Implementation of The Iot System as The Condition Regulator of The Electrical Engineering Department's Laboratory Room

Indra Setyawan [1], Hadi Suyono [2], Rini Nur Hasanah [3],
1st Universitas Brawijaya
Email: nggitchan@student.ub.ac.id, hadis@ub.ac.id, rini.hasanah@ub.ac.id,

***Abstract*— Technological developments in the 4.0 era are currently growing rapidly, one of the advantages is that it makes it easier for users to control electronic equipment remotely. Only with a device, users can access all information through connectivity called the Internet of Think. The Internet of Things is a technological concept where all electronic equipment is interconnected with internet media so that it can be controlled or monitored from wherever the user needs it. The purpose of this research is to create a room condition control system based on the Internet of Think, where the device can be operated either automatically according to the schedule we set or manually. This system also has a monitoring system via a web server so that we can control and monitor the device without having to approach the device to turn it on or off. The device made in this study utilizes a temperature sensor and a smoke sensor as a sensor input medium to the controller. As an output, it utilizes a servo that is used to open and close the window so that the condition of the room can be controlled. To control the device remotely, the device is connected wirelessly by using wifi media which is one of the features of the nodemcu controller. The output of this research is the servo status on the window, fan, and air content displayed on the device and the web so that comfortable room conditions can be created according to the predetermined set point.**

***Index Terms*— IoT, NodeMCU, Web Server.**

***Abstrak*-- Perkembangan teknologi di era 4.0 saat ini sedang berkembang pesat, salah satu kelebihannya adalah memudahkan pengguna untuk mengontrol peralatan elektronik dari jarak jauh. Hanya dengan perangkat, pengguna dapat mengakses semua informasi melalui konektivitas yang disebut Internet of Think. Internet of Things merupakan sebuah konsep teknologi dimana semua peralatan elektronik saling terhubung dengan media internet sehingga dapat dikontrol atau dipantau dari manapun pengguna membutuhkannya. Tujuan dari penelitian ini adalah untuk membuat suatu sistem pengendalian kondisi ruangan berbasis Internet of Think, dimana alat tersebut dapat dioperasikan baik secara otomatis sesuai dengan jadwal yang telah kita tetapkan maupun secara manual. Sistem ini juga memiliki sistem monitoring melalui web server sehingga kita dapat mengontrol dan memonitor perangkat tanpa harus mendekati perangkat untuk menghidupkan atau mematikannya. Perangkat yang dibuat pada penelitian ini memanfaatkan sensor suhu dan sensor asap sebagai media input sensor ke pengontrol. Sebagai outputnya memanfaatkan servo yang digunakan untuk membuka dan menutup jendela sehingga kondisi ruangan dapat dikontrol. Untuk mengontrol perangkat dari jarak jauh, perangkat terhubung secara nirkabel dengan menggunakan media wifi yang merupakan salah satu fitur dari pengontrol nodemcu. Keluaran dari penelitian ini adalah status servo pada jendela, kipas angin, dan konten udara yang ditampilkan pada perangkat dan web sehingga dapat tercipta kondisi ruangan yang nyaman sesuai dengan set point yang telah ditentukan..**

***Kata Kunci*— IoT, NodeMCU, Web Server.**

I. INTRODUCTION

Internet of Things or IoT is a development of new electrical devices that are becoming popular both in the research and industrial fields. The concept of the IoT system is that IoT will have mutual communication between electronic devices around us so that the equipment can be controlled automatically[1][2]. The number of devices that can be connected on an IoT network is unlimited. The impact given by the IoT system itself is quite a lot, especially in terms of the economy. Researchers define IoT as something that connects various everyday objects, with the nature of the connection still to be determined. A two-way connection via the Internet Protocol is the most widely used communication protocol, although many communication protocols can still be used. IoT cannot be separated from a network of sensors that can monitor but not control. Both connect objects and sensor networks utilizing a series of technological advances, simultaneously forming miniature, power-efficient sensing, processing, and wireless communications [3].

Activation of electronic equipment in the room is usually required to provide simple functions such as turning on or off electronic equipment so that work efficiency can be increased [4]. In addition, if the condition of users with limited physical activity such as people with disabilities or users with fatigue or illness conditions, the activity of using switches becomes difficult to do. Taking into account these conditions, efforts were made to increase the ease of use of indoor devices called the Automated Room System.

