

**MINI PROJECT PRACTICUM REPORT
AUTOMATIC CONTROL SYSTEM
(19G04132501)**

**AQID MUKHTAR
G041201009**



**AUTOMATIC CONTROL SYSTEM LABORATORY
AGRICULTURAL ENGINEERING STUDY PROGRAM
DEPARTMENT OF AGRICULTURAL TECHNOLOGY
FACULTY OF AGRICULTURE
HASANUDDIN UNIVERSITY
MAKASSAR**



FUZZY LOGIC CONTROL SYSTEM

Aqid Mukhtar¹⁾, Andi Refi Mustaqim²⁾ and Muh. Putra Ansyari Naim²⁾

¹⁾Practicum practicum of Automatic Control Systems Agricultural Engineering Study Program,
Hasanuddin University

²⁾ Assistant Practicum for Automatic Control Systems, Agricultural Engineering Study Program,
Hasanuddin University

ABSTRACT

The agricultural sector faces various complex problems, such as controlling pests and plant diseases, efficient management of water and soil and increasing agricultural productivity. One solution to overcome this problem is to use a *fuzzy logic* based control system. The purpose of doing the *Fuzzy Logic Control System* practicum is to be able to understand the basic concepts of the *Fuzzy Logic system* and know how to make programs using the MatLab application on a circuit. The usefulness of doing the *Fuzzy Logic Control System* practicum is to be able to apply the *Fuzzy Logic* control system in the agricultural sector. The method used in this practicum is to assemble a circuit that uses an *expert system*. The results obtained are to more easily understand the concept of *fuzzy logic* by using the MatLab *software which consists of several stages, namely fuzzification, fuzzy inference system and defuzzification*. The conclusion obtained is that fuzzy logic can be used to assist in making decisions from uncertainty, especially in the agricultural sector which can assist in controlling a system.

Keywords: *Feedback, Fuzzy, Sugeno.*

INTRODUCTION

Background

One of the problems in agriculture is increasing productivity and production efficiency. In addition, the agricultural sector faces various complex problems, such as controlling pests and plant diseases, efficient management of water and soil and increasing agricultural productivity. One solution to overcome this problem is to use a control system based on *fuzzy logic*. *Fuzzy Logic* based control systems allow us to integrate uncertain information, such as weather data, soil quality, humidity and other environmental factors, in decision making. Taking into account various factors based on *Fuzzy Logic* can optimize the use of resources and increase agricultural productivity.

Fuzzy logic is an appropriate way to map an *input space* in an *output space*. In *fuzzy logic*, there are three methods, namely, the Tsukamoto method, the Mamdani method and the Sugeno method. The determination of the *inference* model must be exactly according to the data to be processed because the treatment of each method is a *fuzzy* different *inference* system and has characteristics of membership function and *fuzzy set*. In developing a *fuzzy logic* algorithm, the decision-making main frame consists of *input*, process and *output* (Alimuddin, A. 2020).

Fuzzy control is very simple and consists of *input*, management and output. At the input stage, the sensor data is mapped to the membership function of the truth values. The management stage involves each correct rule and each rule generates results, then the results of the rules are combined. Finally, the *output stage* converts the combined results into *output control values*. *Fuzzy system* variables include *input* and *output variables*. The



input variables are obtained from the process being controlled and the input variables are determined by the fuzzy logic control . In a closed loop FLC system, the input variable E consists of an error (e) and an error derivative (de), while the output variable is the control signal (u) (Sinadia, B, S. 2018).

fuzzy inference system is a fuzzy inference method for rules represented in the IF-THEN form, where the output or consequence of the system is not in the form of fuzzy sets , but in the form of constants or linear equations. This method was introduced by Takagi-Sugeno Kang in 1985. The reasoning with the Sugeno method is almost the same as Mamdani's reasoning, it's just that the output or consequences of the system are not in the form of fuzzy sets , but in the form of constants or linear equations (Setiawan, 2018).

An important part of fuzzy rule-based This system uses IF-THEN rules, which contain antecedents and consequents for changing fuzzy statements. A fuzzy rule-based system will be adjusted by the knowledge base, including providing information by experts in the form of fuzzy language rules. Fuzzification of the interface will give the effect of transforming certain data into fuzzy sets. While inferences the system will be used together with the knowledge base to make inferences in the middle with the method of consideration or causation. Then defuzzification the interface will translate fuzzy rules and get real action using the defuzzification method (Setiawan, 2018).

Pulse width modulation, abbreviated as PWM, is a technique for producing an analog signal in the form of pulses using a digital process. PWM is also known as pulse duration modulation because the resulting signal is in the form of a pulse which can be adjusted for the width and narrowness of the signal by manipulating the signal duration. PMW is a mechanism to generate an output signal whose period repeats between high and low , where we can control the duration of the high and low signal as desired. Pulse width modulation (PWM) controls the specifics of the analog quantity by varying the pulse width with a fixed frequency rectangular wave (Fernando et al., 2021).

One of the components in making a control system is the sensor. Sensors are components that play a very important role in a system such as an expert system because they can detect a change automatically. The sensor acts as a signal or parameter detector in a condition. The sensor detect changes in the environment by converting electrical quantities into physical, chemical, mechanical quantities and so on into information. The reading value from the sensor is used as a feedback value that determines an automation system changing conditions to match the setpoint (Mariadi et al., 2016).

Software proteus and fritzing have differences. The difference between the two softwares that is software proteus is used to simulate circuits that are made in real terms so that by testing them in the software, we can find out whether the circuits that are made are successful or fail so as to reduce the risk of damage to the components in the circuit, while fritzing is only used to design or sketch a circuit, cannot be used to simulate the circuit that is created. Fritzing helps in making electronic designs which are often used to design in terms of concept drawings only while proteus is used for virtualization of electronic circuits that will be implemented in PCB form (Firdaus & Al Fansah, 2020) .

Based on the description in above , then a Fuzzy Logic Control System practicum is carried out to understand the basic concepts of the Fuzzy Logic system and know how to make programs using the MatLab application on a circuit.



