IOT BASED HYDROPONIC VERTICAL FARMING SYSTEM

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ABSTRACT

This project showcases a cutting-edge indoor plant growth optimization system that utilizes the internet of things (IoT) in a vertical hydroponics setup. The system incorporates a number of sensors, such as a DHT11 for tracking humidity and temperature, a moisture sensor for detecting soil moisture levels, a turbidity sensor for evaluating water quality, and a pH sensor for tracking acidity levels. These sensors are always gathering data and sending it to an internet of things platform where it can be analyzed and seen in real-time. To further enhance plant development, the system uses RGB LEDs for controllable illumination that mimics natural sunshine. With the help of the IoT platform, users may remotely monitor and regulate environmental factors, letting them optimize conditions for the development and sustainability of plants. In terms of indoor farming, the suggested technology provides an efficient and environmentally friendly option, which would help with both food security and conservation.

Keyword: Ph Sensor, Iot,Dht11. Blynk App

1. INTRODUCTION

Unprecedented weather events, environmental contamination, water scarcity, fossil fuel depletion, and biomass shortages are just a few of the world's growing crises. The reliable and secure supply of goods made from plants will therefore be jeopardized. The weather, soil fertility, and local climate all have a role on the yield and quality of leaf vegetables cultivated outdoors. Conversely, plants typically exhibit enhanced quality and production when cultivated in this artificial setting. One method of cultivating crops in a regulated indoor setting is the artificial environment. There will be no need to use pesticides or insecticides on the crops because the environment is indoors and there won't be any insects or other pests. Minimal watering is required since water cannot evaporate or seep into the ground in an indoor setting. Artificial lighting allows crops to be cultivated year-round in the controlled indoor environment.

2. LITERATURE SURVEY

Mirza, B., Mirza, N., Ali, S., & Ullah, S. (2020) This article details the planning and execution of an IoT-based smart hydroponics system. The rising global need for food and the need for a new, sustainable farming approach that makes use of the Internet of Things are two of the main obstacles that this system aims to overcome. During component selection, the necessary criteria were considered while selecting NodeMcu, Node Red, MQTT, and sensors. These components were then sent to the cloud for monitoring and processing. There was research on prior efforts as well as an examination of IoT and hydroponic systems. It all started with building, programming, and testing the prototype. Then, data was collected from sensors in two separate surroundings and kept track of on a cloud-based website using a mobile app. Additionally, a bot has been implemented to manage the supply chain and send out notifications. The system's enhanced performance enables it to accomplish the complete system's intended goal. Future work can address these constraints by incorporating data science and artificial intelligence to enhance crops and achieve better results. Lastly, the end user platform should be designed with an attractive user interface that does not require any technical configuration. This would greatly simplify user engagement.

Pooja Thakur, Dr. Manisha Malhotra, Dr. R.M. Bhagat (2022) An Internet of Things (IoT)-based method for monitoring and controlling a hydroponic system is presented in this research. In order to measure vital parameters including water, humidity, pH, nutrients, and temperature, the system incorporates a plethora of sensors. Connected to a microcontroller or single-board computer, these sensors collect data and transmit it to a cloud-based platform for analysis and storage. The data may be accessed and managed remotely using a web or mobile application. Equipped with sensor data and predefined criteria, the system's automatic control alters nutrition levels, humidity, and temperature. Any hydroponic situation or system may be simply adapted to using the proposed system, which offers a comprehensive and efficient method for controlling and monitoring hydroponic systems. Through trials and findings, we demonstrate the usefulness and feasibility of our proposed system.

Punya Prabha V; Sarala S M; Sharmila Suttur C (2020) In emerging nations such as India, farming has become a deeply held hobby. In the realm of agriculture, people are facing several challenges. Traditional agricultural methods that rely on human labor are still widely used in many parts of India today. People nowadays are more interested in smart irrigation systems than in conventional farming methods, thanks to technology advancements. The time constraints of city dwellers make conventional farming impractical; this study proposes hydroponic farming as a solution, using a sophisticated watering system. This irrigation method eliminates the need for space and water, which are both abundant in the conventional frame method. Incorporating data from all the sensors linked to the Raspberry pi and transmitted to the IoT server across the network, this suggested work seeks to construct an automated irrigation farming system.

