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Developed with IoT

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## Control System for Planting Cordyceps Militararis Developed with IoT

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### Abstract

*This research aims to develop herbs, mushrooms, rental tanks that can be grown in households or confined spaces in the Thai climate. With a purpose 1. To develop a system for controlling the environment suitable for growing mushrooms in a rental tank. 2. To determine the efficiency of the golden chartered mushroom cultivation control unit for controlling temperature and humidity by designing a control system for mushroom cultivation development. Cordyceps using IoT technology to apply It has the main control device is Temperature and humidity sensor (DHT22), compressor and mist sprayer to measure and control humidity and temperature to create a good environment for mushroom growing, rental tanks, and it is controlled by ESP8266, it receives commands and displays the status of the equipment. Through NETPIE, the results showed that in observing the growth of golden cordyceps mushroom. In the control system cabinet Can grow very well Under control as set*

**Keywords:** Cordyceps Militararis, IoT, NETPIE

### 1. Introduction

According to The government hopes to promote the agricultural market or the development of agriculture in the 4.0 era, so that agriculture can develop in 4.0 and four directions. It plays an increasingly important role in agricultural society. In order to manage the farm effectively, use the least labor. These technologies connect agricultural equipment to Internet systems. Make the device more independent. In order to make these devices communicate and control the devices of the wireless network system. Multifarious. With golden cordyceps Currently, a highly sought-after strain in the market is Cordyceps sinensis, but the golden cordyceps is difficult to grow because it requires a

relatively specific growing environment. Therefore, the project team has an idea to develop herbs, mushrooms, rental tanks that can be grown in a household or area. Limited in the climate of Thailand with the equipment that the project team has designed Guidelines for the development of cordyceps cultivation using IoT technology. It has the main control device is Temperature and humidity sensor (DHT22), compressor and mist sprayer to measure and control humidity and temperature to create a good environment for mushroom growing, rental tanks, and are controlled by ESP8266, it receives command and display status. Of devices through NETPIE

I. Study of working structure of various parts of the golden bucket mushroom cultivation control system set Developed by IoT technology and related research as the basis for education as follows. Golden Cordyceps Mushroom is a mushroom that is formed by the fungus that grows on the carcasses of insects. In the nature of the mushroom cordyceps There are many species Currently, a highly researched and desirable strain on the market is Cordyceps sinensis (cs-4). This mushroom requires a fairly specific growing environment. The house or mushroom incubator has to adjust the average temperature at a minimum of 25 degrees Celsius so it is necessary to install air conditioners. In addition, the place where mushrooms and equipment are used must be standardized and hygienic. Able to control almost 100% of the seeding process.



Fig. 1 Cultivation of Golden Bucket Mushrooms in Glass Bottles.

## 2. Experimental Setup

A.) In this research, IoT systems that use sensors and devices including temperature sensors are applied. Relative humidity in mushroom incubators, rental tanks Automatic on-off control of LED light and mist sprayer and service used to send data via Wi-Fi network.

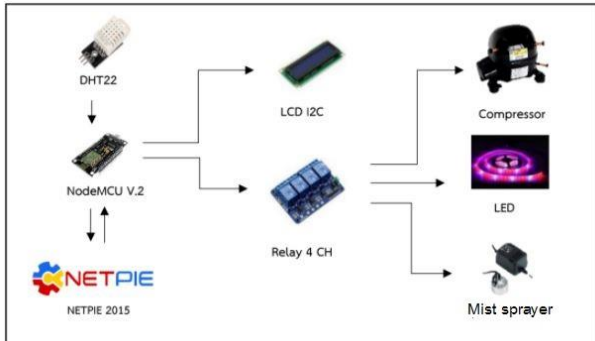


Fig. 2 Device connection of the Golden Cordyceps Planting Control Unit

Figure 2 shows the factors affecting the growth of golden cordyceps, including.

1) Temperature, temperature levels suitable for the growth of golden cordyceps. There is a value in the range 18 - 21 degrees Celsius. If the temperature is below 10 degrees Celsius or higher than 30 degrees Celsius, the golden cordyceps will not bloom.

2) Humidity Golden Cordyceps Mushrooms require relatively high air humidity, the condition of the mushroom incubator should have a humidity of at least 60 - 80%

3) Light is the main factor that helps the golden

cordyceps grow well.

B.) Structure of the Golden Cordyceps Mushroom Growing Control System.

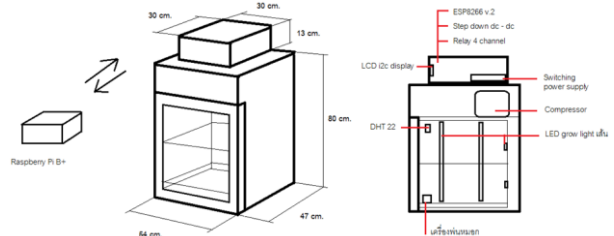


Figure 3 shows the structure of control cabinet for growing Cordyceps mushroom.

