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An Eye on Hydroponics

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***Abstract*—The importance of soil in agriculture cannot be overstated, and it plays a significant role. However, the trend of urbanization robs increasing regions of their land. As a result, continued cropping on the remaining land causes the soil to become less fertile because all the nutrients are being used up. We have looked at hydroponics in search of an alternative solution. In this paper, we use solar energy to cut power usage and integrate IoT into our solution. A unique kind of farming called hydroponics uses a substrate devoid of soil and a mixture of nutrients and water to produce plants. Here, Rockwool is being used as a substitute for soil to provide support for plants. We offer the We supply the nutrients that plants need in their water so that they do not need to send their root systems searching for water, nutrients, or oxygen. The plant is allowed to use its energy for manufacturing during this procedure. We can create farms using hydroponics in some areas when the soil is too poor to sustain farming and there isn't much available space. The IoT system continuously keeps an eye on the farm and displays information about plant growth, allowing us to determine the pH, water level, temperature, and humidity readings in the hydroponic reservoir. Since we are using nutrient-enriched water, the pH sensor plays a crucial role. The introduction of IoT in hydroponics helps farmers by monitoring by providing information on the elements of water, humidity, and temperature, the plant grows. Through sensors that are connected to the cloud, the relevant statistics are obtained.**

***Index Terms*— pH, water level, temperature, and humidity in hydroponics.**

I. INTRODUCTION

The integration of existing technologies to build an IoT ecosystem is where the difficulties start. But in recent years, it has been a boon for farmers since technology is increasingly being used for their advantage. Through IoT, several approaches are being applied in the farming industry. Real automation has been put into place, and the outcomes meet expectations. The government helps farmers raise their income by using technical breakthroughs and establishing smart farming practices instead of old ones because agriculture is the foundation of the economy in many developing nations. The extent of productive agricultural land has decreased as a result of urbanisation and the industrial revolution. Around the world, intensive research is being done to find a solution for the problem of farms without fertilised soil. a couple of technologies These research projects led to the development of hydroponics, aquaponics, and aeroponics. Among these, hydroponics has a greater influence because it is easier to utilise and profitable. Recent developments in the hydroponics technique are discussed. With hydroponics, it is possible to grow things without using soil or precious resources. As a result, it had a significant impact in cities where hydroponics enabled terrace cultivation. The proposed system is designed with farmers in mind, and it accomplishes this using IoT and automation by sending periodic statistics over the cloud.

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There are advantages and disadvantages to conventional farming. The inability to control pests may be the biggest downside ever. But when it comes to hydroponics, it helps to reduce the risk of weeds and pests. like this. The manufacturing will be clean and healthy if all the necessary ingredients are provided through water. elements of the environment, such as the temperature and humidity, the water quality and water Here, levels need to be checked on a regular basis.

II. Literature Review

Some of the studies that have been published in the past using IEEE principles are included in the literature review. The works listed below are a few of these:

A. An Eye on hydroponics the IoT initiative

The importance of and significance of the soil's involvement in agriculture cannot be overstated. However, the trend of urbanisation robs increasing regions of their land. As a result, continued cropping on the remaining land causes the soil to become less fertile because all the nutrients are being used up. We have looked at hydroponics in search of an alternative solution. In this article, we incorporate a lot into our approach and cut down on energy use by using solar power. A unique kind of farming called hydroponics uses a substrate devoid of soil and a mixture of nutrients and water to produce plants.

B. Greenhouse Monitoring and Fuzzy Control System Based on WSAN and IoT

In order to improve crop productivity and easier supervision, the goal of this work is to set up an intelligent system for monitoring and controlling an agricultural greenhouse based on the Internet of Things. In order to achieve this, a Wireless Sensor and Actuator Network (WSAN), a fuzzy logic controller created in Python, and an IBM Node-Red server-based Human-Machine Interface (HMI) are all used. The outcomes of the tests conducted demonstrate the usefulness and success of the suggested approach. The monitoring of environmental indicators, including water quality and level, can be done on a regular basis with the use of the appropriate sensors.

