MULTIDISCIPLINARY APPLIED RESEARCH AND INNOVATION
e-ISSN: 2773-4773

MARI

Vol. 5 No. 2 (2024) 167- 171
https://publisher.uthm.edu.my/periodicals/index.php/mari

Wireless Temperature and Humidity Monitoring System for Oyster Mushroom House

M. Fakhruddin A. Hamid[1], A. Haziq A. Nizam[1], Farhan Nur Iman Ismail[1], M. Faizal Ismail*[1,2]

[1] *Centre for Diploma Studies, Universiti Tun Hussein Onn Malaysia Pagoh Campus, 84600 Muar Johor*
[2] *Microcontroller Technology for IoT Focus Group (MTIT), Centre for Diploma Studies, Universiti Tun Hussein Onn Malaysia, Pagoh Higher Education Hub, 84600, Pagoh, Johor, MALAYSIA.*

*Corresponding Author: ifaizal@uthm.edu.my
DOI: https://doi.org/10.30880/mari.2024.05.02.025

Article Info

Received: 1 December 2023
Accepted: 30 April 2024
Available online: 30 Jun 2024

Keywords

IoT, Monitoring System, Mushroom Cultivation, Indoor Farming

Abstract

Oyster mushrooms are simple to grow and require only a small amount of space. Regardless, mushroom cultivation requires specific growing conditions such as temperature and humidity. Because mushrooms do not require direct sunlight, temperature and humidity are two parameters that must be carefully monitored during cultivation. As a result, the creation of a wireless monitoring system for mushroom houses is required. Using the ESP8266 WiFi module, this monitoring system will monitor the temperature and humidity of the mushroom house, and an IoT dashboard will display the sensors' readings. The mushroom house's temperature and humidity are measured using DHT11 temperature and humidity sensors. The ESP8266 is outfitted with a 12V water pump to take corrective action to keep the mushroom house's temperature and humidity below 25°C and 80 percent, respectively. A Blynk dashboard will notify the oyster mushroom grower of the mushroom house's temperature and humidity. The development of this wireless temperature and humidity system will benefit farmers by enhancing oyster mushroom production and yielding better oyster mushrooms.

1. Introduction

People are spending more time at home because of the pandemic's digital era. Every facet of life, including trade, transportation, government, education, and others, has seen tremendous changes as a result of it [1]. practically everyone uses digital tools for practically all of their activities during this pandemic, including written and oral communication. Even environmental parameters, such temperature, humidity, and air quality control in a room to improve its quality and comfort, have been digitalized [2],[3], and [4].

There is more to quality air than merely comfortable, clean air. For comfort and health, the right humidity levels are crucial when performing tasks at home [5, 6, 7]. Relative humidity (RH) units are typically used with air humidity units. Tropical nations like Malaysia, often have humidity levels above 70% RH and daytime highs of around 30°C, with consistent humidity levels throughout the year [8],[9],[10]. It is more likely for humidity levels to fluctuate indoors than outside. Showering and cleaning might result in a space with excessive humidity. However, since cold air can only contain so much moisture, other activities that don't involve water in the room can use air conditioners to dry the space [11].

Agricultural waste rich in cellulose and lignin can increase the yield of oyster mushrooms as it will help promote more production of cellulose enzymes. This indicates oyster mushrooms are easy to grow and more sustainable as well as environmentally friendly. Inconsistent weather in subtropical countries such as Malaysia is a major problem for oyster mushroom growers. This is because temperature and humidity are the main aspects that need to be considered to produce a high-quality mushroom harvest. As Malaysia experiences hot and rainy weather throughout the year, the yield of oyster mushrooms becomes insufficient to meet market demand. This is a huge loss to oyster mushroom growers [12-14].

As a result, this paper develops a wireless temperature and humidity monitoring system to address the issues that traditional oyster mushroom growers face because the mushrooms will not grow if the temperature of the mushroom house is higher than 33°C or lower than 25°C. The DHT11 sensor will read the mushroom house's temperature and humidity, and the water pump will act to lower the temperature and increase the humidity. The sensor's readings to the oyster mushroom grower will be displayed on the Blynk dashboard. This monitoring system will ease the workload of the oyster mushroom grower to always monitor and control the temperature and humidity of the mushroom house.

