

Smart Greenhouse Monitoring using Internet of Things

Aadil Imam¹, Deepak Gaur²

Email: aadilimam07@gmail.com¹, dgaur@amity.edu²

Computer Science & Engineering Amity University

Abstract- Internet of Things is one of the most important technologies of the 21st century. Smart green Housesystem is basically a system in which various sensors are used for controlling and monitoring various parameters inside a greenhouse such as temperature, pressure, humidity, soil moisture, ph sensors etc. And green house is basically a place or we can call it an environment where plants like vegetables and flower and grown and they are usually covered with glass or "translucent plastic roofs". The purpose of this project is to design an easy, easy to install, user-friendly to monitor and trace the values of parameters such as temperature, humidity, natural sunlight which are continually monitored and controlled with an aim to optimize them for getting maximum possible plant increase and yield.

Keywords: Internet of Things, Arduino UNO, DHT11, MQ2, LDR, Greenhouse.

1. INTRODUCTION

Before coming to the main topic let us discuss a little bit about green house and greenhouse effect. Green house is something related to a building or a place where small plants and vegetables are grown. And the area under green house is covered with glass or translucent plastic roofs. And this plays an important role for the vegetation in colder regions, because it is still very cold to take them to an outside environment. And now moving forward to discuss about the greenhouse effect. Greenhouse effect is simply a process in which various greenhouse gases entraps the infrared rays from the sunlight thus leading to increase of level of carbon dioxide which further helps in increasing the amount of chlorophyll and thus leading to impressive plant growth and yield.

As we know that the green house contains the environmental parameters such as humidity, temperature, moisture, light etc. And sometimes what happen, due to the lack of knowledge among farmers, they are not able to perform their activities with accuracy. They usually perform such activities on the basis of their own observation from the past and with their gut feeling which may lead to unexpected results most of the times. So in an order to cover it up and get more proper and accurate results for what activities a farmer should perform in different environmental condition this system is used. And the green house system helps in boosting the efficiency. And thus our system are based to perform such activities that are to monitor and control the sytem from a particular place which would take care of weather inside the green house It contains Aurdino UNO microcontroller, various sensors such as temperature sensors, humidity sensors, LDR sensors, smoke sensors etc and windows application for controlling green house and its parameters. When sensors reaches a certain threshold or critical value it will send the signal to microcontroller and required action will be taken automatically e.g fan will

automatically start working when temperature inside the green house crosses the critical value (say 30 C).

2. INTERNET OF THINGS

Internet of things is one of the most important technologies of the 21st century. It is trending everywhere. It is basically an environment in which simple physical objects are made capable enough to get accessed through internet. The physical objects are assigned with an IP address to make them able for collecting and transferring data over internet without any manual assistance or intervention.

Internet of things could also be considered as collection of physical objects, controller, sensors, actuators and internet in appropriate and required manner. The Internet of Things permits articles to be detected and controlled remotely crosswise over existing system framework, making open doors for a more straight forward combination between the physical world and PC based frameworks and bringing about enhanced effectiveness, exactness and monetary advantage. It contributes to improved customer engagement, enhancing data collection, technology optimization and reducing waste.

And we are making use of this technology in our proposed project. "Most physical parameters which are required in a nursery could be measured via programmed sensors. This includes temperature, light, soil dampness, and relative mugginess. Precipitation can likewise be distinguished, in spite of the fact that it is to some degree less normal. All the said physical factors are inspected and put away electronically at general interims when something is evolving. In general, the estimations give a significant decent information yield photo of the physical part of the nursery edit framework. This proposed a commitment to the advancement of nursery observation.

3. SYSTEM OVERVIEW

The proposed system uses the concept of Internet of

Things. In short, Internet of things is an environment for connecting the available physical objects with internet so that they could be accessed through internet and in this each physical object is assigned with an IP address thus making them capable enough for collecting and transferring data over a network without any manual intervention. And internet of things comprises of physical objects, controller, sensors, actuators and internet. The proposed system consists of microcontroller Arduino, various sensors such as temperature sensors, humidity sensors, light sensors and smoke sensors and windows application for controlling green house and parameters inside green house. Microcontroller is basically the heart of the system and kit helps in monitoring the digitized parameters of various sensors and verifies them with predefined threshold values. In case, any unfavourable situation arises, it then takes the required control operation. And there are various sensors as mentioned above for controlling the parameters inside the greenhouse. And when sensors reach a threshold it will send the signal to the microcontroller and required action will be taken.

