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TOOLS DESIGN OF TEMPERATURE AND HUMIDITY CONTROL IN OYSTER MUSHROOM CULTIVATION BASED ON ARDUINO UNO

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ABSTRACT

Oyster mushroom had been known since long time ago in Indonesia. Besides its yummy taste, oyster mushroom has a lot of benefits for health. Even though oyster mushroom was known easy enough but in fact it is not as simple as we know. As we know, the key of this cultivation is a right temperature and humidity control so that oyster mushroom can grow well. If the temperature and humidity are not appropriate so they will detain the growth of the mushroom and the farmer will get crop failure. Therefore, in this journal the writer supposed to design a monitoring tools like temperature and humidity control for oyster mushroom cultivation based on Arduino Uno.

INTRODUCTION

An economic growth in Indonesia is not loose from one of important factors such as agricultural factor. As we know, Indonesia is agrarian country. Furthermore, Indonesia is a tropical region which has many biodiversity and mushroom can grow well. From many those backgrounds so one of them is agricultural factor which has in demand is oyster mushroom cultivation. Oyster mushroom has a high economical value besides its yummy taste and has many benefits for health.

In general, the farmer uses packed sawdust inside polybags as a medium for oyster mushroom cultivation. In its process, temperature and humidity sphere are very affecting a fruitfulness from this oyster mushrooms cultivation. Generally, oyster mushroom will grow optimum year around in its origin habitat in highlands territory altitude above 400-800m meters above sea level (MASL), air temperature 21^{o}C-29^{o}C, and humidity 60%-80%.

Oyster mushroom cultivation was thought neither easy nor difficult because we need to supply the right temperature and humidity so oyster mushroom can grow well. Because if they are not appropriate, it can be happened an abortive crop and farmer will be loss. In consequence, in this journal, the writer supposed to design a monitoring tool as like temperature and humidity control for oyster mushroom cultivation based on Arduino Uno which used for oyster mushroom cultivation

THEOROTOCAL BACKGROUND

Arduino Uno

Used Arduino Uno in this tools design is Atmega328 which has specification as follows:

- Microcontroller Atmega328
- Power operation 5V
- Voltage input (suggested) 7-12V
- Voltage input (limit) 6-20V
- It has 14 digital I / O pins
- It has 6 analog input pins
- Smooth DC is 40 mA I / O pins
- When 3.3V, it will be 50 mA DC pins
- Flash memory 32 KB (Atmega328) where is 0,5 KB used by bootloader
- SRAM 2 KB (Atmega328)
- EEPROM 1 KB (Atmega328)
- Clock speed 16 MHz

Soil Humidity Sensor

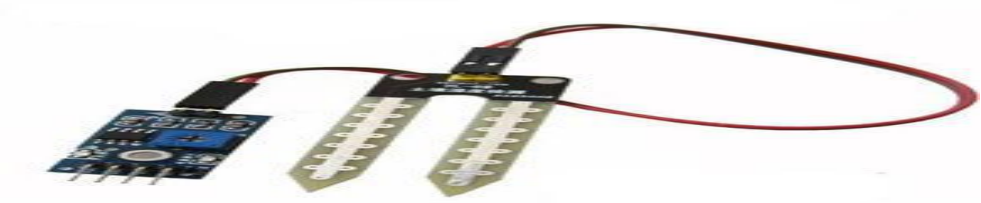

Figure 1. Soil Humidity Sensor

Soil humidity sensor or soil sensor is a sensor of humidity which can detect humidity inside the soil. This sensor contains two probe to get through the stream by soil. Then reading the resistance to get the number of humidity level. More water will make soil easier to send an electricity (low resistance), but dry soil is very difficult to send an electricity (high resistance).
The specification of soil humidity sensor as follows:

- Power supply: 3,3 V or 5 V
- Output Voltage signal: 0 - 4,2 V
- Current: 35 mA

- Pin definition: analog output (blue wire), GND (black wire), power (red wire)
- Size: 60 x 20 x 5 cm

DHT-11 Temperature Sensor

Figure 2. DHT 11 Sensor

DHT 11 has an output calibrated digital signal with a complex temperature and humidity sensor. This technology makes sure a high reliability and best stability in long term. The specification of DHT 11 Sensor is:

- Input voltage: 5 Vdc
- Temperature length: 0 - 50° C and error ± 2° C
- Humidity 20 - 90% RH ± 5% RH error

Pin description:

- The VDD power supply 3.5 – 5.5 Vdc
- DATA serial data, a single bus
- NC, empty pin
- GND ground, the negative power

12 V The Water Pump

Figure 3. The Water Pump

Mini water pump in this diafragma model has many benefits enough such as water pump for watering the household, water pump for aquarium, garden or terrace, and water pump for fountain, and etc. This water pump is appropriate for project controller/ Arduino. The pump specification which is used are:

- Size pump: 90 mm x 40 mm x 35 mm
- Weight: 106 gram
- Voltage: DC 12 V

- Working stream

IMPLEMENTATION

The writer designs the tools of temperature and humidity control and monitoring the length of harvest in oyster mushroom cultivation. Arduino Uno is related with DHT 11 Sensor, soil humidity sensor and RTC. DHT 11 sensor will detect the temperature and the sensor of humidity soil will detect a moisturize. If the humidity less than 60%, the pump with 12V power will be watering to oyster mushroom baglog automatically. And if the humidity has reached 60% or more, the pump will be off automatically. Next, RTC will count the first day until the harvest time which has been along 7 days. And LCD 16 x 2 will display an output or result in time from the first oyster mushroom baglog has been put inside box. The temperature and humidity number. Flowchart from the planned system was showed on Figure 4.

