

SMART MUSHROOM CULTIVATION SYSTEM

2.1 EXPERIMENTAL SETUP AND PROCEDURE

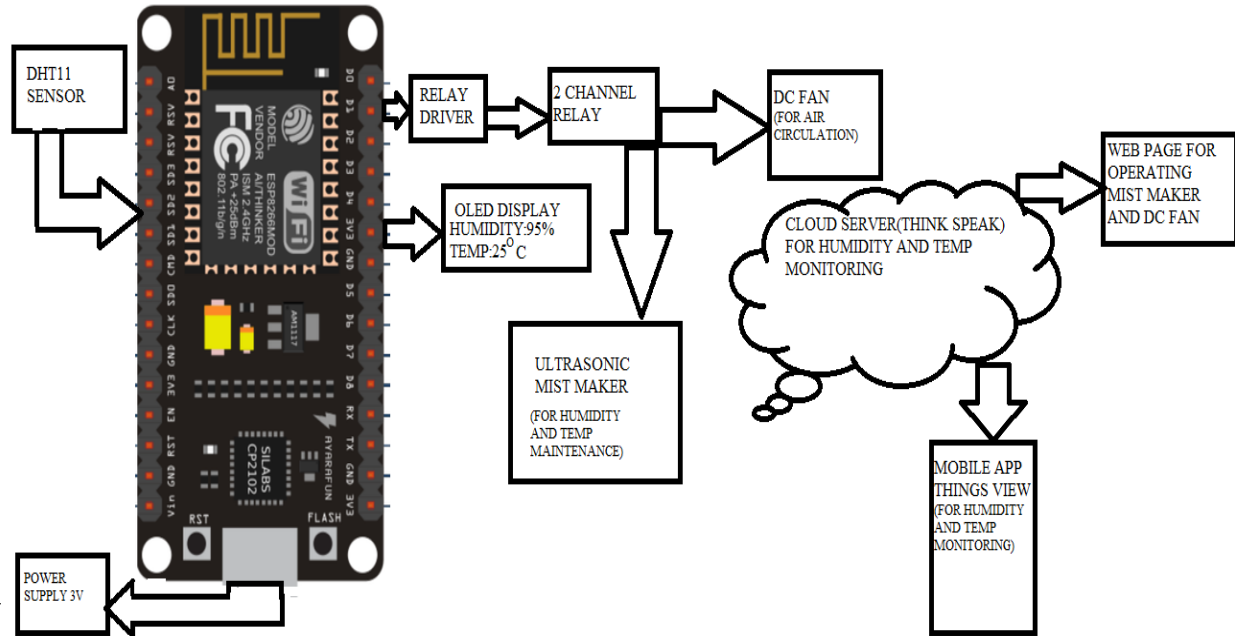


Fig: 2.1.1 BLOCK DIAGRAM

The smart mushroom cultivation starts with a well covered steel chamber with thermocol bended layer with proper air circulation. Here the automation of moisture maintenance is done by controlling the mist maker which provides humidity when needed and keep dry in other condition. Both the humidity and temperature are monitored by DHT11 sensor so the controller (Nodemcu) can change the state and on/off the mist maker. The use of water flow meter and solenoid valve use the water resources correctly and watering the mushrooms on bed. All these to the IOT server to retrieve the sensor data from the system and due process in mobile automatically.

To cultivate oyster mushrooms and it requires 55 to 65 Fahrenheit of temperature with 50 to 80 percent of moisture level which is to be maintained. It also need 48 hours of dryness to grow and about 15 to 20 days mushrooms will completely emerge(to be maintained). All these done on a closed and well maintained environment to cultivate better mushrooms. So it is automatically done by using the specified hardware's along with mist maker and proper watering of thrice in a day.

2.2 DELIVERABLE

This smart mushroom can be delivered as the whole setup and fixing the cost but the bed used is to be replaced for a duration(30 days).By doing this people can cultivate mushrooms in the home itself. When using smart mushroom cultivator we can produce mushrooms for good quality and sell it to the customers.

2.3 TIMELINE

This involves the design of steel case chamber and requires proper maintenance conditions the outer case design needs time (1 month).The design of automated product with IOT operation needs time along with creation of overall product in a compact and single board structure. Finally all the setup are assembled and testing of product requires one month. It is expected that it takes about 2 months of duration to complete.

2.4 BENEFICIARY OF INNOVATION

The main beneficiary is automated monitoring of mushroom cultivation. This will find in a separate marketing product .Due proper setup and the parameters are correctly predefined in software, fertile mushrooms are cultivated. The bed can be easily replaced as many times as possible and eliminates special monitoring person.

