



MONITORING AND CONTROLLING OF MUSHROOM CULTIVATION THROUGH IOT

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Abstract

Agriculture sensors are crucial in contemporary agriculture. The use of sensors in many agricultural processes reduces crop pollution, increases productivity, and lowers operational costs. Among other agricultural sectors, the mushroom industry is relatively new and modest. Because the majority of mushroom plantations are small-scale, their production capacity is limited by insufficient integrated environmental systems and a lack of funds to improve facilities. This project offers an environmental monitoring and control system based on an ARM Processor that uses the Internet of Things to monitor and regulate environmental parameters such as temperature, humidity, and light intensity in a mushroom farm. It allows users to use an Android device to monitor temperatures and humidity in a mushroom farm using the web portal UBIDOTS. The control algorithm can autonomously operate equipment in a mushroom farm, utilizing sensor data to maintain the environment in ideal conditions for mushroom cultivation. The settings are presented on an OLED screen in the farming room. As a result, the collected information is on the cloud. The Arduino comprehensive development environment uses to write the controller's code in the Arduino programming language, then debug and compile the code before burning it into the microcontroller. The outcome demonstrates the viability of remote environmental monitoring over the Internet. Perhaps helpful to Indian farmers, it reduces the need for human labour and automates manufacturing.

Keywords— ARM Processor, Internet of things, Sensors, UBIDOTS, OLED Display .

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1. Introduction

In the food world, mushrooms are classified as vegetables, yet they are essentially fungi. Even though mushrooms

are not vegetables, they contain multiple important nutrients and play a significant role in the food industry. Mushrooms are high in nutrients and provide medicinal advantages, such as lowering the risk of

obesity, overall mortality, diabetes, and heart disease. Vitamins also promote healthy skin and hair, greater vitality, and general weight loss. Engaged in agriculture is a huge proportion of the Indian population. In comparison to other agricultural industries in India, mushroom production is recent and modest in scope. The mushroom is grown and processed manually, from spawn creation through packaging, which requires mushroom growers to spend more time and work harder to ensure sanitary conditions and the proper temperature and humidity. Thus, the risks of pest and disease incidence are significantly higher, which sometimes severely destroys mushroom production, resulting in a serious loss to the grower. As a result, the introduction of IOT and the use of sensors in many agricultural sectors has had a tremendous beneficial influence on modern agriculture, which helps in improving output and lowering operating costs, and the same may be applied to mushroom cultivation.

LITARATURE SURVAY

Arjuna Marzuki and Soh Yan Ying[1] suggested an interface circuit for agriculture sensors that incorporates a monitoring role that allows the user to wirelessly monitor temperature, moisture, concentration of carbon dioxide and illuminance in a mushroom farm, and a deal with these issues that can control the status in the mushroom farm utilizing sensor feedback. The monitoring system was capable of collecting sensor data and transmitting it to the Thing Speak internet cloud for monitoring and storage. The user can access the data at any time by utilising a computer that is linked to the Internet. Based on sensor data, the control system was able to regulate an ac-powered humidifier, light, and fan to maintain temperature, humidity, carbon dioxide concentration, and intensities at optimal growing conditions in an actual mushroom farm.

The AT89S52 controller, SHT10 sensor, and TC35i GSM (Global System for Mobile Communication) Module make up the

climate and humidity monitoring system proposed by Wang X. [2]. A Nokia 3310 LCD (liquid crystal display) module is used to monitor and show environmental conditions such as temperature and humidity. If the current temperature or humidity level is too high, the user will get a text notification on their mobile device.

Rahali et al. [3] proposed a greenhouse monitoring and control system based on GSM. This technology is more advanced than its predecessor since it not only collects data but also enables its users to control climate variables like humidity, temperature, and soil moisture by text message (Short Message Service). The LM35DZ temperature sensor and the HIH-4000-001 humidity sensor were used.

An Arduino microcontroller-based indoor environmental monitoring system was proposed by Kalinin, Y. S., Velikov, E. K., and Markova, V. I. [5]. The system consists of a wireless module, a main module, and a dialer module. If two or more readings are beyond the allowed range for more than 10 seconds, the dialer module will make a call and send an SMS in the event of a fire [7]. Sending an SMS to the dialer enables the user to configure up to four phone numbers to automatically call or send an SMS message to.

