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# IoT based Automated Polyhouse Monitoring and Control System

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***Abstract*—The system proposed in this paper is based on Internet of things (IOT), is a cloud of interconnected physical devices, which can communicate with each other over the internet. Physical devices such as microcontrollers, microprocessors, actuators and sensors will not directly communicate with the Internet, they do so by using an IOT gateway. This entire infrastructure is known as IOT infrastructure. In which crop monitoring and controlling the parameters like temperature, soil moisture, humidity, light intensity, etc., is automated inside the poly house. The actuated data from these sensors is pushed in to the cloud and displayed on the server database using windows application. The system is implemented using low power wireless components and easy to install.**

**Index Terms—Crop monitoring, Data server, Poly house, Sensors, Windows application**

## I. Introduction

Majorly Indians depend on agriculture and to achieve the maximum agricultural growth Indians have to depend or start using automation devices. To increase the growth of plants greenhouses is the solution. We get lot of mechatronic devices which can observe the growth of plants closely. Based upon the greenhouse feature using multiple automation sensors and controlling using microcontrollers and tuning is an easy procedure. When it comes to larger fields observing it manually is a difficult task and results may be dependable on natural climate conditions. And result will a huge loss for a bigger field. Here cost involves and a crucial feature. To get a better result combining greenhouse and automation will result in positive. And production system will be maximum. When it comes to manual operation the results will surely vary, semi-automation still depends on man power. Combining manual process, physical process and automation will still get a better result. Here monitoring multiple features which are required for growth of plants is very much necessary. Taking heat or radiation is an example. This procedure obviously depends on environment condition, the crop which we are going to yield, the affects are variations of the sensors or actuators we are going to use and many other minute conditions.

The maximum plant yields with a better result can be achieved by using the micro-control climate in greenhouse structure. Internet of things (IOT), is a cloud of interconnected physical devices, which can communicate with each other over the internet. Physical devices such as microcontrollers, microprocessors, actuators, and sensors will not directly communicate with the Internet; they do so by using an IOT gateway. This entire infrastructure is known as IOT infrastructure. For example we can take a Home Lighting System, where all the switches are been connected to the main controller which is connected to the internet.

Rest of the paper is organized as follows: The Section II provides the IOT characteristics and feasibility study. The Section III discusses the Implementation of the proposed work. The Section IV presents results and discussion, and finally paper is concluded in Section V.

## II. IoT Characteristics and Feasibility Study

The number devices connected over the internet is very huge taking humans also into consideration. There are many devices which are already connected that includes for electronic things to electronic things, humans to electronic things, electronic things to humans and also humans to humans. Now the question is how all these discussions influence people to depend on internet of things. And the response to this is when we say almost most all the devices are connected to each other this obviously become a necessary, who knew all of all the people around the world would own a cell phone.

One of the major reason using technology based micro control climate poly or greenhouse is to get better plants growing environment situation. Taking the complexity into consideration, monitoring the greenhouses excessively may result in harmful in growth of plants. The system needs to very much in natural process to achieve the objectives, including the conditions, favors and non-favors of sensors and actuators. The production costs play a major role. The practical approach discussed in one of the previous implementation is a real time monitoring of the growth of plants inside the greenhouse. The external or internal factors considered by the control system should be related to process of regulation. The actuators are triggered based upon the sensor data which reads repeatedly in cyclic manner to implement proper conditions of the greenhouse.

The challenging part of design will be based on algorithm control in the design for process control in complexity to influence the variables of the greenhouse. To get such a type of mechatronic effective system by implementing in affordable bigger greenhouse agriculture field. The profit will surely depend on the size of the land and greenhouse built in that area. Considering the smaller system in greenhouses which will observe data sophisticated, where monitoring data is centralized and other sensor units are distributed over the land with multiple assets. The programmable logic control covers

the different greenhouses and the set of programmable logic control will split the system into one distribution unit as a monitoring system which will lead to one main governing unit. By using this procedure considering a sing greenhouse multiple plants can be grown in a single location. Where, the micro climate control system is a single unit.

