# AN IMPLEMENTATION OF ADVANCED POLYHOUSE MONITORING AND CONTROLLING USING WIRELESS SENSOR NETWORK

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**ABSTRACT**

*Abstract: In this system the controlling mechanism for monitoring the environmental factors inside a polyhouse is proposed. By using this technique the ambient temperature, moisture and humidity can be controlled. These factors are crucial for the plant growth inside a polyhouse. The prototype will be designed by using Arduino processor as per feasibility. This technique can facilitate ideal humidity and temperature values as needed for the accurate growth of the plant. Using the Android Application the farmer can check the temperature inside the polyhouse from a remote location and based on the preloaded temperature values the motors and by using of fans give proposer humidity and cooling inside the polyhouse. The major benefit of this proposes system lies in reducing the human effort by automation which further provides suitable environment inside the polyhouse. For monitoring temperature inside the polyhouse LM35 temperature sensor is used because of its accuracy and fast transmission of data. This system provides security to the polyhouse using buzzer and also provides crop income and expense to the farmer.*

**Keyword :** - *Arduino Processor, Remote Farm Monitoring, Bluetooth module, Network communication*

## 1. INTRODUCTION

Traditionally, the farmers needs to take the readings of parameters in different areas to maintain the data as well as to maintain the operating conditions in the farm. The existing monitoring systems mostly use cable network. This kind of a network has poor performance as far as expansion is concerned and using cables have high incidence of defect failures due to wear out and aging. When the working surface is expanded, area to be monitored also increases and hence the new cost for installation and maintenance is needed. We design a wireless sensor network based on Bluetooth data acquisition system in view to minimize manual interaction and accident potential in the process of data acquisition of an embedded system. Also traditional monitoring system has high possibility of potential loss of data; same is reduced in Wireless sensor network using co-operative communication system. Through researching the characteristic of main wireless communication protocol, is chosen as lower layer communication protocol. Arduino is used to maintain high accuracy. Wireless sensor Node will collect the data using different sensors. Temperature Sensor is used to sense the temperature at each node. The sensor used for temperature is calibrated in directly degree Celsius with Sensitivity +10mv/C. Output range for this sensor is 4 to 30 volts and operating current is 60μA. Soil moisture sensor is used to sense the humidity of the soil. IR sensor is used for obstacle detection. The sensor is used for security purpose. LDR is used as it is highly sensitive to light with range of 1 to 3 V DC. The output from sensors is in the form of analog signal. This signal is fed to ADC which will convert it into digital form. Once converted into digital form, the microcontroller can process the digital signal as per the application. The digital signal is then applied to Arduino Uno. The Bluetooth module is interfaced to

Arduino processor. Here the Bluetooth module works on TTL Txd and Rxd pins. LCD will display the data at each wireless sensor node. Relays are used for controlling action. There are three analog sensors interfaced with the ARM microcontroller with inbuilt 10 bit ADC. The output of these 3 sensors is fed at the input of ADC. ADC will convert the analog signal into digital form and then the microcontroller will perform the necessary operation. Arduino is used for Sub master units. In this technique most of the components used require 5 V as operating voltage. Total electricity, which our circuit sinks from the power supply, is not more than 100 mA. Therefore we have used the transformer with the voltage rating 230v-10v and current rating 500 mA.

## 2. LITERATURE SURVEY

### 2.1 Polyhouse Monitoring and Controlling Using Wireless Sensor Network

To control and monitor the environmental parameter inside Poly-house, using wireless sensor network. This sensors not only sense it also send and receive data. The technology name Telecommunication is a science of receiving and sending information such as sound, visual images, or computer data, over long distances through the use of electrical, light signals or radio using electronic devices to encode the data as signals and to decode the signals as information. As we know that Wireless communication techniques is a medium to transfer of information between two or more points that are not connected by an electrical conductor. To design and develop a wireless sensor network using co-operative communication based on RF(IEEE 806.15.4) data acquisition system in view of the complicated cables and to overcome the problem of potential loss of data. Combined wireless RF(IEEE 806.15.4) communication technology with data acquisition system, we developed wireless data acquisition system based on ARM7 processor and RF(IEEE 806.15.4) chip in the wireless sensor network which can reduce the cable Connections. This system, which is comprised of IEEE (806.15.4) network and database management system, has many important advantages such as low cost, low power Consumption, and low Date rate.. The difference between other data collector and RF(IEEE 806.15.4) data acquisition system is that it realizes wireless data transmission after the A/D conversion. Furthermore, the system is simpler, integrated, anti-interference, stronger mobility and practicability. The system dedicates to automatic data collection and control.

