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Design of Temperature and Humidity Control of Oyster Mushroom in Kumbung

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Abstrack **-** *Optimal temperature and humidity greatly affect the growth of oyster mushrooms. Cultivation of oyster mushrooms in kumbung is an attempt to control the optimal temperature and humidity for fungal growth. Periodic manual watering was felt to be less effective in controlling temperature and humidity in mushroom kumbung. Current technological developments provide the potential to create automatic control systems to control temperature and humidity in mushroom kumbung. Therefore, in this research, a controller is designed to control temperature and humidity in kumbung mushroom automatically based on a microcontroller. This shows that the control system designed is able to control the temperature and humidity in the mushroom kumbung automatically*

Keywords: *Mushroom, temperature, humidity, microcontroller*

1. INTRODUCTION

Mushroom are one of the plants that are widely cultivated by mushroom farmers in the highland. Oyster mushroom have a higher nutritional compare to other of mushrooms, oyster mushroom contain higher protein, fat, phosphorus, iron and riboflavin compared to other types of mushrooms.

Oyster mushroom are relatively easy to cultivate. The development of oyster mushroom does not require a large area of land, the production period of oyster mushroom is relatively faster so that period and harvest time are shorter.Oyster mushroom cultivation can be managed as a small, medium and large scale economic business industry). Oyster mushroom maintenance is very practical and simplem namely by creating and maintaining environmental condition.

In order to meet food security, human continue to strive to develop and research new types of food sources. From the various types of food, one of which has been found is mushroom.

Mushroom that were once of a wild plant have now become one of the people's food sources that are favored and consumed by all groups and ages. Mushroom are also a source of high nutrition and can be processed into various type of dished. Of the various types of mushrooms that can be consumed and cultivated, one of them is oyster muhrooms.

This study will discuss about oyster mushroom because it is a type of mushroom that widely cultivated other than oyster mushroom so that the place for mushroom cultivation called kumbung mushroom is easy fo find and in terms of easy maintenance. Cultivation of oyster mushroom in lowland areas (temperature $\pm 30^{o}$C) requires controlling temperature and humidity in mushroom kumbung to obtain optimal mushroom body growth. In general, optimal condition for the growth of the oyster mushroom require air temperature ranging from 16 – 28^{o} C with humidity 60 – 90% RH.

Beforemaking this tool, the reserchers first learned about oyster muhrooms, especially at the temperature and humidity. In making this tool, the researchers also added the ATMega8 and DHT11 microcontroller systems as the most influential component. So that later the tool that reseacher makes it able to work optimally in regulating temperature and humidity in oyster mushroom.

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2. RESEARCH METHODE

2.1 Product Design

With the presence of a temperature and humidity control device in this mushroom kumbung, it is able to facilitate the community, especially for enterpreneurs or mushroom farmers who use this rool in lowland areas or area with low humidity levels and a high temperatures. The testing and analysis stage is the most important stage in a design. Because the success or failure of a design is in the testing stage. Initial test were carried out to determine temperature and humidity using a thermometer.

The test of the tool aims to determine whether the DHT11 temperature sensor can read the temperature according to the thermometer.

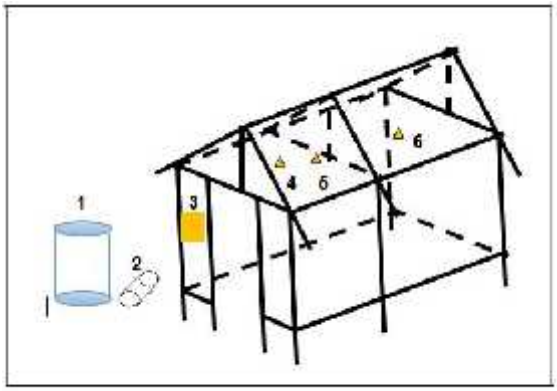

Figure 1 – Control System lay-out

Notes:
1 = drum
2 = water pump
3 = electronic circuit
4 = mist nozzle
5 = sensor DHT11
6 = mist nozzle

Temperature control device and Mushroom kumbung humidity is design automatically to control temperature and humidity in mushroom kumbung according to predetermined design criteria. In this design process the hardware assembled include three parts, namely the the sensing hardware section, the sensing data processing hardware section, the actuator implementing hardware section anf the data processing outputs.

The actuator and the external partsare the last of a series of the temperature and humidity control devices fot mushroom kumbung. Actuator parts and the output is the part functions to provide response to the results of data processing from the mainboard.

The actuator and output parts consisr of a relay module and Liquid Crystal Display (LCD). The two hardware devices are assembled into one mainboard. The relay module will be connected to fans, waterpumps and lights using cables.

In this Research, a control system is designed in the form of a tool that functions to control temperature and humidity in the mushroom kumbung by means of real time water spray.

This tool has several components that have

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their respective functions, namely DHT11 sensor, Microcontroller, Liquid Crystal Display (LCD), and Relay module.

3. RESULTS AND DISCUSSION

3.1 Data Presentation

Testing of the tool is carried out to determine the good performance of each component and the whole tool. The results of the machine testing are expected to be able to get valid data and find out whether the machine is working as expected.

