IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

Greeenhouse Monitoring and Controlling System.

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ABSTRACT

Managed areas for the production of plants are greenhouses. Because current greenhouse plants restrict themselves, they are not automatically controlled and have to be manually operated with various documents. The system suggested must be monitored and controlled continuously to ensure optimal growth of plants, e.g. temperature, moisture, soil humidity, light intensity etc. This work shows a management mechanism for children's nurseries over the Internet of Things (IOT). The System can check for evident conditions, such as humidity, soil immersion, temperature, fire proximity, strength of light, etc. With NodeMCU esp8266, all data from the environment parameters are sent to the nube. If a parameter exceeds the limit set, the associated actuator is switched on. If the Earth parameter does not meet the required value, the microcontroller turns on the motor. A mobile phone and desktop allows the user to display and monitor parameters.

INTRODUCTION

The ecosystem plays a crucial role in plant development The amount of moisture inside the greenhouse cannot be adequately understood by farmers in the greenhouse. The condition in the green building they just understand manually, and they experience it on their own [1]. Experience plays a significant part in their regular activities at the end of the day. The plants would have water if the soil has minimum water content, but if it is too moist, in the greenhouse the roof will be opened during day time. Efficiency in greenhouse plant production must be achieved to achieve effective growth increases, so that high production rates can be achieved at lower cost, higher quality and low environmental burdens. The greenhouse can be controlled by IOT which involves refrigeration, ventilation, immersion of the soil, etc. This System can be managed by concentrating on environmental criterion such as temperature and humidity. A individual can automatically monitor the environmental parameters of the greenhouse [2]. The need for ON/OFF switchgear functions eliminates automation plays an important role in performing things automatically. Automation does not eradicate or suppress human error entirely, but it minimises it at certain stages. It is the need of the world of today for anything to be practical or controlled remotely. Here, assuming that the greenhouse owner will regulate and monitor the greenhouse from anywhere. The owner doesn't have to go over any of them and monitor the circumstances at all times [3]. The owner must remain in one position and constantly track and manage the number of greenhouses at the same time. WiFi Module ESP8266 plays an important role in transmitting data to the network, removing the need for cable or wired links ICCCEBS 2021 Journal of Physics: Conference Series 1916 (2021) 012062 IOP Publishing doi:10.1088/1742-6596/1916/1/012062 2 that automatically minimise costs. So, given all the evidence in our heads, we are developing an IOTbased greenhouse system.

METHODOLOGY

The greenhouse system comprises the monitoring area and the control area. A DHT11 sensor, an LDR sensor, a moisture sensor on the floor and a flame sensor track environmental parameters are included in the control portion.ESP8266 is used to submit IOT cloud systems with environmental parameters [4]. A fan, water pump and artificial light are in the control area. The heart of the machine is the Arduino microcontroller. is shown in figure 1.