2. Materials and Methods

2.1 Material

The materials and equipments used for the Smart Oyster Mushroom House are described as below:

i. This project use ESP8266 with WiFi module as a controller.
ii. The sensor that has been equipped is the humidity and temperature sensor, DHT22 to detect the humidity and the temperature of the mushroom house.
iii. The ventilation fan is installed to remove the trapped solar radiation that may lead to the increase of the mushroom house temperature.
iv. The water pump is connected to the controller and the sprinkler is used to water the mushroom blocks.
v. The coding for this system is developed using the Arduino IDE software.
vi. The coding below Blynk application linked to the ESP8266 microcontroller to notify the user.

2.2 Method

This wireless temperature and humidity monitoring system uses the ESP8266 WiFi module as a controller. As shown in Fig. 1, The DHT11 temperature and humidity sensor are connected to pin D4 of the microcontroller to read the temperature and humidity of the oyster mushroom house. The temperature and humidity readings of the DHT11 sensor will be displayed on the Blynk dashboard on the oyster mushroom grower's smartphone. When the temperature and humidity of the mushroom house respectively exceed 25 ° C and below 80 percent, the DC water pump is connected to pin D2 and a single channel relay and will be turned on to lower the temperature and humidity of the mushroom house by producing a water mist that acts as a cooling and humidifying agent for the mushroom house.

The coding for this wireless temperature and humidity monitoring system is developed with Arduino IDE software using a C++ programming language. The Blynk and DHT sensor library is added to the program. The Blynk firmware configuration, which is template ID, device name and auth token is obtained once the web dashboard is set up. The DHT11 temperature and humidity sensor will detect the humidity and temperature of the mushroom house. If the temperature exceeds 25˚C and the humidity is below 80%, the single-channel relay will provide energy and the water pump will be turned on until the temperature and humidity are at the optimum growth values for oyster mushrooms which are below 25˚C and 80% respectively. The flowchart and block diagram of the system are shown in Fig. 2 and Fig. 3 respectively.

Multidisciplinary Applied Research and Innovation Vol. 5 No. 2 (2024) p. 167- 171

