

Greenhouse Farming using IoT

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ABSTRACT

The most frequent problems faced in Greenhouse Agriculture is pH changes, Watering and Temperature. Plants need light, carbon dioxide and mineral nutrients in order to produce food and grow. Water is supplied through substrate, and it contains dissolved mineral elements. The mobility of these nutrients is determined by pH. A pH reading is measurement of the acidity or basicity of solution. The goal of a greenhouse grower is to maintain stable pH over the life of crop. In greenhouses, in case of insufficient or poor ventilation of greenhouse, the crops may be attacked by diseases. There may be extreme and sudden temperature changes. Moreover, it is not good to have regular watering routine for crops in the greenhouse, but neither it is not good to let plants dry. Hence sunlight, moisture and pH of soil plays vital role in greenhouse agriculture. To overcome these problems an IoT device which can give suggestions about when to water, adjust pH and change lighting for plants in greenhouse to improve the production. The goal is to increase the yield and reduce the complexities in organic farming for the farmers.

Keywords : pH, light and moisture, IoT, three-in-one meter

I. INTRODUCTION

Greenhouses are in starting stages in India. Recently farmers are adopting greenhouse to produce good yield and nutritive outcomes. Using of traditional methods for farming leads to increase in work. Hence many are switching to greenhouse farming.

The main reason to grow vegetables and flowers in greenhouses is to have crops at a time of year when they can't be grown outdoors. Greenhouses grow the crops in controlled conditions by supplying them externally. The fruits and vegetables are highly nutritious. Hence, greenhouse is a better option for farming.

Since the appropriate conditions are artificially created, we have to be accurate with the work.

Greenhouse Environment factors mainly light, pH, moisture should be monitored continuously.

This can be achieved by measuring these factors regularly. In our project, the farmers measures the greenhouse factors regularly using a three in one soil tester. This soil tester contains pH, light and moisture sensors in it rather than using the sensors separately which is not cost effective.

This device is connected to internet and the measured values are sent to our website automatically. On receiving these values, our website gives suggestions to the farmers about their crop's current condition.

We give these suggestions based on the data collected by us from different greenhouses in our nearest regions. So, the data is genuine and helpful in giving better feedback to the farmers. The farmer follows the suggestions and implement them which helps for good plant growth. Greenhouses make farming easy. Hence, they have become boon for farmers.

II. METHODS AND MATERIAL

In our proposed scheme, interested to help farmers in by using IoT technology in greenhouse farming. The device we are using to measure the greenhouse factors such as pH, light, moisture is connected to the internet. The entire system we used contains:

1. Three in one Soil tester
2. Web Interface
3. Internet Connection

1. Three in One Soil tester

This contains 3 sensors namely pH measuring sensor, Moisture measuring sensor, Light measuring sensor. This contains 3 readout scales for pH, moisture and light. It contains pH and moisture sensor in its bottom and light sensor in its top. When it is inserted into the soil, it shows the pH, light and moisture values on their respected readout scales. It gives accurate values and saves time from going to lab tests. The units for sunlight is LUX (Luminous flux per unit area). Coming to moisture, the device indicates the position of soil like dry, moisture and wet. Based on that we will give suggestions for water in PPM (Parts per million). The pH indicates the hydrogen ion activity. This tester is cost effective and is available in Amazon and Flipkart. This reduces the farmer's effort of going to labs for testing the soil and other

greenhouse factors. We have to take a precautions while using this device.



Fig 1 : Three-in-one meter.

How to Use the device:

- Step 1: Switch moisture, pH and light position in the device
- Step 2: Insert the electrodes into the soil for 2 to 4 inches deep
- Step 3: Keep adjusting the position of the electrode until the pointer on the dial move slightly
- Step 4: After 10 minutes, we can note moisture, pH and light level in the dial
- Step 5: After getting values, we can remove device from soil. Then wipe it cleanly for next use.

Tips for using

1. Do not insert the probe against stone or very hard soil in case to damage the electrode
2. Wipe and clean the probe after every use.
3. Do not leave the device in the soil for a long time.
4. Do not use it to test pure water or other liquids.
5. If the soil is too dry, please water the plant first and test again later. The pointer of the dial will not move if the soil is too dry.



Fig 2 : Using of three in one meter in crops

2. Web Interface

A web interface is nothing but a simple website. It acts as a communication medium between greenhouse farmer and device and other greenhouse farmers also. It is also used to notify the upcoming events and government policies. It mainly comprises of three parts.

1. Working for suggestions
2. Discussion forum
3. User manual.

Working

The working page contains entry for plant type and age. The values we got from the device are compared and analysed using our collected database. Hence we can provide suggestions accurately. The suggestions involve how much water the plant needs right now etc. In case of pH, what is to be added to the soil to reduce or increase the pH of the crop. The Farmers who got registered in our website have a facility of getting SMS alerts. They can also notice the day to day crop updates in their web account. We will also provide save as pdf option for further use. We will also provide the chemicals or any other factors which

will be useful to increase their crop yield and nutrients.



Fig b: Mushroom growth in greenhouse

Discussion Forum

It can be visible to everyone for user convenience. If anyone want to add comment, then it will ask to join the group with mail ID. In this discussion forum, the registered users can communicate with each other by sending messages. We have used google discussion forum for discussion which makes development very easy. It was great tool for discussion compared to any other developed forums. We have used google slides for the development of discussion forum and give some videos about how to use the three-in-one meter. We have used google forums for discussion forum.

User Manual

It acts as a guide for farmer. He can refer to it any time for clarification. It contains information about crops such as how greenhouse soil is prepared for a particular crop.

It also contains information about pests that frequently affect the crop and measures to be taken to get rid of pests as greenhouses are closed structures and are frequently affected to pests and insects. It also gives information about features and requirements of a crop. It also contains additional information like

YouTube videos about how to build and maintain greenhouses etc. We also have any online user manuals available.

3. Internet Connection

Internet connection is almost compulsory for our project. We have to run discussion forum and user manual and to get the values from the device and for the analysing the data, we need internet connection. As suggested by the name, IoT is connection of devices using internet. The database is connected to internet using XAMPP. We have used MySQL, HTML and PHP in development of website.

III.RESULTS AND DISCUSSION

Plants depend on many parameters for their growth. We have considered light, water and pH as main components. In the proposed scheme, there is an analysis for performance of considered greenhouse parameters with practical results obtained by using Three in one Soil tester.

Sunlight and water play a vital role in producing food (sugar) through photosynthesis. Nutrients obtained through water and soil are useful for plant growth. The mobility of these minerals is pH and also we can check whether the soil used can be reused for another crop lifecycle or not. They can also be checked by adopting other methods also.

pH for most of the plants range between 6 and 7. pH should be maintained constantly throughout the plant's lifetime by adding acidic components or basic components based on their current pH. The moisture content depends upon the crop and its age.

Greenhouse plants may get sufficient sunlight or may get excessive sunlight. Insufficient sunlight can be altered by using artificial LED bulbs with required

wavelengths. Excessive sunlight can be altered by using effective greenhouse covering materials.

The values obtained from the device are compared with our collected data for effective results and suggestions are given to maintain standard parameters.

IV.CONCLUSION

Our project is very helpful to farmers who cannot afford much money for cultivation. Our motto is to increase greenhouse farming in India which supports cultivation of variety of crops irrespective of seasons, climatic changes and regions. It is very less cost and easy to implement. It produces high nutritious and pesticide-free yield. We cannot say that our project alone can meet all the needs of greenhouse. Our project makes it less cost for these parameters. Greenhouse farmers can adopt their methods for automation of other parameters.

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