Automated green house

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ABSTRACT

Technology is playing a very important and useful role in all the fields like agriculture, industrial sector, Medical etc. Considering the Agriculture sector we need to monitor plants continuously. So, instead of doing all the work manually we can automate it so that there is less human intervention and time is saved and also less human effort. Thus, appropriate condition variables are defined properly. The variables of conditions include soil moisture, temperature, humidity, light etc. In our project we have implemented prototype of a automated greenhouse in which we control the parameters like humidity, temperature and soil moisture, using the sensors like DTH 11, LM 35 and also we take pictures of plant at particular periods of time and send it to mail, so that if a person wants to check the condition of plant that is, if it is diseased or healthy. If it is diseased then he can upload the picture of the plant to the PLANTIX app and can see what disease it is affected from and why it is caused. Therefore, the Owner can check if there is any problem related to the above conditions and he can take proper actions.

Keywords— *GSM, DTH 11, LM 35, Sensors, Plantix*

1. INTRODUCTION

In agriculture, we grow different varieties of plants in which some plants can be fragile where as some don't need much care, they grow on their own without much effort and time to be spent on them. So we need different climatic conditions for a different type of crops. And we can't grow certain crops in particular season, which they are not grown. Keeping this in mind we can create an environment where the crops which are costlier and needs much care can be grown in an automated green house where less human intervention is present. These have the following benefits like we can reduce the labor costs as there is less labor requirement because of automation, appropriate and accurate conditions are maintained, and also once invested can be benefited whole year, also reacts very quickly to the environmental changes hence reduces human errors and also changes the conditions very quickly. Since the green house is automated, the temperature and other climatic conditions inside the greenhouse can be maintained by itself, and hence the labor is not required.

Also, appropriate climatic conditions in the green house allow plants to grow healthier. When a person invests once in a life time for the green house he can get benefits irrespective of the seasons, rain etc. The only investment required here after constructing a green house is for seeds and pesticides.

We have seen automation in almost all the sectors but agriculture is one such sector where automation has not taken place as a whole that is, it has not replaced the human work fully. And we know that greenhouse can give the required amount of light and heat but watering plants etc needs human effort. So we have come up with the solution of an automated green house, which is a very sophisticated and reliable system and is designed to work efficiently. This works on feedback control i.e, it monitors the green house by calibrating accurate results and adjusting the conditions based on the requirement. When done continuously we can achieve accurate conditions. This is controlled as follows, set the accurate threshold conditions for the variable values and if they cross the threshold conditions then notify the owner of the greenhouse about the changes and control it automatically by actuators so that the farmer comes to know about the conditions of green house.

The owner is notified by the message which is sent to his phone number via GSM to the users mobile. This helps him to be aware of the conditions in green house when any severe disturbance or emergency he can step in the green house and check for changes in conditions and manually monitor it. The sensors calibrate accurate conditions and according to that, the green house conditions are changed all this is done by a microcontroller which is programmed and works accordingly as per the threshold values periodically inform the owner about the conditions of the plant. Pi cam module is a camera which is

used to obtain the live stream of the field in the green house. The PI cam will also provide valuable information about the environment. Image processing can be used to identify any changes on the leaves of the plant.

Since we need to know the physical condition of the plant whether it is diseased or disease free, we need to see its current image so we have to take the images and send it to the owner so that we can monitor it.

The Raspberry pi plays a major role in sending signals to capture the image store it and send it to the remote client through the gmail using SSMTP protocol. This helps him to monitor the plants and to check the current condition of the plant. If there is any disease occurring in the plant. An image of the plant is taken periodically and the same will be uploaded to PLANTIX in order to detect the type of disease and take further actions. PLANTIX is the app which helps the farmer for detecting the disease of the plant directly and it is user friendly.

2. LITERATURE REVIEW

In the paper [1], the system has a monitoring system for the sugarcane where it is mostly grown in the northern parts of Karnataka. The WSN is the most advanced technology used hence advanced and recent techniques are used to get the system work. This work is done by getting the sensor values and uploading in the base station system and sends the message via GSM but in our system, we also capture the image and send it to the owner so that he can see the image

The microcontroller is used for controlling the irrigation system. In drip irrigation water flow is to be controlled, this is done by programming microcontroller to perform efficiently.

The drip irrigation controls the water supply as per requirement by the plant. Using this system the farmer can monitor only the irrigation of plant [2].

Paper [3] deals with the system in which sensors, LCD display, ARM processor and GSM modules are interconnected. All these sensors give only analog output, but the processor will accept only digital output. So all these sensors should be connected to ADC channel pins in the processor. LCD is also used to display the values. GSM module contains SIM which sends the messages of results to the remote user. Sensors are used to monitor the conditions like soil moisture humidity, temperature, light etc. All these sensors are interconnected to ARM processor and here GSM module is used for communication purpose using AT commands.
 Technology made everything around us automatic. So we need to use technology and made things easier and simple. The work made by a human is replaced here to make advancement. The paper [3] shows the technology implemented in the agricultural field and which helps the farmers by replacing famer's traditional approach [3].