C. IOT Hydroponics Management System

In this study, a proposed integrated Internet of Things (IoT)-based system for managing and monitoring the hydroponic garden is made. The issues of managing these resources will be resolved by automation and the developing trend of lot. This device, which constantly monitors pH, water level, ambient temperature, and relative humidity, seeks to offer the optimal environment for plants to develop. Additionally, this method offers controlled water irrigation and nutrient solution ingestion through the use of straightforward procedures.

D. IOT Based Automated Greenhouse Monitoring System

Greenhouses are insulated buildings with a roof and walls made specifically for growing plants in the off-season. The majority of greenhouse systems rely on manual methods to monitor the temperature and humidity, which can be uncomfortable for the worker as they must manually control them every day when they visit the greenhouse. Because temperature and humidity must be regularly controlled to guarantee the plants' healthy output, many issues can arise as it impacts the production rate. One of the most recent developments in information, communication, and technology is the Internet of Things, which offers worldwide connectivity and information management for sensors, gadgets, and other objects. In order to solve many of the practical issues that have arisen over the years, the combination of a lot and embedded technology has been helpful.

E. Smart Greenhouse Fuzzy Logic Based Control System

Enhanced with Wireless Data Monitoring Because there are so many variables involved and how they interact makes greenhouse climate control a challenging process. In order to ensure a favourable microclimate for plant growth while conserving energy and water resources, this study offers a contribution that integrates greenhouses into climate key's characteristics. A clever fuzzy logic-based control system was established and enhanced by careful consideration of the relationship between temperature and humidity. The wireless data monitoring platform for data routing and logging, which offers real-time data access, was also added to improve system control. Experimental verification of the suggested control system was done. A review of the system's effectiveness revealed significant energy and water savings.

III. Existing System

Farmers are facing enormous challenges as a result of the sharp decline in agricultural land and the quick development of hydroponic system technologies like Nutrient Film Technique (NFT). The water temperature, water level, pH, and nutrient content (EC/PPM) are only a few of the variables that need specific attention in this hydroponic system. We first track and gather data from NFT Hydroponic farmers before doing a thorough

evaluation and analysis. Unfortunately, it is still managed using traditional methods (human), such as managing the It takes a lot of time to perform nutritional concentrations, which must be done at least once each day. We require a system that is simple to implement and operate in order to handle these problems.

IV. PROPOSED SYSTEM

Here, a brand-new hydroponics system is suggested. A picture of it can be seen in Fig. 1.By supplying enough water to plants, it is possible to establish an environment without soil. Given the steadily declining amount of agricultural land, there is a significant need for hydroponic systems. For more ease, the suggested method can be put into use in large farm locations as well as in residential spaces like balconies and terraces. A smart agriculture system for remote monitoring can be provided by combining the requisite sense network with the right loT platform.
The following are the main parts of the transmitter system:

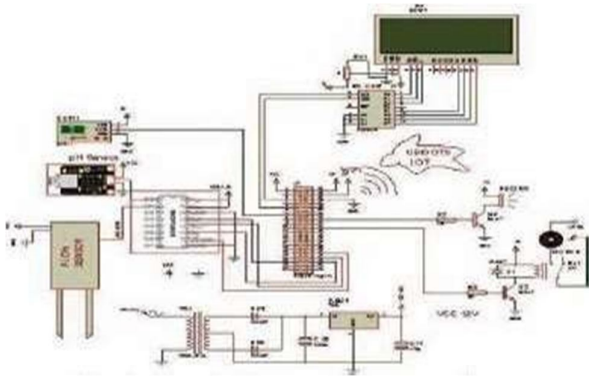

Figure 1: Circuit Diagram

The main component of Human-Machine Interface (HMI) has changed as a result of IoT technology advancements, and that change is cloud dashboards. This platform facilitates the preservation and presentation of data from the physical world as digital data. These resources can be shown on a PC or even a mobile device depending on the needs. In the system being proposed. The user-friendly representation of the Hydroponics system performance data is achieved by means of an IoT dashboard called Ubidots. This helps to increase system efficiency while keeping costs down.
DHT11 - In A thorough understanding of the climate is essential for agriculture. The values of temperature and humidity provided by the DITT11 sensor, a temperature and humidity sensor, allow to track the climate conditions. temperature and humidity sensor image.
Water Level Sensor - This sensor is used to determine the amount of nutrient-enriched water. Using this sensor, the hydroponic system's water level can be determined. the sensor's picture of the water level.
pH Sensor - pH sensors are important in hydroponic systems. Nutrient-enriched water's pH has to be monitored. Readings from the water are taken to track the actual pH.
Local data visualisation and display are made possible by the 20x4 Liquid Crystal Display. Figure 2 displays the 20x4 LCD's image.

Figure 2: 20x4 Photo of a Photo Sensor

V. BLOACK DIAGRAM AND WORKING

A technological fusion in agriculture is hydroponics. Better results and new directions for achieving positive outcomes have been highlighted by recent advances in agriculture. It is believed that the considerate approach to

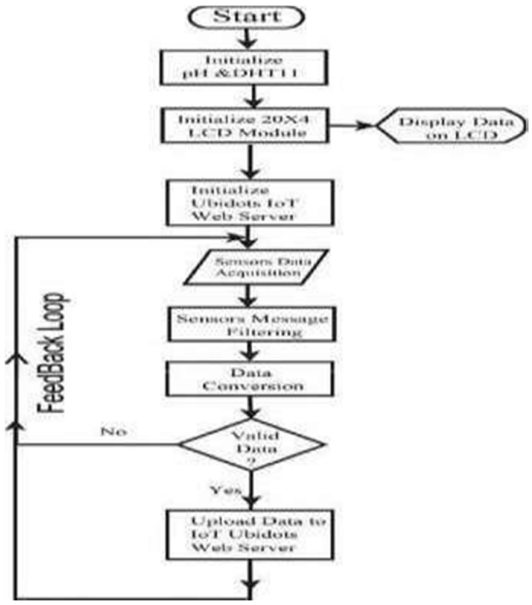

Figure 3: Flowchart

making people's life simpler involves understanding current technology, identifying important problems, and developing solutions to those problems. Here, the current applications have made it possible for agriculture to use technology to complete the rest of its trip. To effectively handle the major problems in the current situation, loT and automation are crucial. There are good reasons that become more significant. The phrase that best describes the is connected. With any gadget, we can observe the whole range of corrections.

Although human error may be common, it should not be ignored. Automation, however, is the best option to reduce mistake and human resources. The monitoring of environmental indicators, including water quality and level, can be done on a regular basis with the use of the appropriate sensors. A farmer can save back on resources and labour by automating the monitoring of the farm's status. Automation guarantees an increase in output by lowering expenses and lead periods.

Climate Information Agriculture is reliant on the occasionally changing climatic circumstances. Therefore, it has a direct impact on the crop's rate of production. Through the usage of loT, we may receive a weather update and be able to move on. The sensors that are positioned within and around the farm provide weather-related information with the highest degree of accuracy, including temperature, rainfall, and humidity. Every time the weather is unsettling, the alert information will be transmitted without a person being present.

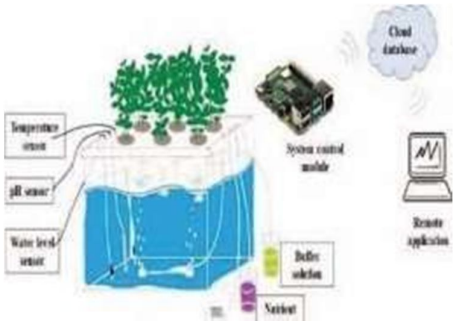

Figure 4: Illustration of the proposed hydraulics system

VI. Experimental Process

An experimental setup is created for the implementation of a prototype in accordance with the concept depicted in the graphical representation in Fig. 1. The block diagram and flow chart are used to further explain the process steps.

