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Cawangan Kedah  
Kampus Sungai Petani

Faculty of Administrative  
Science and Policy Studies

# i-SPIKE 2021

*Leading An Artificial Innovation In Knowledge, Education And Design*

## **i-SPIKE 2021 INTERNATIONAL EXHIBITION & SYMPOSIUM E-PROCEEDINGS**

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## **IOT BASED MONITORING SYSTEM FOR OYSTER MUSHROOM FARMING PONDOK SERI PERMAI PASIR PUTIH KELANTAN**

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## ABSTRACT

In Malaysia, many farmers depend upon the traditional agricultural practices. Adapting modern agricultural technology plays an important role in improving overall efficiency as well as yield production. In modern agriculture, the Internet of Things (IoT) connects farmers to their farm via the sensors so that they can easily monitor the real-time conditions of their farm from anywhere. Oyster Mushroom is a widely cultivated crop among Malaysian farmers. Although being the most consumed and cultivated crop, it is still overshadowed by the traditional cultivation approach which results in low productivity, high manpower efficiency, more effort and cost. This work aims to develop a monitoring system to monitor the environmental conditions of a mushroom farm. It enables users to monitor crucial factors such as temperature, humidity, moisture, light intensity on a mushroom farm through the end devices. Oyster Mushrooms require optimum temperature between 26°C to 29°C and humidity between 85% to 95% and carbon dioxide level not more than 600 ppm. Sensors are placed on fixed locations and spots of the farm. The sensors measure the parameter status which is transmitted to the remote monitoring station via a low power Node MCU. Obtained data is stored in a cloud platform. The codes for the controller are written in the Arduino programming language, debugged, compiled, and burnt into the microcontroller using the Arduino integrated development environment. The result shows successful monitoring of environmental conditions accessing the internet from anywhere. It minimizes human efforts and automates production, which could be beneficial to Malaysian farmers.

**Keywords:** : IoT, end devices, sensors, monitoring station, Node MCU, Arduino

## INTRODUCTION

This project is conducted to create a system to monitor the environmental conditions such as temperature, humidity, carbon dioxide level, and lighting conditions of the oyster mushroom farm located at Pondok Seri Permai, Pasir Puteh, Kelantan by using IoT. Internet of Things (IOT) is defined as a network of physical devices embedded with physics, software, sensors, actuators, and property that allow these objects to attach and exchange knowledge. As these kinds of structures need refinement, a scientifically designed mushroom farm needs heavy investment and hence is out of reach from small & marginal mushroom farmers. Not only that, mushroom units need to keep their air-conditioning plants running almost all year round. For a large cultivation of oyster mushrooms, we consider the temperature, humidity, light, and carbon dioxide levels as part of the parameters that need to be observed. As the main focus is to reduce human labor and to enhance the yield, this system will provide a novel method to monitor the farm. The need for food and limitation of space or land for agro-economic activity make urban farming technology becoming popular and has become one of promising solutions for securing food supply. Apart from that, according to Jesús Martín Talavera (2017), extreme weather changes and climates affect the production of crops, causing price increase and lower quality of crops produced. Putting this idea in mid, this paper presents an internet of things (IoT) based monitoring and environment control for indoor cultivation oyster mushroom, which is a smart urban farming system that requires less maintenance, less manpower, and saves a lot of space as discussed in prior papers (A Mustafa Alper Akka, 2017), (Jiang Zhaohui,2010). Furthermore, this project is dedicated to improving and enhancing the conventional plantation system in general. Using the IoT platform, this will enhance the capability of current equipment for remote monitoring purposes and at the same time log the data for analysis and references (Fernando Terroso,2017), (C. Cambra,2017).

## METHODOLOGY

The room studied for this project is 30 m in length, 15 m in width and 3 m in height inside a concrete building as seen in Figure 1. The wall was made of bricks and the roof of the room built under the main concrete. The room was installed with four rows of rack; each rack contained around 1000 blocks of mushroom. Ventilation system is specified at 3500 cubic meters per hour (CMH) for each exhaust fan, lights with 50 watts for 3000 lumens, and cooling pad installation at the front building to bring air from outside to inside. All the devices were installed at positions outside the cultivation room and were fixed by an electrical and electronic device to monitor temperature, humidity, light intensity, and CO<sub>2</sub> level during the experimental procedure as seen in Figure 2. The optimal value of temperature, light intensity, CO<sub>2</sub>, and humidity for oyster mushroom planting is at 26 – 29 deg C, 200 – 500 lux level, 85 – 95 % humidity and 600 particles per minute (PPM) CO<sub>2</sub>. The humidity and temperature created are by exhaust fan and cooling pad system as shown in Figure 3. Light intensity is provided by fluorescent lamps. The range of normal conditions for oyster mushrooms indoor plantation is given by Table 1.