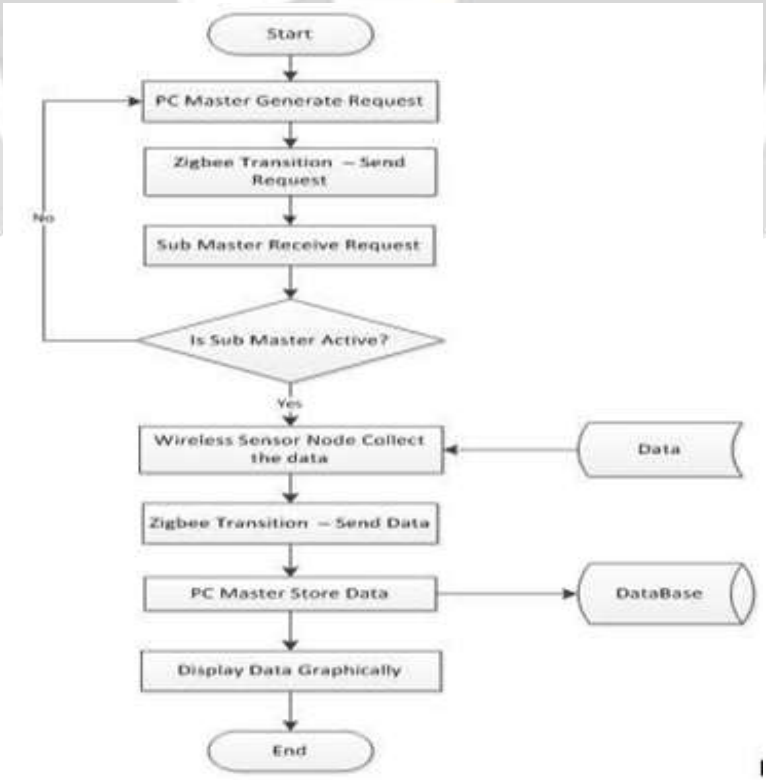



**Fig -1:** Work Flow of Wireless Sensor Network

**2.2 Wireless Solution for Polyhouse Cultivation Using Embedded System**

In this system the controlling mechanism for monitoring the environmental factors inside a polyhouse is proposed. By using this technique the ambient temperature and humidity can be controlled and these two factors are important for the plant growth inside a polyhouse. The prototype is designed by using AT89S52 microcontroller and tested successfully. The system can provide ideal temperature and humidity values as required for the proper growth of the plant. The farmer can check the temperature inside the polyhouse using the GSM module and from a remote location and based on the preloaded temperature values the motors and fans provide sufficient cooling and humidity inside the polyhouse. The advantage of this system lies in reducing the human effort by automation which further provides suitable environment inside the polyhouse. For monitoring the humidity inside the polyhouse SY-HS-220 humidity sensor is used. These two sensors are integrated with the microcontroller through MCP3208Analog to digital converter. Whenever the temperature and humidity inside the polyhouse increases beyond 25 degree C, the motor and the fan are turned on automatically to cool the temperature, which are connected to the microcontroller by L293D. The exact data of information about the status of humidity, temperature and motors is transmitted to the farmer and PC node through GSM Module via MAX232. Keil uVision4 cross compiler has been used for implementing the proposed system.

**2.3 Environment Monitoring and Control of a Polyhouse Farm through Internet**

Here, Control and monitoring of environmental parameters inside a Polyhouse farm, so as to ensure continuous maintenance of favorable crop atmosphere is the objective of the work presented in this system. The objective is achieved through the use of internet based technology. The concept of encompasses data acquisition of thermal process parameters through a sensor network, data storage, post processing and online transmission of data to multiple users logged on to their respective web-browsers and further, control of process parameters of a Polyhouse (for e.g., toggle off/on control of pumps and accessories, louvers and ventilators, air flow rate, sunlight management, etc.) from one or many remote monitoring stations over the web server in real time is also integrated with the system. A graphical user interface is unified for the ease of operations by the farming community. System allows also to transmission of process parameters, with emergency alarm signals via e-mail client server or alternatively sending a SMS on a mobile phone. A communication chat system has also been designed with the GUI to add vibrancy to inter-user communication. This feature can be embedded in upcoming 3G mobile technology. Video tutorials and simulations can also be integrated in the web server for teaching the farming community. Such integrated approach greatly widens the socio-economic possibilities for farmers through interaction with modern technological resources.