Purpose and benefit

Fuzzy Logic Control System practicum is to be able to understand the basic concepts of the *Fuzzy Logic system* and know how to make programs using the MatLab application on a circuit.

Fuzzy Logic Control System practicum is to be able to apply the *Fuzzy Logic* control system in the agricultural sector.

PRACTICUM METHODOLOGY

Time and place

Practice The *Fuzzy Logic* Control System was carried out on Monday, 03 April 2023 at 12.30 WITA until it was finished at the Soil and Water Engineering Laboratory, Agricultural Engineering Study Program, Department of Agricultural Technology, Faculty of Agriculture, Hasanuddin University, Makassar.

Tool

The tools used in the *Fuzzy Logic Control System practicum* are Arduino Uno, DHT21 sensor, LCD (*Liquid Crystal Display*), SSR (*Solid State Relay*), *breadboard* , jumper cables, USB cables, laptops, stationery and *cellphone cameras* .

Material

The materials used in the *Fuzzy Logic* Control System practicum are Arduino IDE, Proteus and *Matlab software* .

Practicum Procedure

Control System practicum procedure *Experts* are as follows:

1. Prepare tools and materials.
2. Doing *fuzzy set simulation* in Matlab.
3. Assemble the tool according to the *data sheet* .
4. Create a *Fuzzy Logic control system program language* using the Arduino IDE *software* .
5. Conduct trials on a circuit connected to a lamp with a *fuzzy logic control system*.
6. Documenting practicum activities .

RESULTS AND DISCUSSION

Results

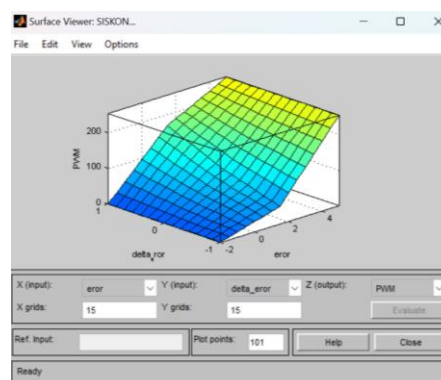


Figure 1 3. *Surface* from Matlab Simulation.

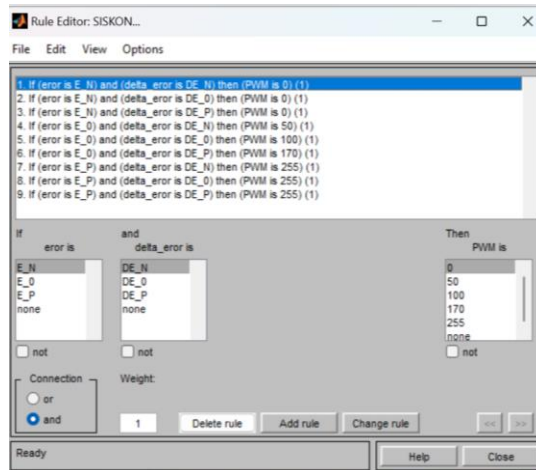


Figure 14. *Ruler* from Matlab Simulation.

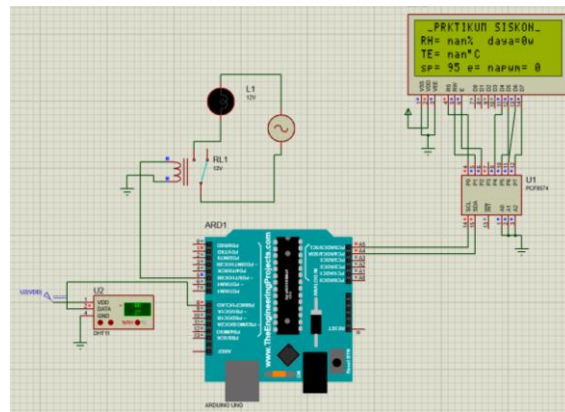


Figure 1 5 . Proteus Simulation Results .

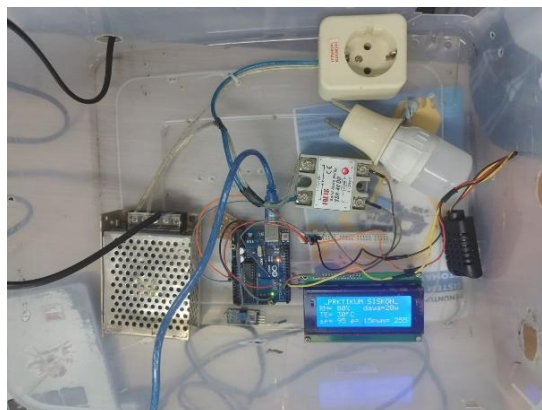


Figure 1 6 . Results of the *Fuzzy* Control System Circuit .

Discussion

Fuzzy Logic Control System practicum that has been carried out, it can be seen in Figure 14 that the display *surface* is used to visualize data in three dimensional 3D. *Surface* plot displays data in the form of a surface formed by a collection of data points in three-dimensional coordinates. The x and y axes are two-dimensional views on the image plane where the x-axis is the *error value* and the y-axis is the *delta error value* , while the z-



axis is represented by the height which is the PWM value. The *surface display* can be used to see how the relationship between the x, y and z values of *the rules* is made based on *fuzzy logic* or *fuzzy logic*. This is in accordance with the statement of Alimuddin, A. (2020), which states that *fuzzy logic* is an appropriate way to map an *input space* in an *output space*.

Based on Figure 15, it can be seen that the process of making the rules of the control system is made. This stage is *fuzzy inference system* where the rules that are made determine *the output* of the control system that is made later. this stage is a system that is used to make decisions based on rules that are *fuzzy* or *uncertain*. *Fuzzy inference the system uses fuzzy logic* to process information from *the input* given and produces *output* that is also *fuzzy*. This process will determine the shape of *the surface* that is created and the PWM value that will come out later using the Sugeno method. The PWM output from the Sugeno method is in the form of constants or linear equations. This is in accordance with the statement of Setiawan (2018) which states that the *fuzzy inference system* of the Takagi-Sugeno-Kang method is a *fuzzy inference method* for rules represented in the form of IF-THEN, where *the output* or consequence of the system is not a *fuzzy set*, but is in the form of constants or linear equations.

