Smart Hydroponics Monitoring and Controlling System Using IoT

Priya Shrikhande
Department of Electronics and Telecommunication, Marathwada Institude of Technology ,Aurangabad
Corresponding Author: Prof. M. R. Vargantwar

Abstract

The effects of the global warming make more difficult for planting in uncontrolled environment. In traditional farming method, farmers require fine quality of soil with natural mineral strengths. It also requires working cost for ploughing and removal of weeds and also needs large amount of space and water. In case of seasonal plants, the yield does not satisfy the customer needs and the expectation of farmers in productivity. For these reasons, a farming method which needs lesser requirements in cost factor and also it easy to maintain and control the important factors such as light, water level temperature, and humidity throughout the year is needed. This proposed work presents a Smart Hydroponic style of farming which is the method of growing plants without soil & sunlight. In this method the plants are grown with only their roots exposed to the mixture of ash fertilizer with water instead of underground soil. This method is a type of indoor agriculture style which is independent of weather, and it also avoids the cost of ploughing and labour works. Watering and controlling of humidity is done with the help of a microcontroller Kit connected to Wireless Sensor Network with internet which senses the humidity, temperature , water level, light, pH level, EC level. With the help of this Internet of Things technology, the real time status of plant's growth could be monitored by the authorized person from remote location. This technology helps efficiently for the agricultural development with minimum resource utilization.

Keywords: Internet of Things, Smart Hydroponic Style, Wireless Sensor Network.

I. INTRODUCTION

Hydroponics is an agricultural method of producing plants in an artificial environment without using soil – nutrients which are provided through water – and by optimizing the growing conditions to improve the production. Hydroponically cultivated plants have a growth rate that is much faster and highly yielding than that of plants grown in soil. Because they are cultivated in containers, pest and disease control is at an optimum. In natural conditions, soil itself acts as a mineral nutrient reservoir but it is not essential for plant growth. The roots can easily absorb the mineral nutrients in the soil if it is dissolved in water. If the minerals are present in the supply of plant's water artificially, then the plant no longer requires soil to thrive. We can grow any terrestrial plant by this method. The method for growing plants by using mineral nutrient solutions, in water, without planting in soil is known as hydroponics. In this method the plants are grown with only their roots exposed to the mixture of ash fertilizer with water instead of underground soil. This method is a type of indoor agriculture style which is independent of weather, and it also avoids the cost of ploughing and labour works. Watering and controlling of hydroponics is done with the help of a microcontroller Kit connected to Wireless sensor network with internet which senses the humidity, temperature , water level, light, pH level, Electric Conductivity(EC) to measure nutrient level. If the microcontroller deemed that the pH, the nutrient level, water level was too high or too low, the micro controller would adjust the solvent by activating pumps. Also, if the light intensity, temperature and humidity are low or high then microcontroller will activate LED bar and cooler fan. With the help of this IoT technology, the real time status of plant's growth could be monitored by the authorized person from remote location. This technology helps efficiently for the agricultural development with minimum resource utilization.

II. LITERATURE SURVEY

In [1], the writer has proposed a method mentioned the significance of agriculture within side the world. There are issues persisting agricultural, this could be solved with the help of smart agriculture by modernizing the conventional manner of farming. So, this could conquer with the help of hydroponic farming using IoT. The foremost capabilities of this assignment are, the vegetation are supplied with water and nutrients

depending at the sensors values like temperature and humidity (DHT 11), pH sensor and electric conductivity circuit.

In [2], the writer has proven the significance of agriculture. High yielding and high grade of vegetation are essential in present day Agriculture; this can most effective be completed with the help of clever farming generation. Manual monitoring is now no longer so true and now no longer advocated due to the fact the flowers can also additionally die if there isn't sufficient vitamins provided. The structure of this hydroponic device which is completely automatic. The automatic monitoring and manage of all of the sensors primarily based totally at the environmental modifications together with light, pH for vitamins, electrical conductivity to degree the saline with inside the water , water temperature, and humidity is finished out with the help of sensors and actuators onto the device. The automatic monitoring are done with the help of IoT which are used to examine the sensors data and store it to the internet. And later, the popularity of the hydroponics device may be checked and managed with the aid of cell utility via internet.

