

“ENVIRONMENT CONTROLLING AND MONITORING OF GREENHOUSE USING WIRELESS SENSOR NETWORK (WSN)”

The main Objective of this paper to control and monitoring the greenhouse by using Wireless Sensor Network (WSN). Basically the greenhouse is used to improve the quality and quantity of plants. The micro-controller is used to sense and record the values such as temperature, humidity level, soil moisture, light generation and drainage process inside the greenhouse by actuating a cooler, fogger, dripper and lights, CO₂ for growth of plant. The basic purpose of this embedded system is, farmer can easily control the environment of greenhouse. Also the farmer can give the command to turn ON or OFF to the system and system inside devices which are installed in the greenhouse through the Wireless Sensor Network (WSN). A 12Volt fan is also installed and turn ON when the temperature is too high. Servo motors have been used to push the roof when there is rain detected. It also demonstrates the real time monitoring of parameters or values or environmental conditions of greenhouse with the help of a computer based GUI applications developed on Java platform. The fuzzy controller used to control the micro-climate of greenhouse.

Abstract:

Keywords: Greenhouse, Micro-controller, Wireless Sensor Network (WSN), Embedded System, GUI, Fuzzy Controller

I. INTRODUCTION

Now a day, there is strong virtue of latest technologies such as Wireless Sensor Network (WSN) technologies, smart sensors, micro-controllers are used in wide are such as engineering and industrial as well as agriculture applications. WSN technique is precisely control the environmental to achieved plant growth. Qualitatively to get higher productivity. Many controls can be achieved for greenhouse automation by fuzzy logic[1]. High demand of quality fruits, it is unsolvable problem faced by farmers now a day. Due to use of real time monitoring and controlling of greenhouse easier to solve this problem[2]. Automated greenhouse minimizes the human care needed for the plant by monitoring the greenhouse. The program functioning is: i) Push the roof by servo motor when rain is detected by rain sensor. ii) Activate the ventilation system when temperature sensor system detects temperature is too high[3]. A Java based GUI application is developed for computer which enhance the real time monitoring of greenhouse parameters using sensor node as well as remote control of application using actuators nodes[4]. Farmers will able to use WSN technology to monitor and control the growth of plants. With indoor environment therefore, monitoring and control the environmental values of plant which improve

productivity and also plants are prevent from damages by blight and harmful insects[5]. Actuators, sensors, control, wireless-communication, decision making is included in WSN technology. Actuators are used for control cooling, fogging etc. such necessary conditions under greenhouse[6]

II. METHODOLOGY

This System monitor and control the greenhouse environmental conditions such as temperature, humidity level, soil moisture, through the sensors by using WSN technology. The three main components of the greenhouse control are:

- Internal Climate

A). Control objectives required to system:

- The control of humidity and temperature in the greenhouse is the main task, hence to control influence of outside temperature and humidity and sun radiation.
- Ventilation process is basically to control unheated greenhouses.

i) During summer:

- High temperature can be reduced by ventilation process or electrical fans for maintaining desired environment or climate for plant.

-CO₂ is used to help the plant growth. If plant get sufficient solar radiation then there is no need to add CO₂.

ii) During winter:

-In Winter due to less solar radiation low temperature make on plant growth.

-By adding CO₂ Concentration when roof is closed, then help to rise the inside temperature of greenhouse.

B). Control parameters: in the greenhouse system temperature and humidity are two important parameters have to control efficiently.

i) Temperature control:

-Heating and cooling devices are basically used to control the greenhouse temperature. Heating can be achieved by heaters inside the greenhouse and cooling can be achieved by ventilation shading and evaporative cooling.

ii) Humidity control:

-Humidity can be controlled by fogging and sometimes ventilation when the greenhouse humidity is greater than required value.

A 12 Volt fan is also used to control the temperature. By making fan on high temperature can be goes down.

Standard servo motor can rotate approximately 180° (90° in each direction). It is used to push the roof to the max distance. The servo will remain until the rain has stopped and the rain detection is recognized by rain sensor is used in system.

C). Micro-controller: the controller makes communication with the sensors in real time for controlling over the light, aeration, drainage process more efficiently inside the greenhouse by actuating a coolers, heaters, lights, foggers and drippers for making the necessary conditions to plant growth.

D). Wireless Sensor Network (WSN) Technology: With all sensors which are installed in the greenhouse are connected with wireless network. The values are detected by sensors are given to the controller with the help of wireless network and then controller works according to its control program.

