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Increased income for farmers using smart polyhouse farming

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Abstract

Agriculture is becoming an important growing sector throughout the world due to increasing population. Major change in agriculture sector is to improve farm productivity and quality of farming without continuous manual monitorin g to meet the rapidly growing demand for food. Apart from increasing population, the climate change is also a big concern in agricultural sector. The purpose of this research work is to propose a controlled farming method based on Internet of Things (IoT) and cloud to deal with the adverse situations. The controlled farming can be adopted which offer high precision crop control, collection of useful data and automated farming technique. This work presents an intelligent agriculture field monitoring system which monitors soil moisture, temperature, Co2 level, intensity of light, and plant growth. After processing the sensed data, it takes necessary action based on these values without human intervention. Here all these parameters of the plant are measured and these sensed values are stored in Thing Speak cloud and for future data analysis the stored values are viewed through Things View. Even if there is no internet connectivity the continuous data transfer is done using GSM.

Keywords: Increased yield, Cloud storage, Thingspeak, GSM, Arduino programming

1. Introduction

Polyhouse farming is the same as greenhouse farming. The "poly" part of the name refers to polyethylene plastic, which is the material used to cover the house, and being transparent to translucent, it lets sunlight in for photosynthesis and plant growth, while reducing detrimental organisms from affecting the crop. A polyhouse is a specially constructed structure like a building for growing plants under controlled conditions. It is covered with transparent material as such polythene permits entry of natural light. Traditionally the greenhouses were constructed on wooden frames where glass was used as a covering material. On the advent of the plastic technology, it became possible to replace the glass with plastic material. As the polythene material, being the most popular, the greenhouses came to known as polyhouses in recent times. Farming in simple terms can be described as growing crops by people for food and raw materials.

It is considered as important and respected occupation especially in our country. Farming is affected by one or many factors which affects the yield. So, practicing farming in closed environment ensures the sure yield and thus contributes to higher income of our country and also for an individual. Controlled environment means controlling each and every factor which is related to the growing of crops. It is difficult to control nature but it is possible to change a particular environment according to our need. The main factors for farming are temperature, soil condition, water for crops, nutrient level, oxygen level, carbon-di-oxide level, rainfall, relative humidity and many more. So controlled farming should ensure control of these one or more factors for good yield and it should be practiced in indoor. Poly houses are basically naturally ventilated climate controlled. Jain Poly houses have a variety of applications, the majority being, growing of vegetables, floriculture and planting material acclimatization, fruit crop growing for export market.

This paper describes [1-3] the emergence of the Internet-of-Things technology designed almost every modern industry included in the smart farming which moved industry from statistical to quantitative approaches. The revolutionary changes caused great impact in agricultural methods and providing new opportunity range of challenges. This is based on wireless sensors and IoT in the agricultural field. IoT devices used in the agricultural field are widely used nowadays. Various sensors monitor parameters like soil preparation, crop status, irrigation, insect and pest detection. These technologies increase the output throughout the stages, from the sowing till harvesting, packing and transportation. The use unmanned vehicles for the crop monitoring and other applications like optimizing crop yield is considered. IoT based architecture used are discussed in this article. The standard farming procedures are considered and the farmers need to visit the agriculture sites and increases the throughput of the field. 70% of farming time is spent on the monitoring and understanding the crop states and increases the actual field work. Internet-of-Things (IoT) affected the wide array of sectors in the agricultural field.

2.Related works

This paper represents [4-5] LoRa is low power wide range wireless sensing network used for low rate and long range IoT based applications. LoRa helps farmers to monitor the agricultural land for any remote places and it is very helpful in c ase of large farmlands. Since LoRa has low data rate and small bandwidth transfer of images, videos and multimedia restricted the use of LoRa in real time. To preserve the image quality the number of data transmitted through the channel is limited and images of the field is transmitted at limited time interval. The images will be captured by the camera at recurring time interval and it is transmitted with the LoRa module. The main challenge is to reduce the amount of the data transmitted while preserving the quality of the image and quality of the service delivered to the application.