Analogue data from the hydroponics system is captured by the sensors. The Raspberry Pi 3 board, which controls the functioning of the complete system, receives digital data created by a sophisticated 10-bit ADC (Analogue to Digital Converter- MCP3008) and transmits it to it. The processor will analyse the data and conduct the necessary steps, such as displaying messages, activating alarm buzzers, controlling motor pumps, and storing the data in a cloud dashboard.

VII. Results

With the use of Ubidots cloud database, the management and monitoring of hydroponic systems are demonstrated. The Hydroponics system's various factors, including temperature, humidity, water level, soil level, pH value, etc., are deliberately monitored utilising a numerous sensor network. For the farmer's updates, the periodic data is kept on a user- friendly cloud dashboard. a picture of a prototype that was used. The relevant sensor data is shown on the LCD panel and in a mobile application built on a cloud dashboard. The screenshots of various parameters are displayed in Figures 5, 6, 7, and 8. There are many benefits to using hydronic systems for heating and cooling. They are a well-liked option for residential, commercial, and industrial settings due to its effectiveness, comfort, and adaptability. Using water as a medium Hydronic systems, a medium for heat transfer, maintain constant, equal temperatures across an area to ensure maximum comfort.

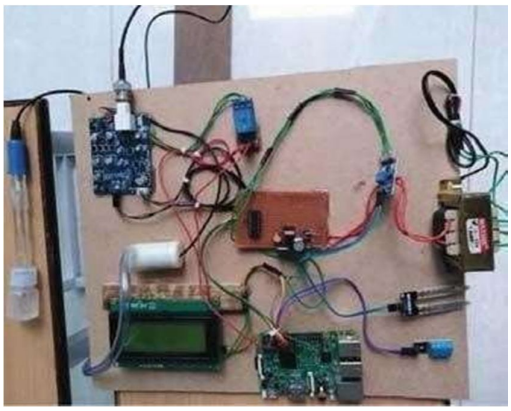

Figure 5: Prototype Implemented in Photography

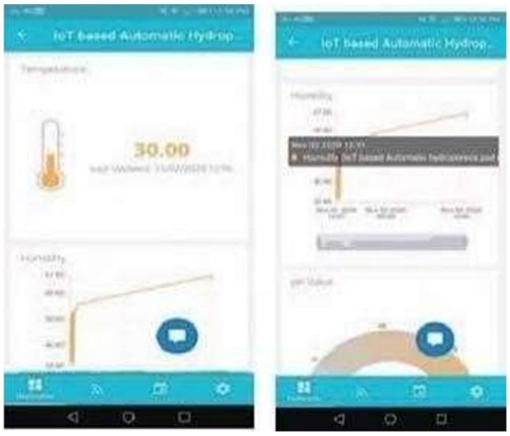

Figure 6: Models of LMS

Figure 7: Screenshot of water and soil level parameter

Figure 8: Photograph of LCD screen

VIII. Conclusion

The primary goal is to create a hydroponic farm that uses a sensor network to communicate and assist the farmer in monitoring the health of the crop. Here, the suggested IoT system minimises power consumption while serving as a watchful eye on farmers. The farmer can monitor the farm remotely and be aware of specific parameters. use it as a backup and effectively manage the farm.

Future scope

Hydronics has a bright and hopeful future ahead of it, with many chances and substantial developments. Integration of smart and connected technology with hydronic systems is an important area of future scope. We can picture a time when hydronic systems are seamlessly connected, enabling effective monitoring, control, and optimisation as the Internet of Things (IoT) develops further. Real-time data gathering, analysis, and modifications will be made possible by smart sensors and actuators, leading to improved energy efficiency and customised comfort settings.

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