Based on Figure 17, it can be seen that the circuit uses the Arduino Uno microcontroller which has been *input in the fuzzy logic* program language. This circuit uses a DHT 21 sensor that measures temperature in the range -40 to 80 °C and humidity in the range 0% to 99.9%. Using a pump as a load to be driven by the SSR. The use of *fuzzy logic* is used to make decisions in the form of PWM outputs with a range of 0 to 255 according to the rules made in the *defuzzification process*. This is in accordance with the statement of Setiawan (2018), which states that then *defuzzification the interface* will translate the *fuzzy rules* and get real action using the *defuzzification method*.

CONCLUSION

Based on the practicum that has been done, it can be concluded that the *fuzzy system* consists of 3 stages, namely *fuzzification*, *fuzzy inference system* and *defuzzification*. Several methods that can be used in *fuzzy logic* are mamdani, sugeno and Tsukamoto. In this practicum fuzzy logic is used in making decisions on 2 inputs, namely temperature and humidity to determine 1 output, namely the pump by controlling the PWM value. *Fuzzy logic* can help in the field of control, especially in agriculture to control the system automatically.

BIBLIOGRAPHY

- Alimuddin, A. 2020. *Theory and Basic Applications of Intelligent Control Systems*. Untirta Press: Attack.
- Fernando, AJ, Amaratunga, KSP, Dharmasena, DAN, Abeyrathna, RMRD, Gajasinghe, IL, Weerakoon, HST, ... & Bandara, DMSP 2021. Pulse-Width-Modulation Control of a Heat Pump Dryer with Cascade Evaporators and Parallel- Flow Condensers. *Tropical Agricultural Research*, Vol. 33(1): 1-17.
- Firdaus, DS, & Al Fansah, Y. 2020. Design of Making Door Guards Using Arduino and Keypad. *Journal of Management Informatics & Accounting Computerization*



Agricultural Engineering Study Program

Department of Agricultural Technology

Faculty of Agriculture

Hasanuddin University *Practical Report on Automatic Control Systems*

/, Vol. 4(1), 32–36.

Mariadi, S., Iqbal, I., & Sapsal, MT 2016. Development of Water Level Telemetry on the Ta'Deang River, Kab. Maros. *Journal of Agritechno*, Vol. 9(2) : 134-141.

Setiawan, A., Yanto, B., & Yasdomi, K. 2018. *Fuzzy Logic with Matlab (Example of Cases of Infant Disease Research with Fuzzy Tsukamoto)*. *Jayapangus Press Books* : Bali.

Sinadia, B, S. 2018. Design of a *Fuzzy - Expert Control System on a Solar Hybrid Powered Food Dryer and LPG*. *Thesis* . Hasanuddin University: Makassar.



ATTACHMENT

Fuzzy Logic Control System

```
//----- -- FOR LCD -----  
----- //  
#include <Wire. h>  
#include <LiquidCrystal_I2C. h>  
LiquidCrystal_I2C lcd(0x27,20,4);  
//----- -- FOR DHT 11 -----  
----- -//  
#include "DHT.h"  
#define DHTPIN8 8  
#define DHTTYPE DHT21  
DHT dht6(DHTPIN8, DHTTYPE);  
float h1;  
float t1;  
//----- -- FOR fuzzy logic -----  
----- -//  
float e;  
float de;  
float e_1;  
int PWM980=5; // PWM pin for control at pin 5 frekuensi 850hz  
int fan=2; // pins for fans  
float sp = 95 ; // set point RH 95%  
float en,ez,ep; // negative error, zero error, positive error  
float den,dez,dep; // negative error delta, zero error delta, positive error delta  
float p1,p2,p3,p4,p5,p6,p7,p8,p9;  
float dPow,nPow;  
float power,watts;  
//----- FUZZY FOR RH CONTROL-----  
-----//  
void config()  
{ e = sp-h1; // error= setpoint-rata_rata_rh  
de = e-e_1;  
e_1= e;  
//----- - INTERVAL ERROR -2 TO +5-----  
-----//  
if (e <= -3) // big negative error  
{ en = -2;  
ez = 0;  
ep = 0; }  
  
else if (e > -5 && e < 0) // small negative error  
{ en = (0 - e)/(0 + 5);  
ez = (e + 5)/(0 + 5);  
ep = 0; }  
else if (e > -2 && e < 5) // small positive error
```




```
{ en = -2;
ez = (5 - e)/(5 - 0);
ep = (e - 0)/(5 - 0);}
else if (e >= 5) // big positive error
{ en = -2;
ez = 0;
eps = 5; }
//----- -INTERVAL DELTA ERROR -1 +1-----
//-----//

if (de <= -1)
{ den = 1; // big negative error
dez = 0;
dep = 0; }

else if (de > -1 && de < 0)
{ den = (0 - de)/(0 + 1); // small negative error delta
dez = (de + 1)/(0 + 1);
dep = 0; }

else if (de > 0 && de < 1)
{ den = 0; // small positive error delta
dez = (1 - de)/(1 - 0 );
dep = (de - 0)/(1 - 0); }

else if (de >= 1)
{ den = 0; // large positive error delta +5
dez = 0;
depth = 1; }

//-----3 inputs 3 outputs so a 3*3 matrix equals 9 rules-----
//-----//

//Rule 1 // positive error (ep) and positive delta error (den)
if (ep <= dep){p1 = ep;} // find membership degree
else {p1 = depth;}

//Rule 2 // positive error (ep) and delta error zero (dez)
if (ep <= dez){p2 = ep;}
else {p2 = dez;}

//Rule 3 // positive error (ep) and negative delta error (den)
if (ep <= den){p3 = ep;}
else {p3 = den;}

//Rule 4 // zero error (ez) and negative delta error (den)
if (ez <= dep){p4 = ez;}
else {p4 = deep;}
```



```
//Rule 5 // zero error (ez) and positive delta error (dep)
```

```
if (ez <= dez){p5 = ez;}  
else {p5 = dez;}
```

```
//Rule 6 // error zero (ez) and delta error zero (dez)
```

```
if (ez <= den) {p6 = ez;}  
else {p6 = den;}
```

```
//Rule 7 // negative error (en) and positive delta error (dep)
```

```
if (en <= dep){p7 = en;}  
else {p7 = deep;}
```

```
//Rule 8 // negative error (en) and delta error zero (dez)
```

```
if (en <= dez){p8 = en;}  
else {p8 = dez;}
```

```
//Rule 9 // negative error (en) and negative delta error (den)
```

```
if (en <= den){p9 = en;}  
else {p9 = den;}
```

```
//-----DEFUZZIFICATION-----  
-----//
```

```
{  
dPow = (p1+p2+p3+p4+p5+p6+p7+p8+p9);  
nPow = ((p1*255)+(p2*255)+(p3*255)+(p4*170)+(p5*90)+(p6*40)+(p7*0)+(p8*0)  
+(p9*0));  
if (dPow== 0){ power = 0;}  
else { power = nPow /dPow;}  
}  
}  
void setup() {  
Serial. begin(9600);  
lcd. init(); // initialize the lcd  
lcd. backlight();  
lcd. begin(20,4);  
dht6. begin();  
pinMode(PWM980, OUTPUT ); // pin 5 is used as control output  
}  
void loop(){  
h1 = dht6. readHumidity(); // read rh sensor 1  
t1 = dht6. readTemperature(); // read temperature sensor 1  
config(); // call the confuz function for fuzzy logic  
watts = (20*power)/255; // power formula = load power * PWM used/255  
analogWrite(PWM980,power);  
lcd. setCursor(1,0);  
lcd. print("_SISKON PRKTIKUM_");  
lcd. setCursor(0,1);
```



```
lcd. print("RH");
lcd. setCursor(2,1);
lcd. print("=" );
lcd. setCursor(4,1);
lcd. print(h1,0);
lcd. print("% ");
lcd. print(" ");
lcd. setCursor(9,1);
lcd. print(" power ");
lcd. setCursor(14,1);
lcd. print("=" );
lcd. setCursor(15,1);
lcd. print(watt,0);
lcd. print("w");
lcd. print(" ");
lcd. setCursor(0,3);
lcd. print("sp= ");
lcd. print(sp,0);
lcd. print(" ");
lcd. setCursor(7,3);
lcd. print("e = ");
lcd. print(e,0);
lcd. print(" ");
lcd. setCursor(12,3);
lcd. print("PWM = ");
lcd. print(power,0);
lcd. print(" ");

lcd. setCursor(0,2);
lcd. print("TE ");
lcd. setCursor(2,2);
lcd. print("=" );
lcd. setCursor(4,2);
lcd. print(t1 ,0);
lcd. write((char)223);
lcd. print("C");
lcd. print(" ");
delay(1000);
}
```