III. PROPOSED SYSTEM

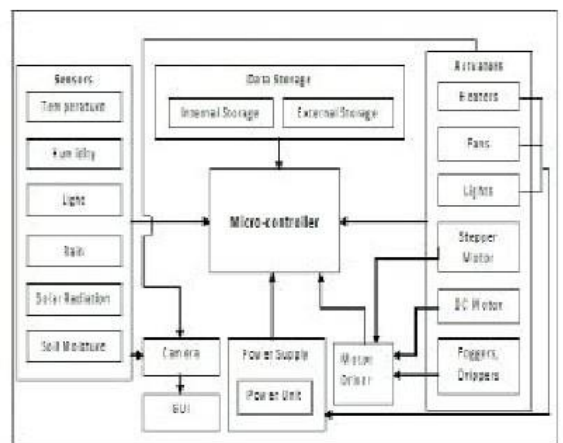
Proposed system designed to help the farmer for improve the productivity and quality of plant.

Following are the parameters which are used in the system:

i). Sensors: numbers of sensors are used to collect all information related to the environmental conditions

required to plant growth in the greenhouse system. The following actuators are used:

- Temperature sensor; measuring temperature inside the greenhouse.
- Humidity sensor; measuring humidity inside the greenhouse.
- Light sensor; measuring light quantity.
- Rain detection sensor; detecting rain.
- Solar radiation detection sensor; measuring solar radiation.
- Soil Moisture sensor; detecting if soil needs water or not.



Architecture of proposed system

ii). Actuators: numbers of actuators are used to modify and maintain the greenhouse environmental conditions. The following actuators are used:

- Lighting unit; 220V AC blue lights.
- Heating unit; 220V AC heaters.
- Cooling unit; 12V fans with DC motor.
- Moistening unit; DC motors for moistening ducts and valves.
- Ventilation unit; stepper motor to adjust window side ventilation, DC motor to adjust roof ventilation.
- Foggy unit; supplying water in pipes with drippers.

iii). Power supply: power supply is given to the actuators used in the greenhouse such as:

- 220V AC source; for heaters and lights.
- 12V DC source; for motors.
- 5V DC source; for controller.
- Motor driver is used to handle the DC motor and stepper motor.

iv). Data storage: the data recognized by the devices which are installed in the greenhouse is stored. The storage implementation is done by following ways:

- Internal storage; 512KB to store the program.

- External storage; 4GB to store all updating of parameters and its database.

v). Micro-controller: micro-controller is used to take input as measurement of sensors and do activity according to the control program. For example, micro-controller turns ON-OFF of fans when temperature is detected too high. The farmer can remotely monitor the control of parameters using PC or smart phone.

v). GUI: with the help of GUI application farmer gets idea about everything in the greenhouse such as temperature, humidity level etc. And if whenever the greenhouse climate gets changed then farmer can give the commands to the installed devices such as ON-OFF with his PC or smart phone which is connected with the cameras which are set in the greenhouse.

III. RELATED WORK

Control the greenhouse with the WSN through the micro-controller based monitoring and control system has to measure several parameters in the greenhouse. Generate required signals to control the environmental parameters with respect to plant growth with the help of sensors, actuators. Farmer can operate or give the commands to system and system variables with ON-OFF operation[1].

The system provides real time monitoring and controlling of the greenhouse, thus the productivity and quality of the plant/fruits can be maintained or improved which help to farmers[2].

The use of this system is to minimize the human work and human care for plants by automating the greenhouse as well as the maintenance of temperature and prevention of plant from rain[3].

With the help of GUI (computer based GUI application or smart phone application), farmer can monitor or operate the working of all devices which are installed in the greenhouse. Thus farmer need not to go in greenhouse and check for plants growth and all required conditions for plant growth, this problem is solved by GUI application with live record captured by camera which settled in the greenhouse[4].

It is possible for farmer to use WSN technology to monitor and control plant growth through closely. Therefore, improvement in productivity, quality, plant growth and prevent plants from damages by blight and harmful insects[5].

Controller communicates with all the sensors which

are installed in the greenhouse to control the light, drainage and aeration inside the greenhouse by the use of actuators for the necessary condition of plant growth[6].

IV. CONCLUSION

This paper describes the automation of the greenhouse using WSN technology with the use of micro-controller based controlling and monitoring farmer can easily measure the all required parameters for the greenhouse. Farmer can easily get the information about the plant as well as the values of parameters which are required for plant growth. Thus he/she can give the command to controller to control over the parameters which are required for plant growth. Therefore, productivity and quality of plant or product can be maintained easily as well as efficiently. Also the cost cultivation which is increased due to various diseases and pests which are comes due to change in overall environment that means change in humidity and other parameters are overcome by this system. To improve the productivity and quality with fullfillments of customers satisfaction is the aim of this system which make farmer or user to encourage and build wide area of greenhouses using wireless sensor network.

V. ADVANTAGES

System having following advantages such as:

- Easy access of wireless sensor network operations.
- Flexible inputs/output interface.
- Reliable
- Live record of plant growth.
- On detection of required things for plant growth can easily supply by farmer.
- Farmer can remotely operate or monitor his greenhouse.

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