iJETRM
International Journal of Engineering Technology Research & Management
Published By:
https://www.ijetrm.com/

IOT-BASED SMART MUSHROOM FARMING MONITORING SYSTEM

Ananya H S, Ankitha B, Anusha R, Bhagyashree Patil
Students, Dept of Electronics and Communication Engineering,
Sapthagiri College Of Engineering Bangalore, India

Prof. Prathiba.P
Assistant Professor, Dept of Electronics and Communication Engineering,
Sapthagiri College Of Engineering Bangalore, India

ABSTRACT
The comprehensive system aims at improving mushroom farming through advanced technology. Traditional methods of mushroom farming are inefficient due to manual intervention and difficulty in maintaining optimal environmental conditions such as temperature, humidity and carbon-dioxide. The system includes automated irrigation, ventilation, and lighting to optimize resource usage and reduce manual labor. It also incorporates an AI module (utilizing YOLOv5) for disease detection, enabling early identification of infections to prevent yield loss. Farmers can monitor and control the system remotely through a web dash board or mobile app, receiving real-time alert and data insights for decision making.

Keywords:
Raspbian OS, OpenCV, YOLOv5, Thing speak, LDR sensor, DHT11 sensor, moisture sensor.

INTRODUCTION
Mushroom cultivation is sensitive to environmental conditions like temperature, humidity, and CO2 levels, requiring precise monitoring for successful growth. Traditional farming methods, relying on manual intervention, often result in inconsistent yields and increased risk of crop failure. This project introduces a technology-driven solution, integrating IoT and automation, to revolutionize mushroom farming. Mushrooms are unique organisms classified as fungi. Unlike plants, they lack chlorophyll and depend on decaying organic material for growth. They thrive in specific conditions, such as dark environments with controlled temperature, humidity, and carbon dioxide levels. For instance, white button mushrooms grow only half a year in controlled environments and five to six months in favorable outdoor conditions. However, maintaining these conditions manually is labor-intensive and prone to human error, making the adoption of smart technology essential.
By utilizing the scalability and accessibility of cloud platforms, The IoT-based system addresses these challenges by continuously monitoring critical parameters like temperature, humidity, and CO2 levels using sensors such as DHT11. Soil moisture sensors ensure that the mushroom beds receive the optimal amount of water. The data collected by these sensors is processed in real-time. Automated mechanisms, including drip irrigation, ventilation, and lighting, are regulated based on this data to ensure that the environmental conditions remain within the desired range.
An innovative aspect of the project is the incorporation of AI- driven disease detection using YOLOv5 technology. This module identifies infections early, preventing potential yield losses. The remote monitoring system allows farmers to access real-time data and alerts through a mobile app or web dashboard. By analyzing historical data, AI algorithms can predict optimal growing conditions and identify anomalies, enabling better decision-making and reducing risks.

OBJECTIVES
1. Develop an integrated Raspberry pi platform for mushroom farming.
2. Implement automated environmental monitoring and control.
3. Create a machine learning model for Mushroom disease detection.
4. Provide real-time remote monitoring capabilities.

PROBLEM STATEMENT
Mushroom farming struggles with inefficient environmental control, making it hard to maintain optimal temperature, humidity, and CO_2 levels. Delayed disease detection leads to crop losses, while traditional methods waste resources and increase labor costs. Manual intervention limits scalability and accuracy. A technology-driven, automated system is essential for efficiency.

iJETRM
International Journal of Engineering Technology Research & Management
Published By:
https://www.ijetrm.com/

PRPOSED FRAMEWORK

A. **Hardware components used**

1. Raspberry Pi
2. DHT11 sensor
3. LDR sensor
4. Moisture sensor
5. LED Light
6. Water pump
7. Fan
8. Jumping wire
9. Relay
10. Power supply
11. Charger
12. Memory card

