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Design Of Fertigation System Control In Green House Based On Internet Of Thing (Iot)

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Abstract - Green house must be able to control the environment with temperature and humidity parameters that are suitable for plant growth. However, manual watering must always be done at any time, which is time-consuming for farmers. Greenhouses with modern technology create automatic controls such as plant sprinklers. Thus, the time spent on watering plants is less than the manual system. In addition, farmers can save water which has been wasted all this time because they do not know the condition of water requirements for plants. An automatic plant watering system with a DHT 22 sensor is used to control the greenhouse environment. With the development of the internet almost all over the world, giving changes to daily human activities. Internet of Things (IoT) technology allows objects to connect and communicate with each other. In this fertigation control device, IOT connects sensor devices and solenoid valves to be monitored via the internet network. IoT is built with the ESP8266 module which allows access via the internet. The hardware design uses a microcontroller as a control method. The data is then sent online to an open-source site that acts as a web server. The web server is used for controlling and monitoring data accessed via the internet. The conclusion of this tool is that the system can do watering automatically. The system can do watering automatically, greater than the humidity temperature of 30 and humidity of less than 90%. So that the condition of the plants can be maintained properly. The system can be controlled with a WIFI network through the Blynk application. Can display the status of humidity, temperature and humidity conditions on the LCD and the Blynk application. Can be controlled from anywhere and anytime.

Keyword: Green house, Control System Fertigasi, Sensor DHT22, Mikrokontroler NodeMCU ESP8266, Blynk

I. INTRODUCTION

Agriculture in Indonesia is one of the main producers of raw materials consumed at home and abroad. As a result, more and more agricultural methods are being developed. The method that is widely used is the Green house or commonly called the greenhouse, or what is commonly referred to in Indonesia as the kumbun. It can be interpreted as a building designed to avoid and manipulate the environment to create the desired building. Environmental conditions for subsequent plant maintenance. Compared to plants outside the greenhouse, plants are more controlled and their growth is maximized, but greenhouse construction is not fully adapted to the climate in which the greenhouse is built. Greenhouse management also uses a lot of manual methods to meet the expectations of quantity, quality and continuity. Based on this, we want to create a smart greenhouse system that can be monitored automatically and remotely. However, in this system, it only focuses on controlling the smart usage center which is already equipped with sensors and controllers..[1]. The design of this tool uses the DHT22 Sensor as input to be processed on the NodeMCU ESP8266 microcontroller. After processing, it will be sent to the relay to turn on the selonoid valve as output. With the advancement of information and communication technology. All sectors will have a positive impact. In this case in the agricultural sector. It is important that the integration between technology and agriculture in Indonesia must be treated optimally. The design of this tool will be implemented in Sokaan dorp, Pakuniran District, Probolinggo District.

Green house designs with different shapes, depending on climatic conditions. Plants have certain conditions that help them to thrive and be productive. Climate adaptation in the greenhouse should be optimized with a system similar to the climate required for the growth of these plants. Below are some greenhouse systems that rely on technology in their construction. [2]

This greenhouse is very simple, made of wood and other bamboo materials. At Low Tech there is no specific control to regulate the environmental parameters in the greenhouse. A simple technique is used to increase and decrease the temperature and humidity, the light intensity can be reduced by covering or curtain material. The temperature can be reduced by making gaps in the walls. [3]. This type of greenhouse is built from Glavish Iron (G.I). The canopy cover is made with a structure and

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screws for convenience. The whole structure is sturdy and strong against the wind. Heaters and coolers are used to regulate temperature, as are humidity regulators. This system is semi-automatic, so it requires a lot of attention and care. Then a lot of manpower is needed to maintain the ideal environment. This type is suitable for dry and composite climate zones.[4]. In this discussion many environmental factors in the greenhouse are controlled simultaneously. The control system has sensors, comparators, operators and signal receivers. Determining the position of the sensor is very important because all control systems seek to represent the state read by the sensor. The sensor collects variables, calculates them, and compares them with standard value measurements. For more controllable such as temperature control system, humidity control system, timing system .[5]

Temperature is very influential on plant growth. Some processes in plants that are affected by temperature are plant transpiration, photosynthesis, and respiration processes. Plant growth is maximized when the temperature or temperature is maintained properly. When evaluating, focus on the growth limiting factors rather than the underlying temperature.[6].

The DHT22 sensor is a sensor with digital signal calibration. It can provide temperature and humidity information. This sensor has very high quality components For the DHT22 sensor can measure a wide range of temperature and humidity Send an output signal via a cable up to 20 meters.[6].

