

MONITORING ENVIRONMENT PARAMETERS OF GERBERA FLOWER CULTIVATION IN GREENHOUSE USING INTERNET OF THINGS

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Abstract-The proposed system is based on monitoring and analysing of greenhouse environment which is built for cultivating gerbera flower. The system is designed to monitor four important environmental parameters such as temperature, humidity, soil moisture and light inside the greenhouse through Internet of Things (IoT) technology. Sensors are attached to Arduino interface which collects the data and broadcast the data on to the IoT cloud platform. This cloud platform in-turn creates real-time dashboards and analyses data graphically. Once the data is collected and analysed then, through mobile application interface the data can be regularly monitored and tracked by the end user. Threshold has been set for each environmental parameter. If any of these parameter value crosses this threshold, then notification will be received to the end user through the mobile app or through sms. Mobile application developed will guide the farmers to remotely monitor the greenhouse and also to take controlling action against notification. The proposed system is very efficient and cost effective to monitor vital environment parameters of greenhouse which helps the farmers to avoid crop damage and increases the yield of crop.

I.INTRODUCTION

The advancement in technology has made many things around us to be controlled and operated automatically. Automation is being used in every sector, which is one of the main reasons for rapid acceptance of technology in many fields; on the other hand there are still a few imperative sectors in our country where automation is not completely in use, it maybe because of various reasons like cost, one such sector is agriculture. Agriculture has been one of the major occupations of many people since early civilizations and even today manual involvements in farming are still in practice.

Greenhouse farming plays an important role in agriculture and horticulture; greenhouses can be used to cultivate plants under precise climatic conditions for better production. Use of automation in a greenhouse visualizes monitoring and controlling of the climatic parameters which directly or indirectly govern the plant growth and hence their produce.

Many systems are designed to monitor the environment inside the greenhouse but different crops need different climatic condition to cultivate inside the greenhouse. The generally set environment parameters cannot be used for specific type of crop monitoring. Hence there is need for a system to monitor the climatic conditions of particular kind of crop.

Technology has become an important part of modern world which is used in almost all the fields, it has played a very important role in agriculture industry which has enabled farmers to overcome with the huge challenges they face. One such technology which is currently growing fast is Internet of Things (IoT).

Internet of things (IoT) refers to a network of physical “objects” or “things” which are embedded with microchip technology, software, measuring devices and internet connectivity, which allows this objects to gather and exchange data. The IoT allows physical world to connect with the computer-based systems through existing network infrastructure, physical objects such as sensors collect the data and this data can be monitored remotely through mobile applications or web applications. With the help of IoT, industries products are receiving smart characteristics and capabilities.

There is a huge hype for IoT in the current world, every day companies announces some IoT supported product to the market. The popular IoT applications presently are: Smart home, smart farming, connected health, wearable, smart city, connected cars, smart grids etc.

Agricultural industry in particular, mainly depends on engineering technology, physical and biological sciences. In this growing digital era, the agriculture industry has been an eager adopter of IoT and the applications of IoT in this sector is growing at a lightning speed. Every year we hear news about various countries facing drought and loss of crop yield due to climatic changes etc. With the advancement of technology in agriculture address the solution to solve this kind of problems, it ensures that sensors are getting smaller, sophisticated and more economic and real time data about temperature, humidity, soil moisture, air quality will help the farmers to take better decision about cultivating and harvesting crops which increases the yield of the crop.

Smart farming is one of the best solutions to solve agriculture problems. Smart farming offers crop monitor, suitable data collection, and automated farming techniques. It is a technology through which you can predict and prevent disease; monitor data on crop condition in near real-time and machines can predict that the crops are nourished and watered without any intrusion. The cloud allows us to store the data that sensors will be collecting.

There are many different ways of farming in agriculture: Greenhouse is one of those, it is the technique of providing constructive conditions to the plants. Cultivating crops is both an art and science. The concept of smart farming helps the farmers to cultivate high demand crops through which they can make profit.