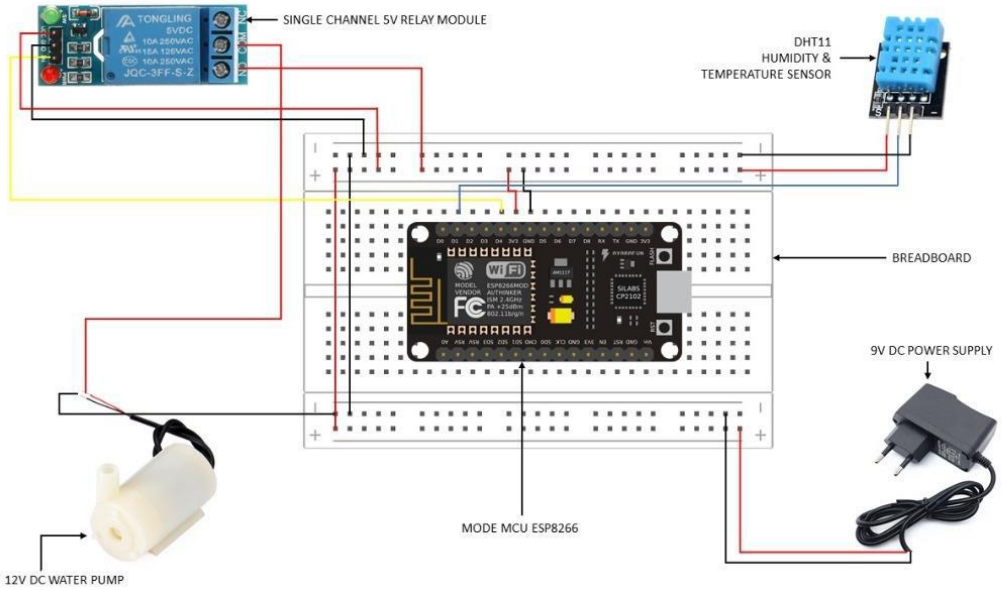

Fig. 1 *Hardware circuit design*

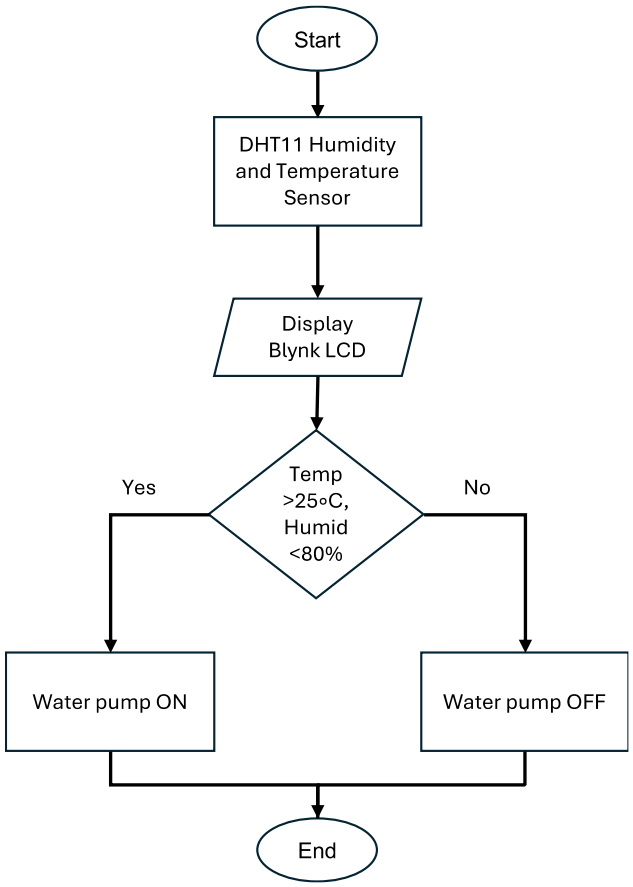

Fig. 2 *Flowchart of the system*

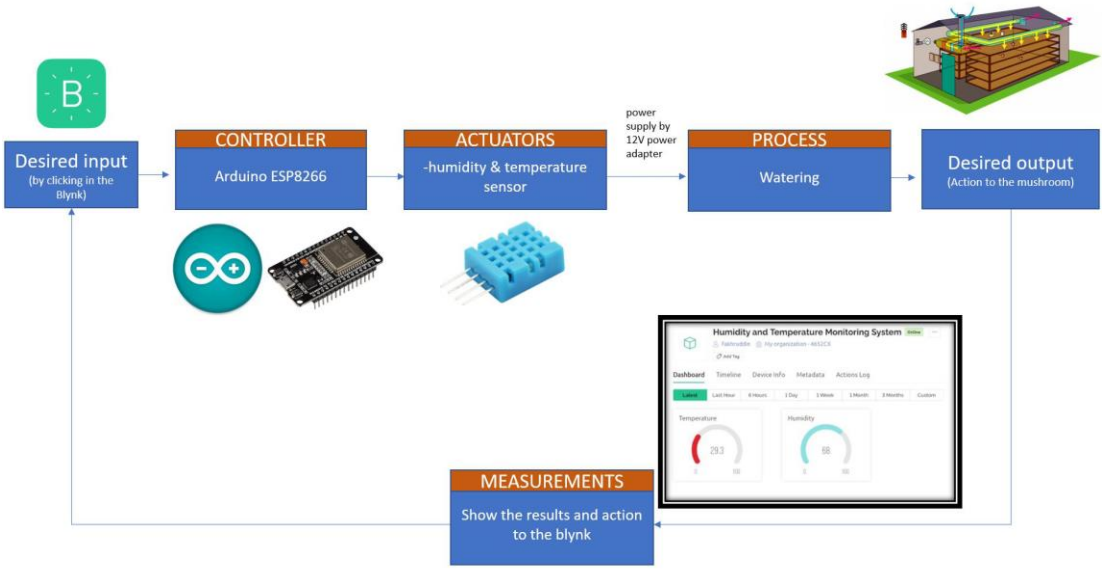

Fig. 3 *Block Diagram of the system*

3. Results and Discussions

This wireless system is connected to Blynk. In Blynk, user can monitor the temperature and humidity of the mushroom. The coding for this wireless temperature and humidity monitoring system is developed with Arduino IDE software using a C++ programming language. The Blynk and DHT sensor library is added to the program. The Blynk firmware configuration, which is template ID, device name and auth token is obtained once the web dashboard is set up.

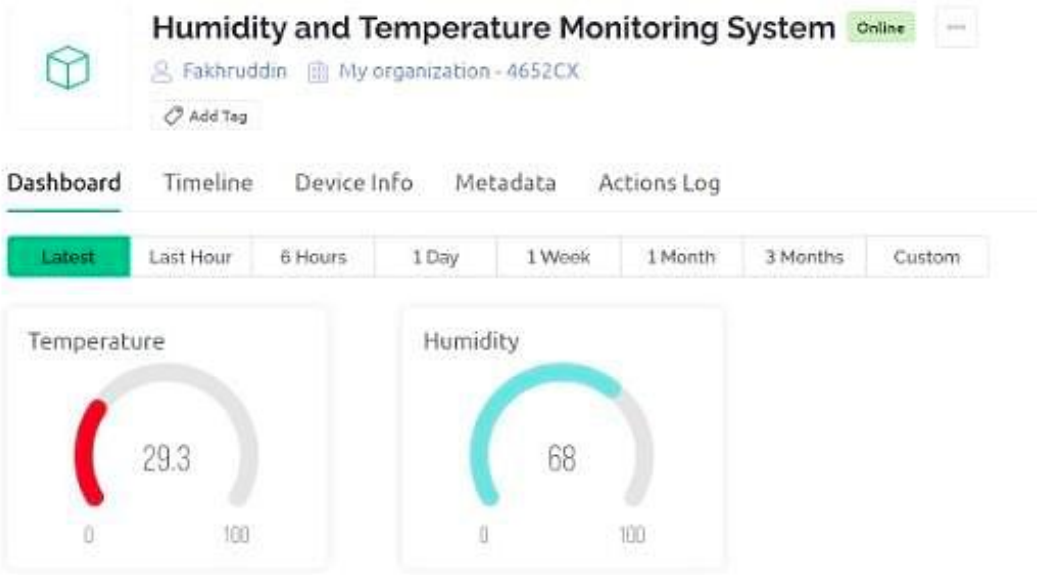

Fig. 4 *System monitoring using Blynk software*

4. Conclusion

This project met its goal of identifying appropriate hardware for monitoring in-house oyster mushroom cultivation. The installation of the ESP8266 with the appropriate code using the Arduino IDE was then completed successfully. The DHT11 humidity and temperature sensor installation has been completed. The hardware function in oyster mushroom cultivation is to monitor and control the variable parameters inside the mushroom house, which are temperature, humidity, and water pump. Thus, the mushroom cultivation monitoring system built with the ESP8266 was a success.

References

[1] M. Rosmiza, W. Davies, R. C. Aznie, M. Jabil, and M. Mazdi, "Prospects for Increasing Commercial Mushroom Production in Malaysia: Challenges and Opportunities," Mediterr. J. Soc. Sci., no. January, 2016, doi: 10.5901/mjss.2016.v7n1s1p406.

