Dr AMBEDKAR INSTITUTE OF TECHNOLOGY

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SYNOPSIS FOR MINI PROJECT : 22ETM506

ON

"Smart Hydroponics Monitoring and Controlling System Using IoT "

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Submitted by

Student Name	USN
Swetha .N	1DA22ET051
Spoorthy .G	1DA22ET053
Varsha .A S	1DA22ET056
Praveen .M N	1DA23ET404

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Vishveshwaraiah Technological University

Jnanasangama, Belagavi, Karnataka – 590018

ABSTRACT

The explosion in human population has left researchers scrambling for solutions on how to feed the world. Furthermore, rural-urban immigration has on the one hand left the farms in the rural areas devoid of farmers and on the other hand has left the urban areas over-populated. Hydroponics is a form of agriculture where crops are grown without soil. This technique allows the farms to follow the farmers to the urban area. In addition, the fact that no soil is needed, allows hydroponic system to be stacked vertically (also known as vertical farming)to save space. The final frontier in hydroponics is automation. It will allow one farmer to work more than one job and cultivate more than one farm simultaneously.

Growing certain plants and vegetables in remote areas such as deserts and the north and South Pole can be a challenge because of the extreme outside weather. very few species of plants thrive in such situations and are often not used as a food source. In this study, we created a system that can grow common plants and vegetables and can operate without depending on outside climate. we achieved this by using a technique called automated hydroponics. Hydroponics is a method of growing plants without using soil. The system was automated using microcontrollers and sensors to keep human intervention at a minimum. An internet of Things (IOT) network was created to improve reliability and allow remote monitoring and control if needed. The user is only required to plant a seeding and set initial parameters.

INTRODUCTION

The purpose of the project, is to expand and improve the utilization of hydroponics as well as to create an environmentally independent system for indoor plant growth. In a hydroponic system, a plant is placed in solution composed of soluble nutrients and water as opposed to soil. In most conventional hydroponic system parameters such as EC and Ph of the water solution are set to the desired value while setting up the system.

There are several other parameters such as air temperature and humidity, light, water temperature etc. which are not controlled or maintained. These parameters are important for healthy and faster plant growth. In this project, we built a system which monitors and controls all the parameters necessary for healthy indoor plant growth. In general, the process goes as follows: create a nutrient solution based on the plant being grown, apply this solution to a bed of water, place a germinated plant into water such that the exposed roots are touching the solution if the parameters are maintained within optimum levels, the plant should grow faster and healthier than its natural growth. The aim of the project is to make a system that is cost effective and most importantly, is completely automated and requires virtually no human interaction after placing the germination plant into system.

LITERATURE SURVEY

Conventional soil-based crop cultivation has various drawbacks, such as access to land, poor soil quality, erosion, low efficiency of water utilization, pests, and the multiple environmental limitations associated with climate change. These drawbacks are exacerbated by a growing human population and associated increase in demand for cereals, fruits, vegetables, and other food crops. Thus, interest has grown in soilless cultivation research in the last two decades. Hydroponics, a form of soilless cultivation, has become popular because it can produce higher yields than traditional soil-based agriculture, it is conducted in a controlled environment that is free from climate and other environmental constraints, and crops can be produced with significantly lower use of pesticides than those grown conventionally. This paper provides a literature review of recent research on hydroponic crop cultivation (HCC), including the historical context, classification, requirements for HCC, and the latest technologies employed in this field. The review closes with an analysis of the challenges ahead for the development of HCC.

The term IoT refers to a system in which numerous sensors, controllers and actuators are connected with *things* using the Internet and a cloud server. IoT can be used to monitor and control many aspects of crop life without human intervention, making farming smart. Hence the term *Smart Farming* to indicate IoT technologies applied to the agrifood sector. As for hydroponic agriculture, the integration of the IoT into the system could add other advantages to this methodology, such as efficiency and simplicity, which will make it appreciated even more. In addition, the sensors can collect data and automatically send it to a cloud server that can be accessed remotely via a web application or a mobile application. This means that farmers can monitor plants even if they are far away or not constantly present on the farm. Therefore, resources can be easily optimized with a fully automated and independent system.

In this project, we propose an implementation of a smart hydroponic greenhouse which makes use of some sensors to monitor the temperature, humidity, light and water level of the greenhouse. All the data collected by the sensor are sent to a cloud server by using Wi-Fi and it is then displayed in real-time in a dashboard with the additional possibility, for the final user, to control remotely the power on/off of some components.