From Figure 3, the design of the control cabinet layout. By the structure of the control cabinet for the cultivation of Cordyceps Mushrooms For this structure use Small refrigerator, cabinet size, width 54 cm., Length 47 cm., Height 80 cm., While the slave set installed on the cabinet is a square size, 30 cm long on each side, 13 cm high. Cordyceps Designed to be lightweight, easy to transport, and also has a compact area suitable for growing mushrooms, rental tanks in a limited space. Inside the Slave set includes an LCD i2c display showing time, temperature, percentage, humidity. Later Relay 4 Channel controls in the compressor section, LED and mist sprayer to work as required.

Inside the cabinet, the equipment will be positioned, with the top of the cabinet installed linear LED lights on both the sides and the back so that the light can penetrate evenly through the mushroom. The humidity and temperature sensors are located on the top right of the refrigerator, as this is where the cold comes out. The mist sprayer is located downstairs inside the refrigerator.

C.) FreeBoard window overview on NETPIE web browsers.

Units

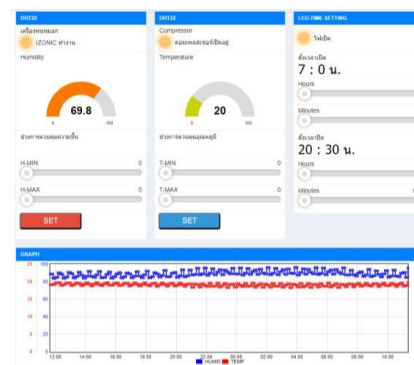


Figure 4 Overview of the FreeBoard window on the NETPIE web browser.

From Figure 4, the FreeBoard page is divided into 4 sections: 3 vertical sections and 1 horizontal section. Temperature setting and setting section, humidity setting and setting section, and LED lamp on-off time setting section, which can be controlled by adjusting the values as follows: Temperature control, the adjustment range is between 0 - 100 degrees Celsius, humidity control, the adjustment range is from 0 - 100 percent relative humidity. By temperature and humidity, if the values are adjusted, the SET button must be pressed as confirmation to prevent accidental contact. Time control, the adjustment range is between 0.00 - 11:59 PM and the working status of the fogger, compressor and LED lamp will be indicated on the indicator. If active, the indicator will be on. If not working, the status light will be off. The horizontal section shows a graph of humidity and temperature. Blue shows humidity and red shows temperature.

D.) Equipment installation in the Golden Cordyceps Mushroom Farming Control System

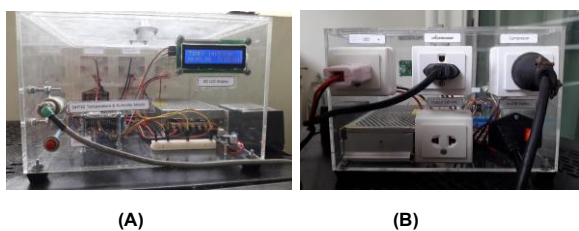


Figure 5 Control system unit box

### 3. Results and Discussion

**Table 1: The results of the temperature and humidity measurement test of the Cordyceps Mushroom growing cabinet**

| Time               | Temperature (°C) | Humidity (%RH) |
|--------------------|------------------|----------------|
| 6:00 น.            | 18.74            | 80.37          |
| 12:00 น.           | 19.50            | 84.14          |
| 18:00 น.           | 19.25            | 78.62          |
| 23:00 น.           | 18.90            | 87.01          |
| mean ( $\bar{x}$ ) | 19.10            | 82.54          |

From Table 1 were found that the temperature and humidity sensors of the Cordyceps Growing Cabinet were tested at the specified time. Rent was able to control the average temperature of 19.10 degrees Celsius and the average humidity was 82.54 percent of the relative humidity.

Recording and tracking the growth of golden cordyceps mushroom.

It was an observation of the growth of golden cordyceps mushroom. The actual planting cost of 2 jars will be collected by recording pictures and details of the growth of the 2 jar of cordyceps every week, for a total duration of approximately 8 weeks. This is not the time to drop the fungus during the first 2-3 weeks