The automatic room system utilizes sensors as inputs that provide control commands to the device automatically, so that the activities that occur require very little or no human energy. If the user still wants to control the device, then the system can be adjusted according to the needs and desires of the user without having to rely on reading sensors. Thus, this device can be activated either manually or automatically. Users can also monitor room conditions via internet streaming. The concept and design of IoT technology was developed with the aim of replacing human motion in controlling electronic

equipment[5][6][7]. In this system, users do not need to move at all to control the comfortable room temperature. With an automatic room system, users can not only control room devices automatically, but also can control the system manually

II. METHODS

This section will discuss the parts of each function of the entire system, namely hardware design and program structure. The method used in this research is the manufacture of prototype tools. In this research, the first stage is tool making and programming, and the second stage is tool testing. As a description, the processes taken in the design process are:

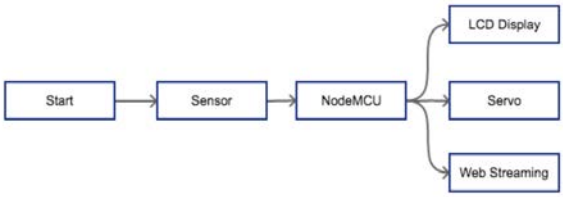

Fig. 1. Flow Chart System

In the explanation of the process taken in the design process as shown in Figure 1. Start is the prefix of the laboratory room system automatically, where the coding is inserted into the micro controller in this study using the NodeMCU which will process the input obtained from the sensor[8][9]. The sensor captures input in the form of air temperature and smoke / air quality. The input signal will go to the controller which then processes the data so that the controller can perform actions automatically according to the entered algorithm. The LCD device itself displays output in the form of device status writing, while the Servo controls the window opening system to regulate air circulation. The system is also connected to the Web to make it easier for users to view the device's activation status from anywhere. The objects that are sent to the web server are information that has been collected by the system as data processing In IoT.

A. Hardware

In this research, the hardware part can be divided into several parts. Each part consists of the following components:

- Servo, functioning as an output, controls the window.
- NodeMCU functions as a controller and transmitter of data to the web server.
- Sensors, functioning as inputs, receive temperature and air quality from the surrounding environment and will continue the data to the microcontroller.

The following are the details of the tools and materials used in this study:

1. *Node MCU*
   NodeMCU is a micro controller that is often used in IoT systems. This controller consists of a wireless device running on the ESP8266 with a 2.4ghz frequency as well as an esp12 based micro controller hardware. The NodeMCU microcontroller has been integrated with the wifi module so there is no need for an additional module. The system design on the chip (SoC) allows devices to communicate via a wifi network, making system implementation easier. [8][9]

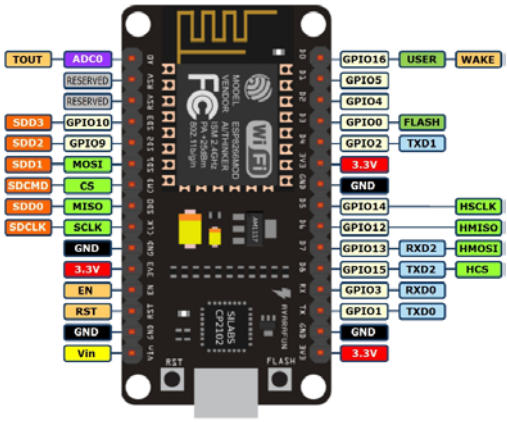

Fig. 2. NodeMCU

Figure 2 review that with Internet of Things, every device can communicate to the internet over the network in real time and from anywhere can be accessed to provide any service by any network to anyone. This concept will enable new types of applications to engage, such as smart vehicles and smart homes, to provide multiple services such as notifications, security, energy saving, automation, communications, computing, and entertainment.

2. *Servo*
   A Servo motor is a hardware or rotary actuator (motor) designed to use closed loop (servo) feedback control system, so it can be set to determine and ensure the angular position of the motor output device shaft

Fig. 3. Servo

Figure 3 is a servo device used in this study. the servo It has the features of being small and light with high output power. The servo can play about 180 degrees (90 in each direction), and works like the standard type but with smaller

3. *Temperature Sensor*
   The temperature sensor in Figure 4 used in this

study is an NTC thermostat that is packaged in an iron layer [6]. The advantage of this sensor is that it can be used in difficult environments and has a fairly large temperature range compared to other sensors others such as the LM35. This sensor has the following specifications :

Fig. 4. Temp Sensor

How to change the desired temperature limit or range is to change it directly in the programming software. In this research, the software used is Arduino. The limit or temperature range used in this study is 27 Celsius. The program will perform certain actions if the detected temperature is below or above that temperature. The temperature of 27 Celsius was chosen because this temperature is the ideal room temperature in general. This temperature setting can be changed directly on the Arduino software according to the user's desired temperatures.

4. Air Quality

A smoke sensor is a sensor that can detect air concentration levels. Each smoke sensor can detect certain types of smoke such as MQ-2 which is suitable for detecting Methane, Butane, LPG, and MQ-3 which is suitable for detecting Alcohol, Ethanol

Fig. 5. Gas Sensor

In this study, the smoke sensor used is MQ-4 as shown in Figure 5. The sensitive material for the MQ-4 gas sensor is SnO2, with lower conductivity in clean air. When a flammable target gas is detected, the sensor's conductivity increases as the gas concentration increases. The MQ-4 gas sensor has a high sensitivity to Methane, as well as to Propane and Butane. This sensor can be used to detect various combustible gases, especially Methane, which is suitable for different applications

B. Software

The software acts as a command link between all elements in the system, which is the way the system communicates. Therefore, to move the wheel, it is very important to design the appropriate software in the right order. In designing this system, the software that will be used is an open-source software from Arduino IDE version 1.8.5. The software will take control of an infinite loop for the room until it reaches a certain temperature, and the push button reaches the threshold limit.

