

A Smart Greenhouse Seedling Crops Based on IoT and Cloud Computing

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ABSTRACT: This paper presents the Smart Greenhouse for monitoring of crops from growth to its final product using Internet of Things (IoT) platform. This is mainly to improve the current agriculture practices by using modern technology. This system reduces the manual work and allow to carry out the work automatically. A closed structure made up of transparent material which provides a suitable climatic conditions for optimum growth of plants is called Greenhouse. The parameters such as temperature, humidity and moisture content of the soil inside the greenhouse are monitored and controlled automatically using different sensors. IoT platform is used where the farmer can know the temperature inside the greenhouse. Finally, a GSM module is also used in order to connect call or sms to an e-commerce company.

KEYWORDS: Smart Greenhouse, Sensors, pi camera, IoT, Cloud platform, GSM.

I. INTRODUCTION

Indian agriculture is faced by a several problems. Several problems are uncertainty in water supply, lack of remunerative income, fragmentation of land holdings, lack of access to formal credit and insurance, use of poor quality seeds, inadequate storage facilities. Farmers have to face problems such as lesser rainfall. This is mainly due to lack of education and technical resources.

In order to overcome from these problems a Smart Greenhouse has been introduced. The parameters such as temperature, humidity and moisture content in the soil are monitored and controlled automatically. Hence it is called as Smart Greenhouse. An IoT is nothing but Internet of Things where a hardware can be controlled with the help of internet. The farmer can use this platform to know the climatic condition inside the greenhouse.

The insects and pests cannot enter inside the greenhouse because of its closed structure. This eliminates the requirement of pesticides. To measure the temperature inside the greenhouse a DHT11 sensor is used. The threshold value of temperature inside the greenhouse is between 23-30 degree Celsius.

A Raspberry pi camera is used to capture the image of plants inside the greenhouse. In IoT platform a dashboard is created, which is used to capture the image whenever the farmer want to view the image. This helps the farmer to know the growth condition of plants. The pi camera will capture the image and send to cloud. Using the cloud platform credentials the farmer can download and view the image. A GSM module is used to establish communication between the farmer and an e-commerce company. This avoids the middlemen between them.

II. RELATED WORK

The artificial intelligent techniques are applied for modelling and control of some climatic variables within a greenhouse. The first part of the work is based on the development of a computer simulator for the greenhouse based on physical considerations. The second part of the work deals with the development of a suitable methodology for the temperature and humidity control.

The design of a simple, low-cost system to monitor the value of environmental parameter and they are continuously updated and control in order to achieve optimum plant growth. The circuit becomes more complex, speed of controller is low, high maintenance and unfeasible.

A simple system which must be easy to install, user friendly to monitor and sunlight of the natural environment that are continuously modified and controlled in order to optimize them to achieve maximum plant growth and yield. The process has been divided into three application domains corresponding to plant management, animal farming and food/agricultural product traceability.

The monitoring and control for greenhouse through Internet of Things (IoT) has been designed. If any condition crosses certain limits, a message will be sent to the registered mobile number through GSM module. This system will eliminate the risk of greenhouse not being maintained at specific environmental conditions due to human error.

III. METHODOLOGY

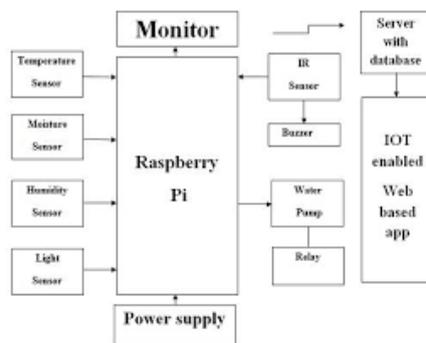


Figure 1 : Block diagram of designed system

Figure 1 shows the block diagram of a smart greenhouse using IoT platform. The system is composed of a various sensors to measure the climatic conditions inside the greenhouse, thus facilitating the process of communication with an external subject. This sensors measures the various parameters and the value will be sent to IoT platform with the help of internet and the pi camera will capture the image and send to cloud. The user interface enables the quality of the product to be assessed, along with the safety of the greenhouse planting.