Anitha M L; Jnaneshwari A; Harshitha S R (2020) Hydroponics is a method of gardening that does away with soil altogether in favor of nutrient solutions. Using a fertilizer solution that is dissolved in water, plants are cultivated in this manner. By making better use of available resources, it promotes faster plant development. In order to develop and expand the agricultural area, there has been a great deal of study and several attempts to include IoT. When compared to soil farming, this technique has many advantages. One form of hydroponic farming that we employ in our work is Deep Water culture (DWC). At certain points in the growth process, you'll need to regulate things like airflow, light intensity, water quality, and so forth. Incorporated sensors measure the system's parameters, including humidity, electrical conductivity, light intensity, air pressure, temperature, and humidity.

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Omolola A OGBOLUMAN Ini (2022) Recent years have brought significant difficulties to the agriculture industry as a result of unsustainable farming techniques and dwindling soil fertility. All throughout history, this has been the main source of nourishment for the whole planet. Intense farming techniques are required to economically meet the rising food demand. This research presents a new kind of smart farming that takes into account the interdependence of water and food resources in order to grow food and agricultural products in a sustainable way. The food-water nexus is supported by hydroponics, a kind of farming that eliminates the need for soil by growing plants in solutions of nutrients in water. To ensure the plants grow to their full potential, it is necessary to create a hydroponic system that tracks their light, water, humidity, pH, and temperature. Water is conserved since nutrients are delivered just when they are needed. At last, the system will react to changes in environmental factors in real time. Thanks to the Internet of Things (IoT), these sensors can send data in real-time to Amazon Web Services (AWS). With the help of an Android app powered by a Raspberry Pi3, the system can be remotely monitored and controlled, making human interaction unnecessary. Experimental results confirmed the accuracy of the sensor network. These results highlight the promise of hydroponic farming as a solution to the water crisis in agriculture and a means to increase food security throughout the world.

3. Block diagram

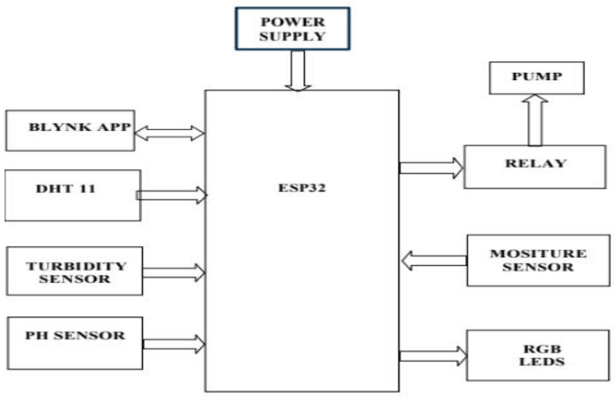

Fig. 3.1Block diagram

3.1 ESP32 module

A few years ago, the ESP8266 was all the rage in the embedded IoT community. For about $3, you can acquire a programmable microcontroller with Wi-Fi connectivity, allowing you to manage and monitor devices from any location on Earth. Now, the ESP32, a flawless super-charged update, has been produced by Espressif, the semiconductor company responsible for the ESP8266. This board is ideal for any Internet of Things (IoT) project because it is the successor of the ESP8266 and has WIFI and Bluetooth 4.0 (BLE/Bluetooth Smart). Typically, an Arduino comes to mind when we consider incorporating a microcontroller into a project. It's cheap, user-friendly, and packed with digital I/O ports plus a few of analog inputs. Despite its many advantages, the Arduino is deficient in certain respects. One is speed; the widely used Arduino AVR boards operate at 16 MHz. While that may be quick enough to construct hundreds of apps, it becomes a stumbling block for others. The Arduino's digital inputs and outputs are more than enough to meet most needs, and the analog inputs are handy as well. On the other hand, you'll need to buy extra parts to add features like Bluetooth and WiFi. The Arduino, come on! It's been around since 2005. In technological terms, that's one hundred and fifty years.Espressif Systems of Shanghai makes a line of microcontroller chips that go by the name ESP32. It comes in a variety of affordable packages.

Fig.3.2 esp8266 module.