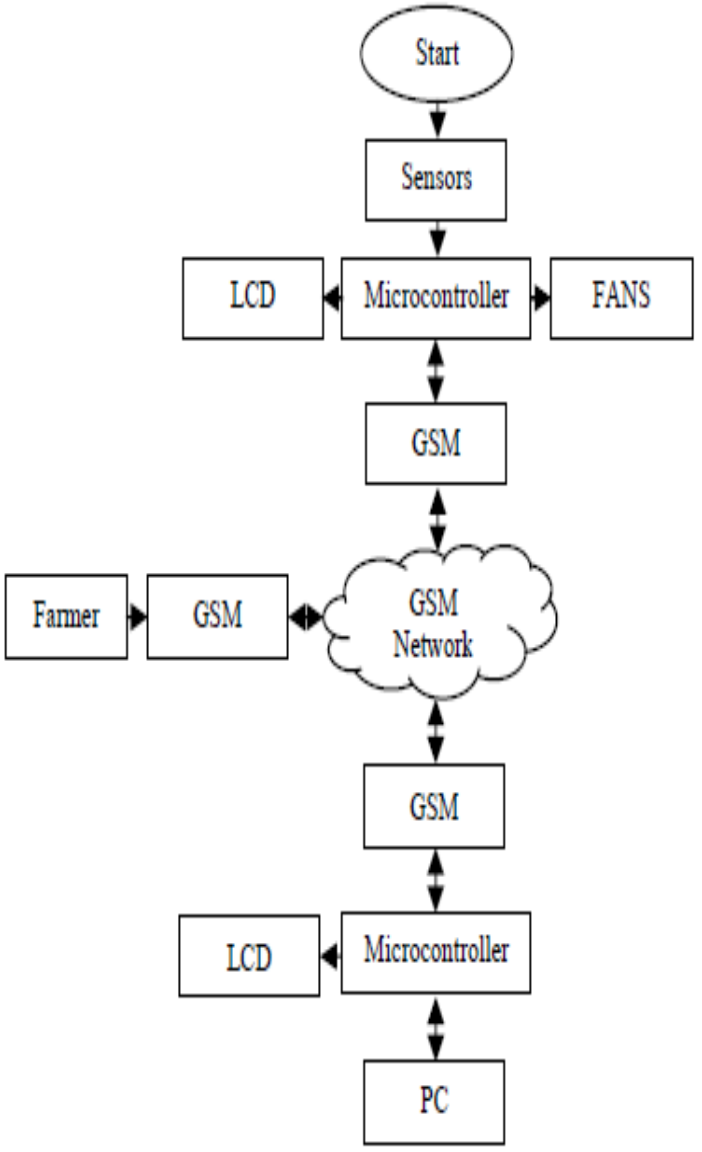



**Fig -2:** Movie Flow diagram of the Polyhouse system.

**2.4 Integration of Wireless Technologies for Sustainable Agriculture**

Agriculture and farm is a source of livelihood of majority Indians and has great impact on the economy of the country. In India, where climatic conditions vary substantially and irrigation facilities are poor, sustainable agriculture practices that conserve resources and make a farmer's life easier are absolutely essential. This system proposes a system that makes use of contemporary technologies- wireless sensor networks, GSM and SMS - to provide the farmer with the ability to handle the water level in the field remotely and in real time.

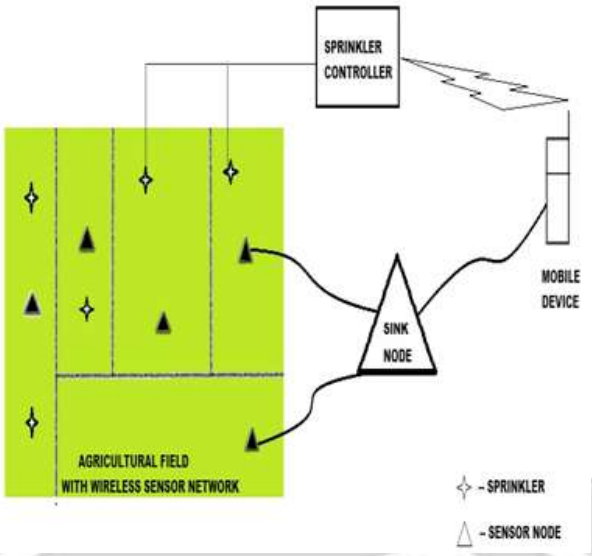



**Fig -3:** System Architecture

### 2.5 Proposed System summary

The detail architecture of the system is shown in the below:

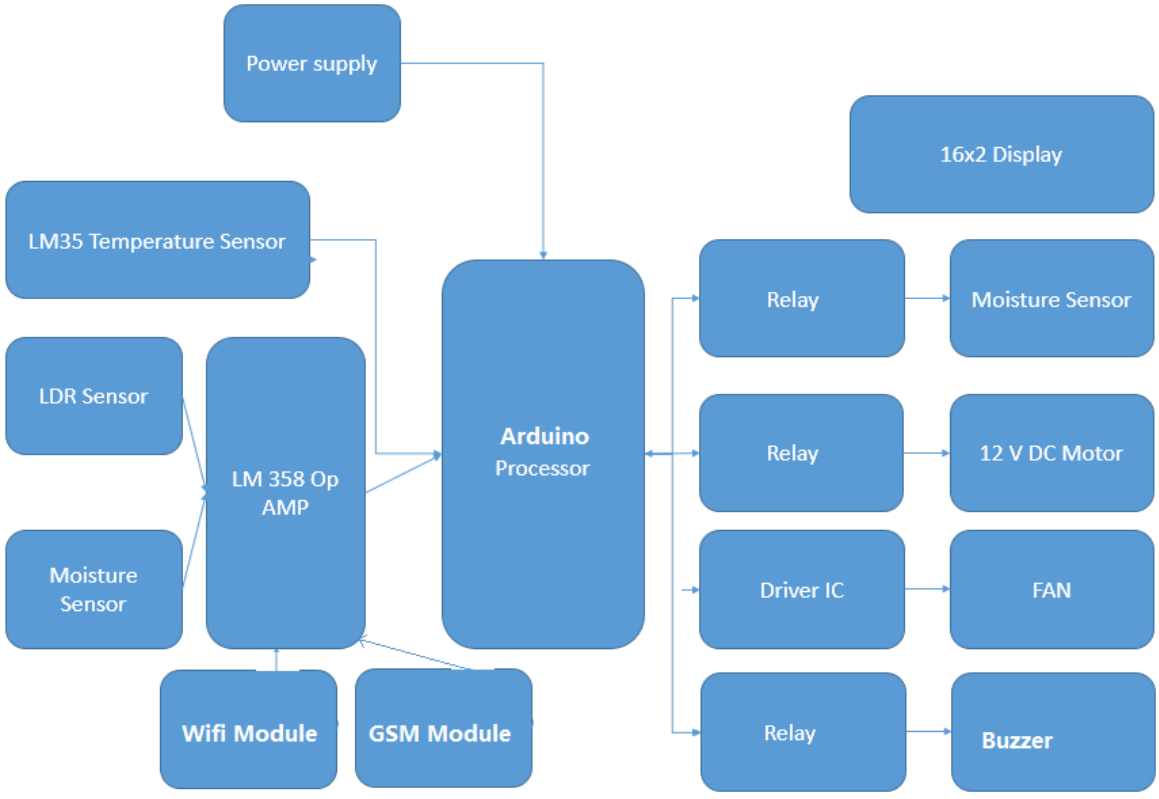



**Fig -5:** Block Diagram of the proposed polyhouse system

The system can be formulated as a digital remote farm monitoring and controlling system 'A' having a processor 'P' connected to it to fetch the environment conditions in Farm and send it to the authorized farmer 'F' where sensors 'S' values will be captured and monitored and sent via Wireless Medium to registered mobile and the Relay 'R' connected between the Processor and the Operation Module will be controlling the working of Farm or Light or Pump based on threshold value of sensor. The IR sensor in the farm can sense the presence of animals in farm and can immediately turn on the buzzer to make the animals run away from the farm.

## 5. PROPOSED SYSTEM IMPLEMENTATION

1. Sensor Module
2. Server Module
3. Notifying Module
4. Farmer/Admin Module

**Sensor Module:**
Sensor values are analysed and compared to identify whether the value sensed in below threshold or above.
The sensor values are monitored on real time basis.
Sensors used are:
1. Temperature Sensor
2. Soil Moisture Sensor
3. LDR Sensor
4. IR Sensor

**Temperature Sensor:** The LM35 is one kind of commonly used temperature sensor that can be used to measure temperature with an electrical o/p comparative to the temperature (in °C). It can measure temperature more correctly compare with a thermistor. This sensor generates a high output voltage than thermocouples and may not need that the output voltage is amplified. The LM35 has an output voltage that is proportional to the Celsius temperature. The scale factor is .01V/°C.
The LM35 does not need any exterior calibration and maintains an exactness of +/-0.4°C at room temperature and +/-0.8°C over a range of 0°C to +100°C.One more significant characteristic of this sensor is that it draws just 60 microamps from its supply and acquires a low self-heating capacity