Appendix 8. Documentation of *Fuzzy Logic* Control System Practicum



Figure 17. Documentation of Fuzzy Logic Control System Practicum .



MONITORING VIA WEB

Aqid Mukhtar¹⁾, Andi Refi Mustaqim²⁾ and Muh. Putra Ansyari Naim²⁾

¹⁾Practicum practicum of Automatic Control Systems Agricultural Engineering Study Program,
Hasanuddin University

²⁾Assistant Practicum for Automatic Control Systems, Agricultural Engineering Study Program,
Hasanuddin University

ABSTRACT

The application of IoT technology in agriculture can be a solution to overcome problems such as monitoring and supervising plants continuously so that the plants will still be monitored even though the farmers are not on the land. The purpose of doing *Monitoring via the Web* practicum is to be able to understand the basic concepts of web servers and know how to monitor temperatures that occur through *ThingSpeak web access*. The usefulness of conducting a *Monitoring* practicum via the Web is being able to access *ThingSpeak* using the correct method so that it can be applied in the agricultural sector as well as in everyday life. The results obtained are NodeMCU ESP8266 can send temperature and humidity data from DHT11 to *ThingSpeak* which is displayed in the form of graphs and *gauges* that are *updated* every 15 seconds where the data obtained can also be transferred to *excel* for processing according to user needs. The conclusion obtained is that monitoring requires several components such as hardware such as Arduino, ESP, and other devices, also requires *software* such as *Thingspeak*. and other IoT *platforms* that are interconnected via wireless networks such as Wi-Fi.

Keywords: NodeMCU , *Realtime*, *ThingSpeak*

INTRODUCTION

Background

One of the problems in agriculture is that it is often difficult for farmers to manage their farms, especially in terms of continuously monitoring and supervising crops. When farmers cannot supervise and monitor their crops continuously, crop growing conditions can change rapidly and can result in huge losses, such as reduced crop yields and even crop failure. Therefore, the application of IoT technology in agriculture can be a solution to overcome these problems. By using sensors installed on plants or around agricultural land, data can be collected in *real-time* and sent to a control center via the internet network.

The internet of things is a development that makes it possible to link machines, equipment and other items with organized sensors to obtain information and handle their own presentations, in this way empowering machines to cooperate with and even act on newly acquired data independently. A distribution explains that in 2020 *the Internet of things* is a state when things have character, can work wisely, and can speak socially, nature, and clients. As a result, we can assume that the internet allows us to make associations between the internet and machines, so that these machines can connect and work freely according to the information they get and handle independently, the goal is to make it easier for humans to interact with objects, even though these objects can also communicate. with other objects (Hanif, A, 2022).

NodeMCU is a *single-board microcontroller* that has a Wi-Fi feature, making it useful in making IoT *platform products*. NodeMCU consists of hardware in the form of



a System on Chip ESP8266 made by Espressif System and also uses the LUA scripting programming language *firmware*. ESP8266 has on-board processing and storage capabilities that allow the chip to be integrated with sensors or with certain device applications via input output pins with only short programming. NodeMCU has embedded the ESP8266 into a compact board with various features such as a microcontroller with access to WiFi as well as a USB to serial communication chip. So that the programmer only needs a USB data cable extension similar to that used as a data cable and Android smartphone charging cable (Sanusi, A. F, 2018).

