GREENHOUSE AUTOMATION SYSTEM THROUGH WIRELESS PROTOCOL USING LabVIEW

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ABSTRACT

Environmental conditions have a significant effect on the plants growth.All plants require certain conditions for their growth properly. Therefore, it is necessary to bring the environmental conditions under control inorder to have those conditions as close to the ideal as possible. To create an optimal environmental condition, the main climatic and environmental parameters such as temperature, humidity, soil moisture, light, Co2, pH level in the atmosphere are to be controlled. Inorder to gain the control over the parameters mentioned above a Microprocessor Raspberry-Pi is interfaced with LabVIEW.

Keywords: Raspberry-pi, pH sensor, Soil moister sensor, Temperature sensor, Humidifier, Pump, Light source

1INTRODUCTION

More than 90% of plants around the world, either foodcrops or cash crops have been grown in the open field undernatural environmental conditions. The continuous change in climatic condition may affect the plant's growth. The green house is the technique of providing a favourable environmental condition to the plants. It is used to increase the growth rate, yield, and quality and also protects the crops/plants from the bad weather situations such as cold/hot current of air, extreme temperature, insects, and diseases. It is also important to create an ideal climate condition around the plants for their proper growth. Most of the greenhouse systems till uses manually monitoring and controlling system. There are some difficulties in controlling the greenhouse parameters such as humidity, temperature, soil moisture, CO2, pH and light intensity. It is necessary to automate the greenhouse field for precise control and monitoring these parameters. The above-mentioned green house parameters are interdependent which has to be considered while designing a successful control system. The greenhouse field is a multivariable

process, in that the sensor network has been used to collect the data from point to point to trace down the local environment parameters from various parts of the big greenhouse to make the greenhouse automation system working properly. The acquired data is now available to the Raspberry-Pi which has as a processor. The generally monitoring systems have the following communication methods as, wired communication and wireless communication, as in present days all devices are being wireless NRF modules are used as mode of data transfer and communication. Here communication mode is wireless. The data has been transmitted and received through a NRF module interfaced with microcontroller Atmeaga328P.Atthereceiver end, NRF module interfaced with microcontroller Atmeaga328P has been connected with the host system using LabVIEW through COM port. The received data has been displayed in LabVIEW panel at the user end and compared with the set point and the data has been stored as a text file for backup database maintenance.

2. LITERATURE SURVEY

In this paper, the Design had been aimed data acquisition in greenhouse for multiple sensors to use data for simulation or processing to achieve the better enhancement of growth in greenhouse, this data has effect on the climate of greenhouse. Graphical User Interfaces (GUI) had been used through LabVIEW, firmware of Raspberry Pi as software and Atmega328P and sensors as hardware, by using Raspberry Pi provides multiple inputs analogs and I/O digitals to made read data sensor easy to take temperature, humidity, CO2 gas, also measuring the soil moisture that needed for irrigation plants and the intensity of lights that applied for greenhouse. These factors have the major effect on increase growth plants. Greenhouse environments monitoring present difference changes to parameters, the system for this purpose had been provided and given ability to control on climate of greenhouse.

Chen.et.al [1] The proposed paper is about remote monitoring greenhouse environment system by the smart mobile. We establish a system to control greenhouse environment through the smart mobile or PDA. National Instrument's (NI) Field Points are applied to retrieve the environment parameters on real time in the greenhouse. Environment parameters are transmitted to a PC server after data processing. Users can use smart mobile or PDA to control and monitor the system in anywhere by the wireless network. Phalaenopsis are high-priced products in Taiwan, so we chose the orchid as our sample to build a

greenhouse environment system. The result shows that the designed system could be more effective in manpower savings and raising the economic value of products

Zaidonet.al [2] This system involves three intelligent controllers that designed to stabilize the temperature degree, water level in soil, and light intensity inside the greenhouse prototype structure. These systems have been built by two important parts: the hardware and software. The hardware part could be achieved by designing and implementing the control circuits, actuators, and install the sensors as well as the devices. The second one is the software part which is involves implementing Fuzzy Inference Engine that represent the system's brain that monitor and manage the entire process in the system to ensure the best performance. This system has been built to contain three control systems that means there are three different Fuzzy controllers. In order to keep the system practicality, the fuzzy controllers should be aggregated in single code that resides in single microcontroller chip with additional codes that perform the IoT duties.