Solenoid valve is a valve that is controlled by electric current either AC or DC through the coil / solenoid. This solenoid valve is the most frequently used control element in fluid systems. As in pneumatic systems, hydraulic systems or in machine control systems that require automatic control elements. [8].

The ESP8266 NodeMCU is a development derivative of the ESP8266 family of ESP-12 IoT (Internet of Things) platform modules. The ESP8266 module can be found in our previous article. Functionally, this module is very similar to the Arduino module platform, only that it is dedicated to "connecting to the internet"[9]. Blynk is an Android or IOS operating system platform as a control module for Arduino, Rasberry Py, Esp32, and others via internet access. The Blynk application functions to control IoT (Interner of Things) devices, for communication between the Blynk Application and the microcontroller board must use a code called a token. In this final project, the author uses the Blynk Platform to monitor the temperature and humidity that is read by the DHT22 Sensor and the soil Moisture sensor in real time using the Internet of Things method in the shallot seed storage room project so that it can be controlled remotely [10].

From the description above, the research will focus on how to design a fertigation control system in an IoT-based greenhouse, and how to regulate and monitor temperature and humidity conditions in the greenhouse that are displayed online.

II. METHOD

1. Research Stage

This research was carried out by following the steps as shown in the following flowchart:

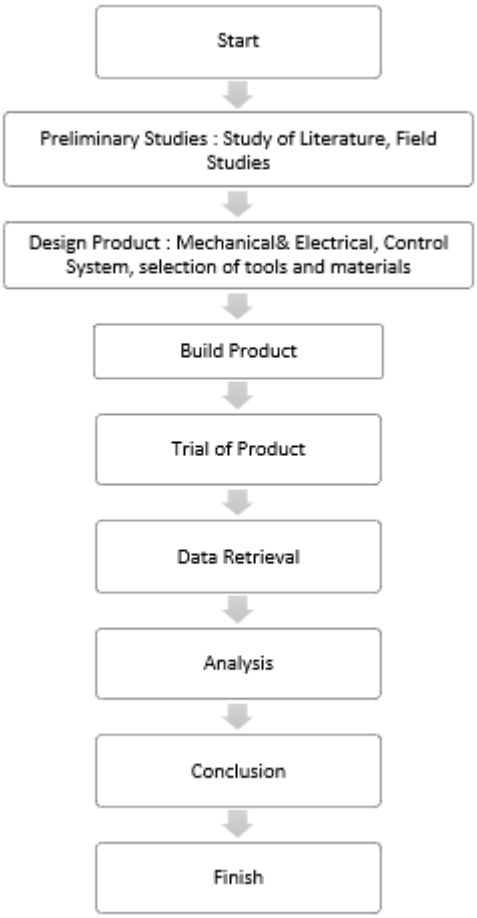

Figure 1. Research flowchart

2. Planning Tool In Box

Figure 2. Tool In Box

This design is a stage in designing the placement of several components including the esp8266 microcontroller, relay, DHT22 module, RTC and LCD.

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Overall Electrical Design

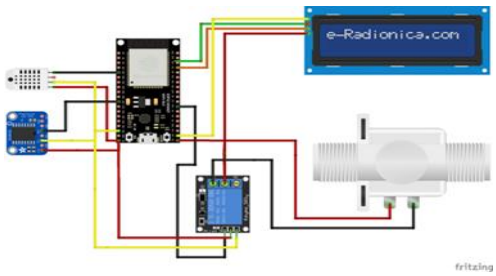

Figure 3. Overall Electrical Design

In the picture about the design above, it can be seen with a description of the overall electrical design, a microcontroller with a DHT22 sensor, RTC, relay, LCD and Selonoid Sensor.

The following is the flow of Figure 3:

- Gron i2c to gron nodemcu
- Vcc i2c to vin nodemcu
- SDA i2c to D2 nodemcu
- SCL i2c to D1 nodemcu
- Gron Relay to gron node
- In Relay to D7 nodemcu
- VCC Relay to D1 nodemcu
- Gron RTC to Gron nodemcu
- VCC RTC to 3V nodemcu
- SDA RTC to D2 nodemcu
- SCL RTC to D1 nodemcu
- Gron DHT to gron nodemcu
- DHT OUT to D6 nodemcu
- VCC DHT to vin nodemcu

3. DHT22 . Electrical Design

The DHT22 sensor itself is a sensor that usually detects the state of the temperature at a predetermined place and in order to function to read and process data, a microcontroller or brain is needed as a processing center and its resources. In order for these two components to be integrated and work together, an electrical connection is needed between them. So in this step, the electrical design between the microcontroller and the DHT22 sensor is carried out, in the picture below the DHT22 design is carried out

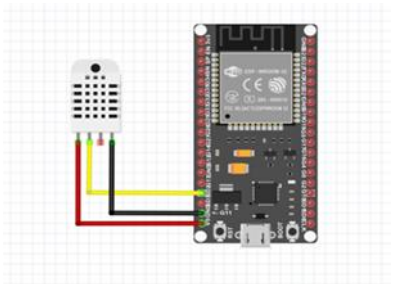

Figure 4. DHT22 . Electrical Design

4. LCD Electrical Design

LCD electrical design. This design is carried out for the information interface between the user and the research tool. On the LCD is displayed information about the tool that is running. The plan is as follows.