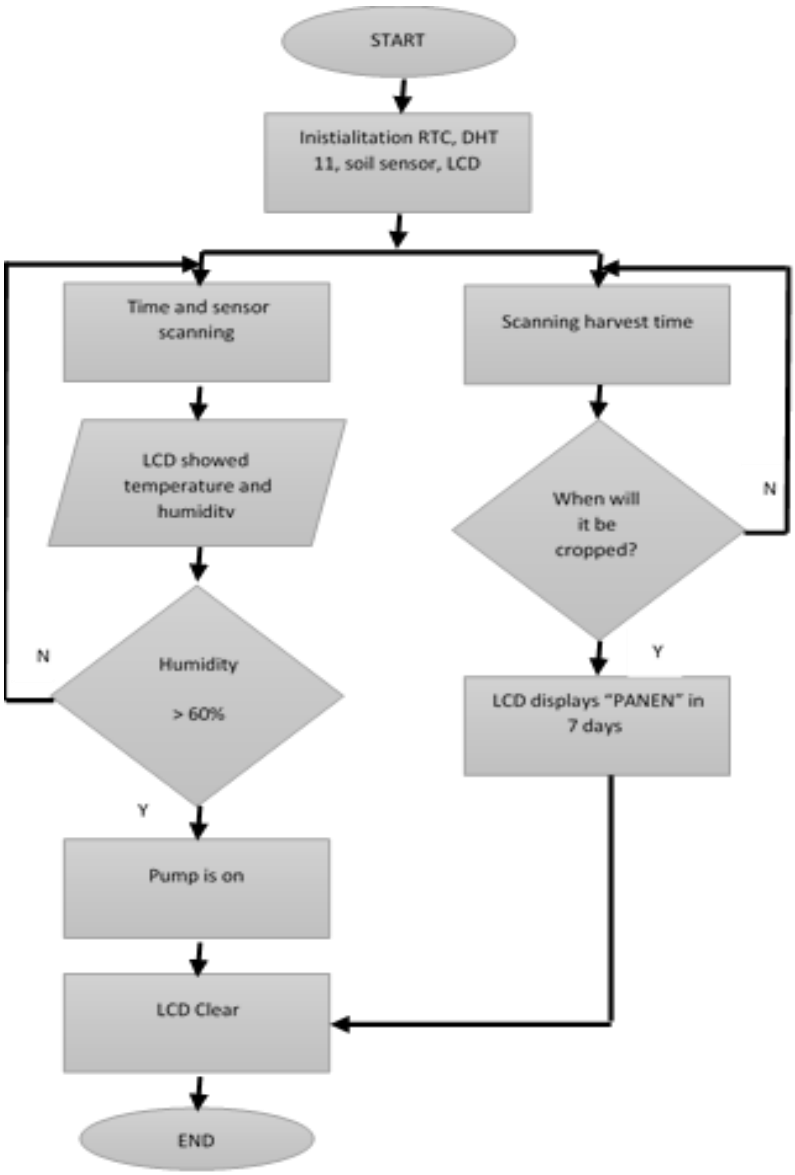

Figure 4. Flowchart System

The Trial of Tools Function

After the trial of the tools has been done to know a good performance from each component and whole system. There is the result table of the trial system as long as 7 days with the power ratio 12 V.

Table 1. Temperature sensor (DHT 11) test results

Day	Temperature on device	Temperature on digital metering	Error Percentage
1	28ºC	28ºC	0%
2	29ºC	30ºC	3,33 %
3	28ºC	29ºC	3,44%
4	28ºC	28ºC	0%
5	28ºC	29ºC	3,44%
6	29ºC	30ºC	3,33 %
7	29ºC	29ºC	0%
An average error			1,93%

According to Table 1, DHT 11 temperature sensor in system is working well and as expected, but it is still having difference output number between DHT 11 temperature sensor metering with digital metering. From the result of trial system is still having an error average number 1.93% for DHT 11 temperature sensor. For an average temperature is still ideal for oyster mushroom growth, as we know an ideal temperature in its habitat is 21°C – 29°C.

Table 2. Soil Moisture test results

Day	Humidity on device	Humidity on digital metering	Annotation
1	50%	DRY	Compatible
2	61%	WET	Compatible
3	58%	DRY	Compatible
4	48%	DRY	Compatible
5	59%	DRY	Compatible
6	65%	WET	Compatible
7	62%	WET	Compatible

The result of soil humidity sensor metering according to Table 2, the system can be worked well as expected. When the dry condition the pump would be on and would supply the water. In Table 3, it can be seen that the result of soil humidity sensor trial after watering has been done.

Table 3. Soil humidity sensor trial after watering test results

Day	Humidity on Device	Humidity on digital metering	Annotation
1	67%	WET	Compatible
2	61%	WET	Compatible
3	76%	WET	Compatible
4	69%	WET	Compatible
5	78%	WET	Compatible
6	65%	WET	Compatible
7	62%	WET	Compatible

From Table 3 can be seen an average of humidity is 68,3% and oyster mushroom is still able to grow well because the ideal humidity in its origin habitat is 60% - 80%

CONCLUSION

The result of experiment which has been done through the system into the environment of oyster mushroom cultivation had been well. The system is working as good as expectation. In the experiment of temperature sensor, it is still having a difference in reading result of temperature tool and digital metering, and it is still having an error number 1,93%. Next for soil humidity sensor experiment, the system has been working well. In the environment condition which has the humidity less than 60%, the pump will be on and off if the humidity has reached more than 60%. After 7 days, LCD will give a display output "PANEN" which informs that the oyster mushroom has been ready to be cropped by the farmer.

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