In this paper [6-8] For the part of collection and transmission field data of the agriculture expert system, this paper mainly designs a kind of Bluetooth module. It based on the technology of the data collection and transmission of the Bluetooth chip. So, we can realize the wireless transferring between 10m and 100m, and then achieve the goal of deal with the Real-time monitoring of field data using mobile phones. This paper details the implementation of a low-cost, open hardware, cloud-based intelligent farm automation system. Physical parameters such as soil moisture, temperature and humidity are measured by employing sensors sited across the monitored area.

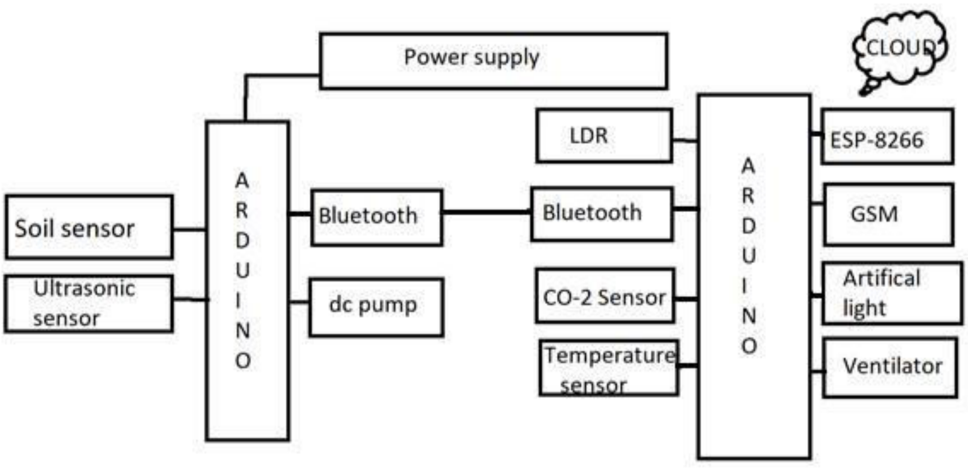
These papers describe [9-11] The required climatic conditions for the polyhouse cultivation can be provided by using this proposed technique. The Bluetooth technology has used for implementing the proposed wireless network. Few of the surrounding parameters of ambient temperature, humidity percentage, light intensity range and soil moisture content inside polyhouse are controlled and optimum conditions for crop growth inside polyhouse can be provided with the proposed model using abrupt actuators used. This model has developed with the mesh topology consists various nodes which are deployed inside polyhouse and are controlled by one central monitoring unit (CMU).

In this paper [12-15] presents research challenges on the security and privacy issues in the field of green Wi-Fi based agriculture. We start by describing a four-tier green Wi-Fi based agriculture architecture and summarizing the existing surveys that deals with smart agriculture. Then, we provide a classification of threat models against the green Wi-Fi based agriculture into five categories, including, the attacks against privacy, authentication, confidentiality, availability, and integrity properties. Moreover, we provide a taxonomy and a side-by-side comparison of the state-of-the-art methods toward secure and privacy-preserving technologies for Wi-Fi applications and how they will be adapted for green Wi-Fi based agriculture.

3. Proposed System for Smart Polyhouse Farming:

In polyhouse, growth and condition of the plants are influenced by the relevant conditions. Different mechanisms are used to monitor and control the internal environment. The cultivation of crops manually in the polyhouse is the most complex issue and this issue can be simplified by checking level of water in the soil, temperature, Co2 level and light intensity of the field, etc. The sensor data can be encompassed through data storage and data transmission to the user. Polyhouse process parameters can control through pumps, exhaust, buzzer and artificial light.