1. **Temperature and humidity sensor (DHT11) :-**
DHT11 sensor is placed inside the greenhouse to measure both temperature and humidity which generates the calibrated digital output. When the temperature rises above the threshold value, Raspberry pi will trigger the relay to turn on the cooling fan and bring the temperature down. It is a low cost temperature sensor.
2. **Soil moisture sensor :-**
The soil moisture sensor measures the moisture content in the soil. It uses capacitance to measure dielectric permittivity of the surrounding medium. The moisture sensors are deployed in the field to measure the moisture content. Whenever the moisture content falls below the threshold value the motor pump is turned on automatically to water the plants. When it reaches the threshold value motor pump is turned off.
3. **Growing LED light :-**
Different wavelength of light plays a specific role for plant growth. Most of the plants need broad spectrum light for specific growth of plants. During morning plants receive it directly from the sun, during night the LED light provides the required wavelength for the growth of plants. Offering low energy usage, low heat and color optimized for growth.
4. **Irrigation system :-**
For optimum use of water, we use drip irrigation. It is an irrigation system to save water by allowing water to target the root of plants. Water obtained from the sources like canal, rain water harvesting, etc., are not allowed to irrigate the fields directly, instead it is stored in a underground tank. This tank is equipped with a water level

sensor to measure the water level continuously. The motor pump inside the tank is turned on automatically whenever the moisture falls below the threshold. This irrigation system avoids the excess use of water.

5. **Pi camera :-**

The Raspberry pi camera module can be used to take high-definition video, as well as still photographs. It communicates with the pi using the MIPI camera serial interface protocol. This camera is fixed inside the Greenhouse to capture the image of plants. It will capture the image and send it to cloud. The user with the help of internet can download the image from the cloud. This helps the farmer to know the growth condition of plants.

6. **GSM :-**

GSM (Global System for Mobile communication) is a digital mobile network that is widely used by mobile phone users. To save the farmers from the clutches of middlemen, we have designed a marketing system which connects farmer to customer directly. Whenever the products are ready just by clicking the button in the IoT platform a message is directly sent to an e-commerce person bypassing the middlemen.

IV. EXPERIMENTAL RESULTS

The Greenhouse which has implemented it consist of a particular climatic conditions for the optimum growth of plants. During morning the heat will be received from sunlight, it there is a excess of heat the cooling fan will be used in order to cool the temperature and an irrigation system is used for the optimum use of water for the growth of plants.



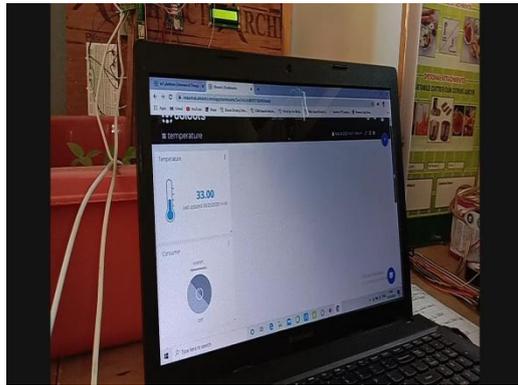
Figure 2 : Prototype of greenhouse



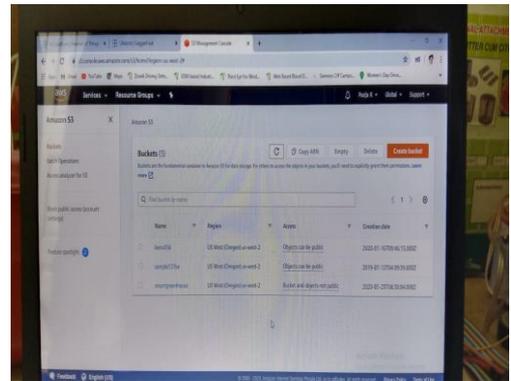
a.



b.



c.



d.



e.

Figure 3 : a. dry soil with moisture sensor b. drip irrigation using moisture sensor c. Scaling output in Ubidots
d. Cloud platform e. image captured by pi camera

Figure 2 shows the prototype of smart greenhouse which is implemented. The parameters such as temperature, moisture are monitored and controlled automatically. Figure 3a. shows the moisture sensor with dry soil, whenever the moisture content in the soil falls below the threshold value the motor pump is turned on automatically. Figure 3b. shows the drip irrigation using moisture sensor, when the motor pump is turned on the soil is watered using irrigation system and turned off automatically when the moisture content reaches to optimum value.