Mobile Technology also helps to solve some challenges in agriculture. Many apps are developed to provide relevant information about weather, plant protection, market prices, and insurance for crops to farmers. This will create opportunity for economic growth of farmers. The apps should be user-friendly so that even the unskilled people can be able to use the application easily.

The proposed system mainly concentrates on monitoring and analysing the gerbera flower cultivation using greenhouse, alters the user when parameter values crosses the threshold and the data can be analysed graphically through android application.

Greenhouse Gerbera Cultivation

Gerbera flower is mainly used for decorative purpose and it has high market demand. Gerbera flower can be grown throughout the year; it is originated from Africa and Asian continents. This flower is well distributed in the areas like Karnataka, Gujrat, West Bengal, and Uttar Pradesh.

Gerbera flower is comes in varieties of colours such as Red, Pink, Yellow, Orange, White, Purple and Cream. This flower can be cultivated in open fields, but these flowers are very sensitive to varying weather conditions hence they are cultivated in greenhouse.

The Importance of growing gerbera flower is, it has high demand in market, cost is high, export oriented, water requirement is very less, with proper care farmers will get better yield.

Since this flowers are beautiful and attractive and available is different colours, they are used for decorative purpose, bouquet, flower pots etc.

Gerbera flower is very delicate flower hence care should be taken during cultivation, even if there is small change in the environment will affect the growth of the flower.

Environment should be maintained properly even if any conditions weather changes farmers should take some controlling action to avoid damage of flower.

The parameters such as temperature, humidity, soil moisture and light play a major role inside the greenhouse so these parameters are taken for monitoring the weather condition for gerbera cultivation. The following table represents the climatic condition that should be maintained for each parameter to grow flower inside the greenhouse

Table 1: Climatic condition required for growing gerbera flower

Parameter	Value Range
Temperature	22 °C – 35 °C
Humidity	50% - 80% RH
Soil Moisture	70% - 85% pH
Light	100 – 200 lux

The above parameter values are taken as threshold values in the project if any of this threshold values changes the notification is sent to farmers mobile, in response to notification farmer can take correct action to avoid flower damage and can get good yield.

II.MOTIVATION

Agriculture is the main occupation of many people in India. Different crops are grown at different parts of the country based on suitable weather conditions. In recent years due to advancement in technology farmers are using modern methods to grow crops. Greenhouse technology is one which is more extensively used by farmers to cultivate crops. Most of the farmers in Karnataka are using greenhouse technology mainly to cultivate flowers. Karnataka is one of the India's largest exporters of flowers to different part of countries. Most of the farmers in Karnataka prefer to grow gerbera flower because of its high market demand and high cost. This gerbera flowers need some specific environmental conditions for their growth. There is a huge variation in the environmental conditions in the present. This will affect the growth of the flower. Also there is an unavailability of labours in the present. From all these problems it is necessary for automatic monitoring and control system for greenhouse which is the place we can cultivate the flowers under specific conditions suitable for it.

III. LITERATURE SURVEY

Proposed work of paper [1] discusses visually guided operations in green-houses. It is a vision system which operates inside a greenhouse the environment designed for tomato cultivation is explained. In this work they have used two PAL (Phase Alternating Line) colour cameras. The signal sent by the cameras is processed by a graphic workstation using a bit-slice microprocessor card for fast image processing.

In proposed paper [2] an embedded system approach is used to monitor and control the greenhouse environment. In paper [2] authors have considered measuring parameters such as humidity, temperature, pH of the water, soil wetness and light intensity. The message will be sent to the owner mobile through GSM module. The disadvantage of this system is few parameters are measured and the message will not be in local language.

Proposed work [3] discusses on data sensing and controlling through wireless technology of Greenhouse management system. In paper [3] authors have used a processor for monitoring temperature and humidity.

ZigBee protocol with PIC (Peripheral Interface Controller) microcontroller is used to establish a wireless communication between two distant locations. The range of the ZigBee is limited. Their main purpose is to monitor and control only the temperature and humidity.

