On Field Monitoring and Control of Polyhouse

Project Guide
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Abstract— Polyhouse is referred to a structure which completely isolates the inner environment around the plantation area from the outside weather by altering the physical parameters such as relative humidity, moisture content of soil and temperature. These changes can be made by foggers, misters and drip irrigation, but this needs lot of experience and expertise. Therefore this method is majorly dependent upon humans, to reduce this dependency and to ensure maximum results we have tried to atomize this whole procedure by using a network of sensors and microcontroller. The atomization process would include continuous monitoring of all the parameters and displaying them on the LCD; these parameters will be processed by the microcontroller to decide the mode of control. Also we have installed an alarming system which alerts the workers about a drastic change.

Keywords- *polyhouse ,microcontroller ,relative humidity*

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I. INTRODUCTION

The agriculture contributes 24% of the GDP and provides a lot of employment to around 67% Indian population. Polyhouse farming contains construction of a metal structure of columns covered completely by polythene [4]. The various physical parameters such as moisture, humidity, available sunlight and temperature in the polyhouse are controlled. But these values can be easily altered using equipment's such as misters and foggers. The traditional method of farming is more prevalent in India,but now this new farming technology like polyhouse farming generates more income. A normal farm of 500 square meters will generate a yearly income of Rs. 25,000 to 35,000, as compared to an approximate annual income from same sized polyhouse of Rs. 52,000 to 70,000[5].

In order to further enhance the productivity and make efficient utilization of resources, through our project we have tried to atomize the whole process. To achieve this, there will be continuous monitoring of all the physical parameters like humidity, temperature, sunlight as well as moisture of soil. The values of these parameters will be given to the microcontroller. Later on, depending upon the algorithm the microcontroller will determine the mode of control. Also in case of very drastic climate change alarms will be turned on. Thus the process will not be completely dependent upon manpower and ensure efficient utilization of resources.

II. METHODOLOGY

The microcontroller will be interfaced with the different sensors. The sensors would measure the different parameters, since we need all values in digital domain these sensors are followed by signal conditioning block. The parameters are then processed by the microcontroller and the mode of controlling action is decided through the algorithm in the microcontroller. The values are prioritized in case of deflection in two or more values. The Block diagram as given in figure below illustrates the same.

A. Sensors:

A sensor is a device that detects any event or some change in quantities and provides the corresponding output, generally this could be an electrical or optical signal; for instance, a thermocouple converts change in temperature into an output voltage. The sensitivity indicates how much the sensor's output value changes with respect to the input quantity being measured [3]. To obtain the values of all the parameters such as temperature, humidity, moisture and sunlight the following sensors are being used

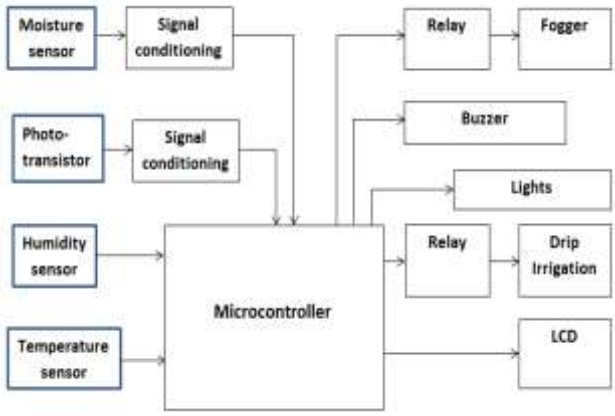

Fig: Schematic Block Diagram

Humidity Sensor**:** The sensor we have used is DHT11. This DHT11 Temperature & Humidity Sensor features a temperature & humidity sensor with a calibrated digital signal output. The advantages are its small size, low power consumption and upto almost 20 meter signal transmission this

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makes it the best choice for various applications. This sensor is having 4-pin single row pin package. It is easy and convenient to connect . It also has proper isolation which makes it suitable for our application.

Item	Condition	Min	Max	Unit
Voltage	--	3.3	5	V
Current	--	0	35	mA
Output Value	Dry	0	10	--
	Humid	270	410	--
	Wet	890	995	--

Electrical Characteristics:

The working of the sensor can be understood from the following figure:

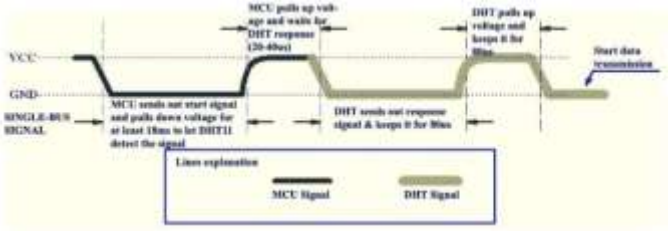

Fig: DHT11 signaling and working

Moisture Sensor: Protech soil moisture sensor can understand the amount of moisture present in the soil surrounding it. In this sensor two probes are used to pass current through the soil, and then it generates the electrical equivalent to get the moisture level. The output value will decrease when the soil has enough water in it and the vice-versa. The surface has been gilded so that the service life can be prolonged and there will be no effect of the soil on it.