4. BLOCK DIAGRAM EXPLANATION

It is a microcontroller-based circuits which monitors and records the values of various parameters such as temperature, light intensity, humidity etc. And all these values are continually updated and are optimized in an order to get maximum yield and growth. And we have used DHT11 sensors which would measure both humidity and temperature. You can directly see the data and its status on web page. Some of the important sensors that are going to be used in this project are listed below:-

- Light Sensors
- Temperature Sensors
- Humidity Sensors
- Smoke Sensors

Now lets discuss each of them one by one.

Light Sensors

LDR(Light Dependent Resistor) is the light sensor which is usually used for the purpose. Its main function is to monitor the intensity of light. It turns off the light when it need to save the power and turns on the light when light is required in the greenhouse.

Temperature Sensors

As the name suggests, these are used for monitoring the temperature and used to check whether the temperature is high or low inside the green house. And a critical value of temperature is fixed. And when sometimes the temperature inside the greenhouse reaches above the critical temperature level, the coolant is provided to cool down the temperature and bring it down to the favourable required temperature inside the green house.



Figure 1 Block Diagram

Humidity Sensors

Humidity Sensors are basically used for measuring the relative humidity, which is the measure of vapour air to the total amount of vapour that could be held in the air for a given temperature.

DHT11 Sensors

We have used DHT11 sensors in our project. It is basically a humidity and temperature sensors which helps in getting digital output. It is quite reliable and has good stability and at the same time is cost effective. It comprises of three main elements- a resistive type humidity sensor, an NTC thermistor (for temperature measurement) and an eight-bit microcontroller which helps in converting analog signals from both sensors and helps in sending out digital signal.

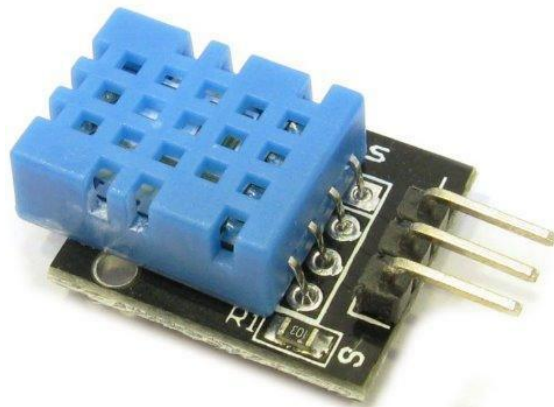


Figure 2 DHT 11 Sensor

Smoke Sensors

MQ2 smoke sensor has been used in this project which helps in detecting if there is some sort of leakage of any gases in the crop field or may be fire. Once the gas is detected alarm is triggered which

helps in alerting people and take necessary action and precaution. It works on inverted logic. MQ2 smoke sensors has great sensitivity and has quick response time and at the same time is stable and has long life time.



Figure 3 MQ2 Sensor

Relays

Relay is simply an electromagnetic switch which helps in opening and closing of circuits electronically. It has four important components-electromagnet, an armature, a spring and set of electrical contacts. In short it is a magnetism device for remote or automatic management that's motivated by variation in conditions of an electrical circuit which operates successively alternative devices (such as switches) within the same or a special circuit.



Figure 4 Relays

The sensors gives the accurate value or status of temperature, humidity, light and smoke inside the green house. You can see the result displayed on a internet website directly.

5. ADVANTAGES OF THE PROPOSED SYSTEM

The proposed system is going to play an important role in future of agriculture system and hopefully it

would going to help in boosting the efficiency of growth and production of agriculture industry. Apart from that some of the important advantages of the proposed system are listed below.

- Easy to use
- Easy to implement
- More accurate results
- Increase Fertility
- Better Productivity
- Focus is on important parameters

6. APPLICATIONS

The project has a great application in agriculture sector and can be used in greenhouses, botanical gardens and agriculture farms. Temperature monitoring and controlling action can be used in home or various halls like conference room, seminar hall to control the temperature of room. With little modification, this project can be used in Mechanical companies to measure various parameters of operating machines like temperature and light.

7. RESULTS

DHT11(for temperature and humidity), LDR (for light), MQ2(for smoke detection) are the important sensors used in the project which gives the exact value or status of temperature, humidity, light and smoke. These result can be seen on a internet website. A smart green house monitoring system is implemented successfully using the concept of Internet of Things which would be a boon for agriculture sector. The model is shown below.



Figure 5 Greenhouse Model

As we know that in traditional approach farmers perform activities based on their gut feelings instead of thinking logically and it doesn't work every time so we need to look for a more accurate and systematic methodology and a system with good success rate. The green house works logically and performed activities based on various important

IOT based Smart Green House

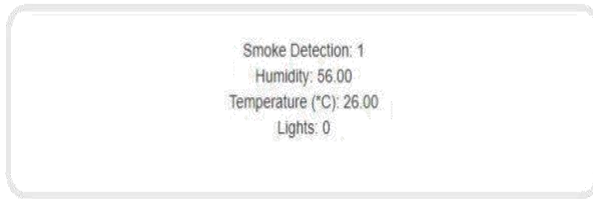


Figure 6 Web Page

parameters such as temperature, humidity and light as these three parameters are the most important parameters for the growth of plant and greenhouse monitors these parameters efficiently thus leading to better results as compared to traditional approach. Thus this system seems to be more promising and can lead to better crop efficiency and better productivity.