B. **Software tools used**

1. Raspbian OS
2. Python
3. Open CV

C. **System Architecture**

IoT-based Smart Mushroom Monitoring System using Raspberry Pi, Python, and OpenCV enables real-time environmental control and disease detection. The Raspberry Pi collects data from temperature, humidity, and CO_2 sensors while a camera module captures mushroom images for analysis. Using Python and OpenCV, the system processes images to detect diseases and monitor growth. Sensor data and image insights are sent to the cloud for storage and machine learning-based predictions. A web allows remote monitoring, while automated relay adjust watering, ventilation, and lighting. Farmers will get to know about the diseases in the early stages itself by referring the images given by the model and it will detect the disease in early stage which is useful to healthy cutivation.

D. **Implementation**

Objective 1 Develop an integrated Raspberry Pi platform for mushroom farming

The fig 1 shows the flowchart of Raspberry Pi.

IoT-based Smart Mushroom Farming Monitoring System using Raspberry Pi and ThingSpeak operates by first initializing the Raspberry Pi with necessary hardware, network connectivity, and sensor interfaces to collect real- time data on temperature, humidity, CO_2 levels, soil moisture, and light intensity. This data is sent to ThingSpeak for storage and processing. The Raspberry Pi then retrieves and compares the data against predefined thresholds. If conditions are optimal, the system continues monitoring; otherwise, it takes corrective actions like activating air conditioning, humidifiers, ventilation, water supply, or grow lights.This smart farming approach enhances efficiency, reduces manual labor, and ensures better yield and resource management, making it highly effective for mushroom farming and other controlled agriculture environments.

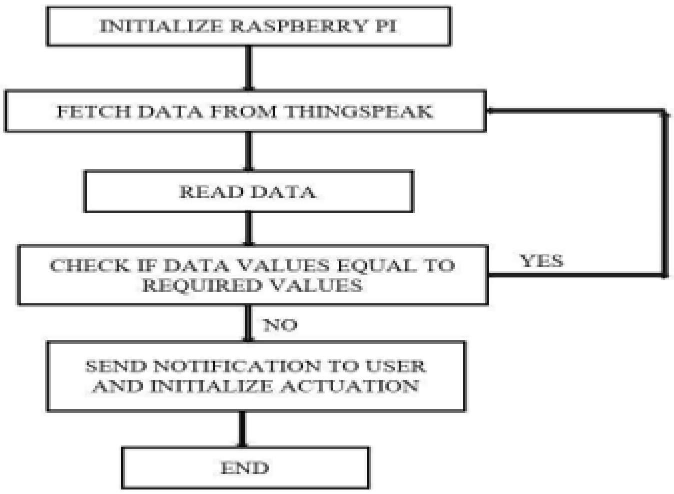

Fig 1: Flowchart of an automated monitoring and control system using Raspberry pi

iJETRM
International Journal of Engineering Technology Research & Management
Published By:
https://www.ijetrm.com/

Objective 2 Implement automated environmental monitoring and control.

The system uses a set of sensors including a temperature/humidity sensor, LDR sensor, soil moisture sensor. The Raspberry Pi analyzes the data and controls actuators like humidifiers, ventilation fans, or water pumps to adjust the environmental conditions. If any of the parameters deviate from the optimal range for mushroom cultivation (temperature: 27-30°C, humidity: 85-95%, light intensity: 0- 500 lux, CO_2 levels: 0-500 ppm), the system automatically triggers corrective actions and helps in the health cultivated of mushroom.