Proposed work [4] discusses various solutions to agriculture related problems for better yielding using IOT. Paper [3] also discusses about the Internet of Things concepts. The issues related to the farmers are obstructing the development of agriculture sector. One of the solutions for these problems is to help farmers to adopt modern techniques in farming. Paper [4] explains the advantages of the important characteristics of technologies such as IOT and web service.

IV. PROPOSED SYSTEM

“Monitoring Environment Parameters of Gerbera Flower Cultivation in Greenhouse Using Internet of Things” is a system with sensors attached to microcontroller. These sensors are mainly used for monitoring the environmental conditions inside the greenhouse, if any condition crosses certain threshold; alert message is sent to users registered mobile number. And also this system is developed with android application through which the users can login and monitor the status of their greenhouse environment. The data collected by the sensors is also used for analyses purpose.

This system is mainly proposed for monitoring gerbera flower cultivation using greenhouse and for informing the farmers about the climatic changes that occur inside the greenhouse so that they can care correct controlling actions and protect the flower from damage or from diseases. To monitor the greenhouse, the four important parameters are considered they are temperature, humidity, soil moisture and light. All these four parameters are monitored using different sensors at different places in greenhouse. Every time sensors sense the data for above mentioned parameters the data is broadcasted to a central computer such as a server. This data is analysed and sent to user’s mobile application.

System Architecture

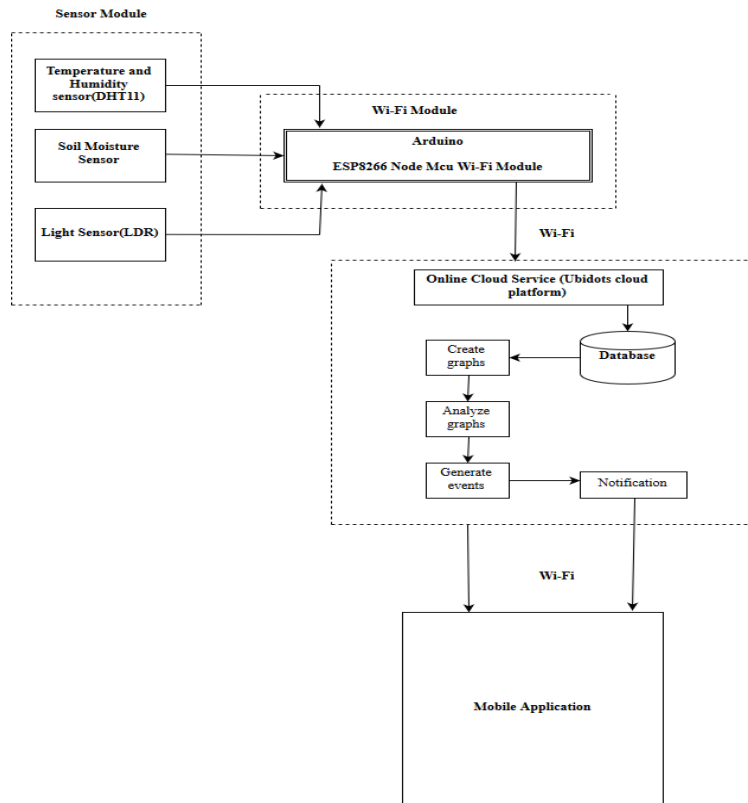


Figure 1: Proposed System Architecture

The proposed architecture consists of four modules namely Sensor module, Wi-Fi module, Cloud platform and mobile application. Each module is having some set of operation which is performed to get the final out of the system.

The sensor module consists of four sensors such as DHT11 temperature and humidity sensor, soil moisture sensor and LDR light sensor. All these sensors are connected to ESP8266 Node MCU Wi-Fi module and Arduino board.

The second module is Wi-Fi module to which all four sensors are connected, both Arduino and ESP8266 is connected to system to provide power to the sensors and Arduino board. The sensed data is sent to cloud via Wi-Fi module.

The cloud platform used in the proposed system is Ubidots, which stores the data sent by the Arduino. Ubidots provides services to analyse data in the form of graphs and stores data in its database for further processing. It also allows to set the events for each variable and sends notification to users mobile if any event is triggered.