ThingSpeak is an IoT platform that enables us to collect, store, analyze, visualize, and act on data from sensors or actuators, such as Arduino, Raspberry Pi, Black BeagleBone, and other hardware devices. For example, with *ThingSpeak* we can create sensor-logging applications, location-tracking applications. *ThingSpeak* serves as a data aggregator that collects data from device nodes and also allows data to be loaded into the software environment for historical data analysis. The main element of the *ThingSpeak* activity is the channel, which contains a data field, a location field, and a status field. After we create a *ThingSpeak* channel, we can write data to the channel, process and view data with codes, and react to data with tweets and other alerts (Krisnadi, 2019).

One of the components in making a control system is the sensor. Sensors are components that play a very important role in an automated system because they can detect a change automatically. The sensor acts as a signal or parameter detector in a condition. The reading value from the sensor is used as a setpoint that determines an automation system to change its condition to *on/off*. The sensor functions to detect changes that occur in the environment by converting electrical quantities into physical, chemical, mechanical quantities and so on to produce information (Mariadi et al., 2016).

Based on the description in above, then a *Monitoring* practicum is carried out via the Web to be able to understand the basic concept of a web server and know how to monitor temperatures that occur through *ThingSpeak* web access.

Purpose and benefit

Monitoring via the Web practicum is to be able to understand the basic concept of web servers and know how to monitor temperatures that occur through *ThingSpeak* web access.

The usefulness of conducting a *Monitoring* practicum via the Web is being able to access *ThingSpeak* using the correct method so that it can be applied in the agricultural sector as well as in everyday life.

PRACTICUM METHODOLOGY

Time and place

Monitoring practicum via the Web will be held on Wednesday, May 3 2022, 15.30 WITA until finished, at the Soil and Water Engineering Laboratory, Agricultural Engineering Study Program, Department of Agricultural Technology, Faculty of Agriculture, Hasanuddin University, Makassar.

Tool

The tools used in the *Monitoring* practicum via the Web are IoT kit modules, connector cables, DHT11, USB cables, NodeMCU ESP8266, laptops, stationery and *cellphone* cameras.



Material

Materials used in the practicum *Monitoring* via the Web, namely Arduino IDE *software* and a *ThingSpeak* account .

Practicum Procedure

Monitoring practicum procedures via the Web are as follows:

1. Open the *ThingSpeak* website
2. Create a new *channel*
3. Create an account on the *ThingSpeak* web
4. Fill in the name column on the account
5. Define *fields* based on the amount of data
6. Fill in the *fields* according to the data
7. Save the created *channel*
8. Open the *ThingSpeak* program in the *software* arduino
9. Programming
10. Uploading the program on the *software* arduino

RESULTS AND DISCUSSION

Results

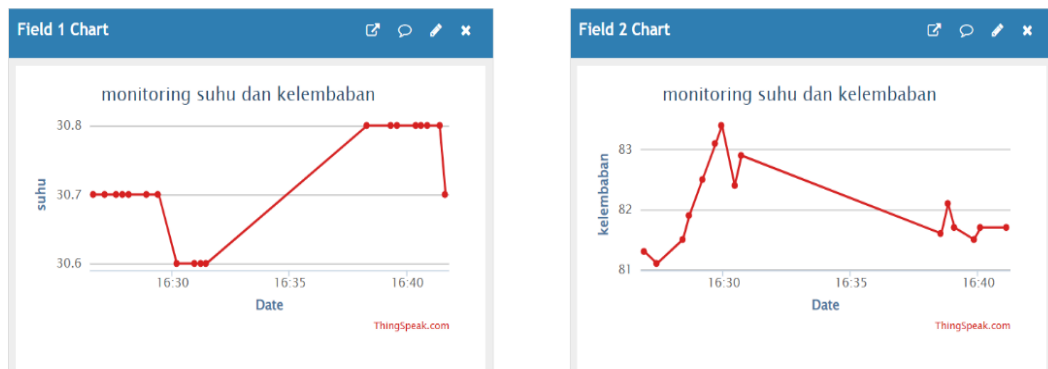


Figure 18. Graph of DHT11 Sensor Reading Results.

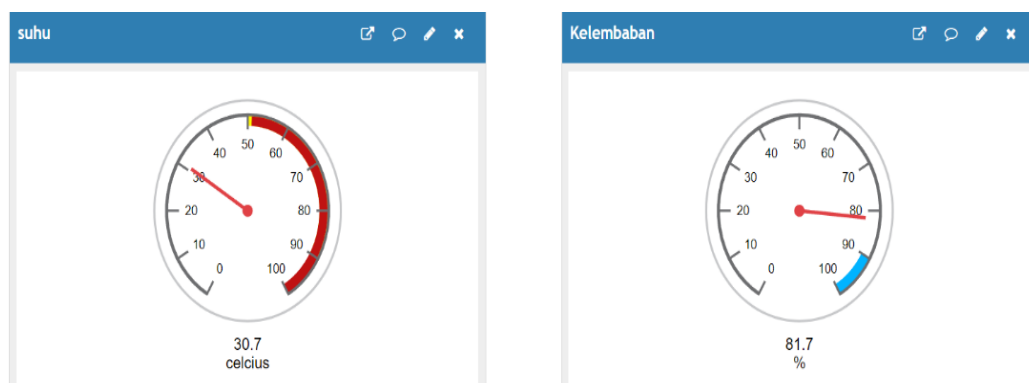


Figure 19. DHT11 Sensor Reading Gauge .

