IOT BASED SOILLESS SOLUTION

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Abstract: The common practice for farming is using soil for cultivation which is the natural way for cultivation. Soil is considered to be rich in nutrients which are required for proper growth of crops. Soil cultivation may not strictly require monitoring different parameters which would affect the growth of the crops. Thus this is the easy way for cultivation and is practiced from very long time. The increase in population led to decrease in land for cultivation, thus leading to shortage of food. So it has become necessary to find an alternative for farming.

There are many ways developed recently to reduce the problem cited above. Aeroponics and hydroponics are two of the ways for cultivation being implemented recently. Here we don't use soil as the medium which acts as the source for nutrition. Thus we call this type of cultivation as "SOILLESS CULTIVATION". Soilless means cultivation without using soil and the required nutrients are provided to the crops depending on the type of farming i.e. water as a medium for hydroponics and air as the medium for aeroponics. Use of technology for monitoring the environment can be very useful for increasing the yield and quality of crops. This paper describes the monitoring system developed for soilless cultivation.

INTRODUCTION

We know that crops are naturally grown in soil and this is the practice done from a very long time. But due to increasing population there is rise in the need for food but the land for cultivation is less. Even if we have land for farming but is not fertile for cultivation, thus it is required to find an alternative for growing crops.

It does not mean that the practice of growing till now is wrong. The proposed methods are just the alternative methods for cultivation. The alternative option for farming would be either hydroponics or aeroponics. This paper focuses on hydroponics as a medium for growth. Hydroponics is the artificial method for growing crops in the monitored and controlled environment i.e. we need to create an environment for proper growth of cultivation. Thus we have to consider all the parameters which affect the growth of crops and control its affect. IoT plays a very important role here. IoT is the concept which considers all the parameters and helps in monitoring and take required action if any changes occur in the surroundings. IoT connect the physical parameters, the data is exchanged over the internet. This way we can monitor the occurrence even if we are at different place. Sensors are used for checking the surrounding parameters, and the data is sent to cloud and the user can get the data even if he is at farther place. Thus the use of technology can relieve the manual work and the readings/results are more precise than the manual work.

LITERATURE SURVEY

1. SOILLESS CULTIVATION USING IOT Vivekanandan.G, MageshBabu.K, Akash ,2021: To reduce the problem of growing population and shortage of land, we used Soilless Cultivation using IOT. Here the crops are grown without soil.

2. Hydroponics System for Soilless Farming Integrated with Android Application by Internet of Things and MQTT Broker,2019 Navneet K. Bharti , Mohit D. Dongargaonka, Isha B. Kudkar: Hydroponics can be implemented in urban location but it requires regular monitoring. Thus for monitoring a system is developed using sensors, automatizing of the entire process with sensors and micro-controller has been reported in this paper. Here an IoT based hydroponics system parameters are monitored

3. A Cloud-Based IoT Platform for Precision Control of Soilless Greenhouse Cultivation Alaa Sagheer , Maged Mohammed , Khaled Riad 1,5, and Mohammed Alhajhoj, 2020: This paper shows our research in which we established a multitier cloud-based Internet of Things (IoT) platform to enhance the greenhouse microclimate. As a case study, we applied the IoT platform on cucumber cultivation in a soilless medium inside a commercial-sized greenhouse. The established platform connected all sensors, controllers, and actuators placed in the greenhouse to provide long distance communication to monitor, control, and manage the greenhouse.

4. Future Hydroponic Systems using IOT for sustainable agriculture Sapna Jain , Prof M Afshar Alam , Prof M.U. Bokhari ,2021: The paper discusses the use of latest IOT technology used with efficient hydroponic systems which help to save environment. This paper discusses how IoT provides a sustainable approach in agriculture sector where various technological devices use sensors and other tools for all the process of production of crops.

5. IoT Enabled Hydroponic System A V N Narendra Rahul 2021: This framework aspires to provide all the 8 appropriate conditions for crops to thrive, a system for consistent pH, water level tracking, air temperature and relative humidity surveillance. Besides, this system provides supervised water irrigation and nutrient supplement ingest with the use of simplistic procedures. Users store, retain, request, and transmit information over the internet through the data gathered by the detectors including the use of web-based technology as the rear end.