2.5 ADVANTAGES OF THE SMART MUSHROOM CULTIVATOR

- The oyster mushroom required less labor to cultivate.
- The advantage of cultivation in plastic bags is that the growing is used more efficiently and in small area more substrate can be placed.
- Pleurotus mushroom can degrade and grow on any kind of agricultural or forest wastes, which contain lignin, cellulose and hemicelluloses.
- Among all the cultivated mushrooms Pleurotus has maximum number of commercially cultivated species suitable for round the year cultivation. Moreover, variation in shape, colour, texture, and aroma are also available as per consumer's choice.

METHODOLOGY

3.1 HARDWARE USED:

- Nodemcu(ESP8266)
- DHT11 Sensor module
- 2 channel Relay module
- DC fan
- OLED display
- Mist maker

3.2 SOFTWARE USED

- Arduino IDE
- Thing speaks

3.3 NODEMCU

Node MCU is an open source IOT platform. Nodemcu Development Kit/Board consists of ESP8266 WIFI chip. ESP8266 chip has GPIO pins, serial communication protocol, etc. It includes firmware which runs on the **ESP8266** Wi-Fi SOC from Expressive Systems, and hardware which is based on the ESP-12 module. **Node MCU** is an open source IOT platform. It includes firmware which runs on the **ESP8266** Wi-Fi SOC from Expressive Systems, and hardware which is based on the ESP-12 module.

The **ESP8266 module** or simply the **ESP-01 module** offers a complete and self-contained Wi-Fi networking solution, allowing it to either host the application or to offload all Wi-Fi networking functions from another application processor. This is a high end module better than the blue colored module available in the market as this has a higher size firmware space for adapting it to the Different open source platforms available for this module.

The features of ESP8266 are extracted on Nodemcu Development board. Nodemcu with Development board/kit that consist of ESP8266 (wifi enabled chip) chip combines Nodemcu Development board which make it stand-alone device in IOT applications.

PIN DIAGRAM

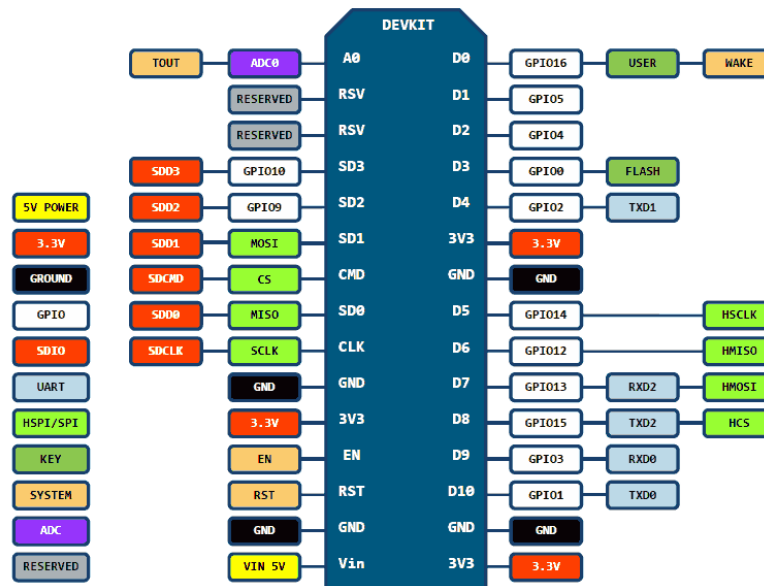


Fig: 3.3 PIN DIAGRAM OF ESP8266

3.3.1 GPIO (General Purpose Input Output) Pins

Nodemcu has general purpose input output pins on its board as shown in above pin out diagram. We can make it digital high/low and control things like LED or switch on it. Also, we can generate PWM signal on these GPIO pins.

Nodemcu Development kit provides access to these GPIOs of ESP8266. The only thing to take care is that Nodemcu Dev kit pins are numbered differently than internal GPIO notations of ESP8266 as shown in below figure and table. For example, the D0 pin on the Nodemcu Dev kit is mapped to the internal GPIO pin 16 of ESP8266.

ESP8266 is a System on Chip (SOC) design with components like the processor chip. The processor has around 16 GPIO lines, some of which are used internally to interface with other components of the SOC, like flash memory. Since several lines are used internally within the ESP8266 SOC, we have about 11 GPIO pins remaining for GPIO purpose. Now again 2 pins out of 11 are generally reserved for RX and TX in order to communicate with a host PC through which compiled object code is downloaded. Hence finally, this leaves just 9 general purpose I/O pins i.e.