So that the results displayed by the DHT11 sensor can be trusted for accuracy, it must be calibrated with existing tools, in this study using a digital meter. The following is the comparison data between the relative temperature values on the tool made with a digital meter:

Table 1 – Comparative Test Result Temperature

No	Time (sec.)	Tool	Digital meter	Difference
1.	1	31°C	30°C	1°C
2.	10	30°C	31°C	1°C
3.	20	31°C	29°C	2°C
4.	30	31°C	29°C	2°C
5.	40	31°C	31°C	0°C
6.	50	29°C	31°C	2°C
7.	60	30°C	31°C	1°C

Testing the relay circuit is done by providing a voltage at the input of the relay circuit with a value of 0 Volts and 5 Volts. The test results are as follows:

Table 2 – Relay Test Result

No	Input (Volt)	Relay condition
1	0	OFF
2	5	ON

From table 2 it can be seen that the relay circuit has worked well, if the input circuit is given a voltage of 0Volt then the relay is off and if the input circuit is given a voltage of 5Volt then the relay condition will be on.

3.2 Analysis Data

System response testing and analysis To determine the ability. From the control system that has been designed, overall testing is carried out on the temperature and humidity response. This test is carried out at 06:00 to 17:00 and data is taken every 1 hour, and the data is obtained as shown in table 3.

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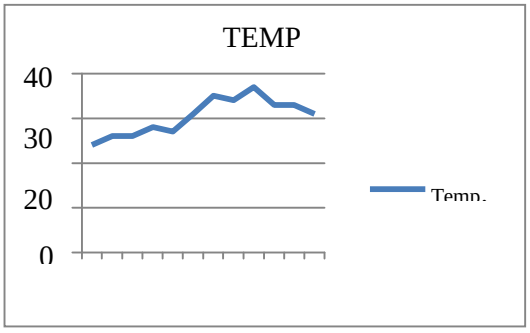
Table 3 – Response Result in the environment

No	Tme	Tempe -rature	Humidity
1	06:00	24°C	77RH
2	07:00	26°C	69RH
3	08:00	26°C	70RH
4	09:00	28°C	81RH
5	10:00	27°C	72RH
6	11:00	31°C	61RH
7	12:00	35°C	64RH
8	13:00	34°C	59RH
9	14:00	37°C	61RH
10	15:00	33°C	57RH
11	16:00	33°C	63RH
12	17:00	31°C	63RH



Graph1 – Temperature measurement

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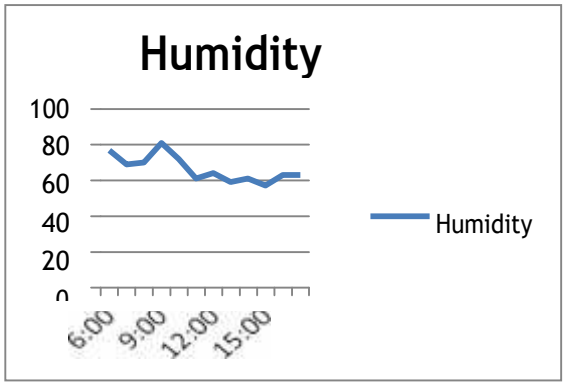
Table 4 – Response to Humidity

No	Time minute	Humidity	Water Pump
1	1	57 RH	On
2	2	64 RH	Off
3	3	70 RH	Off
4	4	75 RH	Off
5	5	78 RH	Off
6	6	79 RH	Off
7	7	81 RH	Off
8	8	82 RH	Off
9	9	82 RH	Off
10	10	81 RH	Off



Graph2 – Humidity measurement

3.3 Discussion

The humidity control system with a DHT11 sensor based on Arduino Uno is a combination of software that is implemented in a program stored on a microcontroller chip as data processing and processing and hardware that is implemented as a temperature control tool in the room. This system is a closed loop control system. We can see this in the system, that there is a measuring element regarding the condition of room temperature.

The size of the error sentreturn to the controller will determine the system action received by the test chamber, until the output reaches the desired one.

From the test it can be seen that all the coordinates in various time variations, the tool only turns on twice, namely at 1 minute, the room temperature is sometimes unstable at the specified set point, this is caused by many things, including environmental conditions where the temperature suddenly changes. down due to rain, and can also be caused by puddles of water on the kumbung floor. From the data that has been analyzed, in general this temperature control has met the general requirements of a controller, where for variations of control variables will produce the desired response from a control system. The system responds responsively to external disturbances, by always trying to

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bring the relative temperature closer to the set point.

4. CONCLUSION

Testing and discussion of the final project regarding the design of the Temperature and Humidity Regulator for Oyster Mushroom Kumbung Based on Arduino Uno, conclusions can be drawn, namely:

1. The results of the DHT11 sensor readings on this tool have a fairly high level of accuracy. Where the error value of the average temperature reading from 7 times of testing is ± 1.2°C.
2. The design of the software to build a Temperature and Humidity Regulator for Oyster Mushroom Kumbung Based on Arduino Uno was made with Arduino IDE software.
   Arduino IDE software is used to create source code programs that use the C language, the source code of the program functions to run the Arduino Uno microcontroller. In the 75 Arduino IDE programs there are several libraries for running components. The hardware design uses an input in the form of a DHT 11 temperature sensor. Then the process is in the form of Arduino Uno and relays and the output is an LCD and a 5V pump.
3. The actuator in the form of a DC motor can work well

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