METHODOLOGY

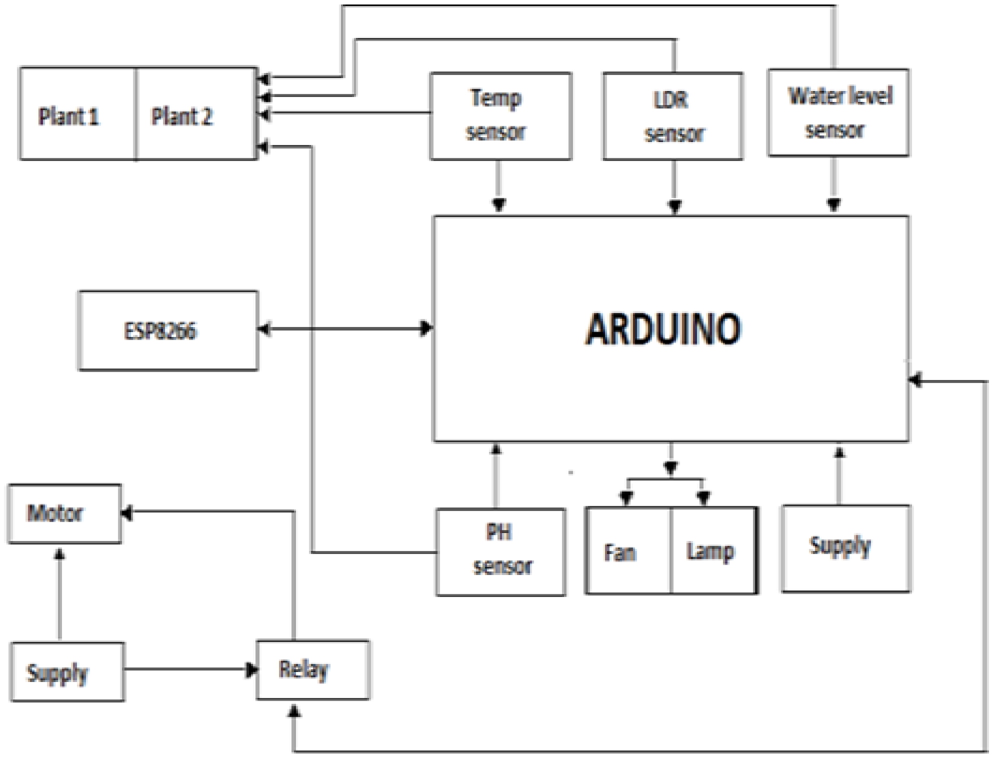
The implementation of hydroponic farming is the fastest growing sector of agriculture and it could very well dominate the food production in the future. Hydroponic farms require 90-95% less water than the conventional farms and the farm can be placed anywhere as no soil is required. The main aim of our project is to make a compact system to automate nutrient dose, PH, water supply and temperature of a greenhouse hydroponic farm. In this technique, we ensure that plant gets all nutrients from the water solution.

Hydroponic system can accomplish this by allowing crop production in urban environments not available for conventional farming. In our project, the parameters are controlled automatically. Also, the cultivators can know the conditions of the plant growth and control the parameters remotely by using IOT technology. Here we have considered the Arduino micro controller with three types of sensors such as temperature sensor, PH sensor and LDR for both plant 1 and plant2. ESP8266 is a Wi- Fi module to communicate by using internet of things with the server. The GSM module is to communicate and relay is used to automatically turn on/off the water supply from the pumping motor.

Nutrients/Chemicals required for plant growth To survive and grow, plants need:

- Oxygen
- Carbon Dioxide
- Lights
- Water
- Nutrients.
- Any good Hydroponic nutrient should contain all of these elements; Nitrogen (N), Potassium (K), Phosphorous (P), Calcium (Ca), Magnesium (Mg), Sulphur (S), Iron (Fe), Manganese (Mn), Copper (Cu), Zinc (Zn), Molybdenum (Mo), Boron (B), Chlorine (Cl)

BLOCK DIAGRAM OF THE PROPOSED SYSTEM



Hardware required

- Arduino Microcontroller
- Temperature sensor:- LM35
- PH sensor :- glass electrode
- LDR
- Ultrasonic sensor
- ESP8266
- Relay
- Dc motor

Software

- Arduino IDE
- Thing Speak(IoT)

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

ADVANTAGES

Water conservation: Hydroponic systems recirculate and reuse water, which can help growers save money and conserve water.

Space maximization: Plants can be grown vertically, in layers, or in small containers, which allows for a larger number of plants to be grown in a smaller space.

Improved plant quality: Enhanced nutrient delivery can lead to healthier plants with improved flavour, aroma, and nutritional value.

Reduced need for chemicals: Hydroponic systems are highly controlled, which can reduce the need for pesticides and herbicides.

Faster growth rate: Plants can grow faster than in traditional farming.

Ease of harvesting: Plants are easier to harvest.

Suitable for various environments: Hydroponic systems can be used in areas with water shortages, on ships, or on rooftops.

APPLICATIONS

Monitoring and control: Farmers can monitor and control environmental parameters remotely, such as water level, pH, temperature, flow, and light intensity.

Crop productivity: Smart hydroponics can increase crop productivity by optimizing the supply of plant nutrient solution.

Plant quality: Smart hydroponics can enhance plant quality by meeting the nutritional needs of plants.

Resource optimization: Smart hydroponics can optimize resources in plant care, crop management, nutrient solution control, and environment monitoring.

Prevent crop loss: Smart hydroponics can send alarms when specific parameters stray from the appropriate range.

Data-based decision making: Farmers can use sensor integration for data-based decision making.

System evaluation: Smart hydroponics can examine large quantities of sensor data to evaluate the effectiveness of the hydroponic system.

System adaptation: Smart hydroponics can be adapted to the particular needs of various crops and growing conditions.

FUTURE SCOPE AND CONCLUSION

Hydroponics is a relatively new technology, evolving rapidly since its inception 70 years ago. From its origins in academic research, to its utilization in industry and government, hydroponics has found many new applications. It is a versatile technology, appropriate for both developing countries and high-tech space stations. Hydroponic technology can efficiently generate food crops from barren desert sand and desalinated ocean water, in mountainous regions too steep to farm, on city rooftops and concrete schoolyards and in arctic communities. In highly populated tourist areas where skyrocketing land prices have driven out traditional agriculture, hydroponics can provide locally grown high-value specialty crops such as fresh salad greens, herbs and cut flowers.

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