[2] M. T. Islam, Z. Zakaria, N. Hamidin, and B. M. I. Mohd Azlan, "A Competitive Study on Higher Yield Performance in Indoor Optimized Environment and Outdoor Cultivation of Pleurotus pulmonarius," MAYFEB J. Agric. Sci., vol. 2, no. November, pp. 13–27, 2016

[3] M. A. M. Ariffin et al., "Automatic Climate Control for Mushroom Cultivation using IoT Approach," 2020 IEEE 10th International Conference on System Engineering and Technology (ICSET), 2020, pp. 123-128, doi: 10.1109/ICSET51301.2020.9265383.

[4] T. Kaewwiset and P. Yodkhad, "Automatic temperature and humidity control system by using Fuzzy Logic algorithm for mushroom nursery," 2017 International Conference on Digital Arts, Media and Technology (ICDAMT), 2017, pp. 396-399, doi: 10.1109/ICDAMT.2017.7905000.

[5] A. Najmurrokhman, Kusnandar, U. Komarudin, A. Daelami and F. Adiputra, "Design and Implementation of Temperature and Humidity Control System in Oyster Mushroom Cultivation using Fuzzy Logic Controller," 2019 International Conference on Computer, Control, Informatics and its Applications (IC3INA), 2019, pp. 146-150, doi: 10.1109/IC3INA48034.2019.8949573.

[6] M. S. Hadi, A. U. P. Y. Kusuma, M. A. Mizar, D. Lestari, A. Witjoro and M. Irvan, "IoT and Fuzzy Logic Based Smart Mushroom Cultivation Technology," 2021 7th International Conference on Electrical, Electronics and Information Engineering (ICEEIE), 2021, pp. 346-350, doi: 10.1109/ICEEIE52663.2021.9616842.

[7] I. Mat, M. R. M. Kassim, A. N. Harun and I. M. Yusoff, "Environment control for smart mushroom house," 2017 IEEE Conference on Open Systems (ICOS), 2017, pp. 38-42, doi: 10.1109/ICOS.2017.8280271.

[8] E. N. Salamat and J. Yoo, "Development of Growing House Control System using Wireless Sensor Network," 2020 20th International Conference on Control, Automation and Systems (ICCAS), 2020, pp. 1031-1033, doi: 10.23919/ICCAS50221.2020.9268365.

[9] T. M. Bandara, W. Mudiyanselage and M. Raza, "Smart farm and monitoring system for measuring the Environmental condition using wireless sensor network - IOT Technology 22 in farming," 2020 5th International Conference on Innovative Technologies in Intelligent Systems and Industrial Applications (CITISIA), 2020, pp. 1-7, doi: 10.1109/CITISIA50690.2020.9371830

[10] M. R. M. Kassim, I. Mat and I. M. Yusoff, "Applications of Internet of Things in Mushroom Farm Management," 2019 13th International Conference on Sensing Technology (ICST), 2019, pp. 1-6, doi: 10.1109/ICST46873.2019.9047702.

[11] R. K. Megalingam and V. V. Gedela, "Solar powered automated water pumping system for eco-friendly irrigation," 2017 International Conference on Inventive Computing and Informatics (ICICI), 2017, pp. 623-626, doi: 10.1109/ICICI.2017.8365208.

[12] Abd Wahab, Hanani & Manap, Muhamad & Ismail, Al Emran & Ong, Pauline & Maznan, I. & Zainulabidin, Muhd & Mat noor, Fazimah & Zaleha, M.. (2019). Investigation of Temperature and Humidity Control System for Mushroom House. International Journal of Integrated Engineering. 11. 10.30880/ijie.2019.11.06.004.

[13] S. Hebbar and G. V. Prasad, "Automatic water supply system for plants by using wireless sensor network," 2017 International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC), 2017, pp. 742-745, doi: 10.1109/I-SMAC.2017.8058277.

[14] T. H. Nasution, M. Yasir, Fahmi and S. Soeharwinto, "Designing an IoT system for monitoring and controlling temperature and humidity in mushroom cultivation fields," 2019 International Conference on Electrical Engineering and Computer Science (ICECOS), 2019, pp. 326-331, doi: 10.1109/ICECOS47637.2019.8984446.