Discussion

Monitoring practicum via the Web, it was found that in carrying out a *monitoring* requires interconnected components starting from hardware, network and software . In this lab the hardware used is NodeMCU ESP8266 with DHT11 which is connected to *ThingSpeak*



via a Wi-Fi network. NodeMCU ESP8266 is a piece of hardware that can receive a WIFI network from a device so that it can connect a device to another. Similar to Arduino uno, NodeMCU ESP8266 is also a microcontroller that can receive, process and send data to a device. However, the advantage of the NodeMCU ESP8266 is that it is equipped with Wi-Fi to be able to transmit data wirelessly, namely by Wi-Fi. This is in accordance with the statement of Sanusi, A.F, (2018), which states that NodeMCU has embedded the ESP8266 into a compact board with various features like a microcontroller with the ability to access WiFi as well as a USB to USB communication chip . *serial* .

The software or *platform* used in this practicum is *ThingSpeak* which is used to receive and collect data from the NodeMCU ESP8266 to be displayed visually and also connected to MATLAB so that data processing can be carried out from the received data such as data obtained from the DHT11 sensor in the image above . in the picture above is one of the features of *ThingSpeak* to be able to display the results of measurement data from sensors which can be displayed using a graph to see changes in temperature and humidity that occur and a *gauge* to see the temperature and temperature at that time. Making it easier for users to *monitor* or monitor. This is in accordance with Krisnadi's statement (2019), which states that *ThingSpeak* is an IoT *platform* that allows us to collect, store, analyze, visualize, and act on data from sensors or actuators, such as Arduino, Raspberry Pi, Black BeagleBone, and other hardware devices. other.

CONCLUSION

Based on the practicum that has been done, it can be concluded that monitoring requires several components such as hardware such as Arduino, ESP, and other devices, also requires *software* such as *Thingspeak*. and other IoT *platforms* that are interconnected via wireless networks such as Wi-Fi. The advantages of thingspeak over other *platforms* are that it can store, analyze, visualize and connect with MATLAB so that data processing can be done and this *platform is free or does not require a fee to be able to use it*.

BIBLIOGRAPHY

- Based Electrical Installation Control and *Monitoring System of things* . *Thesis* . UIN Ar-Raniry : Banda Aceh.
- Krisnadi . 2019. Design and manufacture of attendance systems at Panca Budi Nacutongan Private Middle School Uses Rfid And Internet Of Thing (Iot) *ThingSpeak* Connected To ESP8266. *Thesis* . Post-Buddhist Development University: Medan.
- Mariadi, S., Iqbal, I., & Sapsal, MT 2016. Development of Water Level Telemetry on the Ta'Deang River, Kab. Mars . *Journal of Agritechno* , Vol. 9(2), 134-141.
- Sanusi, AF 2018. Prototype of a remote river water level monitoring system based on IoT (*Internet of things*) with NodeMCU . *Thesis* . Maulana Malik Ibrahim State Islamic University: Malang.



ATTACHMENT

Appendix 9. Web Monitoring Program Language

```
#include < DHT. h >
#include <ESP8266WiFi. h>
#include < WiFiClient. h >;
#include < ThingSpeak .h >;
String apiKey = "L1X8N96LWYGUJWJI";
const char * ssid = "POCO M4 Pro";
const char *pass = "12341234";
const char *server = "api.ThingSpeak .com ";
#define DHTPIN D2
DHT dht ( DHTPIN, DHT21);
WiFiClient client;
unsigned long myChannelNumber = 2097298;
const char * myWriteAPIKey = "L1X8N96LWYGUJWJI";
void setup( ) {
  Serial. begin (9600);
  delay( 10);
  dht. begin ();
  Serial. println ("Connecting...");
  Serial. println ( ssid );
  WiFi. begin ( ssid , pass);
  ThingSpeak .begin (client);}
void loop( ) {
  float h = dht. readHumidity ();
  float t = dht. readTemperature ();
  if ( isnan (h) || isnan (t)) {
    Serial.println ("Sensor Could Not Detect");
    return;}
  ThingSpeak .writeField ( myChannelNumber , 1, t, myWriteAPIKey );
  ThingSpeak .writeField ( myChannelNumber , 2, h, myWriteAPIKey );
  delay( 100);
  // ThingSpeak .read ();}
```

Appendix 10. Documentation of Monitoring Practicum via the Web



Figure 20. Documentation of *Monitoring Practicum* via the Web.



CONTROL USING *BLYNK* AND *BLUETOOTH*

Aqid Mukhtar¹⁾, Andi Refi Mustaqim²⁾ and Muh. Putra Ansyari Naim²⁾

¹⁾ Practicum practicum of Automatic Control Systems Agricultural Engineering Study Program,
Hasanuddin University

²⁾ Assistant Practicum for Automatic Control Systems, Agricultural Engineering Study Program,
Hasanuddin University

ABSTRACT

The application of IoT technology in agriculture can be a solution to overcome problems such as monitoring plants and controlling devices continuously so that the plants will still be monitored even though the farmers are not on the land. The purpose of doing the Control Using *Blynk* and *Bluetooth practicum* is to be able to understand the basic concepts of *Blynk* and *Bluetooth*, be able to know how to assemble on Arduino and be able to control lights using the *Blynk application*. The usefulness of doing Control Using *Blynk* and *Bluetooth* practicum is being able to access and use *Blynk* and *Bluetooth* in a control system and can apply them in agriculture and everyday life. The results obtained are *Blynk* can be used to control a device such as a DC motor via a Wi-Fi network, besides that *Bluetooth* can also be used to control using the HC-05 *Bluetooth module*. The conclusion is that monitoring, and control can be done with wireless networks such as *Bluetooth* and Wi-Fi which can be used according to control needs. Where each monitoring or control requires several components such as hardware such as Arduino and requires software such as *Blynk* and other IoT *platforms* that are connected to each other via wireless networks such as *Bluetooth* and Wi-Fi. Apart from using Wi-Fi, *Bluetooth* can also be used to control a device using the HC-05 *Bluetooth module* with the Arduino *Bluetooth controller platform*.

Keywords: *Bluetooth, Blynk, NodeMCU*

INTRODUCTION

Background

One of the problems in agriculture is that it is often difficult for farmers to manage their farms, especially in terms of continuously monitoring and supervising crops. When farmers cannot supervise and monitor their crops continuously, crop growing conditions can change rapidly and can result in huge losses, such as reduced crop yields and even crop failure. Therefore, the application of IoT technology in agriculture can be a solution to overcome these problems. With this technology, it is possible to control an agricultural device such as a pump or motor through software.