The temperature and humidity inside the greenhouse can be obtained using the IoT platform as shown in figure 3c. When the temperature rises above the threshold the cooling fan is turned on automatically. The pi camera is used to capture the image of plants inside the greenhouse and it will be uploaded to cloud. The farmer with the help of internet can download the image which helps to know about the growth condition of plants. The cloud platform and the image captured by pi camera is shown in figure d and e.

The designed system reduce the consumption of water and the safety of plants in whole agriculture process. The information is recorded in the cloud platform. The IoT which will help the farmer to know the efficient growth of plants from seed to final product.

V. CONCLUSION

The advantage of Smart greenhouse is that all the parameters can be automatically monitored and controlled without use of manual power. This helps the farmer to carry out the agriculture in a very efficient manner with the help of modern technology. A insecticide free crops can be grown. Any type of crops can be grown inside the greenhouse in any climatic conditions. This system can be installed in anyone’s house. It can be able to create a proper climatic

condition for the growth of plants. Finally, it is possible to establish a communication between the e-commerce person and a farmer by avoiding the middlemen between them.

REFERENCES

- [1] M. Bertalmio, G. Sapiro, V. Caselles, and C. Ballester, “Image inpainting”, in Proc. SIGGRAPH, pp. 417–424, 2000.
- [2] A. Criminisi, P. Perez, and K. Toyama, “Region filling and object removal by exemplar-based image inpainting.”, IEEE Transactions on Image Processing, vol. 13, no.9, pp. 1200–1212, 2004.
- [3] Marcelo Bertalmio, Luminita Vese, Guillermo Sapiro, Stanley Osher, “Simultaneous Structure and Texture Image Inpainting”, IEEE Transactions On Image Processing, vol. 12, No. 8, 2003.
- [4] Yassin M. Y. Hasan and Lina J. Karam, “Morphological Text Extraction from Images”, IEEE Transactions On Image Processing, vol. 9, No. 11, 2000
- [5] Eftychios A. Pnevmatikakis, Petros Maragos “An Inpainting System For Automatic Image Structure-Texture Restoration With Text Removal”, IEEE trans. 978-1-4244-1764, 2008
- [6] S.Bhuvaneswari, T.S.Subashini, “Automatic Detection and Inpainting of Text Images”, International Journal of Computer Applications (0975 – 8887) Volume 61– No.7, 2013
- [7] Aria Pezeshk and Richard L. Tutwiler, “Automatic Feature Extraction and Text Recognition from Scanned Topographic Maps”, IEEE Transactions on geosciences and remote sensing, VOL. 49, NO. 12, 2011
- [8] Xiaoqing Liu and Jagath Samarabandu, “Multiscale Edge-Based Text Extraction From Complex Images”, IEEE Trans., 1424403677, 2006
- [9] Nobuo Ezaki, Marius Bulacu Lambert , Schomaker , “Text Detection from Natural Scene Images: Towards a System for Visually Impaired Persons” , Proc. of 17th Int. Conf. on Pattern Recognition (ICPR), IEEE Computer Society, pp. 683-686, vol. II, 2004
- [10] Mr. Rajesh H. Davdal, Mr. Noor Mohammed, “ Text Detection, Removal and Region Filling Using Image Inpainting”, International Journal of Futuristic Science Engineering and Technology, vol. 1 Issue 2, ISSN 2320 – 4486, 2013
- [11] Uday Modha, Preeti Dave, “ Image Inpainting-Automatic Detection and Removal of Text From Images”, International Journal of Engineering Research and Applications (IJERA), ISSN: 2248-9622 Vol. 2, Issue 2, 2012
- [12] Muthukumar S, Dr.Krishnan .N, Pasupathi.P, Deepa. S, “Analysis of Image Inpainting Techniques with Exemplar, Poisson, Successive Elimination and 8 Pixel Neighborhood Methods”, International Journal of Computer Applications (0975 – 8887), Volume 9, No.11, 2010