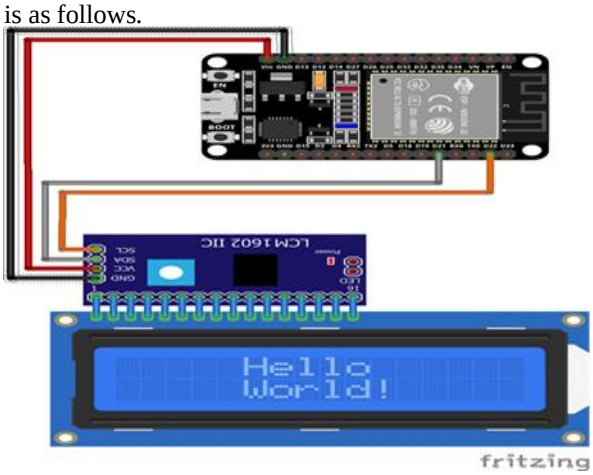

Figure 5. LCD Electrical Design

5. Electrical Design of Solenoid Valve

After designing the electrical sensor, the next step is to design the output or action, namely the selonoid valve. Because the Selonoid valve used works at a voltage of 12vdc, the power source is obtained directly from the main power supply. Then in order to be controlled to open / close, an automatic breaker is used, namely a 5vdc relay controlled by a microcontroller. The picture below the design in detail can be observed.

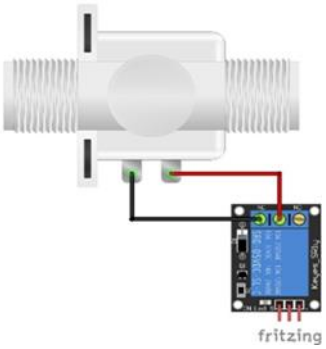

Figure 6. Selenoid Valve Electrical Design

III. RESULTS AND DISCUSSION

Hardware Testing And Results

In this step, a series of tests are carried out on the work on the hardware design that has been designed. This test is carried out to determine the level of success of the design that has been carried out. The tests that will be carried out are testing the 5 volt adapter, testing the sensor readings and testing the solenoid valve.

DHT22 . Sensor Testing

The purpose of this test is to determine the accuracy of the DHT22 sensor reading by comparing it with the medium for measuring temperature and humidity, namely HTC-1. This test is carried out 1 time a day with a span of 30 days. After that, the comparison resultsobtained is

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Day	Watering time	DHT22	Solenoid
Monday	09,00	32,3	ACTIVE
Tuesday	09,00	33,6	ACTIVE
Wednesday	09,00	31,9	ACTIVE
Thursday	09,00	27,4	NOT ACTIVE
Friday	09,00	26.1	NOT ACTIVE

calculated using the error formula, to produce an error calculation. formula as follows

Table 1 Average Results of DHT22 Sensor for 30 Days

After getting the results of the error measurement, then find the average value of DHT22 with HTC-1 using the following formula:

$$\text{Average} = \frac{\text{Total Score}}{\text{Many data}}$$

Test flow	Desired result	Results
The relay is connected to a 3 Volt ESP32 power supply, data to pin 12 ESP8266 and grounding to pin GND	Relay on	In accordance

So that the average value of the error measurement is 3,99 %.

Relay Test

In the design of this tool, the relay functions as a

Test flow	Desired result	Results
Connect the cable to 220V. on the output relay	solenoid valve open/close	In accordance

breaker for the 12 volt dc motor input voltage, so that it can be turned ON/OFF

Table 2 Relay Test

Solenoid Valve Testing

Selenoid Valve testing functions as an automatic

Test flow	Desired result	Results
Reading wifi username and password	Blynk Login	In accordance

water faucet opening device that will be flushed, or a solenoid valve as output.

