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DESIGN OF TEMPERATURE AND HUMIDITY SENSOR IN MUSHROOM HOUSES DISPLAYED VIA WI-FI

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ABSTRACT

Mushroom cultivation requires an understanding of the appropriate environment and some related factors, especially the climatic conditions that are suitable for the growth of the mushroom. The factors include temperature, air, humidity, and light: in the stage of preparing the mushroom house, the aforementioned factors need to be properly acclimated for each type of mushroom. According to the significance of setting a suitable environment in the mushroom house that benefits the growth of mushroom, the researchers, therefore, propose a design of a watering sensor to control the temperature and humidity in the mushroom houses. The technology of Wi-Fi temperature and humidity sensor was used in this research and it can be automatically monitored the water system when the temperature or humidity does not meet the optimum values. The sensor provides the user with the convenience of controlling the temperature and humidity and it can be applied to a variety of mushroom farms as well. It was found that the measured value from the temperature sensor is slightly different from the thermometer. Besides, the Solenoid (water system control) is working normally. Therefore, it can be concluded that the temperature and humidity sensors displaying via Wi-Fi and the operation code of Solenoid (Turning on-off water) can work productively. However, further, development is still needed such as designing applications for monitoring temperature and humidity to be easier to use.

Keywords: *Temperature and Humidity Sensor, Relay, Solenoid*

1. INTRODUCTION

Nowadays, mushroom cultivation is focused on an understanding of the optimal environment for growing mushrooms. There are many related factors in the mushroom production process such as selecting the right types of mushrooms, producing PDA medium, selecting tissue culture, preparing materials and equipment, or care. One of the most important factors is climatic and environmental conditions: they have to be suitable for mushroom growth. To illustrate, if the temperature is too high, the fibers can stop growing leading to a negative effect for the grown mushroom. So, it is important to ensure the optimum temperature level, humidity, air, and light inside the mushroom house because of their impact on the yield and quality of mushrooms.

In this present research, the researchers have applied the agricultural technology with the temperature and humidity measurement system in the mushroom houses leading to convenient usage. Hence, researchers designed a temperature and humidity sensor in mushroom houses displayed via Wi-Fi: it has cooperated with an automatic water control valve. It is seen that the temperature and humidity level can be monitored competently.

Objectives:

1. To design the appearance of the temperature and humidity measuring device properly.
2. To be able to connect the circuit and write code to work with temperature and humidity sensors by displaying results via Wi-Fi.

2.RELATED STUDIES

Duangnapa Phromchan (2013) had designed and developed a temperature and humidity measurement system in the Phoenic oyster mushroom house: microcontroller application technology was used to control the optimal temperature in the range of 25 degrees and relative humidity was at 80-85%. The data was transmitted via a wireless communication device which is Zigbee technology. It could transmit data at a distance of up to 100 meters. It also had an alarm function to control temperature and humidity level based on the standard of the suitable mushroom growth. If the level is lower or higher than the standard, it will have a flashing light as a signal. [1]

Boonyang Singcharoen and Santi Sakaew (2015) investigated the control system and mushroom yield in a temperature and humidity control for mushroom house by using oyster and Phoenic oyster mushroom cubes as indicators. They compared the differences/similarities between a mushroom house with temperature and humidity control with the general mushroom house. The results showed that the number of mushroom yields from the temperature and humidity-controlled house is higher than the conventional house. It can say that temperature and humidity affect the growth of mushroom cultivation [2].

Likhit Arnkaphet and Thongrob Arksorn (2017) conducted an experiment to control the temperature and humidity of mushroom smart farm. The initial step of the

study was collecting data, and then designed and developed a temperature and humidity controller for mushroom house. From the experiment with the sample groups (selected mushroom houses), it was found that the farmers were satisfied with the temperature and humidity controller because the Phoenic oyster mushroom was growing steadily and the products were increased pleasingly. The results of the evaluation of satisfaction were at a good level [3]

Supawut Phaka(2014) developed appropriate system control in mushroom houses. There was a temperature and humidity measuring device that sends the information in the form of electrical signals. The measured value was compared with the setting at temperature 22-36 ° C, humidity 70% -90% RH. If the target value was not reached the setting, the device would send a signal to the water pump system. The results obtained from the mushroom cultivation group Banthungbopan, Pongyang District, Lampang Province, were satisfied with the quantity and quality of the mushrooms at a high range. Mean was 4.26 with a standard deviation of 0.7. mean of the increasing yield was 10.1 kg per harvesting. [4]

Sina Faizollahzadeh Ardabili et al (2016) developed a control system for temperature, humidity, and carbon dioxide density in a mushroom house by using Fuzzy Control. It was used to provide highly accurate system control in the mushroom house and to control the parameters as close to the set value. Comparing the values from the model to the real system such as mean, error value, and output, the results revealed that the mean of the model was closer to the set value than the real system. And the relationship between the real system and the model showed that both systems worked closely. [5]

Uddin et al (2010) explored different seasons of oyster mushroom cultivation in Bangladesh. The results of the study showed that Bangladesh's environment in winter (December-February) was very appropriate for mushroom cultivation. However, from August to October, it was not suitable for cultivating oyster mushrooms. They also suggested the temperature for cultivation: 14-27 degrees and the humidity should be 70-80%. In case of unsuitable weather in the country, the mushrooms should be grown under controlled conditions to achieve target yields [6]