Objective 3 Provide real time remote monitoring capabilities

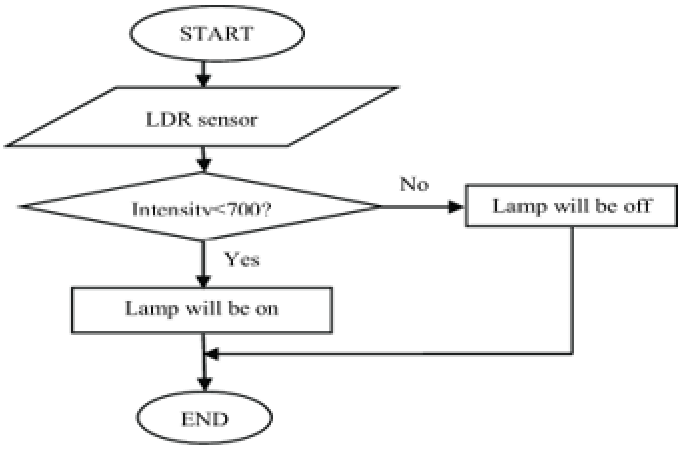

Fig 2: Flowchart of Intensity Detection

The fig 2 shows flow chart of LDR to detect the light intensity. The smart mushroom farming monitoring system integrates IoT-based technology using sensors to optimize growing conditions. The LDR sensor monitors ambient light intensity, ensuring mushrooms receive the required low-light or dark environment for growth.

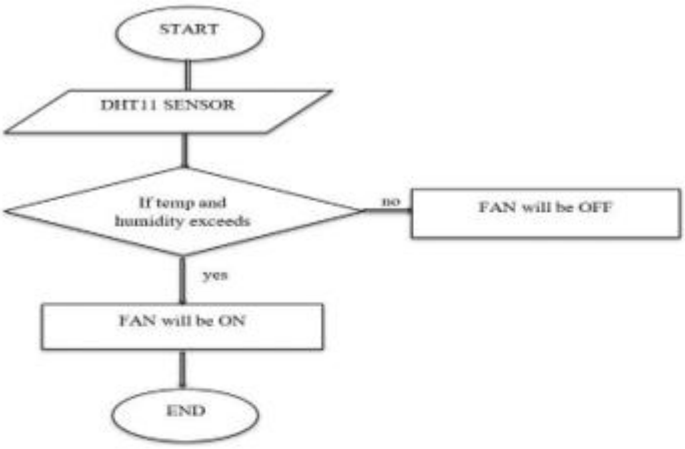

Fig 3: Flow chart of humidity detection

The fig 3 shows the DHT11 sensor monitors temperature and humidity, which are crucial for mushroom cultivation. Connected to a microcontroller like Arduino or Raspberry Pi, the sensor collects real-time environmental data and triggers corrective actions. If temperature or humidity exceeds the predefined limits, actuators like fans or humidifiers are activated to restore optimal conditions.

IJETRM
International Journal of Engineering Technology Research & Management
Published By:
https://www.ijetrm.com/

Objective 4 Creating the machine learning model for mushroom disease detection

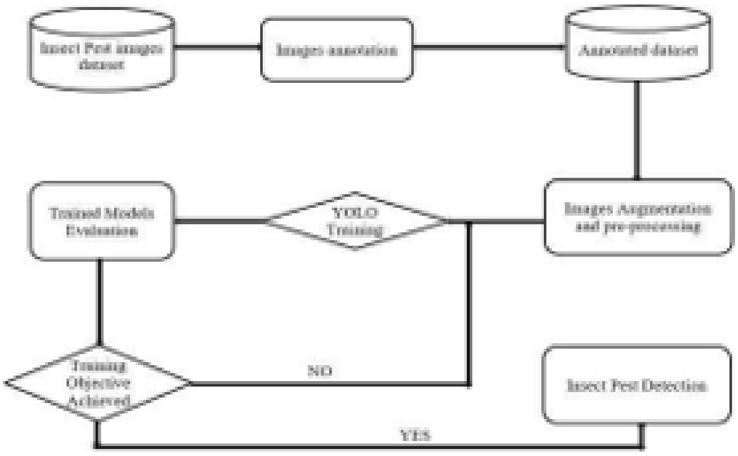

Fig 4: Flow chart of YOLO model

The Fig 4 shows the Flowchart of YOLO model, the implementation of a machine learning model for detecting mushroom diseases using the YOLOv5 (You Only Look Once version 5) deep learning algorithm. The process begins with collecting a dataset of mushroom images, including both healthy and diseased samples. These images undergo annotation, where bounding boxes and disease classifications are added. To improve accuracy, the dataset undergoes preprocessing techniques like rotation, scaling, flipping, brightness adjustment, and normalization.