**Figure 1.** Inside the building



**Figure 2.** Installation of watering and drain system



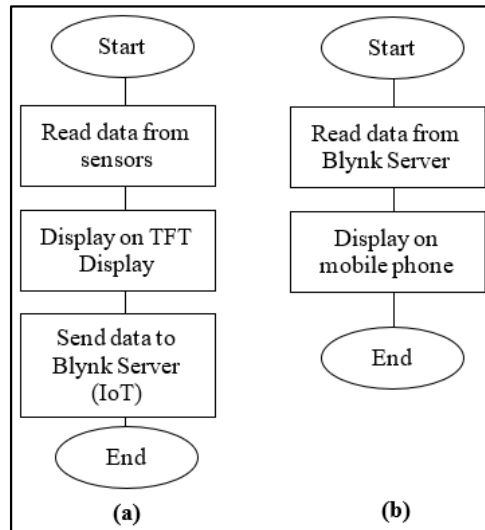
**Figure 3.** Cooling Pad

**Table 1.** Main parameters for Oyster mushroom grow

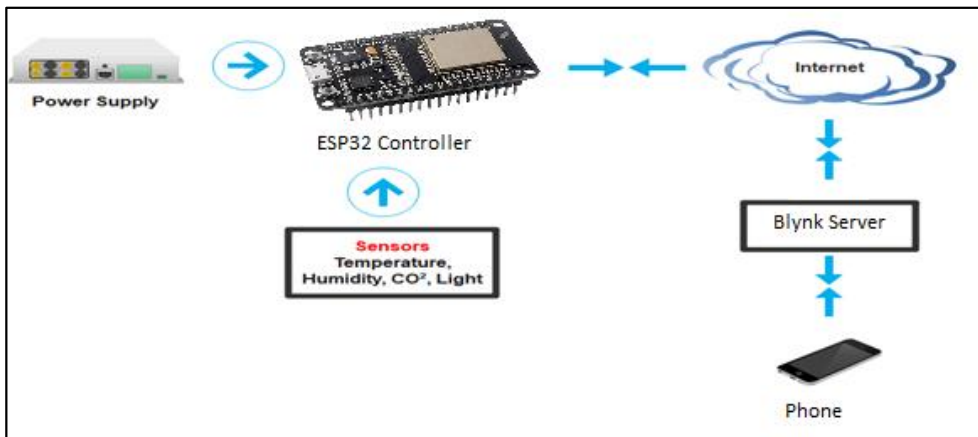
Parameter	Range	Unit	Controlled equipment
Temperature	26 - 29	°C	Exhaust Fan
Humidity	85 -95	RH %	Cooling PAD
CO2	600 <	ppm	Exhaust Fan
Light	200 – 500	lux	Lamp

### Software Implementation

In this project, ESP32 Controller was used as the main controller. It is a microcontroller with an integrated Wi-Fi module. It was programmed using C++ language with Arduino IDE software. All sensor readings are captured by the ESP32 Controller and displayed on the TFT Display on the device and sent to the server. The controller itself has a Wi-Fi capability and is programmed to act as a Wi-Fi client, thus enabling a direct connection to the available Wi-Fi Router with internet connection. An app called Blynk is used as an IoT for this platform. The sensor data captured by the controller are sent to Blynk Server, and users can use the Blynk App to display the readings on Android or IOS Phone. Figure 4 a) and b) show the algorithm data transfer by the ESP32 to Blynk server and from Blynk server to Blynk App, respectively. The data can be displayed in various types such as sensor value, graph, virtual meters and so on. The working block diagram of the whole system is displayed in Figure 5.



**Figure 4. a) and b):** Algorithm data transfer by the ESP32 to Blynk server and from Blynk server to Blynk App



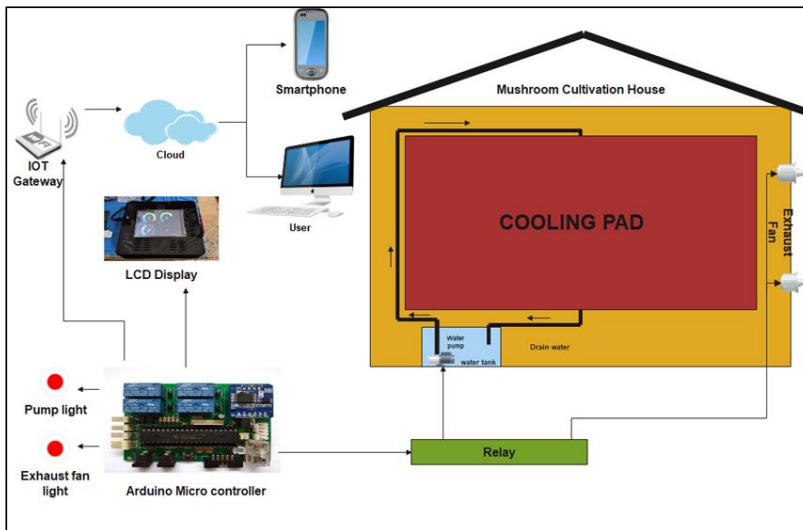
**Figure 5.** Working block diagrams of the system