Sushama et.al.[3] All plants and vegetation require certain conditions for their proper growth. Therefore it is necessary to bring the environmental conditions under control in order to make those conditions as close to the ideal as possible. To create an optimal environment the main climatic and environmental parameters such as temperature, humidity, light intensity, ground water etc need to be controlled to create optimal environment. An automated management of a greenhouse provides the most proper conditions of plant growth. Greenhouse Automation system based on the embedded system is used for the control of the values of temperature, humidity, light intensity and soil moisture that are continuously modified and controlled in order to optimize them to achieve maximum plant growth and yield. A microcontroller receives data on greenhouse environment conditions from a number of sensors and transfers the data to and from a PC via RS 232 port. Accordingly, it changes the state of greenhouse control devices namely, heaters, fans, bulb etc according to the necessary condition of the crops.

Jonathan et.al[4] The automated greenhouse control system achieves monitoring and control of a greenhouse environment by using sensors and actuators which are under the control of a microcontroller running a computer program. The system is composed of two stations: Remote monitoring station and the Actuators/Sensors Station. The controller used in the actuators/ sensors station which ensures that the microclimatic parameters stay within

pre-defined values as determined and set by the user is the Arduino prototyping platform. The climatic conditions of the greenhouse and state of actuators are transmitted to the remote monitoring station via a pair of low power XBee Modulator-Demodulator (MODEM). The codes for the controller were written in the Arduino programming language, debugged, compiled, and burnt into the microcontroller using the Arduino integrated development environment (IDE). A scaled-down prototype of the system was built and tested. Automation of a greenhouse brings about efficient data acquisition and control of the microclimatic parameters.

Vimal et.al.[5] Greenhouses are controlled area environment to grow plants. In order to achieve maximum plant growth, the continuous monitoring and controlling of environmental parameters such as temperature, humidity, soil moisture, light intensity, soil pH etc. are necessary for a greenhouse system. The main aim of this project is to design a simple, low cost, Arduino based system to monitor the values of environmental parameters and that are continuously updated and controlled in order to achieve optimum plant growth and yield. DHT11 sensor, Soil Moisture sensor, LDR sensor and pH sensor are the main sensors used in this project which give the exact value of temperature, humidity, water content, light intensity and soil pH respectively. All environmental parameters are sent to android mobile phone via offline and online. A GSM (Global System for Mobile communication) modem is used to send SMS (Short Message Service) which displays the present status of the environmental parameters. The SMS is sent to the user when the sensor value exceeds a defined level. All farmers can control their greenhouses from any place by knowing the status of their greenhouse parameters at any time and they can control actuators (cooling fan, exhaust fan, water pump, artificial light and motor pump) to adjust environmental parameters by sending SMS. Ethernet is also used to send the data parameters to mobile phone which eliminates the SMS charges. All environmental parameters are sent to server through Ethernet and stored in the database. So the user can monitor and control parameters through android mobile application.

SUMITet.al.[6] Using these collected greenhouse environmental data, indoor environments can be more effectively controlled, and monitoring crop itself can contribute to improve productivity and to prevent crops from damages by harmful sun ray. In addition, it will be possible for farmers to do control plant growth through closely studying relationship between indoor environmental information and monitored information on crop itself. It

is made possible to collect information and control effectively and automatically greenhouse in the site or from a remote place through GSM modem. System components are: temperature sensor, humidity sensor, leaf temperature sensor, leaf humidity sensor, Rain Sensor, Transistor switches, relay nodes for automatic control, and data server to store greenhouse information. The system is implemented using low power wireless components, and easy to install.

Diaaet.al. [7] In this paper, the Design had been aimed data acquisition in greenhouse for multiple sensors to use data for simulation or processing to achieve the better enhancement of growth in greenhouse, this data has effect on the climate of greenhouse. Graphical User Interfaces (GUI) had been used through LabVIEW, firmware of arduino as software and arduino board and sensors as hardware. by using arduino mega board provides multiple inputs analogs and I/O digitals to made read data sensor easy to take temperature, humidity, CO2 gas, also measuring the soil moisture that needed for irrigation plants and the intensity of lights that applied for greenhouse. These factors has the major effect on increase growth plants. Greenhouse environments monitoring present difference changes to parameters, the system for this purpose had been provided and given ability to control on climate of greenhouse.

Prathibaet.al. [8] In this paper 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. These two factors are crucial 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. Using the GSM module the farmer can check the temperature inside the polyhouse from a remote location and based on the preloaded temperature values the motors and fans provide sufficient cooling and humidity inside the polyhouse. For monitoring temperature inside the polyhouse LM35 temperature sensor is used because of its accuracy and fast transmission of data. SY-HS-220 humidity sensor is used for monitoring the humidity inside the polyhouse. These two sensors are integrated with the microcontroller through MCP3208Analog to digital converter. Whenever the temperature and humidity inside the polyhouse increases beyond 25°C, the motor and the fan are turned on automatically to cool the temperature, which are connected to the microcontroller by L293D.

