CLOUD BASED MONITORING AND CONTROLLING GREENHOUSE PARAMETERS USING IOT DEVICES

Pradeep Kyata[1], Pournima Awate[2], Pramita Padhen[3], Arati Hande[4]

[1]*Student, Department of Computer Engineering [B.E], SAOE, Maharashtra, India*
[2]*Student, Department of Computer Engineering [B.E], SAOE, Maharashtra, India*
[3]*Student, Department of Computer Engineering [B.E], SAOE, Maharashtra, India*
[4]*Student, Department of Computer Engineering [B.E], SAOE, Maharashtra, India*

ABSTRACT

The main objective of our work is to design an automated agricultural system which is purely sensor based and economical as well as durable and with the best success rate which can manage everything less human interference. It can communicates with the different sensor modules in real-time in order to control the light, temperature, humidity and soil moisture efficiently inside a greenhouse by actuating a cooler, fogger, dripper and lights respectively according to the necessary condition of the crops. An integrated monitoring and controlling system is used to collect data sensed by various sensors. This makes the proposed system to be an economical, portable and a low maintenance solution for greenhouse applications, especially in developing countries.

Keyword:- *Temperature, Humidity, Soil Moisture, Light Intensity.*

1 INTRODUCTION-

The project centered on greenhouse, and our portion was to come up with a way to automate many of the functions within the greenhouse. The idea was to gather sensor data from the interior and possibly around the exterior of the greenhouse, and then have systems act on that data. As an example, if the greenhouse interior is too warm, windows would automatically open up to create a cross flow of air, or possibly the HVAC system would turn on to actively cool the interior. Another example would be to measure soil moisture and have an irrigation system turn on if the soil is too dry. With today's technology all of this is possible, even when limited by budget constraints of devices.

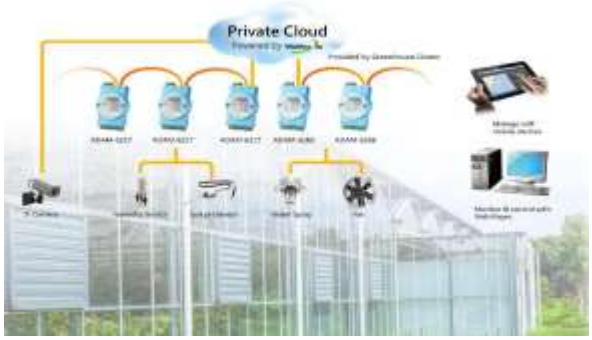

Fig -1. Sample Architecture

2 LITERATURE SURVEY

Jia Song He proposed a system on Greenhouse Monitoring and Controlling System Based on Zigbee Wireless Senor Network using 8051 controller. In this paper we have discussed about Greenhouse Monitoring and Control System Based on Zigbee

Wireless Senor Network using ARM controller and is accessible to the user through the Internet. Ai, Wei,Chen,Cifa. They have discussed about Green House environment monitor technology implementation based on android mobile platform, which uses android mobile phone as the monitoring terminal. In this paper parameters in the greenhouse are monitored on the PC as well as the android mobile phone from anywhere in the world as it is connected to the internet through the team viewer software. He G uomi Wang, Xiaochan;Sun,Guoxiang .They discussed about monitoring humidity and moisture in green house using Zigbee monitoring system. In this paper we have proposed a low cost method using ARM microcontroller and Zigbee technology to accurately monitor and control the various parameters like humidity, soil moisture, light intensity and temperature. Aryo H.Primicanta, Mohd Yunus Nayan, and Moohammand Awan[.They proposed a method on ZigBee GSM based Automatic Meter Reading system. In this paper we are using GSM modem to transmit fault messages to user via Zigbee.

3 SYSTEM REQUIREMENTS

3.1 Low-cost, low-power and small size networking devices.

The system used should be cost effective, small in size and should require less mobility during its functioning. If the system is wireless then it should work on any unlicensed band. It also should require lesser hardware.

3.2 Long battery life

Battery should be used as a backup and it should provide long battery life.