This system was created by Lokesh Krishna K., Madhuri J., and Anuradha K. [8] using ZigBee to monitor, notify, and regulate the environment while minimising energy use. The system is comprised of an ARM7 CPU, several sensors, and a ZigBee module. Temperature, humidity, and soil moisture readings are just a few examples of the types of field data that sensors gather and relay to the cloud and the end user through a ZigBee connection.

To identify and categorize plant diseases using image processing, Andi Wahyu Rahardjo Emanuel has developed a five-step process [10]. The process begins with digital image capture equipment. The second phase, "image pre-processing," involves:

- Adjusting the size of the picture.
- Making it smoother.

- Making the contrast more robust.
- Improving the image quality.

The third process involves picture segmentation and noise removal. Step four involves Feature Extraction, which considers colour, form, edge, and texture. Convolutional neural networks (CNNs) can learn from inputs, classify outputs, and even make diagnoses. Here is where the correctness of the model is checked [10].

The newly proposed area, in this paper is that we used ARM Processor which is advanced Processor, OLED Display to display the respective Temperature, Humidity, Carbon dioxide and Light Intensity in the room as the users use Digital Thermo Hygrometer in the farming room to know the respective parameters, and the use of DS18B20 Temperature sensor probe which is water proofed and can measure temperature more accurately compared to other sensors [11]. The online platform we are using is UBIDOTS which is able to send alerts to the user directly via SMS or Mail [12] without the use of GSM Module.

Detecting the maturity of bananas is the subject of a design presented by Palraj M.P., Hema C.R., R. Pranesh Krishnan, and Siti Sofiah, Mohd Radzi [13]. As part of this

study, we use error-back propagation to alter a model neural network. A banana serves as the study's specimen. The data collection compiles using information gathered from bananas at various stages of ripeness, from fresh to mouldy. This procedure has three steps: Picture Bananas undergo pre-processing, feature extraction, and classification. At first, a digital camera takes a picture at a resolution of 320 pixels by 240 pixels. After that, the concept is recalculated based on its colour index. Grayscale image used to depict the RGB colour component. Simple heuristic approaches using to rescale the colour components of the recomputed picture. The process is that an image's histogram is created and then utilized as a feature vector to identify the banana's maturity. This study demonstrates a detection performance of 96% [14].

2. METHODOLOGY

Fig.1 shows the block diagram of proposed system of the Mushroom cultivation by using ARM cortex-M processor. The data from the sensors are sent to IOT Platform through Wi-Fi module and the controlling devices are activated accordingly.

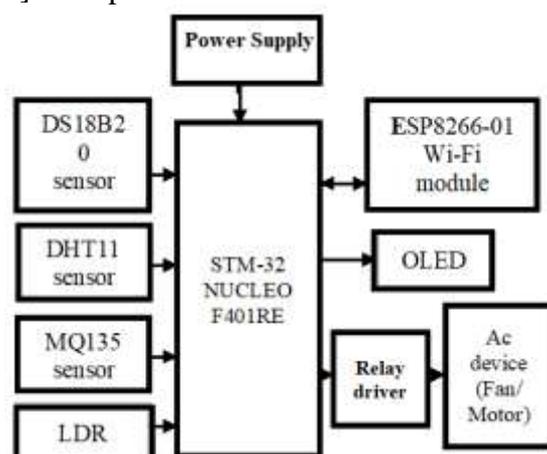


Fig. 1. Block diagram of Proposed System.

a. OLED Display

A light-emitting diode (LED) with an emissive electroluminescent layer that produces light in reaction to an electric current is known as an optical light-emitting

diode (OLED). These sustainably grown layers are located between two conductive materials. OLEDs are used to create digital displays for many different types of devices, including TVs, computers, and mobile

systems like smartphones, small video game consoles, and personal digital assistants (PDAs). The development of white organic light-emitting diodes (OLEDs) for use in solid-state lighting is a major area of research.

b. Temperature sensor (DS18B20)

The DS18B20 Arduino Temperature Sensor has been waterproofed. When you need to measure something far away or in damp conditions, this tool comes in handy. While the sensor is good up to 125, the wire is PVC-coated, so we recommend keeping it under 100. Because they are digital, there is no signal deterioration over vast distances! The DS18B20 offers 9 to 12-bit temperature measurements through a 1-Wire interface, requiring only one wire (and ground) from a central CPU. 3.0–5.5V systems are compatible.