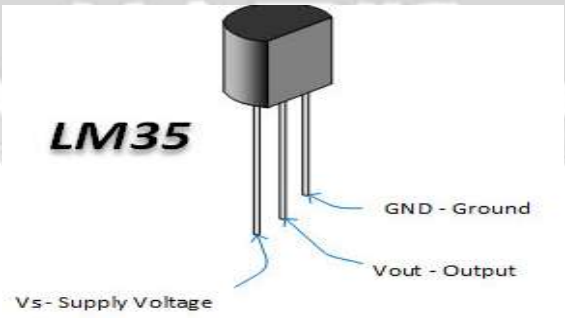



Fig 5.1 LM 35 Temperature Sensor

**Soil Moisture Sensor:** The Soil Moisture Sensor is a simple breakout for measuring the moisture in soil and similar materials. The soil moisture sensor is straightforward to use. The two large exposed pads function as probes for the sensor, together acting as a variable resistor. The more water that is in the soil means the better the conductivity between the pads will be and will result in a lower resistance, and a higher SIG out. To get the Soil Moisture Sensor functioning all you will need is to connect the VCC and GND pins to your Arduino-based device (or compatible development board) and you will receive a SIG out which will depend on the amount of water in the soil. One commonly known issue with soil moisture sensor is their short lifespan when exposed to a moist environment. Interface type is analog and so the values are to be converted into digital using the manual code.

Fig 5.2 Soil Moisture Sensor

A **Light Dependent Resistor (LDR)** is also called a photoresistor or a cadmium sulfide (CdS) cell. It is also called a photoconductor. It is basically a photocell that works on the principle of photoconductivity. The passive component is basically a resistor whose resistance value decreases when the intensity of light decreases. This optoelectronic device is mostly used in light varying sensor circuit, and light and dark activated switching circuits. Some of its applications include camera light meters, street lights, clock radios, light beam alarms, reflective smoke alarms, and outdoor clocks.

Fig 5.3 LDR Sensor

**Server Module**:

Server Module/Processor Module is the main module which interfaces all the sensors with the farmer/user in order to get sensor values and notify the user abut polyhouse condition. Server Module also has the facility to maintain track of expenses and income from the crop. The above track will guide the farmer to decide whether the crop giving him/her profit or not.

**Notifying Module:**

Notifying Module is the proposed system interaction module which takes the values from the server or processor and sends it to the registered users' device in order to notify about the poly house condition. Notifying Module also work at sensor level, whenever animal if detected in polyhouse, it senses it and raises and alarm in polyhouse so that the animals run away.

**Farmer/Admin Module:**

Farmer/Admin Module is the actual and user module who gets the status of sensors from the server and reacts to the sensor conditions either automatically or manually based on his choice. Farmer can also maintain the track of how much has he spend on the farm and how much he has earned, based on which he can decide whether to grow the same plant next time or not.

**Working Of proposed system:**

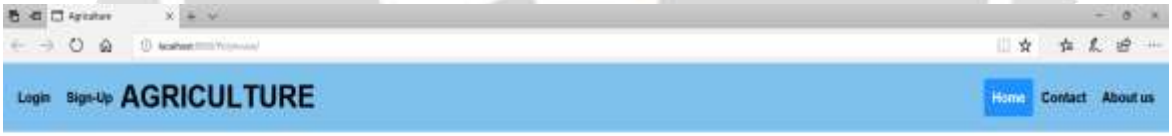
Initialization of Connectivity:

1. Turn of the Server and wamp server for android app to connect to the server using Wi-Fi (laptop and the android device to be connected to same Wi-Fi).
2. Check the ip of the wamp server for saving in the Android app.
3. Turn of the Netbeans polyhouse server and run the Netbeans project.
4. Once all the servers are live, the android app is to be opened for logging in the farmer.
5. The preregistered farmer from the polyhouse project only can login to the app as the registration from mobile will be not operational.

**Farmer Server Operations:**
1. Login to the server
2. Add crops
3. Add the expenses
4. Add the incomes
5. Add the thresholds for the crops.