**Table 2: track record of growing mushrooms blond tank rental.**

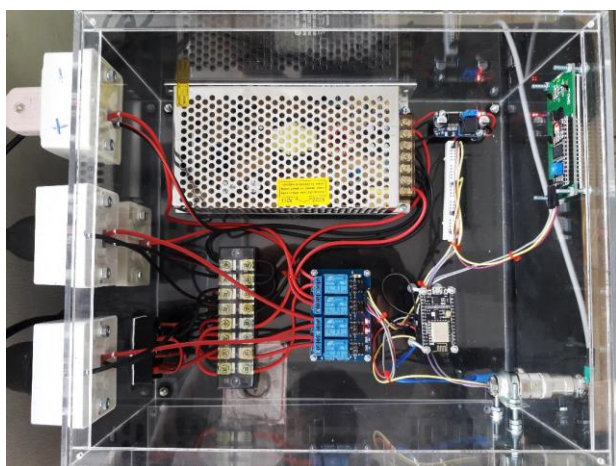










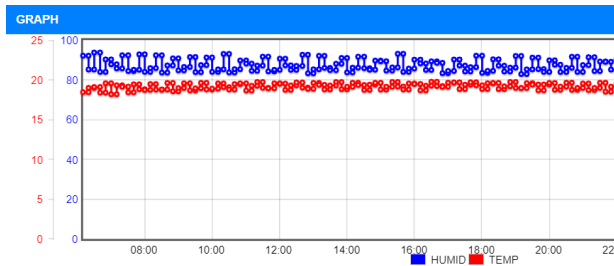
Fig. 6 Installation of controller devices in the control unit box

| สัปดาห์ที่ | รูปขวดที่ 1   | รูปขวดที่ 2   |
|------------|---|---|
| 1          |  |  |
| 2          |  |  |
| 3          |  |  |
| 8          |  |  |

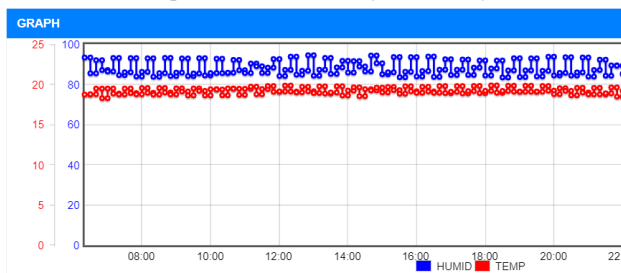


From Table 2, it was found that the growth observation of the two jar of cordyceps mushroom was grown. In the control system cabinet Can grow very well Under control as set.

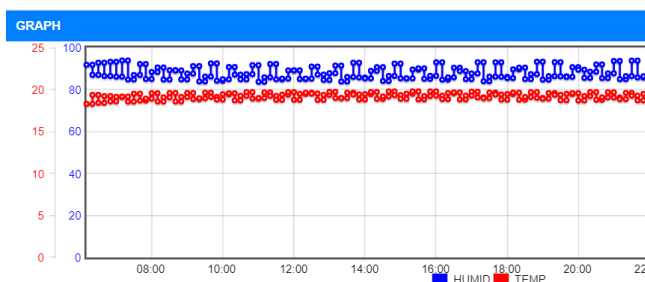
The results of temperature measurement according to the date and time of each cycle in the control cabinet on the test date.



Graph. 1 Graph showing the relationship between temperature and humidity on test day 1



Graph. 2 Graph showing the relationship between temperature and humidity on test day 2



Graph. 3 Graph showing the relationship between temperature and humidity on test day 3

From graph 1-3, it was found that the ability to measure temperature according to the date and time of each cycle in the control cabinet was able to mean the temperature of day 1 was 19.13 degrees Celsius, the mean temperature of day 2 was 19.03 degrees Celsius and The mean temperature for day 3 was 19.15 ° C, with the temperature values during the day and time of each average cycle in the specified range. Is there a

temperature at 18 - 20 degrees Celsius in the control system cabinet

#### 4. Conclusion

From the experiment of the project, the control system for growing the golden cordyceps. Developed by IoT technology, is a set of control system for growing the golden mushroom It is controlled by NETPIE's Freeboard or applications on smartphones via the Internet. The experiment was conducted with DHT 22 temperature sensor LED lights and mist sprayer. It was found that the experiment to control the LED lights which divided the working period, can turn on and off the lights normally during the specified time, which is to work from 07:00 to 20:29. There were no malfunctions when performing 7 tests. Each day and time temperature measurement test was able to control the average temperature. Each day was approximately 19 degrees Celsius during all three days of testing. Where the temperature can be in the range Very well defined And in the testing of the mist sprayer with the performance characteristics Normal humidity range There are two periods of operation: the humidity range below 70 to the range 80 percent of the relative humidity. And the mist sprayer will stop working until the humidity value drops below 70 percent of the relative humidity again, which has not been malfunctioned after 7 tests.

The recording and tracking section of the mushroom growth. Has divided to observe the growth Of 2 bottles of golden cordyceps mushrooms under preset control The experiments were performed to compare the growth of how there were differences in the cultivation using the Golden Cordyceps Mushroom Control System. Developed by IoT technology, so from the experiment it showed that Continued in the follow-up throughout the period of 2 weeks, which, if counting the age, date of instillation of mushrooms until harvest date. It will last about 60 -70 days to be able to collect the produce. To enter the next process.

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