be done quickly and precisely because you always get a notification from *the telegram bot* about the condition of the air conditioner whether it is running well or not. For further development of this tool, it is hoped that this tool will be able to control more air conditioners by using only 1 tool, and on the Arduino IOT Cloud Dashboard can also be developed with the addition of a report system that can be downloaded in the form of a CSV file where data on the efficiency of AC use can be taken and this information is useful for finding out the routine maintenance schedule of air conditioners.

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