METHODOLOGY

1. BLOCK DIAGRAM

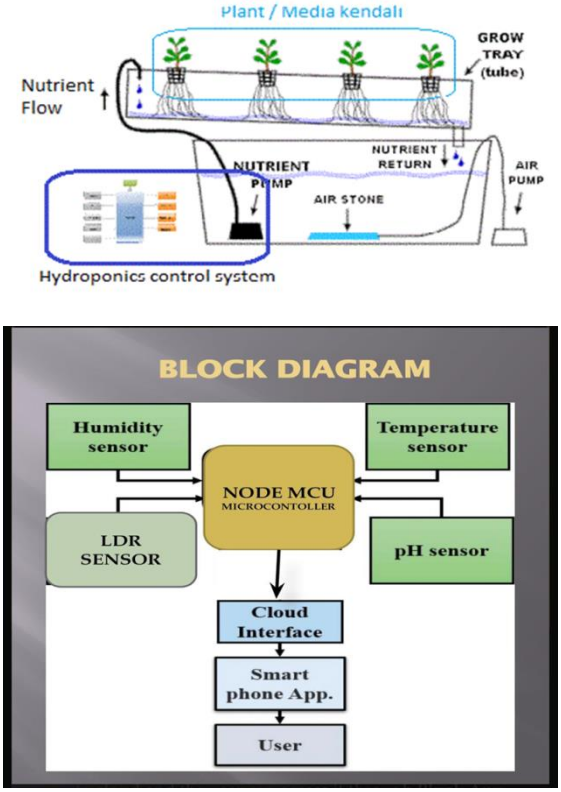

Figure 1: Block Diagram

The above block diagram shows how different sensors are interfaced to NodeMCU and also shows how to connect to cloud. According to the pin configuration of NodeMCU we have only one analog pin, but we have used two analog sensors one being LDR and other is pH sensor. We can use either of it at one time.

2. COMPONENTS USED

For monitoring different parameters we have used different sensors which would sense the surrounding and then the readings are sent to cloud and through internet the user can access the data. The sensors used are DHT11 sensor, pH sensor and pH sensor. The microcontroller used is NodeMCU.

COMPONENTS DESCRIPTION

NodeMCU: Node MCU is a open source IoT platform. It is a microcontroller which has in-built Wi-Fi module, thus can connect objects and transfers data using Wi-Fi protocol.

LDR: Analog sensor used to monitor light intensity.

DHT11 sensor: Digital humidity and temperature sensor for sensing humidity and temperature respectively. For soilless cultivation the preferred temperature value is room temperature.

pH sensor: Analog sensor to read pH value. pH is very important parameter to consider during soilless cultivation. Highly acidic or highly basic hydroponic solution may harm the plant growth. The preferred pH value for proper growth of crops is between 5.0-6.5.

SOFTWARE REQUIREMENTS

Arduino IDE: This is the open platform for coding i.e. for connecting sensors to NodeMCU. We can write our command as per our requirements.

Blynk App: This is the mobile app which is connected to the device and thus gives the information to the user in the form of graphs, gauges etc. We can create our own dashboard according to our convenience.

3. CIRCUIT DIAGRAM

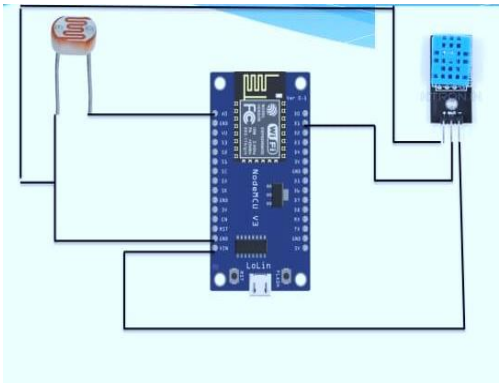

Figure 2: Circuit Diagram

Above circuit diagram shows two sensors i.e. DHT11 and LDR connected. Because we cannot use both LDR and pH at once we can one at a time. The connection for pH is the same as LDR.

4. WORKING

The working of the project is depicted in the block diagram. The working is divided into three parts.

I. Hardware setup
II. Software setup i.e. coding using Arduino IDE
III. Blynk Application

Hardware setup is arranging and connecting the sensors to NodeMCU 8266

Arduino IDE is used for coding i.e. for connection and communication purpose

Blynk is the IoT platform for IOS android smartphones that is used to control arduino, raspberry pi and NodeMCU through internet.

Once the hardware setup is done, we upload the code onto NodeMCU after which the interface is created for communication. Blynk app is the user interface through which the user can monitor the sensor readings.

The environmental conditions affecting the plant growth like pH, temperature, Humidity and light intensity are monitored. If any change in the readings is seen on the Blynk platform then the user can take immediate actions, thus protecting the crops from getting damaged.

HARDWARE SETUP

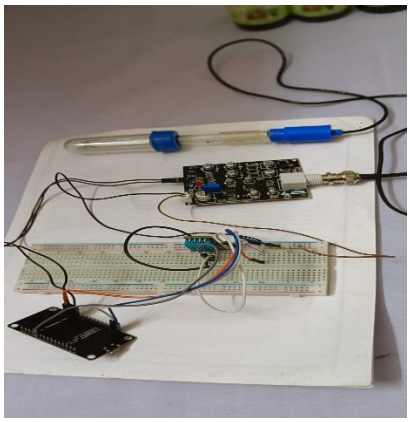

Figure 3: Hardware Setup

The connection for implementation of the project is done as above.