Yang et.al.[9] Because the greenhouse control systems designed in the past are not adaptable in practice, a new greenhouse control system based on RS485 bus is realized in this paper. A new smart sensor block is developed in the system to acquire field environment factor, which can reduce complex routing and increase reliability of the whole system. The model of solar greenhouse is introduced and fuzzy control is adopted in control unit. Besides, a friendly human-computer interface is developed by LabVIEW.

Mirinejadet.al.[10] Environmental conditions have a significant effect on plant growth. All plants require certain conditions for their proper growth. Therefore, it is necessary to bring the environmental conditions under control in order to have those conditions as close to the ideal as possible. To create an optimal environment, the main climatic and environmental parameters such as temperature, humidity, ground water and the like need to be controlled. These parameters are nonlinear and extremely interrelated, rendering the problem of management of a greenhouse rather intractable to analyze and control through the classical control methods. An automated management of a greenhouse brings about the precise control needed to provide the most proper conditions of plant growth. In this paper, a greenhouse monitoring and control system based on the Supervisory Control and Data Acquisition (SCADA) tool like the LabVIEW is described. In order to fully automate the greenhouse climate control, a comprehensive supervisory system is designed and simulated to serve as a user-friendly interface with the operator.

3. METHODOLOGY

- The method we select to implement the project is by using Raspberry Pi as the main component and to display the values LabVIEW is being considered as it is easy to monitor than in the 7 segment monitor.
- First the values are taken from the sensors and controlled according to the optimum conditions.
- If the temperature and humidity are not at the optimum conditions the fan and humidifier will be on.
- If the pH is not at the optimum values to maintain the optimum values some chemicals are used to balance the conditions
- If the soil moisture is less the pump will be switched ON.
- If the light intensity is reduced other than the optimum the light will be switched ON.

The block diagram of the entire system that will be used for greenhouse

monitoring system through wireless protocol using labVIEW is given below.

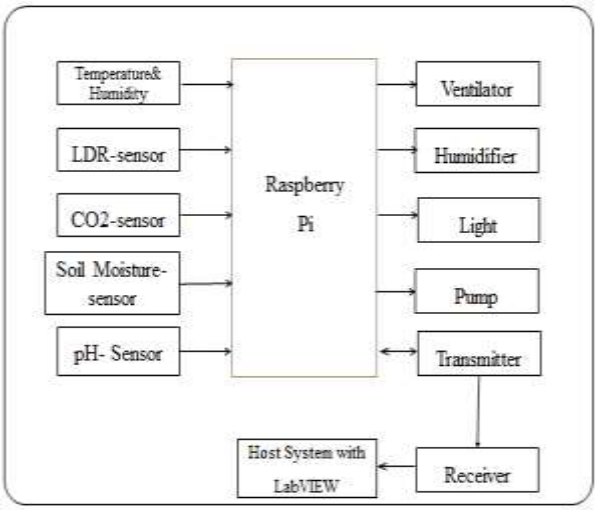

Fig 1 Block diagram

WORKING:

The sensors are connected to the Raspberry Pi with the respective pins. Once the Raspberry Pi is switched ON, it continuously accesses the data from the connected sensors i.e. Temperature&Humidity, LDR sensor, Co_2 sensor, Soil moisture sensor, pH sensor. The collected data is processed and checks the optimal conditions of all the received data, if all the collected data meets the optimal conditions then no action will be taken, if any of the sensor data doesnot meet the required optimal conditons counter actions will be taken for that specific sensor and make it optimal i.e. if the temperature is more than optimal the ventilator will turn ON, if light intensity is low then light is turned ON, if Humidity is more then de humidifier is turn ON, if the CO_2levels gets low then ventilator will be opened, if Soil Moisture is low then Pump will be ON, if the pH levels deflect then buffer solutions are to be mixed such that it could maintain the optimal pH levels(it is to be sone manually). All this data that is transmitted over internet from a Transmitter (NRF module) and the data received by a reciever (NRF module) where it is connected to a system for monitoring, the received data is being displayed in a GUI which is created using LabVIEW.

ALGORITHM:

Step 1: Start.

Step 2: Waiting for Wi-Fi.

Step 3: Initialization of sensors.

Step 4: Read the data from the sensors.

Step 5: If data is detected, Raspberry pi process the data.

Step 6: If received data reaches optimum conditions, again Raspberry pi reads the sensorsdata.