The fourth module is mobile application which is installed at the user side to monitor the data and to get alerts from the server. Through this module user can check the current values of each parameters.

Data Flow Diagram

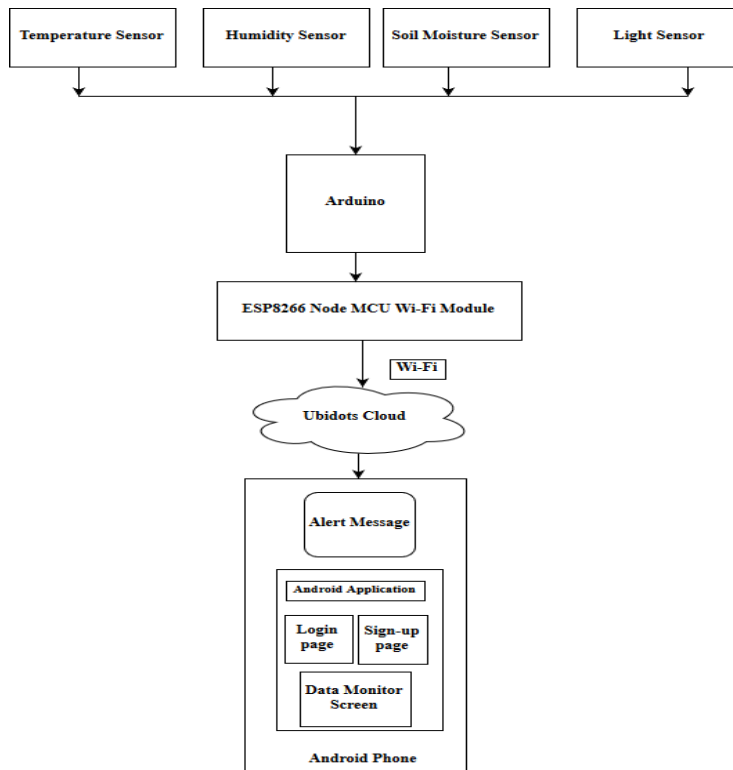


Figure 2: Data Flow Diagram

A data flow diagram helps to easily understand the flow of the system. It provides statistics about how the information will communicate between the modules both internal and external sources. Data flow diagram will not give any information about whether the system is operating in serial or parallel.

Following points explain about how the data flow from module to module

- In the figure 2 we have considered four parameters to monitor environment of greenhouse they are temperature, humidity, soil moisture and light
- The data collected from the sensors are sent to cloud platform in this project, the system is built using Ubidots cloud service to store and analyse the data.
- Once the data is stored inside the cloud, an android application is built and the data from the cloud is extracted to the application.
- Through android application user can monitor greenhouse from remote place and also alert is given if any of the parameter value crosses threshold.