SOFTWARE SETUP

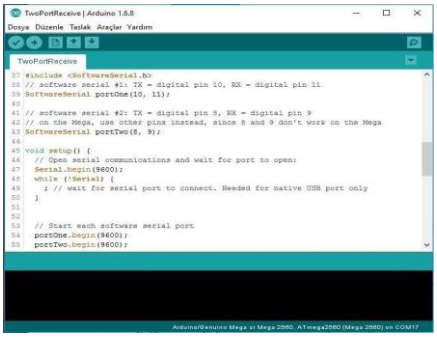

Figure 4: Arduino IDE

Source code is written in arduino IDE. Code for different sensors is integrated here. Working of the sensors and also the display of output also depends on the code written.

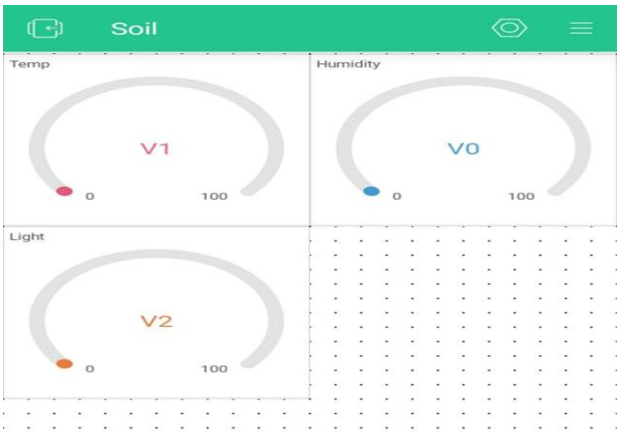

Figure 5: Dashboard for Blynk App

Blynk dashboard is created to see the sensor output. Blynk app/ software generates its own ID and password to connect to NodeMCU. Thus, this makes the user unique. Now the user can monitor the environmental conditions even though he is in farther place.

HYDROPONIC SOLUTION

Because Hydroponic solution is the source of nutrition for crops, it is required to prepare the solution correctly. Here for every 2 liters of water we have added 4ml of nutrient solution.

Process for growing crops starts from germination process. Seeds are sown and kept in dark place for germination. After germination process is done seeds are dipped in hydroponic solution. The solution is placed in rectangular container. There are many ways for placing the hydroponic solution, we can use sprinklers for sprinkling nutrient/hydroponic solution or we can use container and add hydroponic solution to it. Here we have used the later one. If we use the second one then it is necessary to use pump to prevent water from getting stagnant thus preventing bacterial/algal attacks. Net pots are used for placing germinated seeds.

RESULTS

Monitoring system developed here would help in checking important parameters and display the result on the dashboard on the mobile phones. The proper setup and configuration would help the user by providing the required data at the right time which would help to increase the crop yield.

A growing environment for proper plant growth is created. After germination process, the seeds are placed in the nutrient solution tub without damaging the roots and also without allowing the plant to bend by using pebbles. Use of Blynk mobile app helps the user to check on the important parameters being in far places. People living at farther places can monitor the conditions and thus increase the productivity at relatively low cost. The system developed is cost effective and efficiency of the system providing the readings is also higher.

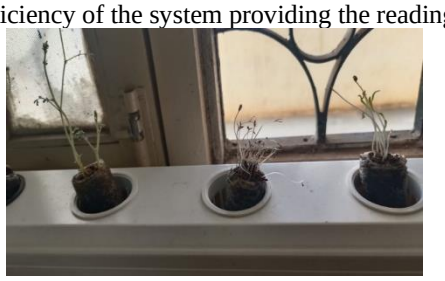

Figure 5: plant Growth

Figure 6: Blynk app readings

CONCLUSION & FUTURE WORK

The system described above is the monitoring system which monitors some parameters like pH, temperature, humidity and light intensity. For further development, we can use nutrient sensor for sensing nutrient content in the hydroponic solution.

Our project is based on monitoring of the environmental parameters also we can develop a system which automatically informs the user about any changes in the parameters which can harm the plant growth. The information can be given by a buzzer or by dropping a message to the user, and now the user can know the condition and can take the required action.

The point mentioned above can provide information only, the user has to take actions manually, we can develop a system which is automated and takes actions without any manual work. Sprinklers can be used to provide nutrients to the crops if the sensor senses lack of nutrients in the solution.

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