**Farmer App Operations:**
IMP: Set the mode of operation to whatever u want before logging in to app, then.
1. Login to the app,
2. Select crop planted in polyhouse
3. Fetch the thresholds of the selected crop
4. Start the connectivity (before logging in to app, turn on android Bluetooth and connect to HC05 Bluetooth Module in project).
5. The selected mode of operation is sent to the Hardware and the sensing and controlling can be done as per mode selection

## 6. RESUTS SCREEN SHOTS





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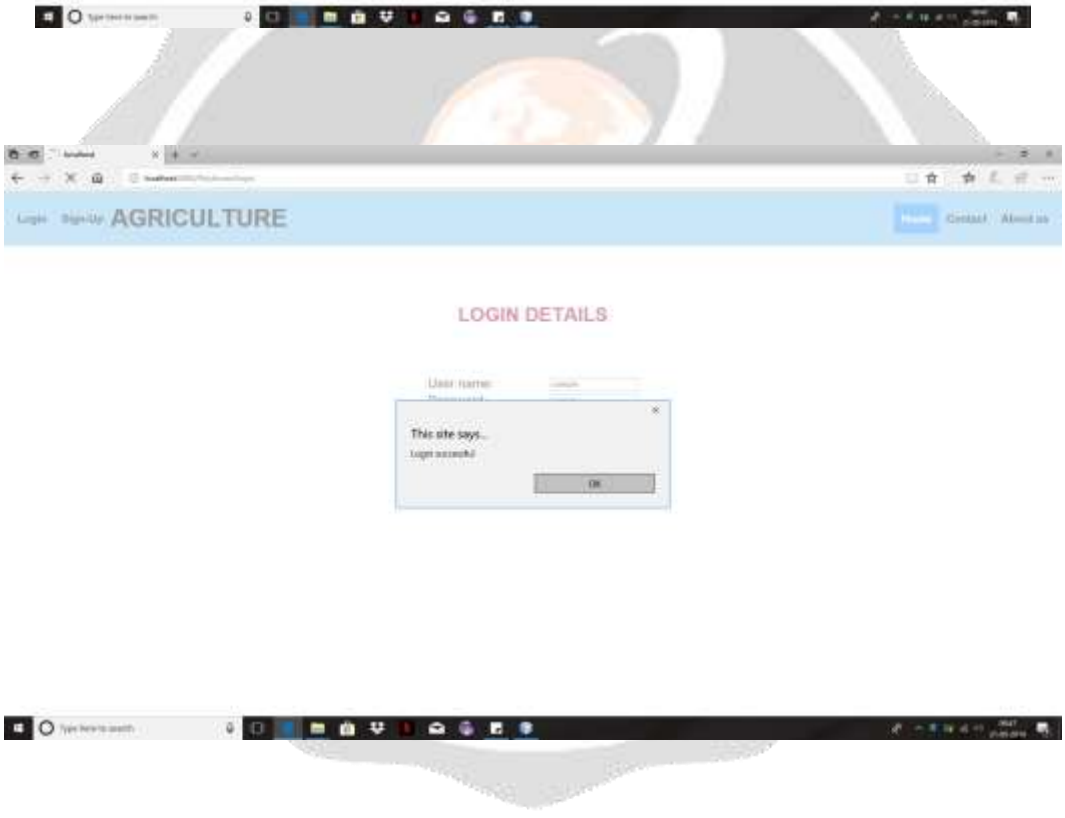
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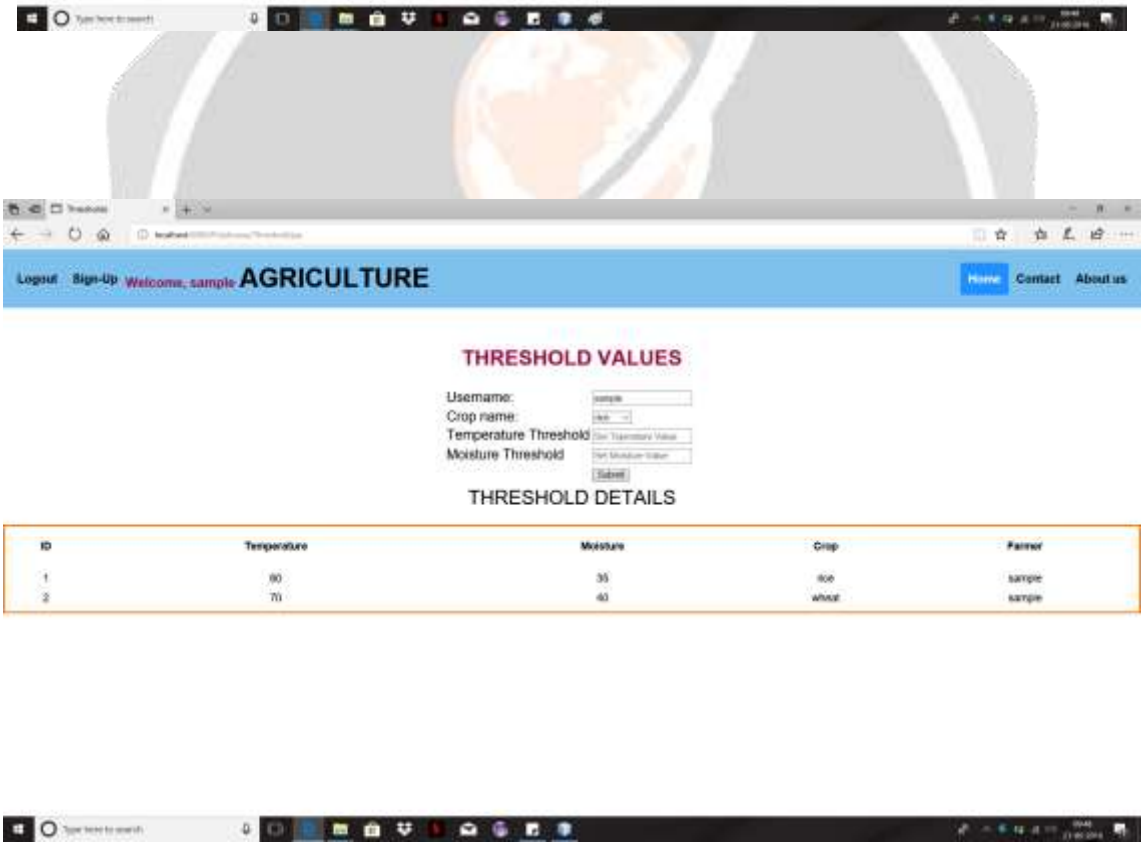
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Temp= 0034 deg C
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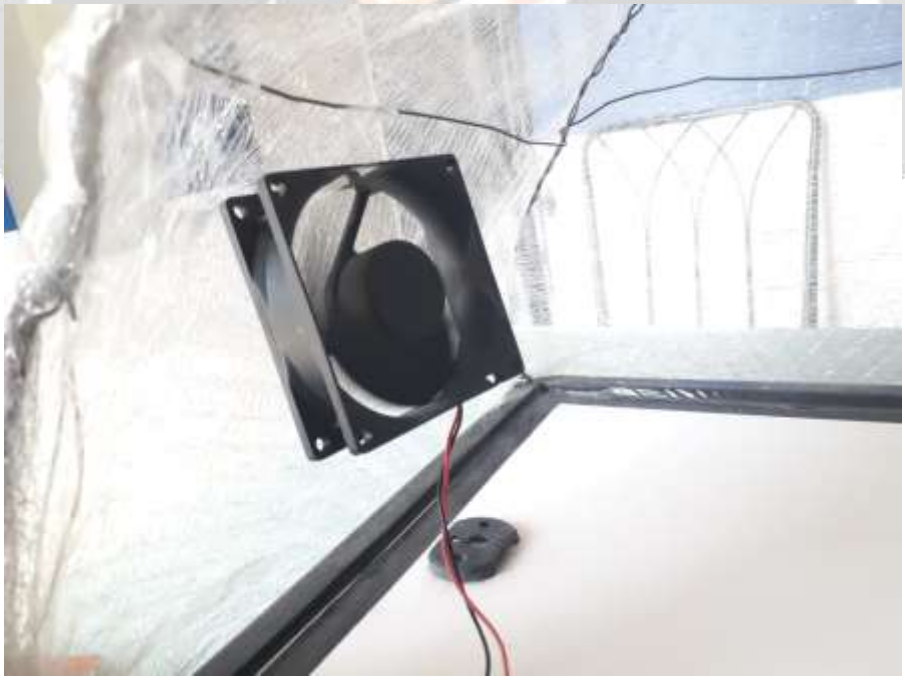