D0 to D8. As shown in above figure of Nodemcu Dev Kit. We can see RX, TX, SD2, and SD3 pins are not mostly used as GPIOs since they are used for other internal process. But we can try with SD3 (D12) pin which mostly like to respond for GPIO/PWM/interrupt like functions. Note that D0/GPIO16 pin can be only used as GPIO read/write; no special functions are supported on it. Now let's see about functions required to initialize pin to GPIO mode, setting pin direction and its state (High/Low).

3.3.2 ADC (ANALOG TO DIGITAL CONVERTER A0)

Nodemcu has one ADC pin/channel on its board. ADC is used to convert analog signal into a digital signal. ESP8266 has inbuilt 10bit ADC with only one ADC channel i.e. it has only one ADC input pin to read analog voltage from external device/sensor.

3.3.3 SPI (SERIAL PERIPHERAL INTERFACE)

Nodemcu based ESP8266 has Hardware SPI (HSPI) with four pins available for SPI communication. It also has SPI pins for Quad-SPI communication. With this SPI interface, we can connect any SPI enabled device with Nodemcu and make communication possible with it. ESP8266 has SPI pins (SD1, CMD, SD0, and CLK) which are exclusively used for Quad-SPI communication with flash memory on ESP-12E; hence, they can't be used for SPI applications. We can use Hardware SPI interface for user end applications.

3.3.4 I2C (INTER-INTEGRATED CIRCUIT)

Nodemcu has I2C functionality support on ESP8266 GPIO pins. Due to internal functionality on ESP-12E we cannot use all its GPIOs for I2C functionality. So, do tests before using any GPIO for I2C applications.

3.3.5 UART (UNIVERSAL ASYNCHRONOUS RECEIVER TRANSMITTER)

Nodemcu based ESP8266 has two UART interfaces, UART0 and UART1. Since UART0 (RXD0 & TXD0) is used to upload codes to board. UART (Universal Asynchronous Receiver/Transmitter) is a serial communication protocol in which data is transferred serially bit

by bit at a time. Asynchronous serial communication is widely used for byte oriented transmission. In Asynchronous serial communication, a byte of data is transferred at a time.

3.4 DHT11 SENSOR

A **sensor** is a device, module, or subsystem whose purpose is to detect events or changes in its environment and send the information to other electronics. A sensor is a device that detects and responds to some type of input from the physical environment. The specific input could be light, heat, motion, moisture, pressure, or any one of a great number of other environmental phenomena. The output is generally a signal that is converted to human-readable display at the sensor location or transmitted electronically over a network for reading or further processing. In our project we are using we are using DHT11 SENSOR.

DHT11 is a humidity and Temperature Sensor, which generates calibrated digital output. DHT11 can be interface with any microcontroller like Nodemcu, Arduino, Raspberry Pi, etc. and get instantaneous results. DHT11 is a low cost humidity and temperature sensor which provides high reliability and long term stability. In our SMART MUSHROOM CULTIVATION project, we will build a small circuit to interface Nodemcu with DHT11 Temperature and Humidity Sensor. One of the main applications of connecting DTH11 sensor with Nodemcu is weather monitoring.