Block Diagram:



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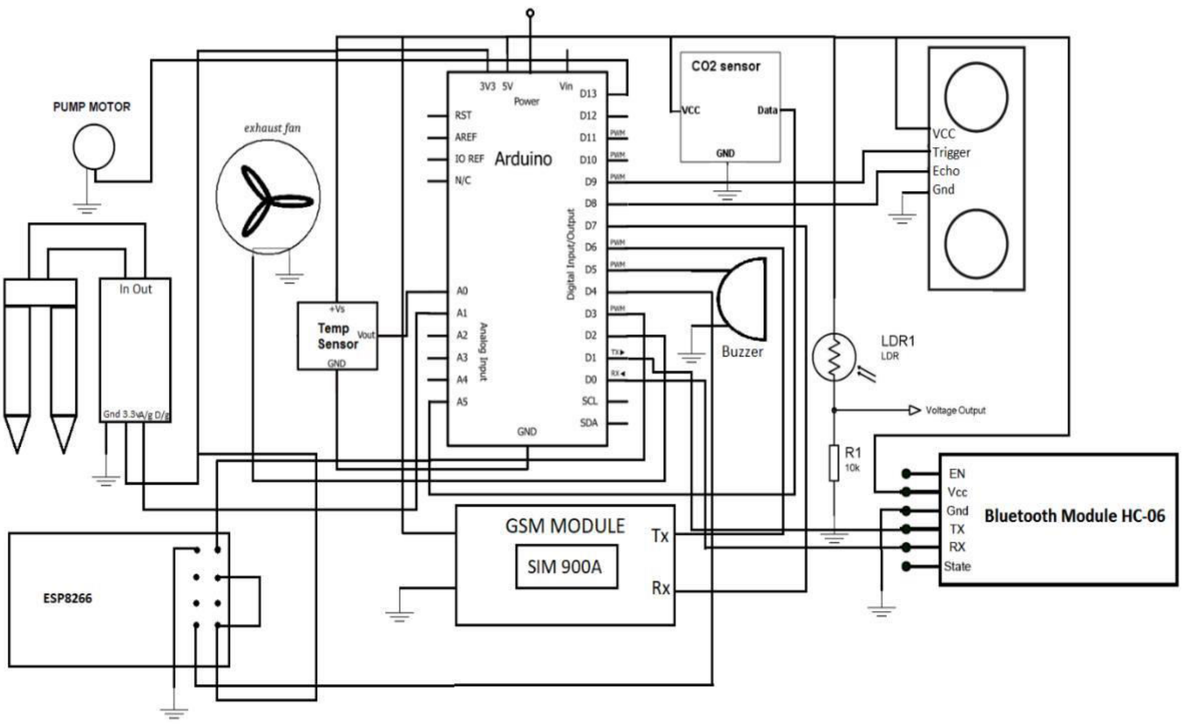
Our model involves collecting the sensors data such as soil moisture sensor, temperature sensor, ultrasonic sensor, Light sensor, Carbon-di-oxide sensor and doing automation according to certain conditions. All these data along with plant height will be transmitted to esp8266 Wi-Fi module and to the GSM module. And these data will be stored in IoT cloud storage and will be available for future research purposes. With this information we can monitor our polyhouse without going into the field. Apart from all these the plant condition in each row will be monitored and data will be transmitted from each node to the common central node and further it will be stored in the cloud.

Circuit Diagram:

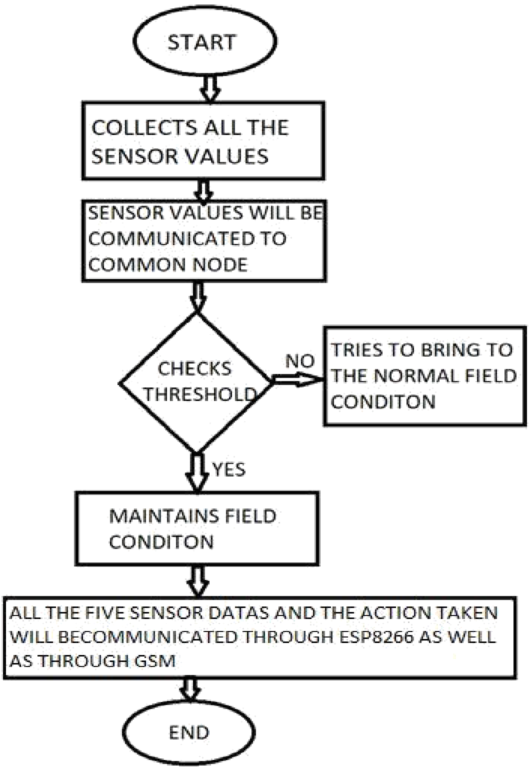
The prototype of polyhouse monitoring has been made using sensor network consists of Arduino, Temperature, Co2, LDR, Soil moisture sensor. All components are monitored and controlled using Arduino.