3.3 Robust design

Developed prototype of WSN should withstand with variations in the temperature, humidity, rain and wind speed.

3.4 User friendliness

Developed prototype of WSN should have GUI and must be easy to understand and work upon in nutshell, socioeconomic status of the farmers needs also to be considered while finalizing the prototype of WSN.

4 DESIGN OBJECTIVES

The horticulturists near Nasik region felt the need of some automatic controller for their green houses where they grow export quality roses. The atmosphere in India changes with the season. Hence, the quality of the roses does not remain the same due to the change in the temperature and humidity parameters. Roses with low quality give less income. The loss in the income due to low quality roses is to the tune of 2 to 3 lakhs per acre per season. For roses, ideally, the green house should provide good light intensity throughout the year, temperature range should be between 15 to 28°C, night temperature should be between 15 to 18°C, and the day temperature should not exceed 30°C in any case. The growth is slowed down with the decrease in temperature below 15°C. If the temperature increases above 28°C, humidity must be kept high. Higher night temperature above 15°C hastens flower development, while lower temperature around 13.5°C delays it.

Depending on the temperature inside the greenhouse, the moisture should be kept in line for the best results. For example, if the temperature is 24 degrees, 60% humidity is suitable.

Hence, variable temperature and humidity control for different crops using wireless technique for WSN environment using low cost technique was the main objective. Low power consumption during testing was another objective. Hence, selection of the sensors and most importantly, microcontroller, was very important keeping power consumption at remote places in view. To bring the temperature within control limit, exhaust fans were made automatically ON and for humidity control, water pump was made ON-OFF.

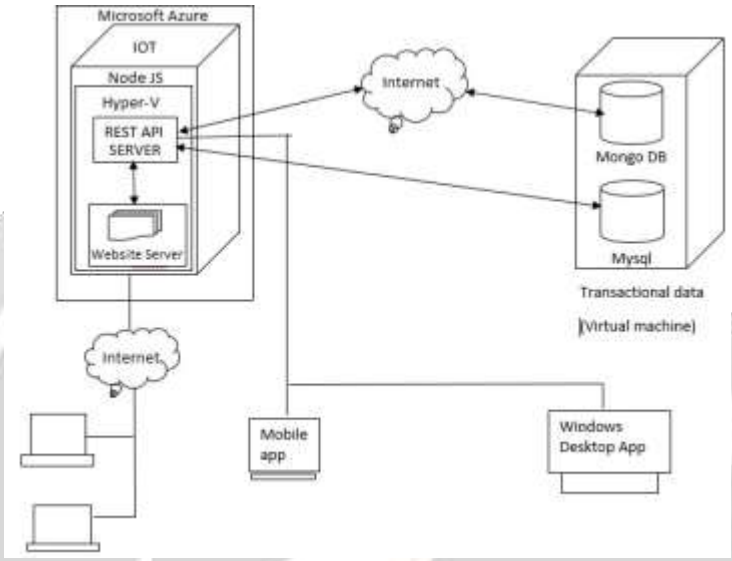

Fig -2. System Architecture

5 TYPES OF SENSORS AND CONTROLLING PARAMETERS IN GREEN HOUSE

In this case study and analysis, we have considered three types of sensors. Sensor Node 'A' which is, outside climate sensor will help to get time to time information about wind flow, wind direction, ambient light, temperature, ambient pressure, humidity and percentage of CO2. Sensor node 'B' is inside climate sensor and will monitor ambient light, temperature, ambient pressure, and humidity and CO2 percentage from the inside of the green house. Soil sensor node type 'C' would be specially design for to monitor the soil conditions like humidity of soil, temperature, pH value, and electric conductivity of a soil.

5.1 Air Temperature Control

Growth of Plants in greenhouse depends on the photosynthesis process which is a measure of photo synthetically active radiation. It is observed that proper temperature level influences the speed of sugar production by photosynthesis radiation. Temperature has to be control properly since higher radiation level may give a higher temperature. Hence, in the diurnal state, it is necessary to adjust the temperature at an optimal level for the photosynthesis process. In night conditions, plants are not active therefore; it is not necessary to maintain such a high temperature.