3.2 DHT11 SENSOR

The DHT11 Humidity & Temperature Sensor is a combination humidity and temperature sensor that produces a calibrated digital signal. High reliability and outstanding long-term stability are guaranteed by utilizing the proprietary digital signal collecting approach in conjunction with temperature and humidity monitoring technology. Connected to a high-performance 8-bit microprocessor, this sensor offers good quality, quick response, anti-interference capabilities, and low cost. It comprises a resistive-type humidity measurement component and an NTC temperature measuring component.

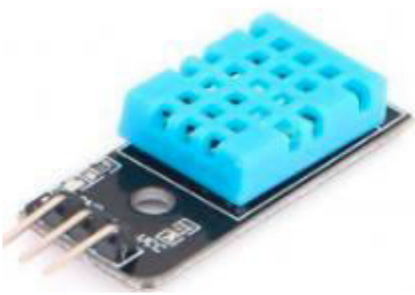

Fig 3.3 DHT11 sensor.

3.3 Moisture sensor

You can find out how much water is in the soil by using the moisture sensor. The output of the module is high when there is a water scarcity in the soil and low otherwise. This device keeps tabs on the soil's moisture level and notifies the user when it's time to water their plants. Its applications in farming, watering crops, and gardening have been extensive.

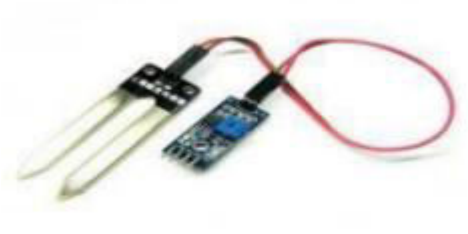

Fig 3.4 Moisture Sensor.

3.4RELAY

An electromechanical switch, a relay may automatically turn things on and off. In figure, we can see a schematic of a double contact relay. If you need to control several circuits with a single, low-power signal or if you need to provide total electrical isolation between the control and controlled circuits, a relay is the way to go.

Fig 3.5 Relay.

3.5 Turbidity Sensor

By monitoring the turbidity level, the Arduino turbidity sensor can identify the water quality. It adjusts for variations in total suspended solids (TSS) concentration in water to identify particles in suspension by monitoring changes in light transmittance and scattering rate. Liquid turbidity rises in relation to TTS. The highest quality Turbidity Sensor Module may be purchased at Tomson Electronics in Kochi, Kerala, India. You may choose between analogue and digital signal output on this arduino turbidity sensor. Since the threshold may be adjusted in digital signal mode, you can choose the mode that corresponds to the MCU.Water quality in rivers and streams, effluent and wastewater, sediment movement, and laboratory tests may all be assessed with turbidity sensors. The turbidity of washing machine and dishwasher water is measured using turbidity sensors manufactured by Tomson Electronics of Kochi, Kerala, India. Both temperature and turbidity may be measured with the 165D6042P003. Appliances can save energy by just washing for as long as the dirt level dictates. The Raspberry Pi Zero W and Arduino Uno are two examples of microcontrollers that work well with this.

Fig 3.6 TURBIDITY SENSOR

3.6 PH SENSOR

A pH probe measures the activity of hydrogen ions in a solution with the use of two electrodes: a sensor electrode and a reference electrode. The pH meter measures the voltage, which is the result of ion exchange, and turns it into a legible pH value. In 1909, Nobel laureate Fritz Haber created the glass electrode; in 1934, Arnold Beckman created the contemporary electric pH meter; and so, pH probes were born, allowing us to precisely measure pH in many different contexts. In a water-based solution, the interaction between hydrogen and hydroxide ions is measured by pH, which stands for the potential of hydrogen. An acid is a solution that has a high activity level of hydrogen ions. Contrarily, a base is a solution that has a high activity level of hydroxide ions. Different sectors rely on pH probes for essential pH measurements, which is why they have various uses. What is a pH probe, how does it test it, and what parts does it contain? All of these questions will be answered in this article.

Fig. 3.7 ph sensor.

