**IOT Based Greenhouse Monitoring and Controlling System**

**G Dheeraj Reddy[1] , B. Mounika[2]**

**PG Student[1], Assistant Professor[2]**

**Department of Electronics and Communication Engineering**

**MJR COLLEGE OF ENGINEERING AND TECHNOLOGY**

**Piler, Andhra Pradesh-517214**

**Abstract:** Greenhouses are controlled environments for growing plants. Due to their inherent limitations, the greenhouse plants of today cannot be operated automatically and instead need direct intervention using a variety of forms. For plants to thrive in the proposed system, environmental factors like temperature, wetness, soil humidity, light intensity, etc. must be constantly monitored and adjusted. The study presented above demonstrates an IoT-based nursery management technique. The humidity, soil submersion, temperature, fire proximity, light intensity, etc. are all things the System may test for. The ESP32 transmits all characteristics of its surrounding environment to the cloud. The related actuator is activated if a parameter goes over the threshold. The microcontroller activates the motor if the Earth variable is below the set threshold. The user may see and adjust settings on their desktop computer or mobile device.

**INTRODUCTION**

The ecology is very important for plant growth. Greenhouse growers have a limited understanding of the moisture levels within the greenhouse. They merely get it via hands-on experience in the green building's environment [1]. At the conclusion of the day, experience is a major factor in their routine. If the soil retains an adequate moisture level, the plants will get water, but if it's too wet, the greenhouse roof is going to be opened throughout the day. High production rates may be attained with less expense, greater quality, and less negative effects on the environment if greenhouse plant production is optimised for efficiency. IoT allows for full regulation of climate conditions in the greenhouse, including cooling, heating, lighting, soil moisture, and more. Controlling this System requires attention to environmental criteria like temperature and humidity. The greenhouse's temperature, humidity, and light levels may all be tracked automatically [2]. Switchgear with simple ON/OFF capabilities is no longer Automation is crucial because it allows tasks to be completed without human intervention. While automation cannot completely eliminate or suppress human mistake, it may greatly reduce its prevalence in specific contexts. Anything useful or capable of being operated from a distance is in high demand in the modern world. Here, we'll assume the greenhouse owner can control and keep tabs on things from afar. The proprietor need not review all of them nor keep constant vigil on the situation [3]. The proprietor can't move very much and yet keep tabs on and manage all of the greenhouses. With the ESP8266 WiFi Module, data transmission to the network is wireless, eliminating the need for costly cables or connected connections. We have gathered enough information to justify creating an IoT-based greenhouse system.

**Literature survey:**

**An IoT-based greenhouse monitoring system with Micaz motes. Procedia computer science.**

One of the most important technologies of the 21st century, wireless sensor networks (WSN) are well suited for dispersed data collection and monitoring in harsh settings like greenhouses. The World Wide Web of Things (IoT) is another one of the century's most important technologies, and it's been fast expanding to include hundreds of uses throughout the public, private, medical, military, and agricultural sectors. In order for the automation system in a contemporary greenhouse to function properly, it is necessary to take readings from a number of various locations throughout the structure. If the measuring system required cabling, it would be more difficult to transfer after installation, more costly, and less secure. In this study, we provide a MicaZ-based WSN prototype for monitoring environmental parameters in greenhouses, including as temperature, light, pressure, and humidity. The Internet of Things has allowed for the dissemination of measurement data. This solution allows farmers to manage their greenhouse from any internet-connected device.

**IoT Based Automated Greenhouse Monitoring System**

Greenhouses are climate controlled structures

with walls and roof specially designed for offseason

growing of plants. Most greenhouse systems use manual

systems for monitoring the temperature and humidity

which can cause discomfort to the worker as they are

bound to visit the greenhouse every day and manually

control them. Also, a lot of problems can occur as it

affects the production rate because the temperature and

humidity must be constantly monitored to ensure the

good yield of the plants. Internet of Things is one of the

latest advances in Information and Communication

Technologies, providing global connectivity and

management of sensors, devices, users with information.