In favorable weather conditions of temperature during the daytime the energy required to reach the optimal temperature is provided by the sun. In fact, the usual daytime temperature control problem is the refrigeration of the greenhouse using natural ventilation to achieve the optimal daytime temperature. On the other hand, heating of the greenhouse up to required temperature is the case of night temperature control. Some cases forced-air heaters are commonly used as heating systems.

5.2 Humidity Control

Water vapor inside the greenhouse is one of the most significant variables affecting the crop growth. High humidity may increase the probability of diseases and decrease transpiration. Low humidity may cause hydria stress, closing the stomata and thus it may lower down the process of photosynthesis which depends on the CO2 assimilation. The humidity control is complex because if temperature changes then relative humidity changes inversely. Temperature and humidity are controlled by the same actuators. The main priority is for temperature control because it is the primary factor in the crop growth. Based on the inside relative humidity value the temperature set-point can be adjusted to control the humidity within a determined range. Hence to control the required humidity is very complex task. For proper control of humidity internal air can be exchange with outside air by properly controlling ventilations of the greenhouse.

5.3 Soil Condition Control

Soil water also affects the crop growth. Therefore, the monitor & control of soil condition has a specific interest, because good condition of a soil may produce the proper yield. The proper irrigations and fertilizations of the crops are varies as per the type, age, phase and climate. The pH value, moisture contains, electric conductivity and the temp of a soil are some key parameters. The pH valves and other parameters will help to monitor the soil condition. The temperature and the moisture can be controlled by the irrigation techniques like drift and sprinkles system in a greenhouse. The temperature of the soil and the inside temperature of the greenhouse are interrelated parameters, which can be, control by proper setting of ventilation. Since the temperature control is depends on direct sun radiation and the screen material used, the proper set point can adjust to control soil temperature. The temperature set-point value depends on actual temperature of the inside and outside of the greenhouse.

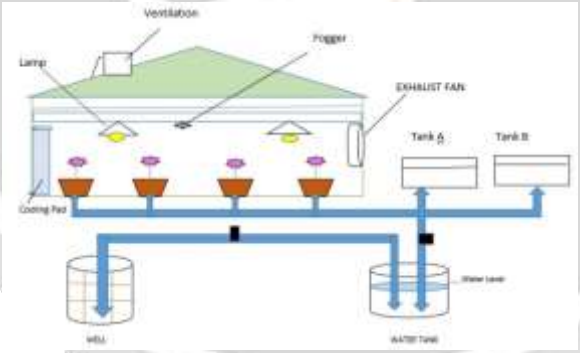

Fig -3. Greenhouse

6 RESULT

In this project we allow the users to set the conditions appropriate to the crop is growing. This will be done via PC interface. The more accurate a sensor is, better it will perform. The unit will monitor the conditions of various parameter considerations and take appropriate action. Action taken is as follows:

1. If temperature is lower than the set point: Heater relay will Turn ON and fan will turn OFF.
2. If temperature is higher than the set point: then Fan will be Turned ON and heater will turn OFF.
3. If Humidity is higher than the set point: then Fan / Humidifier will be Turned ON and heater / Dehumidifier will turn OFF.

4. If Humidity is lower than the set point: then Fan / Humidifier will be Turned OFF and heater / Dehumidifier will turn ON.
5. If temperature is higher than the set point: then Fan will be Turned ON and heater will turn OFF.
6. If Light Intensity is higher than the set point: turn OFF the bulb.
7. If Light Intensity is lower than the set point: turn ON the bulb.
8. If soil moisture is higher than 70%: Pump will be turned OFF
9. If soil moisture is lower than 30%: Pump will be turned ON.

Fig -4. IOT Device (Raspberry Pi)

Fig -5. Home Page

Fig -6. Device Interfacing Page

7 CONCLUSION

In this paper we have discussed about smart greenhouse automation with advantages of system like low cost and accuracy. This system proposes a greenhouse system in which user can control their green house from remote location by using android mobile. This system is capable of controlling the essential parameters necessary for plant growth, viz. Temperature, humidity, soil moisture and light intensity etc.

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