IOT Based Greenhouse 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.

1. 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 greenhouse 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, the roof will be opened during daytime. 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.
that automatically minimise costs. So, given all the evidence in our heads, we are developing an IOT-based greenhouse system.

2. 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.

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].

3. Components

3.1 Arduino UNO

Arduino is an open-source tool that depends on fundamental planning and rigging. 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 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 crystal oscillator, power jack and header ICSP. Operating voltage is 5V and recommended input voltage is 7 – 12V Figure 2.
3.2 WiFi(ESP8266)

NodeMCU is an IoT framework open source. It produces firmware that runs on Espressif Systems’ Wi-Fi SOC ESP8266 and devices that rely on ESP-12. Instead of changes, the verbalization "NodeMCU" by the popular technique indicates firmware. The firmware uses the Lua script. It is established and built on the Non-OS SDK Espressive for ESP8266 Figure 3.

3.3 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.

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:

\[
\text{Temperature} = (V_{\text{out}} \times 100) (50 \, \text{C})^{-1}
\]  

(1)

The relative moisture of the output voltage is determined by equation:

\[
\text{RH} = ((V_{\text{out}}(V_{\text{supply}})^{-1}) - 0.16) (0.0062 \, \%)^{-1}
\]  

(2)
3.4 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 5.

![Figure 5. soil moisture sensor](image)

3.5 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 = 20000000Ω

![Figure 6. LDR sensor](image)

3.6 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 7.

![Figure 7. Arduino IDE](image)

4. 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 8.

5. 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.
6. 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.

References
[1] Jayasuriya YP, Elvitigala CS, Wamakulasooriya K, Sudantha BH. Low Cost and IoT Based Greenhouse with Climate Monitoring and Controlling System for Tropical Countries. In 2018 International Conference on System Science and Engineering (ICSSE) 2018 Jun 28 (pp. 1-6). IEEE.
[2] Shinde D, Siddiqui N. IOT Based environment change monitoring & controlling in greenhouse using WSN. In 2018 International Conference on Information, Communication, Engineering and Technology (ICICET) 2018 Aug 29 (pp. 1-5). IEEE.
[3] H. Anandakumar and K. Umamaheswari, A bio-inspired swarm intelligence technique for social aware cognitive radio handovers, Computers & Electrical Engineering, vol. 71, pp. 925–937, Oct. 2018. doi:10.1016/j.compeleceng.2017.09.016
[4] R. Arulmurugan and H. Anandakumar. Early Detection of Lung Cancer Using Wavelet Feature Descriptor and Feed Forward Back Propagation Neural Networks Classifier, Lecture Notes in Computational Vision and Biomechanics, pp. 103–110, 2018. doi:10.1007/978-3-319-71767-8_9
[5] Rupali S, Hemant G, Shoaib K, Aaditya I, Deep D. IOT based greenhouse monitoring system. International Journal for Research in Applied Science and Engineering Technology. 2018; 6 (4):2084-
[6] Akkaş MA, Sokullu R. An IoT-based greenhouse monitoring system with Micaz motes. Procedia computer science. 2017 Jan 1;113:603-8.