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Iot Based Smart Hydroponics Irrigation System for Agriculture

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ABSTRACT

Hydroponics is a method of farming in which plant nutrition is provided by water rather than soil. As technology advances and people's living standards rise, hydroponic plants become an essential part of our day-to-day lives. Not only do hydroponic plants add beauty to their surroundings, but they also require less time for upkeep thanks to their frequent fertilization and watering. With the help of advancements in communication and computer technology, sensors, the internet, and smart lifestyles, the trend of living a smart lifestyle is becoming increasingly common in our future lives. This system, which is intended to be simple to monitor and control, is intended to fill the void left by the previous one. The hydroponic time data—temperature, humidity, light intensity, and pH level—can be sensed by the system. The term "hydroponics" comes from the Greek word "hydro," which means "water," and "phonics," which means "work." These terms are frequently used in other scientific fields that have nothing to do with gardening. Hydroponics provides us with a lifeline and allows us to produce crops in greenhouses or multi-tiered buildings for agriculture as our population grows and land becomes available for crop production. Already, hydroponic systems are used to grow crops in areas where land costs a lot, like rooftops, greenhouses, and groundwater. You might want to start a garden to grow your own vegetables, but you don't have enough space or you have a lot of pests. This article will guide you through the process of setting up a hydroponic garden at home that works for you and offers advice on how to easily grow plants without spending a lot of money. Hydroponics is a method of farming in which soil is not used to grow plants. Depending on the type of hydroponic system used, the roots of plants may be flooded, suspended, or improperly utilized with nutrient solution so that the plant can obtain the ingredients. Typically, plants are dissolved in water rather than only receiving nutrients from the soil. It is necessary for development.

I.INTRODUCTION

There is a worldwide decline in agricultural land. This occurs as a result of agricultural land being turned into industrial and settlement land. Economic and social factors, scarce land resources, population growth, and economic expansion all contribute to this. Currently, urban farming or urban agriculture refers to the rapid development of agricultural technology in urban areas. One effective strategy for dealing with the diminishing agricultural land is urban farming, also known as urban agriculture. The practice of growing food in urban areas on land that hasn't been used before, like rooftops, balconies, terraces, and even the walls of buildings. Hydroponics is one of the farming methods utilized in urban farming.

The cultivation of plants in a liquid nutrient solution—either with or without the use of artificial media—is referred to as "hydroponics." Expanded clay, coir, perlite, vermiculite, brick shards, polystyrene packing peanuts, and wood fiber are all common mediums. Hydroponics has been shown to be a viable method for growing ornamental crops like herbs, roses, freesia, and foliage plants as well as vegetables like tomatoes, lettuce, cucumbers, and peppers. Greece is where the terms "hydroponics" and "phonics" come from. The NFT (Nutritional Film Technique), which can be arranged vertically, is one of many compact hydroponics techniques that can solve land issues in urban areas. In a hydroponic farming system, water is used continuously and only depletes through evaporation from the sun or plant photosynthesis. When compared to conventional agriculture, in which water is only used once during irrigation, this system is considered to be extremely water-intensive because a significant amount of water is wasted. regulating the pH of the nutrient solution, the temperature of the water, and higher densities of the nutrient solution.

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When it comes to controlling the density of the nutrient solution, the conventional method or the use of human power is still used. If the density of the nutrients is too high or too low, water or nutrients are added, which takes a lot of time for farmers or owners of hydroponic farming systems.

Because it is ineffective and less efficient, this becomes a problem that is very important. This paper focused on developing a hydroponic farm management system that could monitor water temperature, water level, higher densities of nutrient solution, and nutrient solution acidity (pH) using sensors that were linked to the microcontroller and connected via a website. The management system for hydroponic farming enables remote control and monitoring.

The commons' use of green energy concepts. The sun, which was converted into electricity through the use of solar panels, is the alternative energy source. Several previous studies on hydroponics and automation in agricultural systems at a greenhouse are connected to this research. The information gleaned from this analysis will be used as input into fertigation systems that already automate the activation and deactivation of pumps that supply plants with water and nutrients**.**