The Internet of Things is a development that makes it possible to connect machines, equipment, and other items with organized sensors to acquire information and handle their own presentations, in this way empowering machines to cooperate with and even act on newly acquired data independently. A distribution explains that in 2020 *the Internet of Things* is a state where things have character, can work wisely, and can speak socially, nature, and clients. As a result, we can assume that the internet allows us to make associations between the internet and machines, so that these machines can connect and work freely according to the information they get and handle independently, the goal is to make it easier for humans to interact with objects, even though these objects can also communicate with other objects (Hanif, A, 2022).



NodeMCU is a *single-board microcontroller* that has a Wi-Fi feature, making it useful in making IoT *platform products*. NodeMCU consists of hardware in the form of a System on Chip ESP8266 made by Espressif System and also uses the LUA scripting programming language *firmware*. ESP8266 has *on-board processing* and *storage* capabilities that allow the chip to be integrated with sensors or with certain device applications via input output pins with only short programming. NodeMCU has embedded the ESP8266 into a compact board with various features such as a microcontroller with access to WiFi as well as a USB to serial communication chip. So that the programmer only needs a USB data cable extension similar to that used as a data cable and Android smartphone charging cable (Sanusi, A. F, 2018).

Blynk is a free downloadable application *platform for iOS and Android that lets you control Arduino, Raspberry Pi and the like over the Internet*. Blynk was designed for the Internet of Things with the goal of being able to remotely control hardware, be able to display sensor data, be able to store data, visualize and do many other advanced things. There are three main components in the platform, namely Blynk App, Blynk Server, and Blynk Libraries. Blynk is a digital dashboard where you can create a graphical interface for projects with just drag and drop widgets, it's very easy to set up everything and you can start working in less than 5 minutes (Yusuf, M. R, 2019).

Bluetooth is a standard two-way communication technology that is used to exchange data between several devices by utilizing UHF radio waves with a rate of 1 Mbps. Bluetooth is a communication technology that operates in the 2.4 GHz radio frequency band. This device can operate in two modes namely master or slave. The master is the first device to provide synchronization, and the others are considered receivers only (slaves). There are two types of Bluetooth modules, namely odd and even. The Bluetooth module with odd series (HC-05 or HC-03) is an improved version of the even series (HC-06 or HC-04). The HC-05 module can be set as a master or slave, while the HC-06 can only be used as a slave (Supriyadi, 2019).

One of the components in making a control system is the sensor. Sensors are components that play a very important role in an automated system because they can detect a change automatically. The sensor acts as a signal or parameter detector in a condition. The reading value from the sensor is used as a setpoint that determines an automation system to change its condition to *on/off*. The sensor functions to detect changes that occur in the environment by converting electrical quantities into physical, chemical, mechanical quantities and so on to produce information (Mariadi et al., 2016).

Based on the description in above, a Control practicum is carried out via the Web to be able to understand the basic concepts of Blynk and Bluetooth, be able to know how to assemble on Arduino and be able to control lights using the Blynk application.

Purpose and benefit

The purpose of doing the Control Using Blynk and Bluetooth practicum is to be able to understand the basic concepts of Blynk and Bluetooth, be able to know how to assemble on Arduino and be able to control lights using the Blynk application.

Blynk and Bluetooth practicum is being able to access and use Blynk and Bluetooth in a control system and can apply them in agriculture and everyday life.



PRACTICUM METHODOLOGY

Time and place

Control Practicum Using *Blynk* and *Bluetooth* will be held on Monday, May 8 2023, 13.00 WITA until finished, at the Soil and Water Engineering Laboratory, Agricultural Engineering Study Program, Department of Agricultural Technology, Faculty of Agriculture, Hasanuddin University, Makassar.

Tool

The tools used in the Control Using *Blynk* and *Bluetooth* practicum are the ESP8266 module, connector cables, USB cables, Arduino uno, relays, laptops, stationery and cellphone cameras.

Material

Materials used in the practicum Control Using *Blynk* and *Bluetooth* , namely the Arduino software and the *Blynk application* .

Practicum Procedure

practicum procedures using *Blynk* and *Bluetooth* namely as follows:

1. Download and install the *Blynk application* on a smartphone
2. Open the web [https:// Blynk .cloud/dashboard/login](https://Blynk.cloud/dashboard/login) and select log in then enter your email and password
3. Selecting new templates in the main view of the *Blynk web*
4. Name the project, choose the NodeMCU ESP8266 device and the wifi connection type
5. Choose new datastream then use pin D0 as a switch
6. Making the interface display by drag and drop on the web dashboard
7. Choose new devices and select the template that was created then *Blynk* will display the authentication token
8. Initiate the connection by uploading the coding to the hardware
9. Web *Blynk* can be used in accordance with the rules of the program that has been made
10. Connect to a smartphone by entering the email that was created on the *Blynk web*
11. Create an interface by dragging and dropping the *Blynk application*
12. *Blynk* can be used in accordance with the rules of the program that has been made
13. Documenting practical results

RESULTS AND DISCUSSION

Results

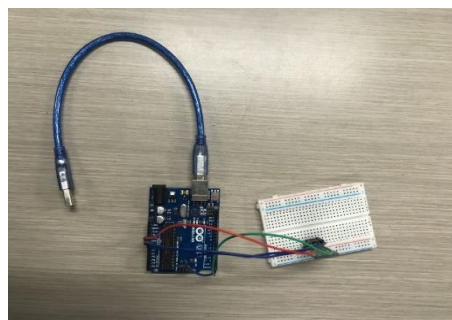


Figure 21. HC-05 *Bluetooth* Module Circuit .