RESULTS

Objective 1 Interfacing Raspberry pi to soil moisture sensor

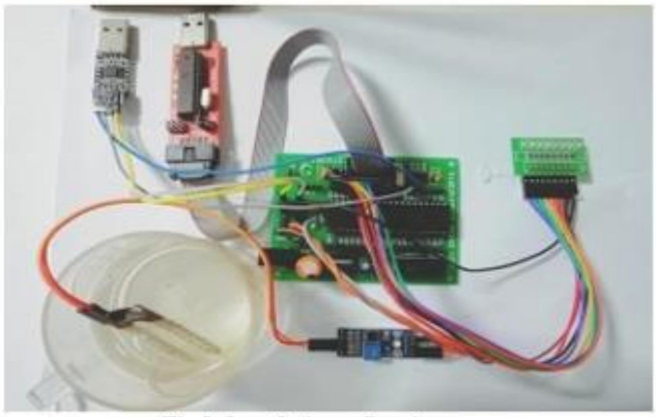

Fig 5: Interfacing soil moisture sensor

The Fig 5 shows the Raspberry Pi interfaces with a soil moisture sensor to monitor soil conditions. A potentiometer sets the moisture threshold; if moisture exceeds it, the digital output goes high, lighting an LED. If moisture is low, the output remains low. This system enables automated irrigation, ensuring optimal conditions for mushroom cultivation.

iJETRM
International Journal of Engineering Technology Research & Management
Published By:
https://www.ijetrm.com/

Objective 2 Interfacing Raspberry pi to DC Water Pump, Fan and LED

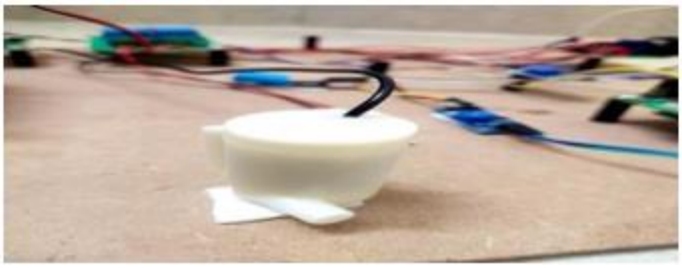

Fig 6: Interfacing Raspberry pi DC water pump

Fig 7: Interfacing Raspberry Pi to Fan

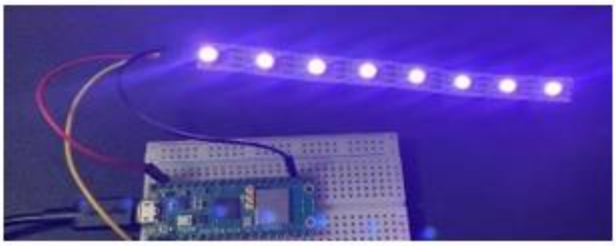

Fig 8: Interfacing Raspberry pi to LED

The fig 6,7,8 shows the interfacing Raspberry Pi to water pump, fan, led. The interfacing of a Raspberry Pi with a cooling fan for temperature and humidity control. The setup involves programming the Raspberry Pi to monitor environmental conditions using sensors and adjust the fan speed accordingly. By implementing variable fan speeds, the system ensures precise temperature regulation, optimizing energy efficiency and reducing noise. This dynamic control helps maintain stable temperatures and enhances overall performance. The system can automatically adjust fan speeds to suit different conditions, ensuring efficient cooling and minimal power consumption. The accompanying image illustrates the hardware setup, where a Raspberry Pi is connected to a fan, showcasing the practical implementation of this system.

iJETRM
International Journal of Engineering Technology Research & Management
Published By:
https://www.ijetrm.com/