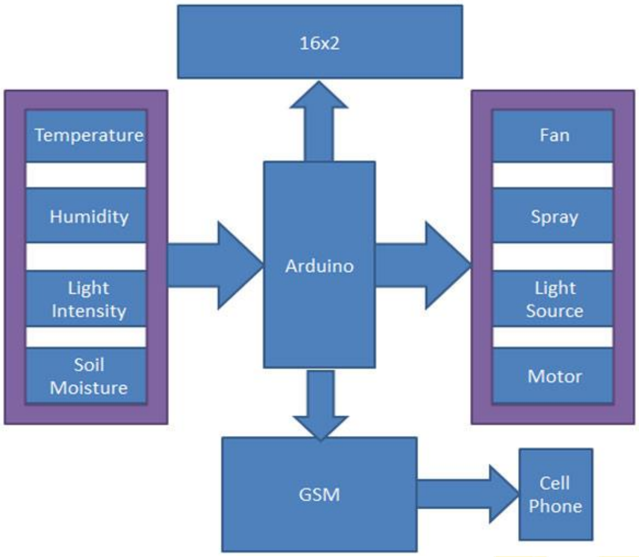

Figure 1. Block Diagram

In this effort, The Arduino is the standard controller used to connect all sensors to each other. To detect the temperature inside the greenhouse the temperature sensor is used. The microcontroller receives the sensor readings. All of these relays is connected to the Buzzer. If the temperature exceeds the threshold level, the microcontroller transmits signals to activate the fan. LDR sensor for detecting the intensity of sunlight in the greenhouse. The microcontroller sends signals using artificial light to increase the strength of light if the amplitude is below the threshold value. The microcontroller can transmit signals using artificial light to increase the light intensity when the amplitude is below the threshold value [5]. The moisture sensor is used to detect moisture and the soil moisture sensor is used to detect moisture from the soil. If the sensor's measured humidity value is above the threshold value, Using a water pump, water is transferred. If soil moisture is limited, the buzzer will be turned on by the microcontroller to decrease moisture and open the water outlet to increase soil moisture. Data on these parameters would be sent to the IOT module at the same time (ESP8266). Regardless of any threshold mismatch observed, the details sent to the IOT will be forwarded periodically. The ESP8266 is a microcontroller link chip for linking TCP/IP links and transmitting the data into Wi-Fi.The information that these sensors detect is then sent to the IOT. And then send it to your laptop and smartphone [6].

COMPONENTS

***1.Arduino UNO* ---** Arduino UNO Arduino is an open-source tool that depends on fundamental planning and rigging. A variable resistor is a thermistor. The thermistor resistance varies with temperature changes. The moisture sensing part has two electrodes between them with a moisture supporting substratum. The resistance between the electrodes increases such that the humidity changes. This resistance change is calculated. The voltage of operation is 3.3V and 5V. The equation for determining output voltage temperature is As follows: Temperature = (Vout x 100)(5 0 C) -1 (1) The relative moisture of the output voltage is determined by equation: RH = ((Vout(Vsupply) -1) - 0.16) (0.0062 %) -1 Arduino sheets will review the inputs light sensor, finger capture, or twitter message and convert it into a feedback to a motor that activates an Internet-spread LED. You can track the board by sending several instructions to the microcontroller. For your purposes, you use the programming A variable resistor is a thermistor. The thermistor resistance varies with temperature changes. The moisture sensing part has two electrodes between them with a moisture supporting substratum. The resistance between the electrodes increases such that the humidity changes. This resistance change is calculated. The voltage of operation is 3.3V and 5V. The equation for determining output voltage temperature is As follows: Temperature = (Vout x 100)(5 0 C) -1 (1) The relative moisture of the output voltage is determined by equation: RH = ((Vout(Vsupply) -1) - 0.16) (0.0062 %) -1 language Arduino and the applications Arduino (IDE). The brainpiece of thousands of operations, from traditional to complicated and reasonable instruments, was Arduino.It has 14 input or output optical pins, 6 input analog pins, 16 MHz crystall oscillator, power jack and header ICSP. Operating voltage is 5V and recommended input voltage is 7 –

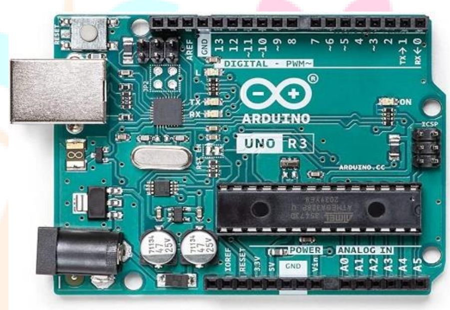

Figure 2.Arduino UNO

2. *DHT11 Sensor*--- For measuring temperature and moisture, the temperature and humidity sensor DHT11 was used. It combines a sensor complex of temperature and humidity and a balanced output of digital signal. The five-star-pushed sign that confirms the technique, temperature and stickiness of the progression perception guarantees strong constancy and genius overall design efficiency. This sensor incorporates a resistive-type soaked quality estimate element, an NTC estimate part and the dominant 8-bit microcontroller to provide the highest possible antagonism and cost-effectiveness with an unparalleled quality, rapid reaction Figure 4.

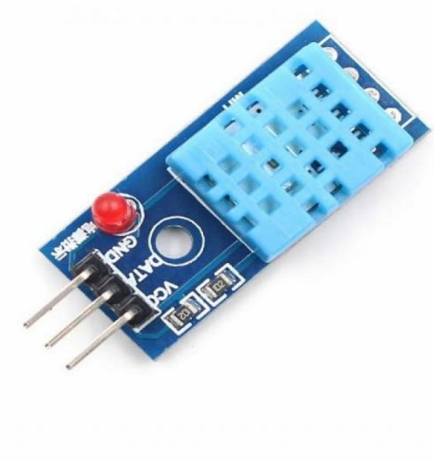

Figure 3. DHT11 Sensor

A variable resistor is a thermistor. The thermistor resistance varies with temperature changes. The moisture sensing part has two electrodes between them with a moisture supporting substratum. The resistance between the electrodes increases such that the humidity changes. This resistance change is calculated. The voltage of operation is 3.3V and 5V.