3.5 2 CHANNEL RELAY MODULE

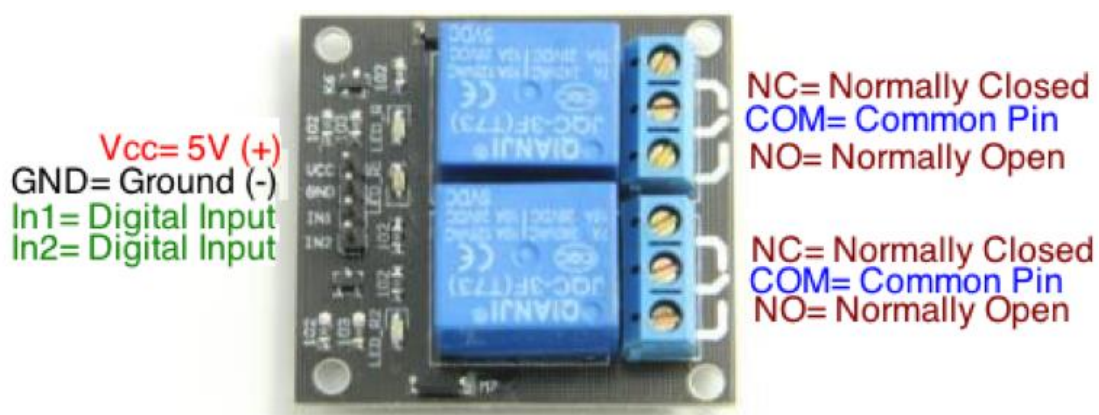


Fig: 3.5 TWO CHANNEL RELAY MODULE

A relay is an electrically operating switch. The main use of relay module is controlling circuits by a low power signal or when several circuits must be controlled by one signal. The first relay was used in long distance telegraph circuits as amplifiers, basically they repeated the signal

they received from one circuit, and transmitted it into a different one, and they were also used in early computers to perform logical operations.

2 channel Relay driver project can be controlled by feeding 2-12V trigger voltage, Very useful project for application like Micro-Controller based projects, Remote controller, Lamp on Off, and any circuits which required isolated high current and high voltage switching by applying any TTL or CMOS level voltage. Two LED works as operation indicator while in , 3 pins screw terminals to connect load and provides both normally open and normally closed switching.

3.6 OLED DISPLAY

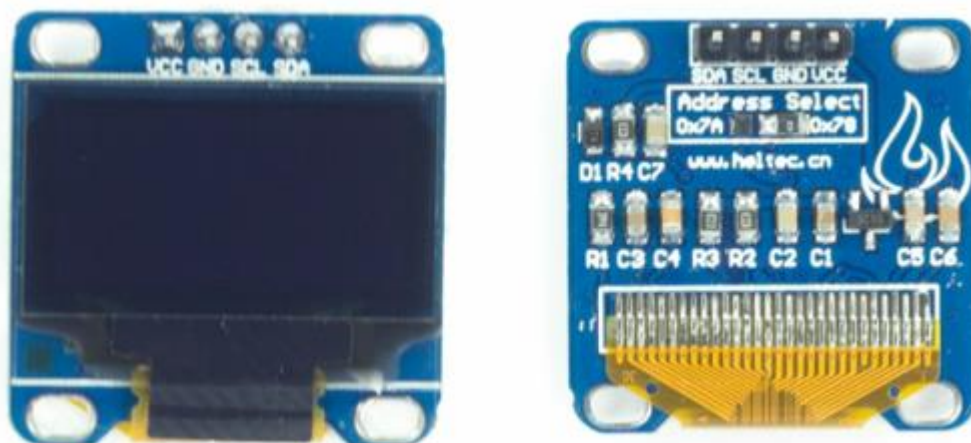


Fig: 3.6 OLED DISPLAY

An **Organic Light Emitting Diode (OLED)** is a display device which has self light-emitting technology composed of a thin, multi-layered organic film placed between an anode and cathode. In contrast to LCD technology, OLED does not require a back-light. OLED offers wide viewing range, almost 180 degree from left to right and up to down and also consumes less power than existing LCD's. OLEDs have been used in television screens, computer monitors, mobile phones, Personal Digital Assistants, etc. In the following, OLED with two different types of interfaces are discussed. They are bright and easy to read with large viewing angle and also have

high resolution. This can be used as a screen in Smart watches, MP3 players, Portable health devices, Smart Car camera monitor real time display.

3.7 DC FAN



Fig: 3.7 DC FAN

An electric **fan** is an electric motor attached with blades. If this motor is designed to **work** on AC it will run on AC, if it is designed to run on **DC** it will run on **DC**. However **DC** series motor can run on both **DC** and AC.

3.8 MIST MAKER

Air conditioning by [ultrasonic mist maker](#) has become more and more important in our lives. Comparing to classical systems, there are so many advantages of ultrasonic humidification especially due to its extremely low operating costs. An ultrasonic mist maker uses water to produce mist. It Increase your immunity level.

3.9 ARDUINO IDE

Arduino IDE is a lightweight, cross-platform application that introduces programming to novices. It has both an online editor and an on-premise application, for users to have the option whether they want to save their sketches on the cloud or locally on their own computers. While Arduino IDE is highly-rated by users according to ease of use, it is also capable of performing complex processes without taxing computing resources. With Arduino IDE, users can easily access contributed libraries and receive up-to-date support for the latest Arduino boards, so they can create sketches that are backed by the newest version of the IDE.

Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them. Programs written using Arduino Software (IDE) are called **sketches**. These sketches are written in the text editor and are saved with the file extension .ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom right-hand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.