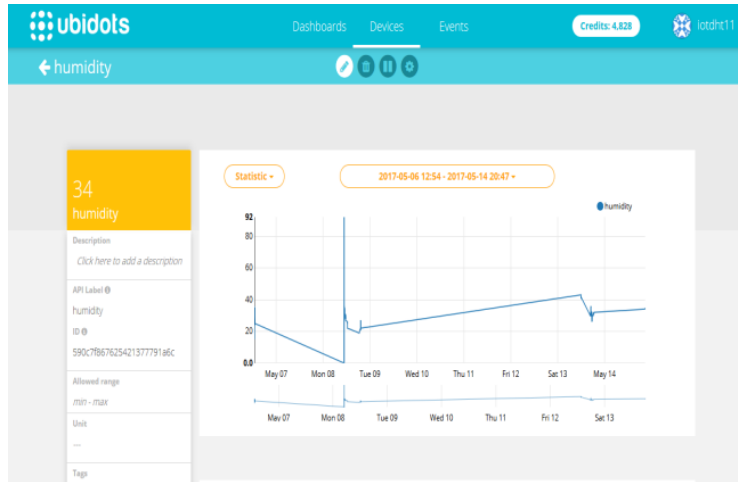


Figure 6: Humidity Graph

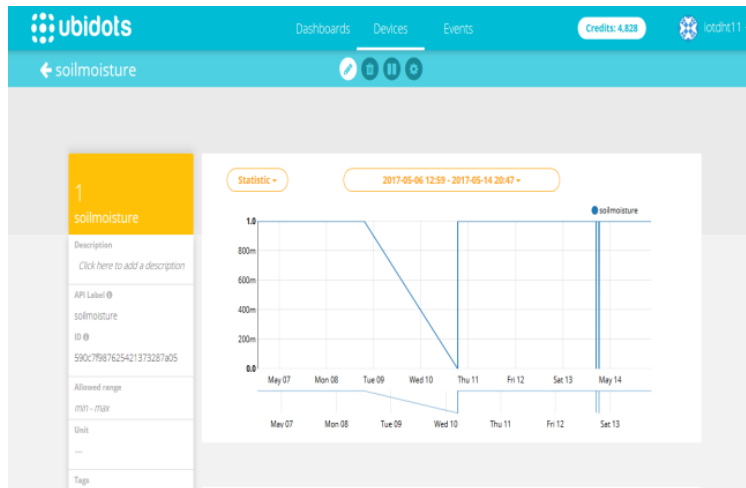


Figure 7: Soil Moisture Graph

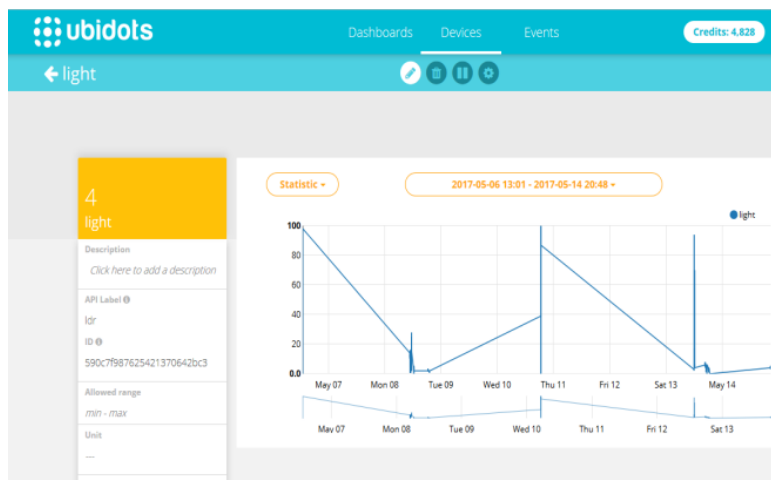


Figure 8: Light Graph

Android Application

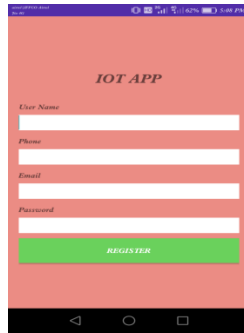


Figure 9: User Sign-up page



Figure 10: Login page

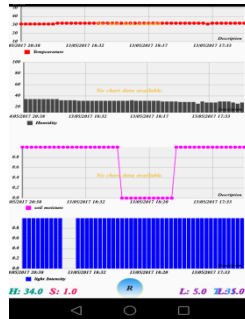


Figure 11: Data Monitoring Screen

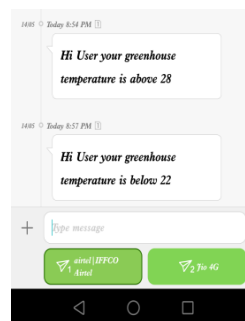


Figure 12: Screen showing alert message

VI.CONCLUSION

In the proposed system, commercial sensors are considered to measure the environment parameters inside gerbera greenhouse. Sensors will sense the data every five seconds and send data to cloud platform for storing and analyses purpose. The proposed system mainly aims to monitor environment conditions for gerbera flower cultivation inside greenhouse and android application developed will help the users to remotely monitor the greenhouse. The system will help the farmers to take controlling action against environment changes occurring inside greenhouse which can avoid crop damage, results in better yield and to get good quality crop

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