c. Humidity sensor (DHT11)

This DHT11 Climate and Humidity Sensor has digitised output signals from its temperature and humidity sensor complex that has been calibrated. The innovation behind it is very dependable and durable. The microcontroller is an elevated 8-bit model. A resistive element and a liquid NTC temperature sensor make up such sensor.

d. Air quality sensor (MQ135)

Multiple gases, such as NH₃, NO_x, alcohol, benzene, smoke, and carbon monoxide, may be detected by the MQ-135 gas sensor. It reacts violently to fire, benzene steam, ammonia, and sulphur dioxide. MQ135's substance is SnO₂, and it is a unique material: when exposed to clean air, it conducts very little; but, when exposed to flammable gas, it exhibits excellent conductivity. Simply construct a basic electrical circuit that converts the change in conductivity to an output signal. In a normal situation, when no gas has been detected, set the sensor's output voltage as the reference voltage. The analogue output voltage will be about 1V. When the sensor detects gas, the concentration of dangerous gas rises by 20ppm for every 0.1V rise in voltage.

e. Light Dependent Resistor (LDR)

A light-dependent resistor (LDR) is a type of electrical component that responds to changes in illumination by changing its resistance value. It is a kind of resistor that resistivity varies depending on how much light hits its surface. The resistor's resistance varies as a function of light intensity. These resistors see widespread use in a variety of systems where illumination is critical. These resistors come in a variety of resistances and serve a number of different functions. For instance, an LDR can be utilised to activate an electrical device whenever it detects darkness, and deactivate it when it detects light. When exposed to darkness, a typical light-dependent resistor has a resistance of 1 MOhm, but when exposed to light, its value drops to a few KOhm.

f. Wi-Fi Module (ESP8266-01)

As a solitary Wi-Fi networking solution, the ESP8266 may serve as either the app's server or a mechanism by which another application processor can offload its Wi-Fi networking responsibilities. The ESP8266EX boots from a USB flash drive when hosting the software. It has a built-in cache specifically designed to speed up systems running these programmes. Any microcontroller-based device can also be easily connected to the internet wirelessly by using a Wi-Fi adaptor.

g. Nucleo-f401re (STM-32)

The STM32 Nucleo-64 development board, which has the STM32F401RE MCU, is compatible with Arduino and ST morpho connectivity. The STM32 Nucleo board provides a low-cost and versatile platform for prototyping using the STM32 microcontroller. Clients have a variety of options in terms of reliability, energy efficiency, and additional functions. The STM32 Nucleo open development platform may be easily expanded with a wide range of technical devices because of its compatibility with the Arduino Uno R3 connector and the ST Morphi connectors. The STM32 Nucleo board comes equipped with the analyzer and programmer ST-

LINK/V2-1. The STM32 Nucleo board includes the STM32 full software HAL library in addition to other sample scripts.

h. Relay controller

A relay is a device that regulates the modular system, such as the motors that open the windows. When the controller sends a signal, the relays are triggered. A relay is a switch that operates electrically. Power flows through the relay's coil, generating a magnetic field that attracts a lever and changes the switch settings, which are doubled through (changeover) switches.

i. 12V DC Fan

This is basically a fan that turns on and off based on the temperature that the user has chosen. The temperature may be adjusted using the input switches. It's referred to as "user temperature. When the room temperature exceeds the user's temperature, a signal is sent to the relays. Whenever the relay receives the signal, it turns on the fan that is linked to it. The fan will turn off when the room temperature falls just below the user's set temperature.

PROPOSED DESIGN

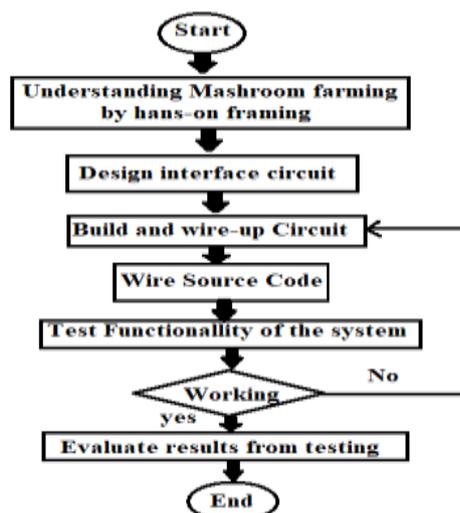


Fig. 2. Flowchart of Proposed System.