So the combination of IoT and embedded technology has

helped in bringingsolutions to many of the existing

practical problems over the years. The sensors used here

are YL69 moisture sensor and DHT11 (Temperature &

Humidity sensor). From the data’s received, Raspberry

PI3 automatically controls Moisture, Temperature,

Humidity efficiently inside the greenhouse by actuating

an irrigating pipe, cooling fan, and sliding windows

respectively according to the required conditions of the

crops to achieve maximum growth and yield. The

recorded temperature and humidity are stored in a cloud

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The focus of this initiative is on automating agricultural upkeep. In this way, the soil's moisture, ambient temperature, and lighting levels will be automatically stabilised. Even if we can anticipate the approaching weather, it is still possible for things like unexpected rain or intense sunshine to occur. These erratic weather shifts might be disastrous for the harvest. This method is going to maintain the circumstances that are good for the crops, so that this won't happen. The system will activate the heat lamp to keep the environment at a safe temperature for the crops in the event of unexpected rain. If the soil loses moisture as a result of excessive heat, the system will activate the water pump in order to restore the lost fluid. Certain plants can't grow in the absence of a certain quantity of sunlight. In cases when the ambient light is insufficient for the plants, the system will automatically switch on the supplemental lighting. The farmer doesn't have to scramble to switch on the water pump, the lights, the fan, etc., in any of these scenarios. The upkeep of farms is completely taken care of by this method. This information will be sent to the farmer's mobile device.

**IoT Based Greenhouse with Climate Monitoring and Controlling System**

The creation of a high-tech greenhouse controlled environment is the primary focus. With the help of the ESP8266 Node MCU board and some clever programming, greenhouse climate behaviour may be detected and the settings adjusted in accordance with the growers' specific needs for crop production. Soil moisture, the intensity of sunlight or artificial lighting, air temperature, and relative humidity are some of the variables that may be improved upon. A soil moisture sensor, a light-detection and -response (LDR) sensor, and a temperature and humidity (DHT22) sensor are proposed for monitoring in this design. The collected data is then provided to the NodeMCU module, where it is processed. The NodeMCU module communicates with the internet wirelessly or via IoT platforms like a telegram bot using the HTTP protocol. Farmers can keep an eye on their crops from afar with the help of the IoT technology, which transmits data on environmental factors to smartphones in an online manner. Technology has advanced rapidly, and continues to do so, to optimise and achieve optimum plant development in the agricultural sector of the food production industry. A reliable system would undoubtedly usher in a new era for Android/IDS smartphone software.

**Existing system:**

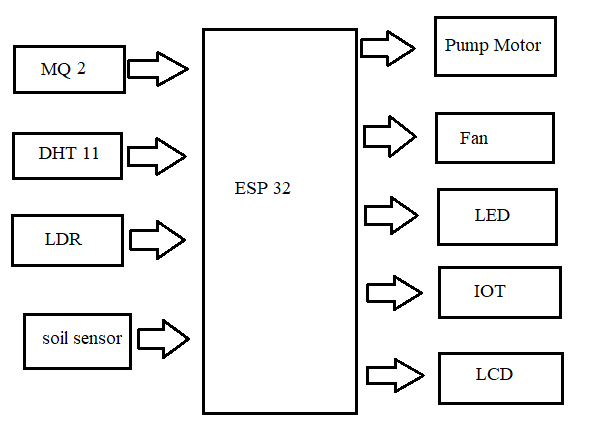
When a greenhouse is manually created or constructed, it requires a dedicated human caretaker to tend to the crops within at all times. Therefore, crops and fields are sometimes harmed as a result.

We thus suggested a method to circumvent this problem; we used sensors to keep the greenhouse at a constant temperature and humidity.

**Proposed system:**

For plants to thrive in the proposed system, environmental factors like temperature, wetness, soil humidity, light intensity, etc. must be constantly monitored and adjusted. The study presented above demonstrates an IoT-based nursery management technique. Humidity, soil submersion, temperature, fire proximity, light intensity, etc. are all things the System may test for. The ESP32 transmits all characteristics of its surrounding environment to the cloud. The related actuator is activated if a parameter goes over the threshold. The microcontroller activates the motor if the planet's gravity parameter is below the set threshold. The parameters may be shown and monitored on the user's mobile device and desktop computer.