Electrical Characteristics:

The different values of sensor in the different conditions can be observed from the table given below.

	Conditions	Min	Typical	Max
Power	DC	3V	5V	5.5V
Current Supply	Measuring	0.5mA	--	2.5mA
	Standby	100uA	--	150uA
	Average	0.2mA	--	1mA
Sampling	Second	1	--	2

Photo Transistor: The silicon photo sensors respond to the complete visible radiation range and also to infrared. In fact, all diodes, transistors, Darlingtons, triacs, etc. have almost similar basic radiation frequency response. The response has peaks in the infrared range only. But, the response is very broad not narrow as required and hence virtually any light source will work. Since we would not exactly be observing the sunlight we have chosen phototransistor, as its response is relatively better, we can understand this from the response figure. L14G2, the phototransistor to be used is an NPN type. It acts as a photo detector which means that it can convert the incident light upon into an electric response. They are commonly used as sensors usually paired with a light source like LED.

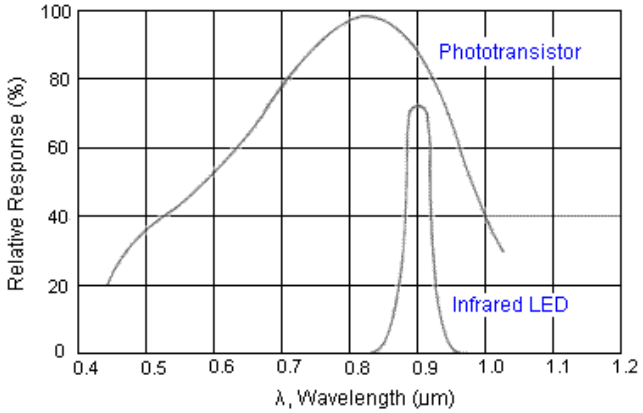

Fig: Responses of the phototransistor and Infrared LED

B. Microcontroller

In this project, we are using PIC16F628A microcontroller. Since the RAM memory of this controller is 224 bytes and the EEPROM in this is 128 bytes and our program memory is about 2K Words, this controller is more than sufficient. Also it has three kinds of timers, Analog Digital converter, and Universal communication port and so on. Also, it also has one set of CCP, it becomes more advantageous. The microcontroller processes at 4.0 MHz clock using an external resonator connected between the OSC1 (16) and OSC2 (15) pins. The use of 4.0 MHz clock in this controller makes the timing calculation easier and much faster as 1 machine cycle becomes of 1 7s duration. The timing information so obtained will be used to calculate the width of the received data pulse from the sensor and that is how we will be able to identify whether the information being carried is 0 or 1.

C. Signal Conditioning Block

Output of every sensor is in different forms and having different voltage and current ranges. Output of sensors should be compatible with Microcontroller; therefore we will be requiring Input Signal Conditioning.

D. Relay and Actuator

Relay is an electromagnetic device which can be used to completely isolate any two circuits electrically and connect them magnetically through coil. They are useful devices and enable one circuit to switch another one while they being completely separate. They are generally used to interface an electronic circuit like a system of microcontrollers and relays to an electrical circuit like MSEB which could be operating at very high voltage.

The Various specifications of relay are:

1. Coil Resistance: 75¬80ohm
2. Contact Configuration: SPCO config.
3. Contact Current: 0.9¬1A
4. Relay Mounting: Through Hole mounting
5. Coil Sensitivity: Two parameters:
   H - High sensitive (330mW).
   Blank-Standard (450mW).
6. Packaging: S-Plastic sealed type.

E. Others

Here we explained about the LCD, Fogger and Drip irrigation used in our project. Their explanation is as follows-

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Fogger: Used to decrease the surrounding temperature in case of increasing temperature and humidity. It will spray water in diameter of 1m range [10].
Drip Irrigation: It is used for irrigating the complete plantation area. This process of spraying water is carried out compulsorily in the morning hours. It can be explained as a setup of pipes which contains holes at regular distances[10].