Here Arduino is the heart of the system. The input components are soil moisture, temperature, Co2, light and ultrasonic sensor. The data from these sensors are fed into the common node where the whole process takes place which in turn produces output. These outputs are from pump motor, exhaust fan, buzzer and artificial light. All these data are communicated via Bluetooth module from which the values are sent as message to the farmers through ESP8266 and also through GSM module.



Flow Diagram:

This flow diagram shows the sequential representation like if the moisture value goes down the motor will be turned on, if the temperature value rises exhaust will be turned on else off, once the natural light intensity decreases artificial light will be ready for the illumination and if the CO2 value increases it will be maintained by the ventilator. The field conditions are maintained. Then the sensed values & actions taken will be communicated via ESP8266 and also through GSM for later reference.



4. Result and Discussion:

The system transmits the data from the sensor to the cloud thingspeak site and display the output in the form of graph as shown in the below figure 4.1 & 4.2. Since it is shown in the form of the graph, we can easily compare the field condition from the previous instant of time. The sensor values which are transmitted is plotted in the form of graph in our thingspeak channel using MATLAB analysis. The figure 4.3 shows the GSM output to the farmers mobile; it indicates all the sensor outputs. Thus, GSM provides the information about the situation of the farm field even if there is no internet connectivity.

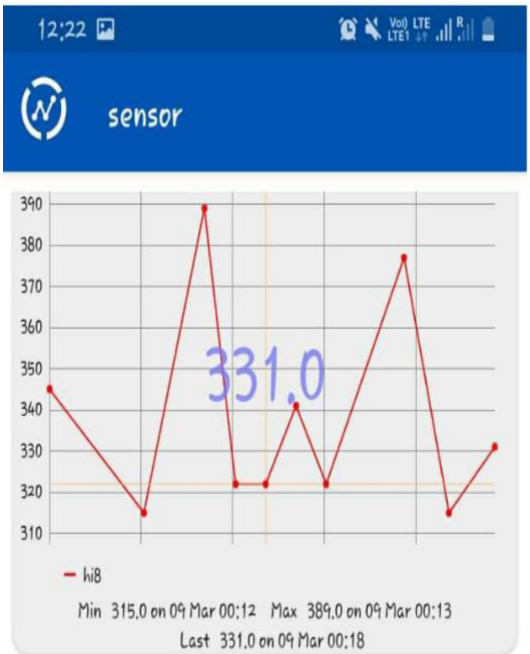


Figure 4.1 ESP8266 output for ultrasonic sensor.