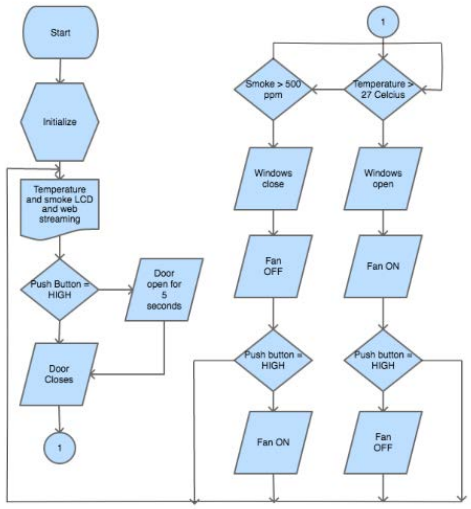

Fig. 6. Flowchart Software System

From Figure 6 above, the flowchart describes the window program, fan, and door program. This system initializes and reads the program temperature sensor and smoke sensor. This system consists of programs for doors. The door is always closed and can only be opened by pressing the door button. The door will open for 5 seconds and then close again. Temperature and smoke sensors using the OR program. If the temperature is more than 27C, 2 servos

will open the window and the fan will turn on automatically. After that, the user can turn off the fan manually by pressing the fan switch, then the program will run again for the initialization process. If the temperature is less than 27C, the program will check the smoke sensor. If the smoke sensor detects smoke, the 2 servos will open the window and the fan will activate automatically. After that, the user can turn off the fan manually by pressing the switch for the fan and the program will run again for initialization. If the smoke sensor does not detect smoke, the 2 servos will close the window and the fan will turn off automatically, after which it can turn on the fan manually by pressing the push button for the fan and the program will Return to initialize

As for the LCD and streaming parts, after initializing the sensor, the temperature will receive the ambient temperature in the raw data. nodeMCU will convert it to degrees Celsius and display it on the LCD)

III. RESULTS AND DISCUSSION

In testing windows and fans, the temperature sensor will provide data or information to the nodeMCU. The output of the nodeMCU will be sent to the L298 motor driver circuit to drive the motor that functions to activate the fan. The input voltage supplied to the nodeMCU and

the motor driver circuit is 12-volt dc.

Figures 7 and 8 below show the output of the program. It shows the temperature in Celsius, Kelvin, and Fahrenheit. When the temperature is above 27C the servo will move 90 degrees from the starting angle. On the other hand, when the temperature is less than 27 C, the servo will return to the initial angle

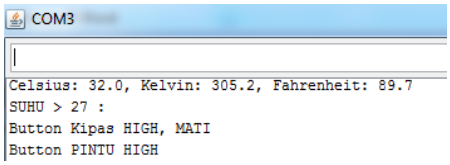

Fig. 7. Flowchart Software System

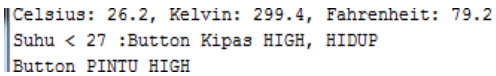

Fig. 8. Flowchart Software System

A. Temp and Gas Sensor System

The sensor will provide data or information to nodeMCU. NodeMCU will read the input as raw data. This means the temperature output is not listed as such as Celsius, Kelvin, or Fahrenheit. However, the raw data can be translated into units in the nodeMCU program

TABLE I
RESULT OF SMOKE SENSOR AND TEMP SENSOR

Temp	Smoke Sensor	Windows Servo	Fan
> 27 C	Detect	Open	Active
> 27 C	Not Detect	Open	Active
< 27 C	Detect	Open	Active
< 27 C	Not Detect	Close	Not Active

B. Webpage display

In the web section, the results displayed are the date and time, and as soon as they are detected

Tanggal	Jam	Servo Jendela	Asap	Kipas
11-8-2018	14:00:02	OPEN	600 ppm	ON
11-8-2018	20:14:05	OPEN	400 ppm	ON
12-8-2018	08:13:30	OPEN	600 ppm	ON
12-8-2018	08:17:40	CLOSE	400 ppm	OFF

Fig. 9. Data Display from Web Server

IV. CONCLUSION

Based on the device design and experiments conducted, it can be concluded when the temperature sensor reaches a temperature of more than 27 C, the servo and fan will operate automatically according to the program. However, the fan can still be operated manually by the user. The air quality sensor can work well according to the predetermined setting point. The controller can send data to the web server in real-time without experiencing problems or error.

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