4. SCHEMATIC DIAGRAM

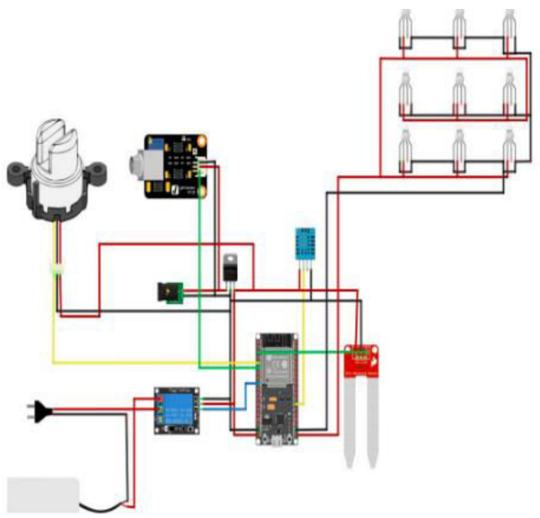

Fig.4.1 Schematic Diagram

5. Flow chart

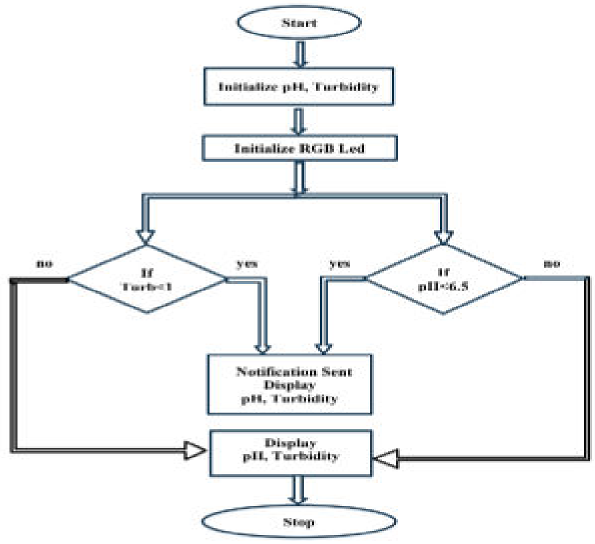

Fig. 5.1 flow chart

6. RESULT AND DISCUSSION

Everything about this project, from the planning stages to the execution, is in line with the original needs and specifications. With its innovative concept and well-thought-out design, this project offers boundless possibilities. Growing plants in controlled environments improves yields and growth rates while reducing negative impacts on the natural world. Below is a picture of an experimental board in action:

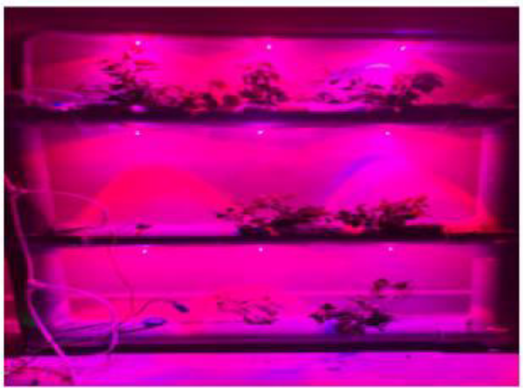

Fig 6.1 Practical Representation of Experiment components.

Fig 6.2 Display in blynk app.

7. CONCLUSION

The primary focus of this study was an analysis of previous agricultural system R&D efforts. This technology is designed to automatically offer consistent weather conditions. This steady flow of parameters nourishes plants and shields them against pests. So that we may maximize crop output in a limited space, we have constructed a rack structure in this project. Within this man-made setting, we are tracking the soil, air, and temperature conditions with the help of sensors. Auridon receives data from the sensors and uses it to manage the water supply, lighting, and fans. To supply the specific light wavelength, the Leds are utilized. Plants will undergo photosynthesis when exposed to certain specific wavelengths. Here, plants undergo the transformation that allows them to produce food. There will be no need to use pesticides or insecticides on the crops because the environment is indoors and there won't be any insects or other pests. Minimal watering is required since water cannot evaporate or seep into the ground in an indoor setting. Artificial lighting allows crops to be cultivated year-round in the controlled indoor environment. The use of organic fertilizers to produce plants improves food quality, cuts down on greenhouse gas emissions, and eliminates the need for pesticides and chemical fertilizers, all thanks to the artificial farming approach. When compared to conventional agricultural methods, electronic farming uses significantly less water. Since it is entirely contained within, the plant is not affected by the surrounding air.

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