II. PROBLEM STATEMENT

There is a worldwide decline in agricultural land. This occurs as a result of agricultural land being turned into industrial and settlement land. Economic and social factors, scarce land resources, population growth, and economic expansion all contribute to this. Currently, urban farming or urban agriculture refers to the rapid development of agricultural technology in urban areas. One effective strategy for dealing with the diminishing agricultural land is urban farming, also known as urban agriculture. The practice of growing food in urban areas on land that hasn't been used before, like rooftops, balconies, terraces, and even the walls of buildings. Hydroponics is one of the farming methods utilized in urban farming.The cultivation of plants in a liquid nutrient solution—either with or without the use of artificial media—is referred to as "hydroponics." Expanded clay, coir, perlite, vermiculite, brick shards, polystyrene packing peanuts, and wood fiber are all common mediums. Hydroponics has been shown to be a viable method for growing ornamental crops like herbs, roses, freesia, and foliage plants as well as vegetables like tomatoes, lettuce, cucumbers, and peppers. Greece is where the terms "hydroponics" and "phonics" come from. The NFT (Nutritional Film Technique), which can be arranged vertically, is one of many compact hydroponics techniques that can solve land issues in urban areas.

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III.EXISTING SYSTEM

One such farming method is hydroponics, which grows most terrestrial plants without soil and only makes use of water and nutrients. Hydroponics can be used in urban areas, but you need to know the basics and keep an eye on it often. This paper describes the automation of the entire procedure using sensors and a microcontroller to address the aforementioned issue. An Android app is used to monitor the parameters of this IoT-based hydroponics system. Based on data from multiple hydroponic farms, this will further assist in system improvement. However, due to the variety of users and the absence of a TDS sensor, LDR, or rain fall detection, the existing system does not meet all control requirements. The majority of the time, existing systems are installed indoors due to this limitation.

IV. PROPOSED SYSTEM

A web application based on the cloud and data mining is used to remotely monitor and control a water management system that is based on microcontrollers. WSN infrastructure houses the entire system. The reading of sensor data from the farm is used to manage

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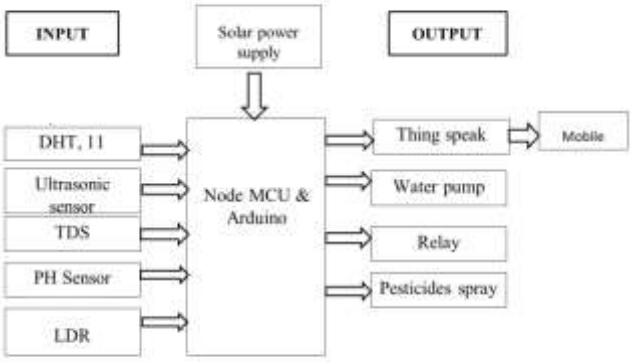
the water. Farmer can easily monitor and control their operations with a web application. Analysis is simplified by the web application's graph. A method of cloud computing involves connecting a large number of computers through a network of real-time communication. The microcontroller receives the data that is sensed by the sensor in this system. The readings are then transmitted to the farm computer via serial communication by the microcontroller. After that, we make use of the data mining concept to store these readings in the database that is connected to the farm computer. The Android phone and PC will display these readings. The cloud connects the computer and mobile devices to the database.

VI. SYSTEM ARCHITECTURE



VII.RESULT AND DISCUSSION

Hydroponics is a flexible and adaptable farming system that can be customized to suit specific crop needs and environmental conditions, allowing for a wider range of plant varieties to be grown. Hydroponic farming can save water and reduce the use of harmful pesticides and fertilizers, making it an environmentally friendly alternative to traditional farming methods. The use of hydroponics can contribute to food security by enabling crops to be grown in areas where traditional agriculture is difficult or impossible, such as arid or urban environments. Hydroponics is a growing industry with a lot of potential for innovation and development, and advancements in technology and research are leading to further improvements in crop yields, plant quality, and system efficiency. In addition to the practical benefits of hydroponic farming, it can also be a rewarding hobby for individuals interested in gardening, and a source of income for those looking to start a small business or farm.

In this we are concluding that this system works fully in the solar power backup making more efficient for renewable energy resources, hence IoT provides a powerful combination to monitor plants and water parameters using clould base application called thingspeak for continuous monitoring.

FIGURE 1 Project Kit

7.2 IMPLEMENTATION

IoT based smart agriculture system is used to generate decisions regarding 32 irrigation using real time data. First of all, farmer logs into the system using his credentials such as username and password from an Android application. He is then allowed to select the crop for that season. System is implemented in three phases: Sensing ,Processing, Information distribution.