The type of model used in present agriculture is a representative model of the greenhouse. By using this method the crop production will not depend on any kind of geographical area or any time in a year. By building this kind of environment, the greenhouse will surely give protection for plants by protecting from bad weather and attacking of pests by which plants can die. This will allow crop to grow in better condition and increases the crop density and results be cent percent positive. The quality of the crop and high productivity will depend on what kind information is brought from the system which is obtained from the management, it will define the quality in the gathering of information got into the greenhouse structure. To work something like this the aim should be to build a very intelligent and automated monitoring greenhouse control system with any human interference. Basically one prefers to build a system in easy structure or architecture which should maintain the proper condition to the growth of plants in greenhouse, and one better solution is preferring open source environment. Which should be implemented successfully.

One should always consider the smooth maintenance after the system is built, and this should be automatic and self-monitored with less human interface. Since maintenance without human interference may result in lot of flaws, involving humans to an extent is always good. Implementing this automation in large scale like coffee estates, areca nut etc. is advantageous.

*A) Problem Statement:*

There are a lot of technology based products designed for agriculture. Taking few of them as an example: turning on motor through mobile phone, knowing the power status, checking the PH value of the soil, checking the properness of fertilizers etc.

Most of the things developed modules are not actually the solution for farmers. These technologies just help farmers in reducing the man power, but not in improving in yields. There has to be proper solution in helping farmers get the better yields or at the least not to spoil the crop they have in time.

*B) Proposed System:*

The proposed system is a solution in a way for the things discussed in problem statement. The architecture is designed using a open source hardware, which helps the developer build the system in very lesser time. Here the Arduino is the open source hardware and Arduino IDE is the tool used. Three sensors are used to monitor the things inside the greenhouse and three actuators for controlling the environment inside the greenhouse. The sensors perform three operation that is, knowing the temperature inside the greenhouse, testing the moist content of the soil and checking the lighting conditions inside the greenhouse. The actuators perform their operation based on sensor values.

## III. MATH

The Block Diagram of the proposed IOT based automated poly house monitoring and control system is as shown in Fig. 1.

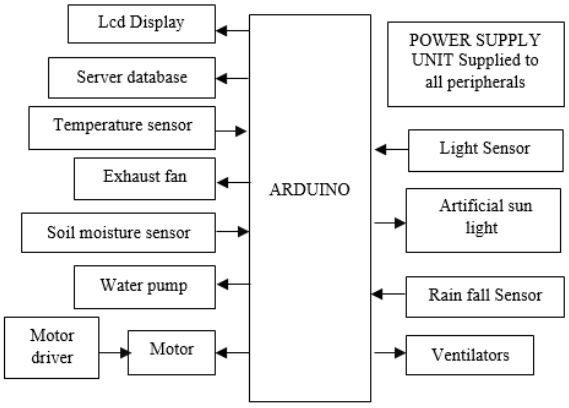


Fig. 1. Represents the block diagram of proposed polyhouse monitoring and control system

Which consist of Arduino board, Lcd display, server database, rainfall sensor, temperature sensor, exhaust fan, light sensor, artificial sun light, ventilators and power supply unit. The Arduino board consists of both physical programmable circuit board (microcontroller) and a software or IDE (Integrated development environment) that runs on your computer, used to write and upload computer code to the physical board.

The system uses temperature sensor to detect the temperature inside the poly house and turn on the exhaust fan if the temperature is exceeded. The rain sensor is used to water the plants by opening the ventilators when raining. So that the water is saved. If the crops are already watered, the rain water can be stored. Artificial lights are available which can be used inside poly house and are used only during the night time and cloudy days. Darkness is identified using the light sensor. Soil moisture sensor is used to sense the moisture content of soil then turn on the water pump if soil is dry else it turn off. All the activities inside the poly house is pushed into the cloud, to monitor through the application and control. A windows application is built to view all the data in a PC.