Table 1: Different Parameters Considered During Study

References	Integrated Ecosystem with holistic solution	Environmental control and remote monitoring	Disease Classification with remedy suggestion	Scalability of Controller and ecosystem
[3] Reed et al	NO	Yes	No	Yes moderate
[1] D.Matt	NO	Yes ,limited	No	Yes moderate
[8] P.Maurya	NO	Yes,limited	No	No
[7]M.P.Angral	NO	Yes,limited	No	Yes ,moderate
Proposed System	Yes, includes automation, disease classification, e-commerce, and expert support.	Yes, precisely manages humidity, temperature, light, and CO_2 via sensors and actuators.	Yes, AI-based, classifies five classes.	Yes, scalable for large farms; easy integration of farmers' farmhouses

Table 1 shows the Different parameters considered during study

Table 2: Model Performance

References	Pre-trained Models	Accuracy (%)
[6]M Suresh	VGG16	N/A
[7]M .P.Angral	DensNet201	N/A
[8]P.Mauria	Xception	76.6%
[10]N.Zahan	NASNetMobile	88.40%
Proposed system	Yolov5	98%

Table 2 shows the compare performance of different pre trained model.

CONCLUSION

The proposed system successfully automates the monitoring and regulation of environmental conditions for mushroom cultivation using Raspberry Pi and various sensors. It enhances precision in irrigation, temperature, and humidity control, leading to improved crop yield and resource efficiency. The system also integrates disease classification using AI, providing a scalable and intelligent solution for modern farming. The comparative study shows that the proposed model outperforms traditional methods and existing pre-trained models, making it a viable solution for large-scale farming and smart agriculture applications.

REFERENCES

[1] D.Matt (2016). Food and Agriculture Organization of the United Nations (FAO). Climate Change, Agriculture and Food Security.[Online]. Available: https://www.fao.org/home/en/
[2] D. C. Zied and A. Pardo-Giménez, Edible and Medicinal Mushrooms: Technology and Applications. Hoboken, NJ, USA: Wiley, 2017.
[3] J. N. Reed, S. J. Miles, J. Butler, M. Baldwin, and R. Noble, ''AEautomation and emerging technologies: Automatic mushroom harvester development,'' J. Agricult. Eng. Res., vol. 78, no. 1, pp. 15–23, 2001. Azoyam, ''Harvesting feasibility analysis of an automated mushroom system,'' M.S. thesis, Dept. Agricult. Appl. Econ., Univ. Georgia, Athens, Georgia, 2004.
[4] H. G. Schiau, ''Considerations on the evolution of mushrooms harvesting systems,'' Res. Sci. Today, vol. 2013, no. 1, pp. 170–183, 2013.
[5] J. J. Mes, ''Breeding for bruising insensitive mushrooms for cost efficient mechanical harvest,'' ,The Netherlands, 2009.

iJETRM
International Journal of Engineering Technology Research & Management
Published By:
https://www.ijetrm.com/

[6] M. Suresh, et al., Monitoring and automatic control of various parameters for science vol. 1055IOP Publishing, 2021, p. 12011.
[7] M.P. Angral, Different automatic monitoring and controlling technique for mushrooms, Turk. J. Comput. Math. Educ. 12 (11) (2021) 3363–3369.
[8] P. Maurya, N.P. Singh, Mushroom classification using feature-based machine learning approach, in: Proceedings of 3rd International Conference on Computer Vision and Image Processing, Springer, 2020,
pp. 197–206.
[9] A. Wibowo, Y. Rahayu, A. Riyanto, T. Hidayatulloh, Classification algorithm for edible mushroom identification, in: 2018 International Conference on Information and Communications Technology (ICOIACT), IEEE, 2018, pp. 250–253.
[10] N. Zahan, M.Z. Hasan, M.A. Malek, S.S. Reya, A deep learning-based approach inedible and poisonous mushroom classification, in: 2021.