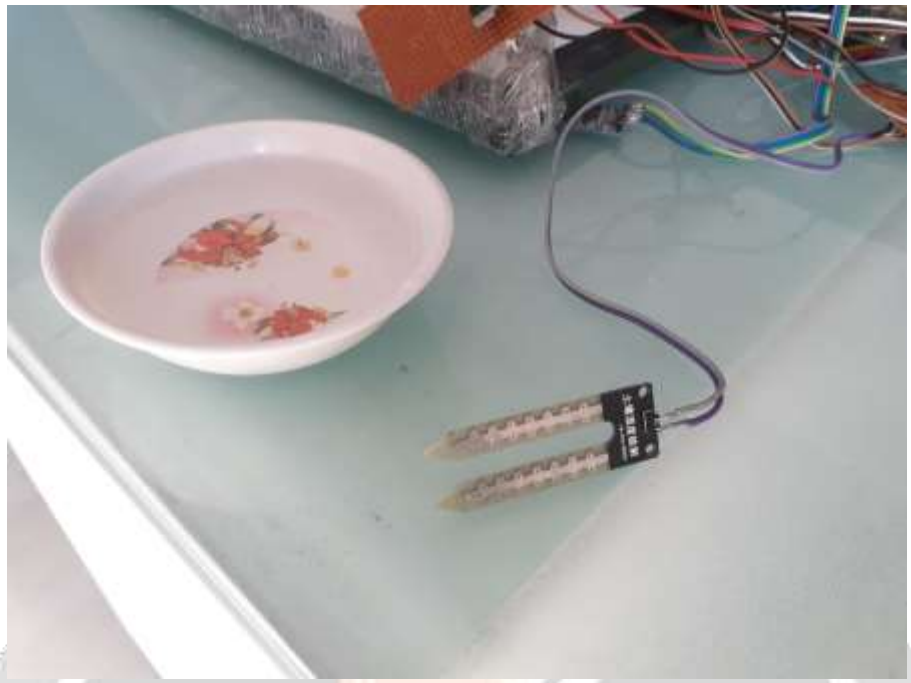


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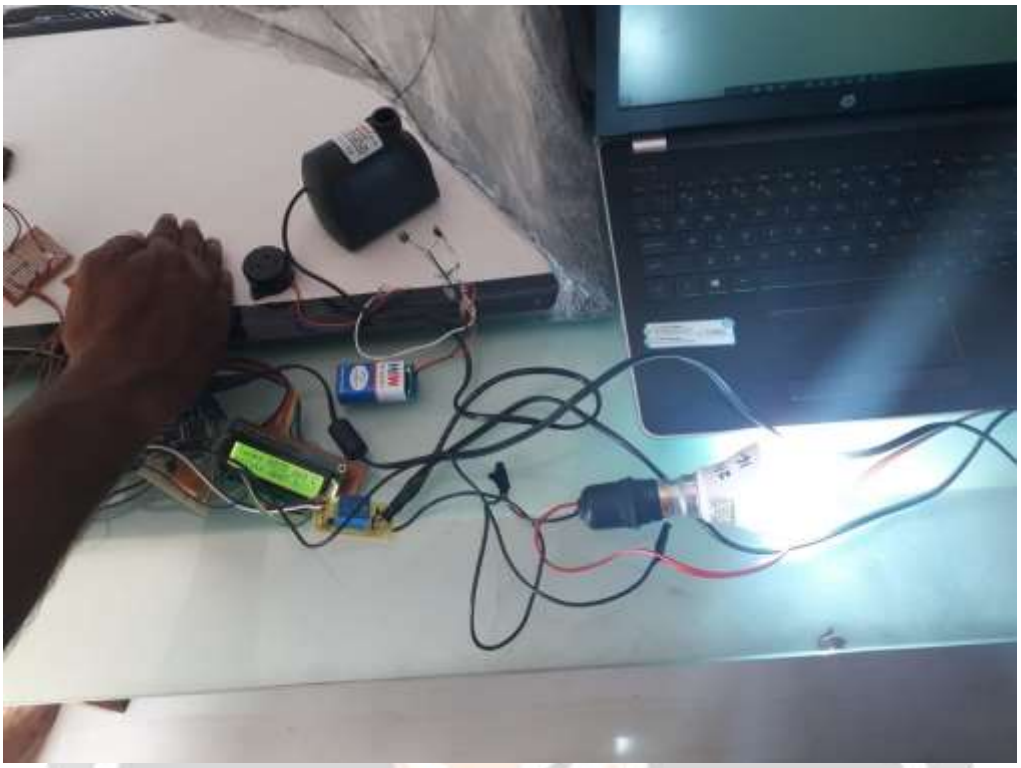

## 7. CONCLUSION

The human effort can be reduced with the proposed system .Remote control of temperature, humidity, moisture inside the polyhouse makes the farmers work easy and it can be achieved by using the proposed system with less hardware and using simple operations. Combined Wireless Wi-Fi and Bluetooth communication technology with data acquisition system is used. We build wireless data acquisition system based on Arduino processor and the wireless sensor network. Arduino is used to maintain high accuracy.System provides security for polyhouse and also gives the income and expense management.

## 8. ACKNOWLEDGEMENT

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