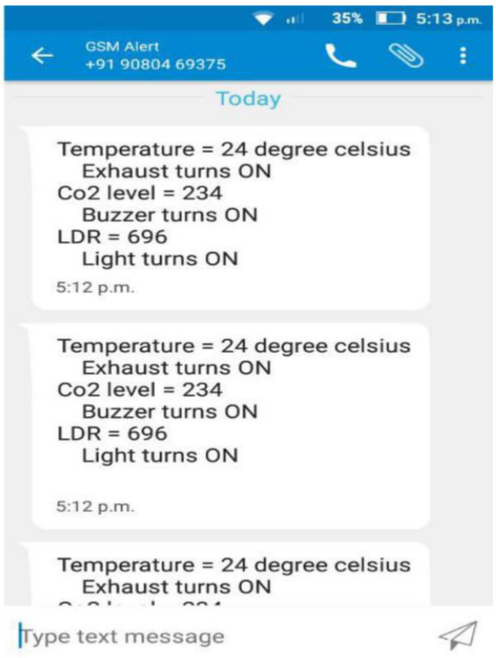


Figure 4.3 GSM output

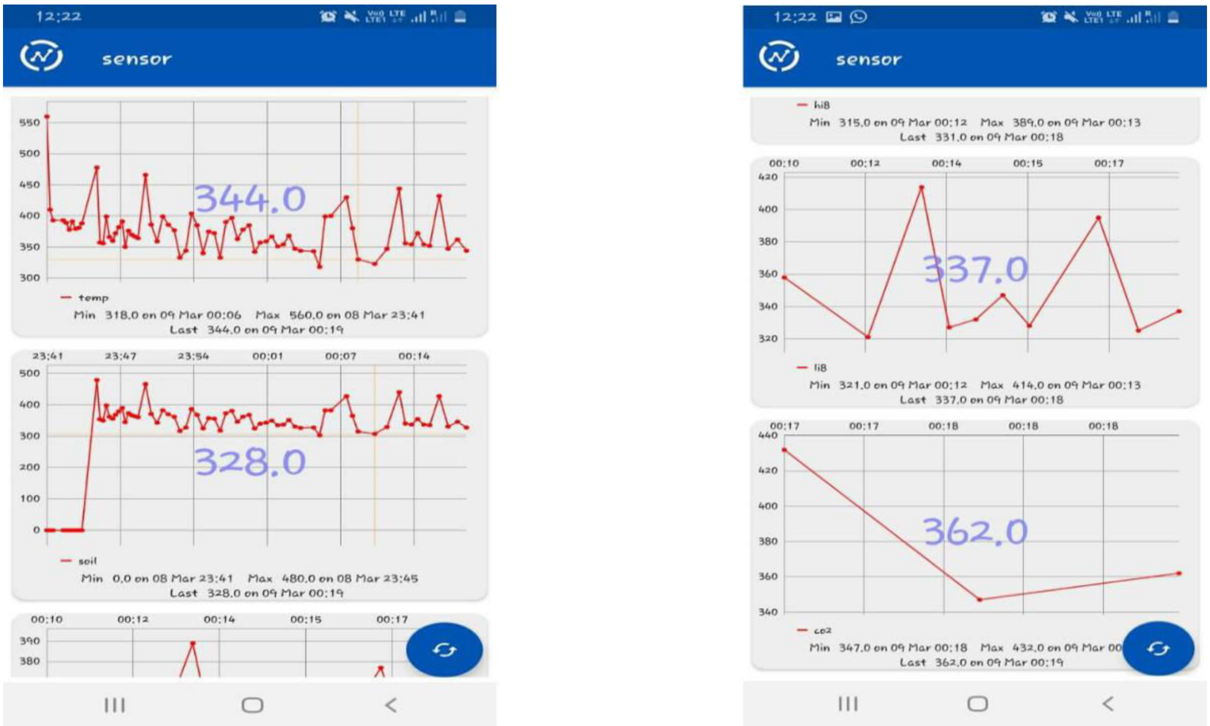


Figure 4.2 ESP8266 output for temperature, soil moisture, light and Co2 sensors.

Conclusion:

This systemcollects and automatically controls the condition of the field environment by using different sensors. New revolution for the better livelihood of the villagers by putting the IOT to work for our farmlands with IOT applications, software & services will reap the benefits of the connected era. This finally not only increases the income but also proves to be efficient and best method of farming which can be implemented in real time application. So, it is time saving, work saving and energy saving method which paves the world to next level.

"If there is IoT, there will be connectivity"

This idea adds meaning and makes powerful the above statement. It integrates both traditional and modern ideas and gives us an efficient method in our farming. The system is also typically suited for India as well as other developing nations where farming is a major source of income and needs continues attention.

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