3.Soil Moisture Sensor--- A dielectric permittivity measuring feature is used in the soil moisture sensor for the binding medium. The sensor emits a dielectric permittive voltage which is considered to contain any water content in the world. Soils-swept state and earth-humidity sensor assess for a volumetric or gravimetric function the quantity of water in a material, e.g. dirt. Soil-packed accuracy sensors offer routine visibility into volumetric water content-calculating sensors figure 4.

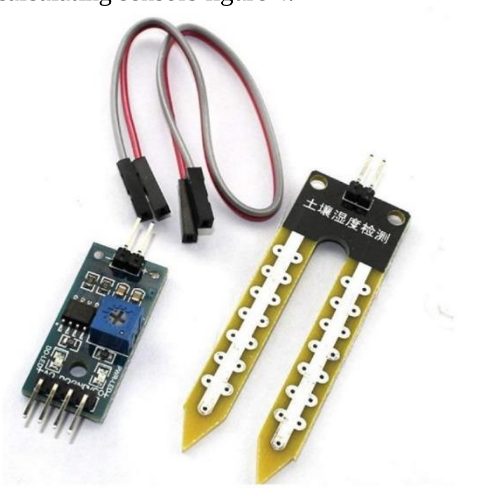

Figure04. Soil Moisture Sensor

4.LDR Sensor--- The LDR sensor module is used to evaluate the frequency of the sun. The analogue output pin and the digital output pin are given. The LDR's resistance decreases with increasing strength of light. As light intensity reduces, the resistance to LDR increases figure 6. There is an LDR sensitivity adjustment with a potentiometer button on the sensor. The strength of an LDR will normally be as follows:

Daylight = 5000Ω
Dark=20000000 Ω

Figure05.LDR

Arduino IDE--- Arduino Integrated or Arduino Framework for Growth. The Arduino IDE is an official Arduino.cc software that includes an editor of scripts, a message box, a text console, a basic toolbar and menus. It attaches to the software built and communicates via Arduino/ Genuino hardware. The open source Arduino (IDE) programme makes writing and uploading your board fast. It runs on Mac, Linux, and Windows. The environment is written in Java and depends on open source processing and other tools figure 6.

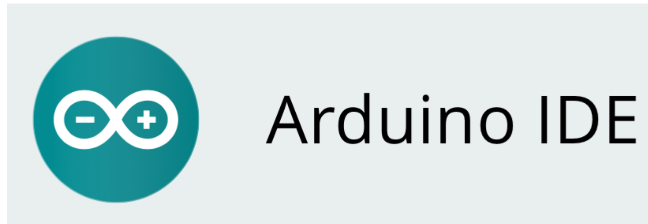

Figure06. Arduino IDE

. FLOW CHART

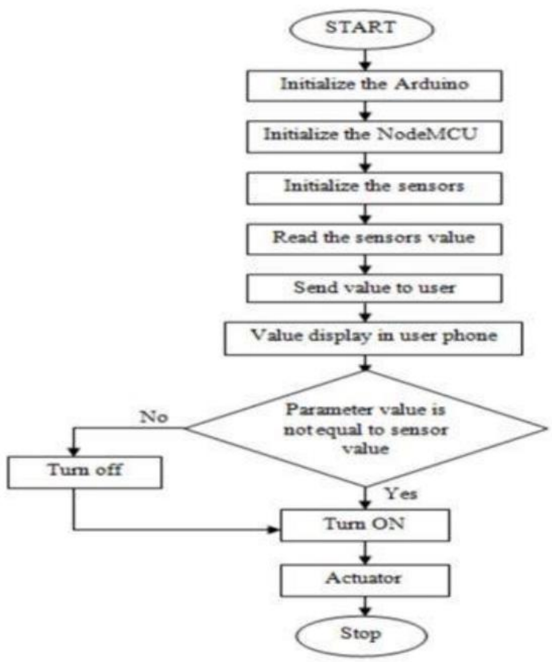

Figure07.Flow chart.