8. CONCLUSION AND FUTURE SCOPE

This paper describes about the various aspects of green house monitoring using IOT. Farming activities, even in urban zones are on an ascent as of late, in remarkable structures. Innovative advance makes the agrarian area develop high, which here is made by the IoT. The IoT will be playing a great role in changing the day to day life experience. The proposed project could be beneficial as it will help in advancing the assets in the nursery. And right now we are using limited number of parameters in our project but with the further advancement more number of parameters could be added for boosting the production. In future by building up a versatile application for IoT framework makes more adaptable to the people groups.

REFERENCES

- [1] Yuquan, M., Shufen, H., Qingzhu, W., "New Environment Parameters Monitoring and Control System for Greenhouse Based on Master-Slave Distributed", IEEE Conference Publications: 978-1-4244-6947-5/10, 2010, Page(s): 31-35
- [2] Eldhose.K.A, Rosily Antony, Mini.P.K, Krishnapriya.M.N, Neenu.M.S, "Automated Greenhouse Monitoring System", International Journal of Engineering and Innovative Technology (IJEIT) Volume 3, Issue 10, April 2014.
- [3] Alausa Dele W.S, KeshinroKazeemKolawole, "Microcontroller Based Green House Control Device", The International Journal Of Engineering And Science (IJES), Volume 2, Issue 11, Pages129-135, 2013.
- [4] Dae-Heon P. and Jang-Woo P., 2011. Wireless sensor network-based greenhouse environment monitoring and automatic control system for dew condensation prevention. *Journal of Sensors*, Vol. 11, pp. 3640-3651.
- [5] Baille A., Kittas C. etKatsoulas N., 2001. Influence of whitening on greenhouse microclimate and crop energy partitioning. *Journal of Agricultural and Forest Meteorology*, Vol. 107, pp. 293-306.
- [6] TeemuAhonen, ReinoVirrankoski and Mohammed Elmusrati.,Greenhouse Monitoring with Sensor Network, Department of Computer Science Telecommunication Engineering Group, Vassa, Finland.
- [7] Feng Chen, Yong-Ning Tang, and Ming-Yu Shen;"Coordination Control of Greenhouse Environmental Factors"; *International Journal of Automation and Computing*, 2011.
- [8] Ibrahim Al-Adwan and Munaf S.N. Al-D "The use of ZigBee Wireless Network for Monitoring and Controlling Greenhouse Climate " *International Journal of Engineering and Advanced Technology (IJEAT)*, 2012.
- [9] LIU Dan, Cao Xin, Huang Chongwei, JI Liangliang, " Intelligent Agriculture Greenhouse Environment Monitoring System Based on IoT technology", *ICIT*, 2015.
- [10] Zhao, Ji-chun, et al. "The study and application of the IOT technology in agriculture." *Computer Science and Information Technology (ICCSIT)*, 2010 3rd IEEE International Conference on. Vol. 2. IEEE, 2010.
- [11] Dan, Liu, et al. "Intelligent Agriculture Greenhouse Environment Monitoring System Based on IOT Technology." *Intelligent Transportation, Big Data and Smart City (ICITBS)*, 2015 International Conference on. IEEE, 2015.
- [12] Lu Tan, Neng Wang. "Future Internet: The Internet of Things" *IEEE 2010 3rd International Conference on Advanced Computer Theory and Engineering (ICACTE)*
- [13] Jun Jiao, Huimin ma, Yan Qiao, Yulin Du, Wen Kong and Zhongcheng Wu. "Design of Farm Environmental Monitoring System Based on the Internet of Things" *Advance journal of Food Science and Technology* ISSN: 2042-4868-4868
- [14] Rooppahuja, H.K. verma, moinUddin. June 2013 "A Wireless Sensor Networks for Greenhouse Climate Control" *IEEE CS on PERVASIVE computing*.

[15] Juan LgnacioHuircan, Carlos Munoz, Hector Young, Ludwing Von Dossow, Jaime Bustos, Gabriel Vivallo, Marcelo Toneatti. “ZigBee-Based Wireless Sensor Network Localization for Cattle Monitoring in Grazing Fields” Elsevier SciVerseScienceDirect in Computers and Electronic in Agriculture