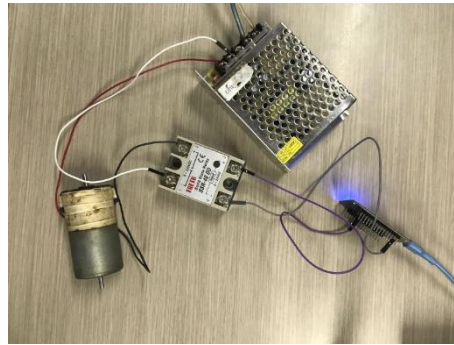


Figure 22. The ESP8266 circuit for DC motors.

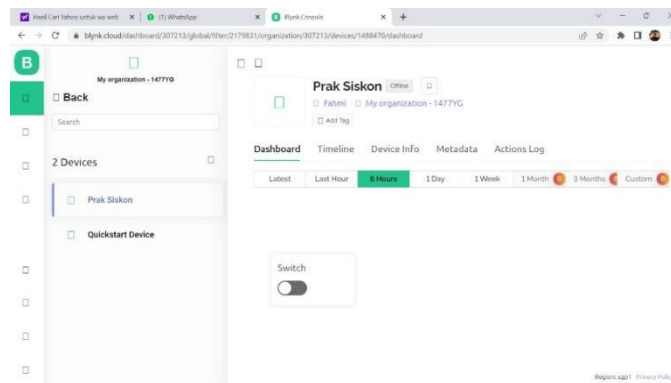


Figure 23. Platforms Blynk .

Discussion

Control practicum using *Blynk* and *Bluetooth*, it was found that monitoring requires interconnected components, starting from hardware, network, and software. In the practicum using 2 methods of carrying wirelessly, namely using Wi-Fi using the ESP8266 and *Bluetooth* using the HC-05 *Bluetooth module* which can be seen in the picture above. The HC-05 *Bluetooth module* is used as a connecting device between hardware and software via a *Bluetooth network* . As with Wi-Fi, *Bluetooth* can also connect a device with other devices, but has a limited range of distance. This is in accordance with Supriyadi's statement (2019), which states that *Bluetooth* is a standard two-way communication technology that is used to exchange data between several devices by utilizing UHF radio waves with a rate of 1 *Mbps* . GHz radio frequency.

The method uses Wi-Fi which uses the ESP8266 to receive the network so that devices can connect. The load that will be controlled through *Blynk* is a DC motor using SSR-DD as an actuator. NodeMCU ESP8266 is a piece of hardware that can receive a Wi-Fi network from a device so that it can connect one device to another. Similar to Arduino uno, NodeMCU ESP8266 is also a microcontroller that can receive, process and send data to a device. However, the advantage of the NodeMCU ESP8266 is that it is equipped with Wi-Fi to be able to transmit data wirelessly, *namely* by Wi-Fi. This is in accordance with the statement of Sanusi, A.F, (2018) , which states that NodeMCU has embedded the ESP8266 into a compact board with various features like a microcontroller with the ability to access WiFi as well as a USB to USB communication chip *serial*.



The software or *platform* used in this practicum is *Blynk* which is used to control or control devices in the form of DC motors from NodeMCU ESP8266 by displaying a *switch- shaped widget* to turn off and on DC motors which are controlled from a cellphone via the *Blynk application* . The advantage of the *Blynk application* is that it can control a device in *real-time* with a fairly fast response depending on network quality. This is in accordance with the statement of Yusuf, M. R (2019), which states that *Blynk* is a digital dashboard where you can create a graphical interface for a project by simply *dragging* and *dropping widgets*.

CONCLUSION

Based on the practicum that has been carried out, it can be concluded that monitoring requires several components such as hardware such as Arduino, ESP, and other devices, also requires software such as *Blynk* and other IoT *platforms* that are interconnected via wireless networks such as *Bluetooth* and Wi-Fi. . The advantage of *Blynk* from other *platforms* is that it can control and control a device directly. Apart from using Wi-Fi, *Bluetooth* can also be used to control a device using the HC-05 *Bluetooth module* with the Arduino *Bluetooth controller platform* .

BIBLIOGRAPHY

- Hanif, A. 2022. Design of an *Internet-Based Electrical Installation Control and Monitoring System of things*. Thesis. UIN Ar-Raniry: Banda Aceh.
- Yusuf, MR 2019. Design of Monitoring and Controlling Home Doors Using an Internet of Things-Based Microcontroller. Thesis. Semarang University. Central Java.
- Mariadi, S., Iqbal, I., & Sapsal, MT 2016. Development of Water Level Telemetry on the Ta'Deang River, Kab. Maros. Journal of Agritechno, Vol. 9(2), 134-141.
- Sanusi, AF 2018. Prototype of a remote river water level monitoring system based on IoT (*Internet of things*) with NodeMCU. Thesis. Maulana Malik Ibrahim State Islamic University: Malang.
- Supriyadi. 2019. Utilization of Android *Bluetooth as an Additional Security Controller* in a Motorcycle Security System. Thesis. Semarang State University: Semarang.



ATTACHMENT

Appendix 11. Control Program Language using *Blynk* and *Bluetooth*

```
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <Blynk SimpleEsp8266.h>
#define BLYNK_TEMPLATE_ID "TMPL6J8Yb84KJ"
#define BLYNK_DEVICE_NAME "PRAK SISKON"
#define BLYNK_AUTH_TOKEN "kQW6p788uMTUh1b1GaTsZeQP4gwiSYvB"
char auth[] = BLYNK_AUTH_TOKEN;
char ssid[] = "POCO M4 Pro";//Enter your WIFI name
char pass[] = "12341234";//Enter your WIFI password
BLYNK_WRITE(V0) {
  digitalWrite(D4, param.asInt());
}
void setup() {
  pinMode(D4, OUTPUT);
  Blynk.begin(auth, ssid, pass);
}
void loop() {
  Blynk.run();
}
```

Appendix 12. Documentation of Control Practicum using *Blynk* and *Bluetooth*



Figure 24. Documentation of Control Practicum using *Blynk* and *Bluetooth* .



Agricultural Engineering Study Program

Department of Agricultural Technology

Faculty of Agriculture

Hasanuddin University *Practical Report on Automatic Control Systems*