Various climatic conditions like temperature, humidity, moisture and soil PH are collected by the sensors nodes and gives as input to the PIC (Peripheral Interface Controller), and if any values of the variables cross certain value then the sensor is made to read the value. By using GSM technology the variation information can be sent to the famer via SMS [4].

The system proposed in the paper [5] helps the farmer by controlling the parameters inside the green house by itself without the intervention of famer. Arduino UNO is used as a microcontroller which controls the overall functions of the green house. Here rainfall can be utilized at most by pushing the roof using servo motor when rainfall is detected.

In the published paper [6], the water harvesting is done where the water from the rain is stored in the underground tank and the underground tank is fixed with the ultrasonic sensor. When the tank is filled then an SMS is sent to the phone of the user. If the water in the tank is less then, an SMS is sent to the user insisting him to send a signal "fill the tank", back to GSM. Also, the field has moisture sensors that measure the moisture of the soil. If the soil moisture is less then irrigation is done till it reaches the required condition. The automatic water pump system is fitted in which the pumping of water is controlled by the user through SMS which is sent to the GSM module [6].

In the paper [7] they have implemented automatic electrochemical sensor system for continuous nutrient determination. The detection of the nutrients is done based on the flow injection analysis technique to detect nutrients. The primary aim is to determine and develop the sensitive electrochemical sensor system

In paper [8] IOT is used for automatic window opening system, the Internet of things is the most widely used everywhere. The most trending technology is IOT (Internet of things). It includes Making simple objects connected and without manual or human interruption controlling them. The objects like sensors, actuators, and microcontrollers are made to connect with the internet where a required amount of internet is made use. In paper [8] automatic window opening system is done using sensors which detects the objects and a complex network

In most of the projects, arduino is used for appropriate functioning so, in paper [9], they have designed a heater and water pump system for crops to provide appropriate conditions.

In the Paper published by Muhammad (2010), The ANN approach is compared with the On-Off controller. An Artificial Neural Network approach is much faster than on off controller method. ANN changes faster according to the input conditions whereas the on off controller fails easily.

According to the conditions, which changes more often the ANN based system react to it without any prior input system. ANN based system saves a lot of resources and makes use of it efficiently.

In a paper published by Kalyan (2011), the need for agricultural development has become more important so, they have made a system of the network that works with the sensors for irrigation, also sending the updates of the field via SMS using GSM module. The field maintenance is done remotely by a connected system that connects the smart phone and all the actuators. By using this type of agriculture time is saved and also economy but the required crops which are grown doesn't give the guaranteed yield.

In the paper by Prisilla (2012), the saving of water is discussed. In today's situation, the need for water is increased as it is contaminated by industries and also because of dumping wastes by humans. For agricultural purposes, irrigation is most required for growing crops. So the saving of water is done by ANN based system where in, the flood water is preserved and is used later for irrigation.

In the paper by Cosmin (2012), it discusses the use of the latest technology that is, Artificial intelligence. In most countries this method is not implemented since there is not much

development in IT industries. The question here is, without the development, the new technologies are difficult to use. Only in some countries, this method is used by 30% of people. In this method, crop monitoring is done by Artificial intelligence.

In the paper of Yethiraj (2012), data mining is used to take care of crops. There is a large amount of data available using that they have monitored the plants by predicting its future condition and taking appropriate actions on it. This is an approach which uses computer science integrated with agricultural factors. They have mentioned that by using this method and also by increasing the resistance to damages due to water and other soil factors we can develop it still more and make it work efficiently.

In the paper published by Patel et al (2013), an automated monitoring and controlling system are done. We need an automated system and a mobilized system that monitors plant health conditions. In this, plants or crops are controlled and monitored by a mobilized system which uses a WSN based approach and Zigbee for an optimized system. Researchers have found out an easier way of controlling agriculture. Also, a survey is discussed about some systems

3. PROPOSED WORK
Now a days, due to lots of urbanization land availability for agriculture is less so there is a need to utilize an available piece of land by building the green house for growing crops. Today farmers who have small land are not able to get maximum yield and profit from the cultivated crops. The farmer faces the above problem due to the lack of guidance and improper cultivation methods.

There are small divided lands that are left unused and uncultivated for a long time, we can use these lands to get a good yield. By using the technology available we can monitor and control the green house built in these available lands using automation, it is possible to control the conditions inside the automated green house, and also continuously checks the health and then nourishing the plant or crop to maximize the production and obtain profitable income under a single roof.
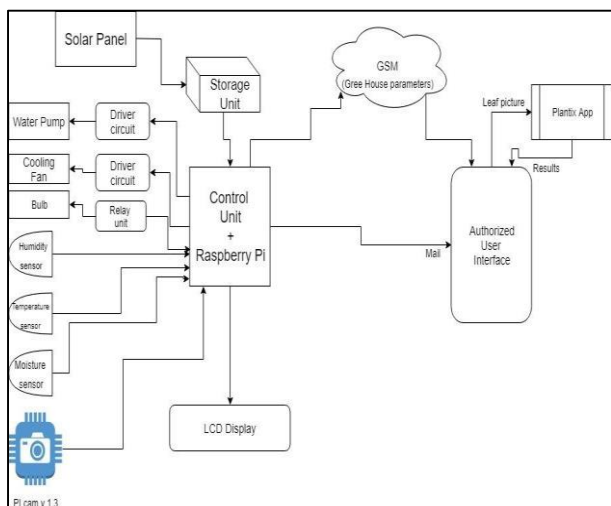