In [3], writer have grown the different plants in a single system. Organized a setup to build a system. The nutrient solution is given to the crops, by mixing the nutrients with the required amount of water. Various sensors are then connected such as, pH sensor for monitoring the pH value of the nutrient solution. And water level sensor to monitor the water level. They have used and efficient algorithm to do this. A specific pH value must be maintained for the plants to grow. The normal tap water does not have the required nutrients, so we add some amount of nutrients. The pH range will be constantly monitored daily. Wrong pH range may affect the photosynthesize and thus affect the growth of the plant. Similarly, the temperature and the light also should be monitored regularly.

In [4], writer have used 4 sensors: pH sensor, water degree sensor, air temperature and humidity sensor and light sensor. All these sensors are connected to ESP32 microcontroller. They have used a relay to control the system. And some actuators such as fan, a nutrient pump, light and a water pump is used. All these are connected to the relay. The system is controlled via mobile application.

III. SYSTEM AND DESIGN

Concerning the integrated system logically, we will set varies of sensors for collecting data such as EC and pH concentration, humidity, temperature, water level and light intensity .At the same time, there are air pumps, and other devices which will be controlled by the data sensor collected to keep the environment stable.

As to the data are sent through WI-FI to the local host to update to the cloud which stores the data and where the data is analyzed. Beyond that, users could access the cloud to check the plant.

What's more, we need to control the environment for the system. There will be 5 factors to control: Humidity, temperature, light, EC, pH, and dissolved water level. Those factors have corresponding sensors and actuators. Sensors will help IoT system to collect these data, and actuators will receive data from cloud to react to corresponding changes on these 5 factors. Data communication between sensors is called a wireless sensor network. After data is being collected, they will be sent to a local server through the sensor network. And the local server will send data to the cloud server. After computing, the data will both send to the local server and user interface. Local server will send data to actuators, and the user interface will receive data to inform users. Overall those functions and devices, IoT system makes the hydroponic system become automated.
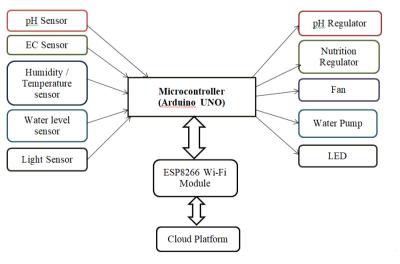
Fig.1 Proposed System

Parameters	Name of Sensors used	Working voltage
Temperature and Humidity	DHT-22	5V DC
Water Level	K-0135	5V DC
Light Intensity Sensor	GY-30	5V DC
pH Sensor	SKU:SEN0161	5V DC
EC Sensor	SKU:765922	5V DC
Relay Module	5 channel	5V DC
Peristaltic Pump	Anyone can be used	5V DC
Cooling Fan	Anyone can be used	12V DC
LED Light bar	Anyone can be used	12V DC

Table 1. Deployment Parameters

- **Algorithm for Proposed System**
  Input :
  EC (necessary nutrient level), pH(necessary pH value), W(necessary water level), H (necessary Humidity), L(necessary Light Density), T (necessary temperature)
  Output :
  Controlling and monitoring temperature and humidity, Light, water level, nutrient and pH level.
  Process :
  Wi - Water level obtained from sensor
  Hi - Humidity obtained from sensor
  Li - Light obtained from sensor
  Ti - Temperature obtained from sensor
  ECi – Nutrient level obtained from sensor
  pHi – pH value obtained from sensor
  Step 1: Read the sensor values (Wi,Hi,Li,Ti,ECi,pHi).
  Step 2 : If the sensor values greater or lesser than the threshold values (EC,pH,W,H,L,T).
      Step 2.1 : Upload sensor data on cloud platform
      Step 2.2 : make the decision to control the actuators based on the values of (EC,pH,W,H,L,T).
  Step 3 : If the sensor values are greater or less than the threshold values(EC,pH,W,H,L,T)
      Repeat step 2.1 & 2.2.

IV. CONCLUSION

A new approach for monitoring and controlling the hydroponics system supported wireless sensor network has been presented. The proposed system will able to effectively measure and control Nutrient level, pH level, water level, light intensity, temperature and humidity collectively. The system uses sensors, Wi-Fi standard wireless coordinator communication protocol for data transfer between the sensors node and coordinator. The coordinator allowing to transfer of knowledge from sensor nodes to the IoT cloud environment, which can allow monitoring and controlling of parameters on IoT platform effectively.

V. REFERENCES

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