LCD (20X4): This will be installed in control room to constantly display the temperature, humidity and moisture.

Fig: Showing the Temperature and humidity of Room

Lights: These would help in enhancing the process of photosynthesis incases of cloudy weather conditions. We will be using LED's since they consume very less power and they can be used for longer durations also.

III. RESULTS

The change observed in the system after deploying our methodology can be understood from the graphs plotted for the bud size and production of the crop. The results were recorded for two different plots, plot 1 where we have implemented the system and plot 2 where the system was not implemented. The dimension for plot 1 and 2 is 500m^2.

Fig: Plot 1where system is installed

The results have been recorded for 5 weeks. The bud size is the cross sectional diameter of the rose.

Bud-Size	Plot 1	Plot 2
week 1	3.0cm	3.1cm
week 2	3.2cm	3.2cm
week 3	3.3cm	3.1cm
week 4	3.4cm	3.1cm
week 5	3.4cm	3.0cm

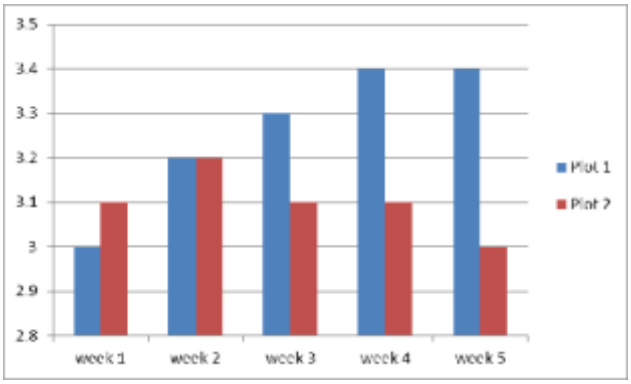

Fig: Graph showing bud size

The results recorded for the change in the bud size of Rose The X-axis shows the week, whereas Y-axis shows the bud size in cm for the respective week.

The bud size is the diameter of the rose. This value is of great consideration when we think about the value of rose. The typical value ranges from 3-3.5 cm[9]. A healthy production implies the bud size to be 3.4 cm. This can be achieved by maintaining the parameters, which we can do by using our system.

Production	Plot 1	Plot 2
week 1	124.7	124.3
week 2	132	126.2
week 3	133.6	127.1
week 4	135.4	126
week 5	137	127.2

The results recorded for the production of Rose. The X-axis shows the week, whereas Y-axis shows the production for the respective week

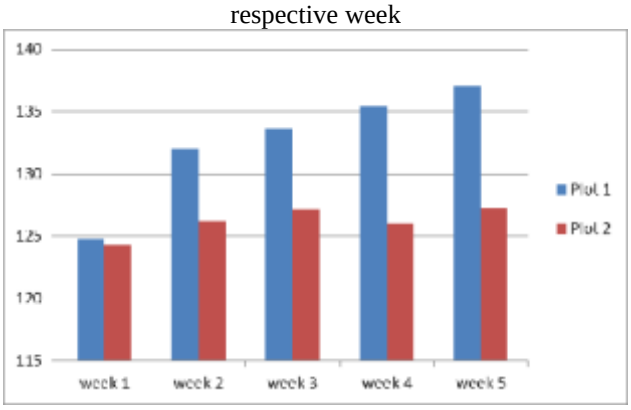

Fig: Graph showing Production

Fig:After in stallation of system

IV. DISCUSSION

Based upon the various aspects and observations regarding the whole process of atomization the following advantages and disadvantages can be listed out.

Advantages:

1. The growth of plants in a stipulated environment would lead to better yield and in turn will benefit the owner.
2. The dependency on the Laborers will be reduced, ensuring minimum errors and better results.
3. This will also result into efficient utilization of water, electricity as well as chemical fertilizers this is an important need of the hour.

Disadvantages:

We have not devised any technique for increasing the temperature of the environment as installing of heater coil and exhausts would consume more power, which would in turn increase the cost of the complete project.

Our project is an application based project and we are doing itt on real times basis we have made an on-field project which implies the entire process will be monitoring physically all the parameters. It can be deployed in any of the polyhouses.

V. CONCLUSION

In conventional method, the Polyhouse is totally dependent upon manpower. Also not always the techniques used can be completely in order with the requirement of the plantation. Through this project we have tried to atomize the whole process. Thus the On field monitoring and control of polyhouse is implemented through our system and we have also recorded the changes in the bud size and production of the rose. We also have worked out the priority of sensing all parameters.

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