7.2METHODOLOGY

Hydroponics can be grown using the different medium like gravel, Rockwool, perlite. etc and it has many techniques. It has more advantages like weed growth is lower, the crop grows two times faster in the hydroponics system, no need for soil setup, manpower requirement is lesser compared to traditional farming, crops can be produced on all year around basis, pesticide usage is lower, water can reused multiple

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times which leads to water conservation and harvesting of crops in hydroponics is much easier. In hydroponics, many techniques are available in that Nutrient Film Technique (NFT) is used. In NFT method, the root is dissolved in the solvent which has sufficient amount of water, oxygen and nutrient mineral. NFT system provides all requirements for plants to be grown in a healthy way. The growth rate is comparatively higher in NFT technique. With the concept of IoT involved in the NFT technique, it resulted in higher yield compared to traditional farming. Plants can be grown in year-round basis without 35 any disturbance from an environment. Water consumption is lesser and a nutrient solution can be recycled. With the NFT technique, the plant growth time is lesser and yield is higher in hydroponics concept. In hydroponics, nutrient solution can be organic or inorganic. Plants in hydroponics need continuous care from the farmer for healthy crops. The nutrient solution needs to be supplied properly on regular interval without any time delay. In case of nutrient insufficient, roots submerged in water solvent will get rotten. To supply water to many hydroponics plants it needs to be done in an automated way based on the requirements of plants. With the technology advancements in the microcontroller, automatic watering to crops can be possible. Hydroponics plants are kept in separate chambers, vessels, PVC pipe etc with a nutrient solution which is flowed automatically based on the needs of plants. Automatic nutrient flow (water solvent) is controlled by Arduino Uno microcontroller and microcontroller can be controlled through Android Smartphone.

1. NODE MCU

The NodeMCU (Node MicroController Unit) is an open source software and hardware development environment that is built around a very inexpensive System-on-a-Chip (SoC) called the ESP8266. The board is equipped with sets of digital and analog input/output pins that may be interfaced to various expansion boards and other circuits.

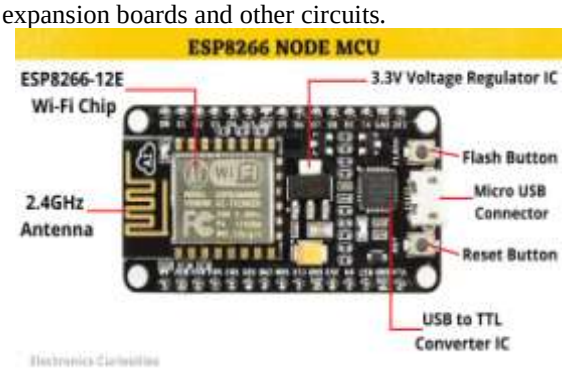

FIGURE 2 NODE MCU

2 ARDUINO UNO

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino. The board is equipped with sets of digital and analog input/output pins that may be interfaced to various expansion boards and other circuits.

FIGURE 3 ARDUINO UNO

3 DHT11 SENSOR

The DHT11 Humidity and Temperature Sensor consists of 3 main components. A resistive type humidity sensor, an NTC (negative temperature coefficient) thermistor (to measure the temperature) and an 8-bit microcontroller ,which converts the analog signals from both the sensors and sends out single digital signal.

FIGURE 4 DHT11 SENSOR

4 ultrasonic sensor

ultrasonic ranging sensors are inexpensive, have no moving parts, have no lenses to clean, are normally small and unobtrusive, and can measure distances amounts of dust, smoke, and humidity.Ultrasonic sensors are highly accurate and can be used to detect very small alterations in position. They also measure the thickness of an object as well as the depth of the parallel surface.

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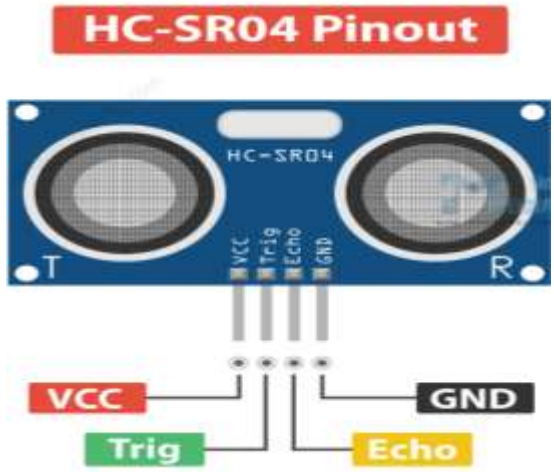

FIGURE 5 ultrasonic sensor

5 TOTAL DISSOLVED SOLIDS

Total dissolved solids (TDS) comprise inorganic salts, principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides, and sulfates and some small amounts of organic matter that are dissolved in water. TDS meter measures the electrical conductivity of water or, in other words, the total amount of mobile charged ions found in water. If an element is dissolved in water and can conduct electricity, it is called an electrolyte.

