WSN BASED GREENHOUSE ENVIRONMENT MONITOR AND CONTROL

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KEYWORDS:
- Greenhouse monitor; leaf sensor; dew-condensation prevention; wireless sensor network; arduino.

INTRODUCTION:
As we can observe the population rate is increasing day by day across the world. This leads to insufficient access to the basic amenities like food. So, to enhance food productivity as well as supply sufficient and good quality of food to all, the greenhouse came into existence. Thus, it is the reason to choose this as our project. Greenhouses are controlled area-environment to grow plants. Greenhouse protects crops from too much heat or cold, shields plant from dust storms and blizzards and help to keep out pests. It is a structural building with different types of covering materials such as a glass or plastic roof and walls.

Greenhouse environment monitoring and control is essential to improve productivity through prevention of diseases in the crops. The dew condensation phenomenon occurs in the greenhouse when the dew point temperature is higher than the temperature of crops, and it is deeply related to relative humidity. Especially, too close to sunrise with the high humidity at daybreak or when humidity inside a greenhouse is too high, the temperature inside a greenhouse gets to rise rapidly but the temperatures of crops rise slowly. Thus the huge difference between the environmental temperature and the crop temperature causes the dew condensation phenomenon to occur.

The system is composed of sensor nodes for collecting data, base nodes for processing collected data, relay nodes for driving devices for adjusting the environment inside greenhouse and an environment server for data storage and processing. Using the Barenbrug formula for calculating the dew point on the leaves, this system is realized to prevent dew condensation phenomena on the crop’s surface acting as an important element for prevention of diseases infections.

OBJECTIVES:
Dew condensation on the leaf surface of greenhouse crops can promote diseases caused by fungus and bacteria, affecting the growth of the crops. As an impact of diseases such as Leveillula taurica Arnaud, the production gets reduced to a great extent. So, to implement we consider following in this project:
1. To implement a system that can understand the greenhouse environment and the state of crops by using sensors.
2. To optimize crop growth conditions with emphasis on the dew point condition.
3. To improve the productivity of crops through prevention of diseases in the crops.
4. To provide security for greenhouse.
5. To provide drip irrigation.

**METHODOLOGY:**

![Block Diagram]

Above figure shows block diagram which consists of four main units: monitor, processing, control and intimation. The monitor unit has various sensors such as soil moisture, rain, humidity, IR, gas, temperature, etc. The processing unit has Arduino mega 2560 and control unit has corresponding controlling parameters such as heater, fan blower, cooling fan, etc. Lastly, for informing the owner about the happenings of greenhouse system by the messages via GSM modem constitutes intimation unit. At the maximum, ten values of temperature and humidity parameters are taken and calibrated to have an average reading so as to avoid error in maintaining the inside environment. This model continuously monitors all parameters of greenhouse to identify if any change occurs. And the controlling unit gets activated to eliminate the identified changes. The program is dumped into the Arduino board through its software act as a processing unit, gets input from all sensors connected, processes the values and activates the corresponding control unit to have optimum value of all parameters that are being measured inside the system. Here, main motive is to avoid dew condensation as it leaves scars on leaf surface and damages it. Temperature and humidity is taken into consideration according to which dew point is set. This dew point should be maintained by either heater or cooling fan of the controlling unit. If the dew
point value is more than the surrounding temperature (T2) then cooling fan will be switched on, so that it should not touch the dew point. On the other hand, if that value is less than T2 then it is maintained by switching the heater on. These conditions will help in growing plants at an optimum level.

RESULTS AND CONCLUSIONS:

As soon as the power is plugged in, the processor is logic high and thus starts all devices for few seconds and returns to initial stage displaying name of the project as per written in the program. The normal working of IR sensor is indicated by green LED. It monitors continuously till it detects intruder. When intruder tries to enter inside the greenhouse, LED glows off while making a buzzer sound to alert nearby users and an intimate message is sent to owner. Harmful gases if present are detected by the gas sensor, and then exhaust fan starts to prevent the damage inside greenhouse. At the same time alert message is given to the owner and buzzer is activated. When the rain droplet comes in contact with rain sensor, detection is done and in order to control the environmental parameter window opens.

We designed and implemented a system that can understand the greenhouse environment and the state of crops by using sensors and optimize crop growth conditions with emphasis on the dew point condition. An automatic dew condensation control system combined with a WSN was realized, which utilizes the dew point condition to prevent the dew condensation phenomenon on the leaf surfaces of crops that is believed to be decisive in the outbreak of crop diseases. Also, a model similar to an actual greenhouse environment was made to verify the performance of the system presented and the model was operated and monitored by applying the automatic dew condensation control system. It can also cope with exceptional situations by providing the greenhouse environment and information about a device’s operating state to users every certain time.

FUTURE WORK:

In future research has to be done to solve the optimal sensor deployment in a real greenhouse for the automatic dew condensation control system. To solve this, more data has to be gathered about the real conditions and refine this system. Additionally more parameters can be monitored like PH level of soil, pressure and water level and try to draw all these parameters using graphs i.e. Graphical User Interfacing (GUI) on computer. In future food nutrients to the plant and crop by air mixed with very less water, with better monitoring and processing can be applied.

Additionally power can be supplied to the system by using solar panel i.e. by using “An intelligent solar energy harvesting system for WSN”. In this, two power supplies are used one from sun i.e. solar energy and another from lithium battery in the absence of sunlight.

In future, TEAM VIEWER software can be used so that user can view the required data anywhere from the world on his android mobile phone as the devices are connected via internet.