The device flow map describes the project flow, initialises the microcontroller, NodeMCU and all the sensors and reads the physical data from the environment. The microcontroller can give read sensors when the data is read. The data from the microcontroller is sent to the smartphone consumer, so when the sensor values reach the Threshold value actuator, another actuator will be enabled Figure.7

TESTING

- Sensor Accuracy: Evaluate the precision and reliability of the sensors used to measure environmental parameters such as temperature, humidity, light intensity, CO2 levels, and soil moisture.
- Data Transmission: Assess the efficiency and stability of data transmission between sensors, IoT devices, and the central monitoring system.
- Real-time Monitoring: Verify the ability of the system to provide timely and accurate updates on environmental conditions within the greenhouse.
- Control Mechanisms: Test the responsiveness and effectiveness of control mechanisms such as automated actuators, irrigation systems, and ventilation systems.
- Energy Consumption: Measure the energy consumption of the IoT devices and assess their efficiency in order to optimize power usage.
- Scalability: Determine the system's ability to handle an increasing number of sensors and actuators as the greenhouse scales up.
- Security and Privacy: Evaluate the system's security measures to ensure the confidentiality, integrity, and availability of the collected data.

IMPLIMENTATION

- **System Design:**

Define the objectives and requirements of the greenhouse monitoring and controlling system.
Identify the environmental parameters to be monitored, such as temperature, humidity, light intensity, soil moisture, and CO2 levels.
Select appropriate sensors and actuators based on the requirements.
Design the system architecture, considering the placement of sensors, connectivity options, and control mechanisms.

- **Sensor Deployment:**

Install sensors strategically within the greenhouse to capture the desired environmental parameters.
Ensure proper calibration and positioning of the sensors for accurate measurements.
Connect the sensors to a central control unit or a network gateway for data transmission.

- **Connectivity:**

Choose a suitable communication protocol (e.g., Wi-Fi, Zigbee, LoRaWAN) for data transmission from sensors to the central control unit.
Set up a local area network (LAN) or wireless network infrastructure to facilitate communication between the components of the system.
Ensure secure and reliable data transmission to prevent unauthorized access or interference.

- **Data Acquisition:**

Develop software or firmware to collect data from the sensors at regular intervals.
Implement data filtering and preprocessing techniques to remove noise and improve data quality.
Establish a data storage mechanism (e.g., database) to store the acquired sensor data for further analysis.

- **Central Control Unit:**

Design and develop the central control unit responsible for receiving, processing, and analyzing the sensor data.
Implement algorithms and decision-making logic to interpret the data and control the greenhouse environment based on predefined rules or user-defined parameters.
Enable remote access and control capabilities for monitoring and managing the greenhouse operations.

- **User Interface:**

Develop a user-friendly interface, such as a web application or a mobile app, to visualize the sensor data and provide control options.
Include features for real-time data monitoring, historical analysis, and customizable alerts or notifications for critical events.

- **Actuator Control:**

Connect and integrate the control unit with actuators such as heaters, fans, irrigation systems, and lighting systems.

Implement control algorithms to regulate the actuators based on the analyzed sensor data and predefined control strategies.

- **Testing and Validation:**

Conduct rigorous testing to ensure the reliability, accuracy, and effectiveness of the greenhouse monitoring and controlling system.
Validate the system's performance by comparing the measured sensor data with known reference values.
Fine-tune the system parameters and algorithms based on feedback and performance evaluation.

- **Deployment and Maintenance:**

Install the system in the greenhouse and ensure proper functioning of all components.
Regularly monitor and maintain the system to prevent sensor or actuator failures, software bugs, or connectivity issues.
Provide user training and support to greenhouse operators for effective utilization of the system.
The successful implementation of a greenhouse monitoring and controlling system can significantly improve crop cultivation practices, optimize resource utilization, and enhance overall greenhouse productivity.

RESULT AND DISCUSSION

We have planned this System to track and monitor environmental parameters. The result was focused on the efficient control of the greenhouse environment by automated means. The automated control mechanism is performed entirely on the basis of coding. Temperature, humidity, soil moisture, content are controlled by portable devices such as mobile devices. The output of System and laptop are shown in Figure 9 and 10 respectively.