### Hardware Implementation

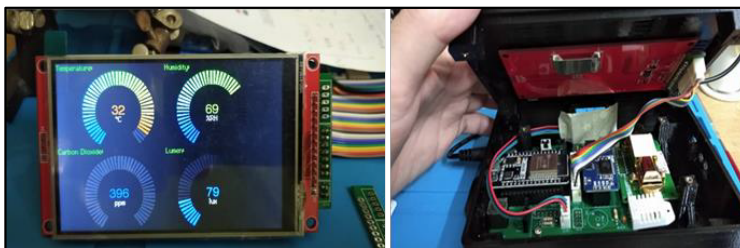
All the main components are shown in Table 2. The supply used in this project are 5V and 3.3V. The system can get an actual time from the internet for the timestamp but DS3231 RTC is also used as a backup. TFT display uses a graphical method, therefore its display is limitless compared to Characteristic LCD. The illustrated diagram for the project is as shown in Figure 6 while Figure 7 shows the display of sensor readings and the controller unit.

**Table 2.** Main Component

Function	Component name	Description
Main Controller Board & Wi-Fi	ESP32 DOIT DEVKIT V1	32-bit LX6 Microprocessor with clock frequency up to 240 MHz
Sensor	DHT 22	Humidity & Temperature
Sensor	MH-Z14A Infrared Gas Module	CO2 sensor
Sensor	VEML7700 Ambient Light Sensor	Light sensor
Thin Film Transistor	4" TFT LCD	Display
Real Time Clock	DS3231	Manage the program functions



**Figure 6:** An illustrated schematic diagram of greenhouse integrated with IoT

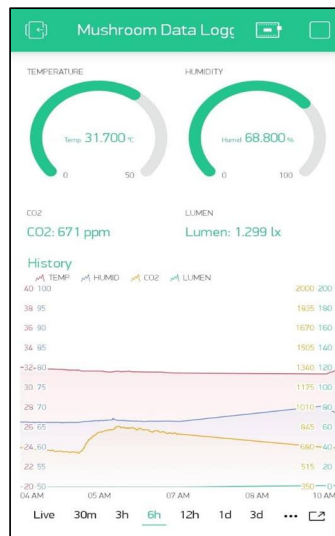


**Figure 7:** The LCD display and controller and socket outlet for IoT Monitoring and environment control system for indoor cultivation of oyster mushrooms

## RESULTS

### System monitoring Function Test

Figure 8 shows examples of dashboard apps that have been used in the system. In this system, there are four parameters that are monitored at a 10-minute sampling rate: room temperature, relative humidity, carbon dioxide and light intensity. Figure 8 shows data with a function of time that was obtained from the IoT server platform. Besides using browsers, the data can be duplicated and can be monitored by the user via third party apps on android. This method gives flexibility to users to monitor their system. After implementing this system, the result shown the mushroom growing is better than conversional method in term of productivity and duration of growing.



**Figure 8.** Graphical user interface Apps user



**Figure 9.** Oyster mushroom

## CONCLUSION

This project redefines farming among farms and agronomists alike. Applying IoT has brought revolutionary change in the monitoring, management, data analysis and costing in improving farming. Temperature and humidity sensors were tested, and the data were sent to IOT platforms for accessing and monitoring. As mushroom farming requires continuous monitoring of environmental parameters, the proposed system plays an important role in innovating new methods of monitoring and improving mushroom farming and to deliver more productivity of mushroom.

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## APPENDICES

memorandum of understanding

### MEMORANDUM OF UNDERSTANDING

BETWEEN

UNIVERSITI TEKNOLOGI MARA

AND

KOPERASI USAHAWAN CENDAWAN KELANTAN BERHAD

ON FRIENDSHIP AND COOPERATION, PROMOTION OF MUTUAL  
UNDERSTANDING, ACADEMIC, CULTURAL AND SCIENTIFIC THOUGHT  
AND PERSONNEL EXCHANGE



Cawangan Kedah  
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