**Block Diagram:**

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**MQ 2**

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Electronic devices called gas sensors (or gas detectors) are able to detect and identify various gases. They are often used for measuring gas concentration and detecting dangerous or explosive gases. Gas sensors are used to detect gas leaks in industrial and commercial buildings, as well as to identify smoking and carbon monoxide levels in residential settings. Portable and stationary gas sensors exist, each with its own range and detecting capabilities. Sound alarms and user interfaces are common components of larger embedded systems used in hazmat and security applications. Gas sensors need frequent recalibration since they are continually exposed to the air and other gases.

**DHT11**

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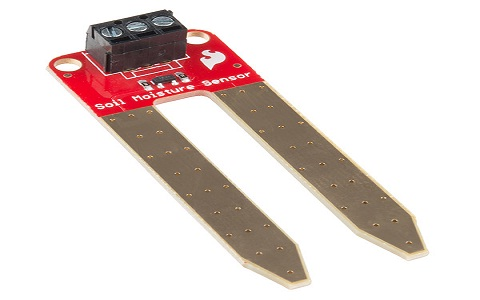
The DHT11 is an inexpensive digital humidity and temperature sensor that meets the most basic needs. It takes readings from a moisture sensor that is capacitive and the thermistor in the air and outputs them digitally (no analogue input ports are required) on the data pin. The interface is straightforward, but the timeliness of data capture is critical. Our library's sensor readings may be as long as two seconds outdated since the only major drawback of this sensors is that you can only collect fresh data from it after every 2 seconds.

**LDR**

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A light-dependent resistor (LDR) is a kind of resistor whose resistance varies in response to the intensity of light striking it. Based on the idea of photo conductivity, they function by offering less resistance in bright light and more resistance under dim light.

**SOIL SENSOR**



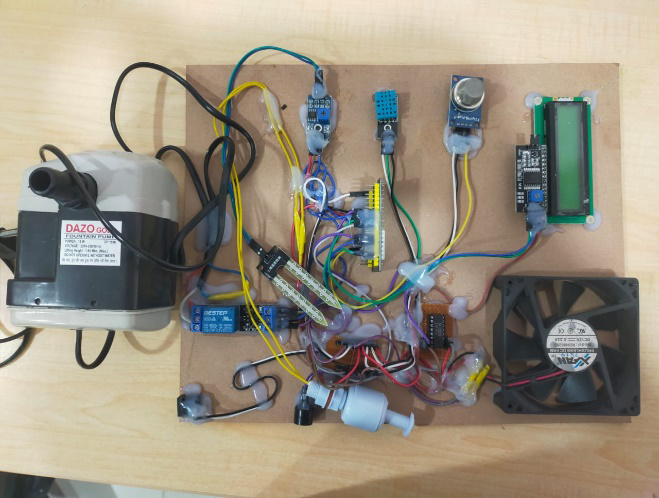
The sensor for soil moisture is a kind of sensors used to determine the soil's water volume. Because the pure gravimetric measurement of soil moisture requires filtration, drying, and reweighing of samples. These sensors calculate the soil's moisture content indirectly, using principles such as the dielectric constant, resistance to electricity, neutron interaction, and moisture replacement.

Ecological variables such as temperatures, the kind of soil, and electric conductivity may affect the relationship between the computed property and the wetness of soil, thus adjustments may need to be made. The reflected microwave emission is mostly used in agricultural and hydrological remote sensing, and may be affected by soil moisture.

PUMP MOTOR



Mini water pumps, as the name implies, are small either AC or DC water pumps that are put to use for pressurising, recirculating, or pumping water. The DC variety may be powered by batteries or sunlight and comes in 3V, 5V, 6V, 12V, and 24V ratings.



**CONCLUSION:**

The Arduino-based power and control system for greenhouses is quite sophisticated. In-depth measurements of temperature, humidity, adhesiveness, and light strength were taken using DHT11 and Earth Humidity sensors in addition to the standard LDR sensor. Using a practical smartphone app, this strategy is widely used in child care facilities to track and record environmental metrics. The NodeMCU esp8266 is used to transmit data between mobile devices and computers. Physical exertion is reduced as a result of this method. This device finds widespread use in greenhouses, garden centres, and hardware stores.

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