3. METHODOLOGY

3.1 Circuit Connection to create a sensor device

The procedures for connecting the device is as following steps:

3.1.1. Convert a 220 VAC mains voltage to 12 VDC using a transformer.

3.1.2. Connect 12 VDC to the Solenoid Valve and Relay circuit.

3.1.3 Convert 12 VDC to 5 VDC using a 16V 100 µF resistor and a 7805 resistor.

3.1.4 Connect 5 VDC to NodeMCU and Relay.

3.1.5 Connect the NodeMCU with DHT22, temperature and humidity sensor, and Relay to transmit and receive data.

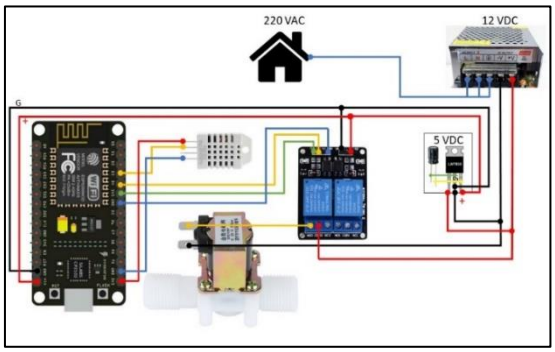

Figure 1 Model for connecting devices

3.2 Coding

Program Arduino (Arduino IDE: version 1.8.5.) was used in this study for coding. In terms of the operation of Node MCU/ ESP8266 (Wi-Fi controller), the researchers had to code the program to operate Node MCU/ESP8266 for monitoring various devices. The code was written as follows.

- Coding to measure temperature and humidity level displayed via Wi-Fi.
- Coding to control the Relay and then the control power was going to monitor the solenoid valves.

3.3 Designing for the storage box

Solid Works program was used to design the storage box by measuring the size of all equipment parts. Its design was concerned with storage space and convenient installation. So, the equipment installation can be done by the users easily.

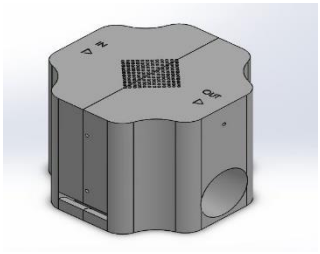

Figure 2 Storage Box

4. RESULTS

4.1 Picture of temperature and humidity sensor in mushroom house displayed via Wi-Fi

Figure 3 Equipment for temperature sensor

Table 1 shows the results of the operation of the equipment.

No.	Temperature from Thermometer (Celsius)	Temperature from Equipment (Celsius)	Humidity from Equipment	Operation of Solenoid	Operation of Wi-Fi
1	35.4	35.39	58.80%	✓	✓
2	36.0	36.29	55.31%	✓	✓
3	35.2	35.23	57.40%	✓	✓
4	36.4	36.52	58.63%	✓	✓
5	35.5	35.69	59.10%	✓	✓
6	37.6	37.61	56.50%	✓	✓
7	36.0	36.04	57.60%	✓	✓
8	35.6	35.51	58.50%	✓	✓
9	35.3	35.47	56.34%	✓	✓
10	35.4	35.40	58.04%	✓	✓
11	36.0	35.98	59.32%	✓	✓
12	35.2	35.42	56.40%	✓	✓
13	36.3	36.78	57.54%	✓	✓
14	37.0	36.82	57.65%	✓	✓
15	35.7	35.73	56.50%	✓	✓

Note
✓ = able to work normally
N = unable to work

It found out that temperature and humidity sensors in mushroom houses displayed via Wi-Fi, the solenoid will turn on the water when the temperature is higher than 35 C or the humidity is lower than 70%: it was working for 60 seconds. After that, the device would delay for 2 minutes, and then the next temperature and humidity measurement would be taken.
The test was performed by measuring the current temperature with a thermometer and a sensor device. The result showed that the level of temperature from the thermometer and sensor was slightly different. The Solenoid system and data transmission could work regularly.

Therefore, the design of a sensor device that measures temperature and humidity in a mushroom house can work effectively Moreover, the investment is not high. The problems and suggestions will be mentioned in the next chapter.

5.CONCLUSIONS AND IMPLICATION

5.1 Conclusion

This study analyzed a design of the appearance of the measuring devices for temperature and humidity. The investigation also pointed to circuit connection and coding to monitor the temperature and humidity sensors by displaying results via Wi-Fi. Temperature controlling in mushroom houses can be done by spraying water in the air with a mist nozzle that can be turned on-off through the solenoid. From the experiment, the created sensors and the code can work properly. Besides, improvement is required in terms of designing the mobile application for monitoring temperature and humidity. The further enhancement will be beneficial for users (i.e. comprehension toward principles and guidelines of the usages).

5.2 Suggestions and guidelines for development

5.2.1 From this project, it can be further developed for measuring temperature, humidity, and used to turn on and off the water with other agricultural fields.
5.2.2 Continued development of mobile applications to make them easier to use and to increase the convenience for those interested in using the device

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PHOTOS AND INFORMATION

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