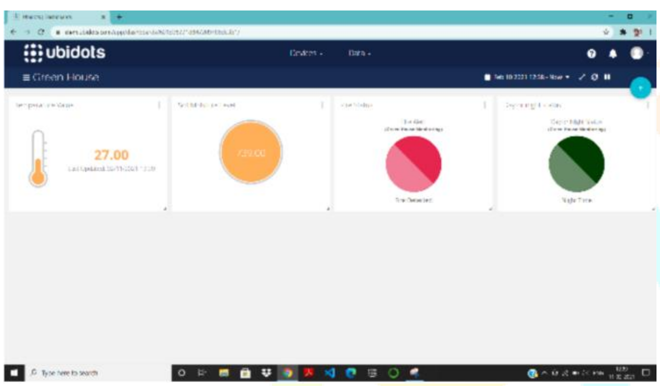

Figure.08 Output at Desktop.

Figure.09 Output at Phone.

FUTURE SCOPE

- **Integration of Artificial Intelligence (AI) and Machine Learning (ML):**

Implementing AI and ML techniques can enable the system to learn and adapt to changing environmental conditions, optimizing control strategies accordingly.
AI algorithms can analyze large amounts of data to identify patterns, predict crop growth, detect anomalies, and provide advanced decision support for greenhouse management.
Precision Agriculture and Smart Farming:

Integrating greenhouse monitoring and controlling systems with other smart farming technologies, such as precision irrigation, aerial imaging, and crop health monitoring, can enhance overall agricultural practices.
Data from greenhouse systems can be combined with data from other sources to gain a holistic view of crop health and make data-driven decisions for optimized resource allocation.

- **IoT Connectivity and Sensor Advancements:**

Advancements in IoT connectivity technologies can enhance the scalability, reliability, and security of greenhouse monitoring and controlling systems.
New sensor technologies, such as wireless and low-power sensors, can improve data collection accuracy, reduce costs, and enable more extensive sensor deployments.

- **Cloud Computing and Big Data Analytics:**

Leveraging cloud computing and big data analytics can enable real-time data processing, storage, and analysis on a large scale.
Cloud-based solutions can provide access to greenhouse data from anywhere, facilitate collaboration, and enable advanced analytics for optimizing cultivation practices.

- **Energy Efficiency and Sustainability:**

Future systems can focus on optimizing energy consumption within the greenhouse, integrating renewable energy sources, and implementing energy-efficient control strategies.
Implementing sustainable practices, such as water recycling, waste management, and reduced chemical usage, can be integrated into greenhouse monitoring and controlling systems.

- **Mobile Applications and Remote Monitoring:**

Develop mobile applications with enhanced features for remote monitoring and control of greenhouse operations.
Incorporate real-time notifications, alerts, and visualization of sensor data on mobile devices, enabling farmers to manage and monitor their greenhouses on the go.

- **Data Sharing and Collaboration:**

Enable data sharing and collaboration between greenhouse operators, researchers, and agricultural experts.
Creating platforms or networks where users can exchange best practices, share data, and access a repository of knowledge can drive innovation and improve greenhouse management practices.

- **Autonomous Systems and Robotics:**

Future systems may incorporate robotics and automation to perform tasks such as planting, harvesting, and pest control within the greenhouse.
Autonomous systems can work in tandem with greenhouse monitoring and controlling systems to optimize operations and reduce labor-intensive tasks.
Overall, the future of greenhouse monitoring and controlling systems lies in the integration of advanced technologies, data-driven decision-making, and sustainable agricultural practices. These advancements can revolutionize greenhouse operations, increase productivity, and contribute to a more sustainable and efficient agricultural industry.

CONCLUSION

The greenhouse control and power system based in Arduino is master mind. DHT11 sensor, Earth Humidity Sensor, LDR sensor and the fundamental sensors used in this experiment include a thorough assessment of temperature, dampness, adhesive content and light strength. This method is popular in children's nurseries to monitor and monitor ecological parameters using a reasonable smartphone application. NodeMCU esp8266 is used for sending the phone information and desktop information. This procedure decreases physical activity. In plant fields, nurseries, and homecenters, this machine can be used.

ACKNOWLEDGMENT

We would like to express our sincere gratitude and appreciation to VIT Pune for their invaluable support in the completion of our project. Their guidance and assistance were instrumental in helping us to achieve our project objectives. We are grateful for the resources and facilities provided by the institution, which helped us to conduct our research and complete our project successfully.

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