Table 3 Solenoid Valve Test

IoT Testing

IoT design testing functions as an ESP8266 Configuration with the Blynk Application

Table 4 Testing IoT

Test Results and System Discussion

At this stage, the DHT22 sensor successfully reads the air temperature and temperature. if the temperature is < 30 C, the solenoid will not be active. However, if the temperature is > 30 C, the solenoid will turn on or be active. Here are the test results

Date	Average humidity	Average temperature
25 June 2022	1,12	2,95
05 july 2022	2,04	3,81
15 July 2022	1,99	5,21
Total average	1,7	3,99

Table 5 Testing Results

ACKNOWLEDGMENT

Conclusion

Based on the analysis, design and testing of this tool, it can be concluded that, among others, as follows::

1 system can do watering automatically.
2 The system can do watering automatically, humidity is greater than 30 and humidity is less than 90%. So that the condition of the plant can be maintained properly. watering time is at 09.00 the DHT22 32.3 sensor is active. and at the next watering at 09.00 the DHT22 26.1 sensor is not activef.
3 The system can be controlled with a WIFI network Through the Blynk application
4 Can display the status of humidity, temperature and humidity conditions on the LCD and the Blynk application.
5 Can be controlled from anywhere and anytime.

Suggestions

In the completion of this final project can not be separated from the various shortcomings that occur. So that it can be developed in the future. Some inputs from researchers, namely:

1. Researchers can add a tool, namely a blower so that it can condition the temperature when the temperature is too hot in the gree house.

REFERENCES

[1] L. A. Lomo, "Smart Greenhouse Berbasis Mikrokontroler Arduino Mega 2650 Rev 3," *Jur. Tek. Elektro Fak. Sains dan Teknol. Univ. Sanata Dharma*, pp. 1–65, 2016, [Online]. Available: https://repository.usd.ac.id/6331/2/125114042_full.pdf

[2] R. Oktaviani and E. T. Pawenang, "Risiko Gejala Keracunan Pestisida pada Petani Greenhouse," *Higeia J. Public Heal. Res. Dev.*, vol. 4, no. 2, pp. 178–188, 2020, [Online]. Available: http://journal.unnes.ac.id/sju/index.php/higeiahttps://doi.org/10.15294/higeia/v4i2/33544

[3] A. Minariyanto, M. Mardiono, and S. W. Lestari, "Perancangan Prototype Sistem Pengendali Otomatis Pada Greenhouse Untuk

p-ISSN 2715-2871
e-ISSN 2714-5247

Tanaman Cabai Berbasis Arduino Dan Internet Of Things (IoT)," *J. Teknol.*, vol. 7, no. 2, pp. 121–135, 2020, doi: 10.31479/jtek.v7i2.50.

[4] O. P. Y. Meishanti, D. Cahyanto, A. S. Arifin, and ..., "Pemberdayaan Green House Enviromental Literacy Desa Kayen," *Jumat Pertan. …*, vol. 2, no. 1, 2021, [Online]. Available: http://ejournal.unwaha.ac.id/index.php/abdimasper/article/view/1152

[5] Arisnandar *et al.*, "Pemanfaatan Greenhouse sebagai Media Pembelajaran Kontekstual ABSTRAK," *J. lepa-lepa open*, vol. 1, no. 2, pp. 298–306, 2021, [Online]. Available: https://ojs.unm.ac.id/JLLO/article/view/16918/pdf

[6] T. Liu, "Digital-output relative humidity & temperature sensor/module DHT22," *New York Aosong Electron.*, vol. 22, pp. 1–10, 2015.

[7] D. Alexander and O. Turang, "PENGEMBANGAN SISTEM RELAY PENGENDALIAN DAN PENGHEMATAN PEMAKAIAN LAMPU BERBASIS MOBILE," vol. 2015, no. November, pp. 75–85, 2015.

[8] F. Marinus, B. Yulianti, and M. Haryanti, "Rancang Bangun Sistem Penyiraman Tanaman Berdasarkan Waktu Menggunakan Rtc Berbasis Arduino Uno Pada Tanaman Tomat," *J. Univ. Suryadarma*, pp. 78–89, 2020.

[9] M. Y. Efendi and J. E. Chandra, "Implementasi Internet of Things Pada Sistem Kendali Lampu Rumah Menggunakan Telegram Messenger Bot Dan Nodemcu Esp 8266," *Glob. J. Comput. Sci. Technol. A Hardw. Comput.*, vol. 19, no. 1, p. 16, 2019.

[10]I. Efimov and G. Salama, "The future of optical mapping is bright: RE: Review on: 'optical imaging of voltage and calcium in cardiac cells and tissues' by Herron, Lee, and Jalife," *Circ. Res.*, vol. 110, no. 10, pp. 292–297, 2012, doi: 10.1161/CIRCRESAHA.112.270033.

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