Fig. 1: Block diagram

Figure 1 shows the block diagram of the automated green house. It consists of sensors like temperature sensor humidity sensor and moisture sensor to sense the conditions of the green house and using analog to digital converter signals are amplified and results will be displayed on the LCD display. Here we have used arduino micro controller which controls the conditions of the green house and keeps those parameters to at

some specified level which is necessary for the growth of the plant.

For capturing the plant image for every 24 hours here we have used pi camera module which is interfaced to the raspberry pi module port CSI that is, camera serial interface through 15 pin ribbon cable.

If there is any disease occurring in the plant and the same will be uploaded to PLANTIX in order to detect the type of disease and take further actions. PLANTIX is the app which helps the farmer for detecting the disease of the plant directly and it is user friendly. The hardware components which we are using in this model are as follows:

- **Servo motor**: It is an actuator used to control the linear position. By providing proper controlling signals to it we can rotate it so that rotational movement is converted into linear by mechanical action. This is helpful to slide the camera to take pictures of plants. Also, another motor is used to cool the environment
- **Motor driver:** It is an H bridge motor with PWM control for speed. It can be used with 5 to 35v dc motors like servo motor
- **GSM Module:** GSM module is used to transmit the messages to an authorized person using AT commands if any changes have occurred in the green house.
- **LCD display**: LCD display used to display physical parameters in green house.
- **Sensors:** Temperature Sensor, Humidity sensor, Moisture sensor etc.
- **Arduino microcontroller:** The Arduino board can be used to synchronize all the modules of the sensors with actuators without any hindrancy.
- **Raspberry PI Model 3:** The Raspberry Pi is a tiny, affordable computer that can be mounted on the robot. It will be used to set the PI camera for getting the live feed information on a screen. The PI will also be used to connect the physical parameters with the remote user to control them.
- **Raspberry pi Cam:** It can be used to obtain the live stream of the field in the green house. The PI cam will also provide valuable information about the environment. Image processing can be used to identify any changes on the leaves of the plant.
- **Battery:** The battery is used to power Arduino, raspberry pi, the motors, and other modules of the green house.
- **Mini water pump:** it is a device that moves the water, by mechanical action. A mini electrical pump can be used to water the soil as the robot seeds the farm.

The system consists of three different components: embedded system, web server and an optional smart phone owned by the user. Using microprocessors requires extra cards (such as oscillator) and it may become difficult to use and design cards. However, Do- It-Yourself (DIY) platforms offer some advantages such as low-cost, easy-to-use capabilities which makes it possible to build up a system for everyone. Arduino and Raspberry Pi [17] are two very popular DIY platforms and also have help support and software library for sensors For detecting humidity and temperature a sample sensor is used that is DTH 11. A sample electronic design of Arduino and DHT-11 sensor will and Raspberry Pi module has already an Ethernet port. However, the Ethernet shield is required to connect with Arduino. The system can gain some extra skills by adding extra components like a rain sensor, oxygen sensor, light sensor, barometric sensor, etc. We need some extra circuitry for connecting the sensor to the module. In that case, a 10K ohm

resistor is essential between DHT- 11 sensors and Arduino card.

4. SIMULATION AND IMPLEMENTATION RESULT

Fig. 2: Green house model

Fig. 3: Image captured by Pi cam

In this paper, we check the condition of the soil, moisture content of the soil, humidity of green house and control them by actuators. Here we use sensors like DTH 11 is used to detect temperature and humidity, according to required conditions we set the temperature valve for the plant followed by humidity control. Also when the message is sent to the farmer to check for plant health conditions, the pi cam is used to take the images of leaf and is sent to our mail, in this way, the images can be taken and if any disease is present we will upload it to the PLANTIX application.

The image which is uploaded shows high accuracy regarding the disease if present in the leaf. The actuators like cooling fan, water pump (which is used for irrigation and moisture control), and a sliding window present at the roof of the green house, controls the green house conditions

5. CONCLUSION AND RESULT

In this paper, we implemented a prototype of an automated green house, wherein we monitor the conditions of greenhouse according to the requirements of the plant. We also capture the leaf of the plant for every 24hrs and send that image to the farmer through the mail and he can upload that image to the PLANTIX application. So that he can check if there is any disease affected by the plant. This way it gives us accuracy about the disease and hence helps the plant so that it doesn't affect much and gives us a message about conditions of green house.

6. REFERENCES

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