Step 7: If Temperature , CO2 and Humidity doesn’t reaches optimum condition then ventilator and humidifier are turned ON.

Step 8: If light reaches its optimal condition then LDR turns ON.

Step 9: If soil moisture reaches its optimal condition then Pump turns ON.

Step 10: If PH sensors reaches its optimal condition then buffer solutions are added to maintain the optimal.

Step 11: All the data transmitted from the Raspberry pi and received by the receiver connected to host system containing LabVIEW.

Step 12: Stop.

FLOWCHART:

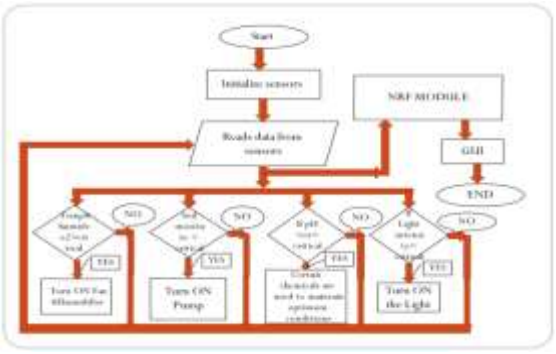

Fig 2 Flowchart

RESULTS:

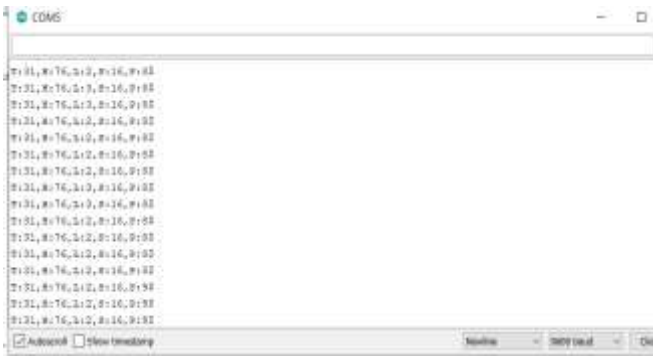

Fig 3 Simulated Output

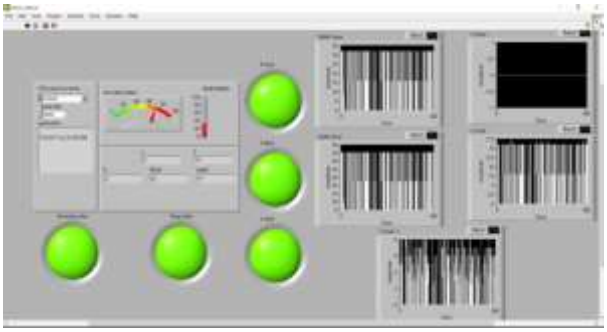

Fig 3LabVIEW Output

SCHEMATIC DESIGN:

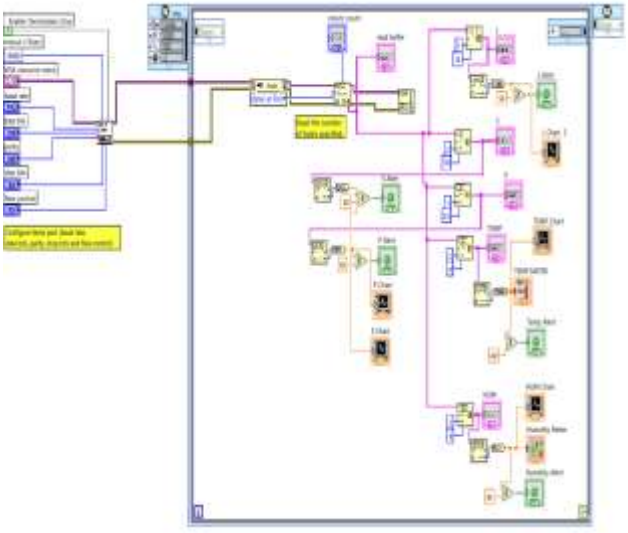

Fig 4 LabVIEW Schematic Design

CONCLUSION

In this project, monitoring of Greenhouse field was automated using Raspberry-Pi and LabVIEW which allows the users to set the conditions based on the crop growth in the greenhouse. The proposed automated system has been designed to monitor the following parameters temperature, light intensity, pH, soil moisture

and humidity.

The system also allows the user to control above mentioned parameters with in the specified range. The system reduces the water and power consumption upto 30%. The very specific data collection and storage of data by LabVIEW allows thorough analysis that can reveal even the most intricate trends in the plant growth, thus directing control process to improve the Greenhouse environment.

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