FIGURE 6 TOTAL DISSOLVED SOLIDS

6 LIGHT DEPENDENT RESISTOR

LDRs are tiny light-sensing devices also known as photoresistors. An LDR is a resistor whose resistance changes as the amount of light falling on it changes. The resistance of the LDR decreases with an increase in light intensity, and vice-versa. This property allows us to use them for making light sensing circuits.

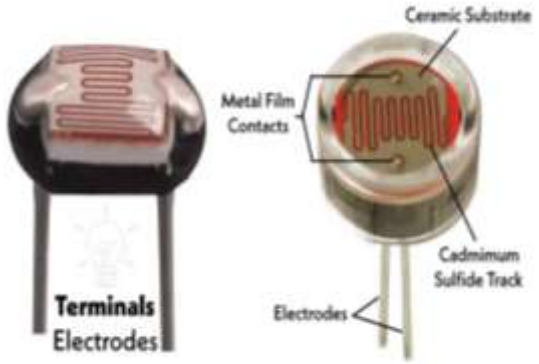

FIGURE7 LIGHT DEPENDENT RESISTOR

7 PH SENSOR

A pH sensor is a scientific device used to accurately measure acidity and alkalinity in water and other liquid substances. It is an important device used in most industries, including power plants, pharmaceuticals, food & beverage, primaries, chemicals, oil gas, and wastewaters. Different pH sensors work differently when it comes to measuring water quality.

FIGURE 8 PH SENSOR

VIII. CONCLUSION AND FUTURE ENHANCEMENT

There are several potential enhancements to the hydroponics system described in the project, Use of artificial intelligence: Artificial intelligence (AI) can be used to analyse data from the hydroponic system and optimize plant growth. For example, AI can help identify the optimal nutrient levels, temperature, an d lighting for different plant species, leading to higher yields and better quality crops. Vertical farming: Vertical farming is a technique that involves growing plants in vertically stacked layers, often in urban areas where space is limited. This technique can be used in conjunction with hydroponics to increase crop yield

and save space. Nutrient recovery: In a traditional hydroponic system, excess nutrients are often discarded, leading to environmental pollution. However, technologies such as nutrient recovery systems can be used to recover and recycle nutrients, making the system more sustainable. Smart monitoring and control systems: Smart monitoring and control systems can be used to remotely monitor and control the hydroponic system, leading to increased efficiency and reduced labour costs. Integration with aquaculture: Aquaponics is a system that combines hydroponics with aquaculture (the farming of fish). In this system, the waste products from the fish are used as nutrients for the plants, and the plants help purify the water for the fish. This integrated system can be more sustainable and productive than either system alone.

REFERENCES

[1]. A. Gulati, S. Thakur, "Smart Irrigation Using Internet of Things", in Proc.IEEE, pp.819-823

[2]. A.R. Chaudhry, V.P. Mishra," A Comparative Analysis of Vertical Agriculture Systems in Residential Apartments", in Proc. ASET,2015, pp. 1-5.

[3]. I. B. M. Matsuo, L. Zhao, and W. Lee, "A dual modular redundancy scheme for CPU-FPGA platform-based systems," IEEE Trans. Industry Application, early access, Jul.2018, 10.1109/TIA.2018.2859386.

[4]. Karan," Hypaponics-Monitoring and Controlling Using Internet of Things and Machine Learning", in Proc. ICIICT,2019, pp. 1-6.

[5]. L.A. Velazquenz,M.A. Hernandez,M. Leon,R.B. Dominguez and J.M. Gutierrez,"First advances on the development of a hydroponics system for cherry tomato culture",in CCE,2013,pp. 155-159.

[6]. M. B. Bastian, W. D. Carman, and D. J. Woodhouse, "Real-time monitoring of substation ground potential rise and grounding system impedance using power system faults," IEEE Trans. Industry Application, vol. 51, no. 6, pp. 5298–5304, Apr. 2015, 10.1109/TIA.2015.2425361.

[7]. M.S. Farooq, S. Riaz, M.A. Helou, F.S. Khan, A. Abid and A. Alvi" Internet of Things in Greenhouse Agriculture: A Survey on Enabling Technologies, 60

[8]. Applications, and Protocols", in IEEE Access , Vol. 10, pp.53374- 53397,2002. 9. Q. Gao, W. Ge, C. Wang, J. Zhang, B. Geng , and X. Jiang, "High voltage equipment online monitoring system of smart substation," in Proc. IEEE PES ISGA, Tianjin, China, 2012, pp.1-

[9]. R. Assaf, I. q Ishaq, "Improving Irrigation by Using a Cloud Based IOT System," inProc. ICPET, Rome, pp. 28-31.