## IV. RESULTS AND DISCUSSION

*A) Use case diagram:*

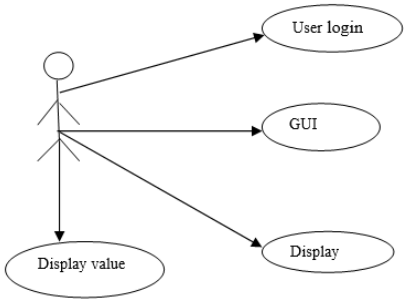


Fig. 2. Use case diagram

Use case diagram is methodology used in a system analysis to identify, clarify, and organize system requirement.

*B) Sequence diagram:*

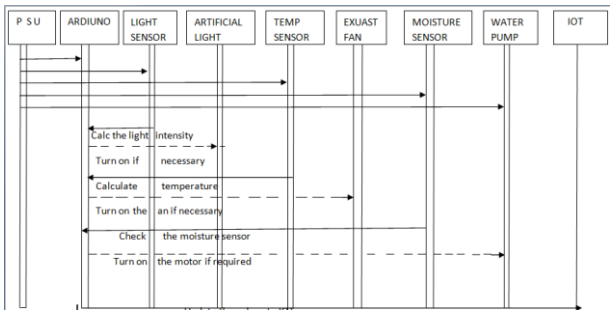


Fig. 3. Sequence diagram

A sequence diagram shows object interactions arranged in the time sequence. Sequence diagrams specifically focus on the lifelines of an object and how they communicate with other objects to perform a function before the lifeline ends.

*C) Final outcome of the proposed work:*

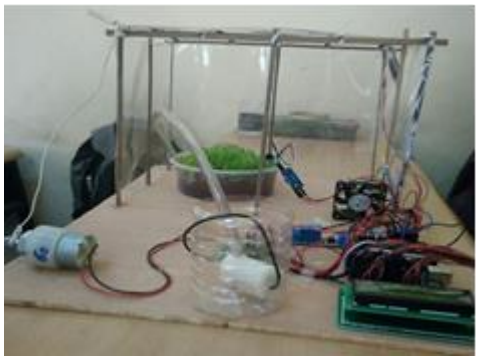

Fig. 4. Experimental setup of the proposed work

## V. Conclusion

It can be more expensive to afford an effectual micro climate control system only for bigger greenhouses but results to it is always more effective. Based on size of the land the profit can be increased on each addition of sensor devices, automating it further helps in large productivity. Considering the small poly-houses or greenhouses, these can observe a control system by keeping the monitoring unit as centralized unit and distributing the sensors and actuators all over the area of sub greenhouses. The central programming unit controls temperature, light and soil moisture and rail by actuating exhaust fan, artificial light, water pump and ventilators based on different conditions of sensors. In this manner, the crop can give a better yield in very less time. Since, the crops are working for extra hours because of artificial environment. Also considering the survey, growing different crops in a single unit gives advantage for the farmer.

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## References

[1] J. W. Overstreet and A. Tzes, "An Internet-based real-time control engineering laboratory," in *IEEE Control Systems*, vol. 19, no. 5, pp. 19-34, Oct 1999. A. Rokade, “Assistance and Control System for Poly house Plantation”, M. Des. Thesis, IDC IIT Bombay (2004).

[2] T. Ahonen, R. Virrankoski and M. Elmusrati, "Greenhouse Monitoring with Wireless Sensor Network," *2008 IEEE/ASME International Conference on Mechtronic and Embedded Systems and Applications*, Beijing, 2008, pp. 403-408.

[3] www.agrifarming.in //poly house-farming.

[4] The Jain irrigation system limited. Source: www.jains.com.

[5] P. P. Joseph, “Poly house farming, the new trend in Tuticorin.” Source:http://www.thehindu.com/todays-paper/tp-national/tp-tamilnadu/polyhouse-farming-the-new-trend-in tuticorin/article5556350.ece

[6] Y. R. Sonawane, S. Khandekar, B. K. Mishra and K. K. S. Pandian, “Environment monitoring and control of a poly house farm through Internet,” in *Proceedings of 2nd Intelligent Computing and Information and Communication*, IIT Kanpur, 2016.