The design and implementation of this project is based on sensor values. Always communicates with each sensor via messages by events present in the IOT platform. ESP-01 is interfaced with ARM Processor with the help of USART. The ESP-01 RX is directly connected to TX of ARM Processor with controller port pin. The ESP-01 has a microchip antenna that emits signals; the antenna responds by sending back its data. ESP-01 communicates with TX and Rx. Fig.2 shows the overall flow of the system.

3. RESULTA AND DISCUSSION

The outcome came about once put the intended technology into action. The equipment that test included the following:

- An LDR.
- A soil moisture sensor.
- A DHT11 humidity sensor.
- An LM 35 temperature sensor.

Node MCU, an ATMEG328 microcontroller unit, offers a foundation for real-time monitoring of the farm's temperature, humidity, soil moisture, and light intensity and transmits this data to the end devices through the cloud. This method yields almost identical results and calibrates to the weather station's typical observations. Idle state of the system switch ON shown in Figure 3. The temperature (LM35) and humidity (DHT11) readings in MATLAB

were taken at various times, OLED display shows parameter values in farming room as shown in Figure 4. The collected

information is uploaded online is shown in Figure 5.

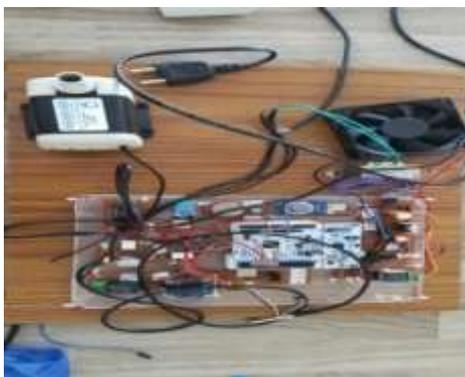


Fig. 3. Idle state of the system when about to be switched on.



Fig. 4. OLED Display displaying the parameter values in Farming room.



Fig. 5. shows values uploaded to UBIDOTS IOT Platform

The Blynk app acted as the system's interface. Graphical representation of all parameter values are shown in Figure 6. With the help of the low-powered Node, MCU sent the sensor readings straight to the cloud. The data was then made available via

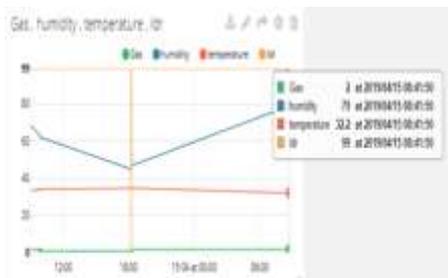
a consumer app called Blynk. In Figure 6, we can observe the sensor's temperature, humidity, soil moisture, and illumination readings. Figure 7 shows SMS alert send when humidity decrease from critical values.

Fig. 6. Graphical parameters.



representation of all

Fig. 7. SMS Alert when critical value.



Humidity decreases from

4. CONCLUSION

In this paper, we have analyzed ARMProcessor based Mushroom farm monitoring and controlling system using IoT. OLED Display used can display the values so that when we reach the farming room we can know the the parameters present in the room.The UBIDOTS Platform can send the alerts through SMS or Mail without the need for GSM module. The proposed system is simple, power efficient and easy to understand. The hardware for the project is implemented and the output results are verified successfully. Gardeners and farmers alike will benefit from the project's reimagining of the idea. Hence, IoT has radically altered the fields of supervision, administration, and statistics. The data from most essential sensors, including moisture and temperature sensors, have been uploaded to IoT platforms for access and monitoring. Growing mushrooms calls for constant attention to the weather and other environmental factors. When it comes to automating mushroom farms, our solution is a crucial first step. This project will aid in the automation and monitoring of mushroom plants, which will help farmers increase agricultural production and take efficient care of mushroom production by cutting down on the labour required to tend to the crop. In addition, we want to build a

standalone Android app that gives farmers quick access to the field's properties, including things like light.

FUTURE SCOPE

The IOT using to cultivate mushrooms. The perceived information is combined with data from the meteorological department to make accurate predictions, which may help the farmer plan accordingly and boost his support. Integrating IoT into plantations will make them more efficient and profitable. Smart Greenhouse has a wide range of potential applications in agriculture, and they will cause a significant shift in how farming practices in the Republic of India.

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