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GREEN HOUSE MANAGEMENT USING SELFPOWERED WIRELESS SENSOR NETWORK

K.M.ISWARYA[1] ,S.KALPANA[2], B.MEENAKSHI[3], C.NIRMALA DEVI[4]
Department of Electrical and Electronics Engineering
Kalasalingam Institute Of Technology, Krishnakovil

ABSTRACT

The main objective of this paper is to develop a efficient green house management system using Wireless Sensor Network(WSN). The system structure is simple, which saves the man power and material resources. The green house environment factors such as temperature, humidity, and light is monitored and the data is collected from the sensors. With the help of that information, at regular time intervals, climatic conditions inside the greenhouse can be controlled using automated actuation devices to increase the overall productivity. The control actions can be done by using fans, ventilators, water spray, LED…etc. All the sensor nodes in the field form a wireless sensor network. All the nodes are working cooperatively. The sensors will send the data to the microcontroller. According to this, the controller will perform the control actions needed. The power supply to the sensor node is made as self powered by using solar panel. The energy collected by the solar cells is given to the batteries and this is meant for supplying power to node. Green house Management is an advanced facility available by which the atmospheric parameters are controlled to increase the plant growth and to avoid the effects of seasonal changes on the plants.

***Index terms:- Actuators,* LCD display, Microcontroller, Sensors, Solar power supply , Relay, WSN**

I INTRODUCTION

Wireless sensor network (WSNs) are tremendously being used in different to gather information or detect special events for environmental applications. Wireless technology using various sensors for exactitude agriculture has become a popular research with the greenhouse effect. A WSN is a comprised of radio frequency(RF) transceivers, sensors, microcontrollers and power sources. In order to protect the plant from changes in atmospheric conditions has the major role in this paper. A huge loss occurs in agriculture at every year due to damage of crops by sensor various disease caused by improper environment. Population rate and improved standard of living are increasing the demand of agriculture production. For that, Green house has the modern trends that can control the climate to increase the growth and quality of plants. Green house system playing a more significant role in the production out of season fruits, flowers and vegetables. The need of green house climatic control is to get the best climatic conditions (ambient temperature, humidity and light) for increasing crop growth and quality. The various kinds of factors in the green house needs automatic monitoring and controlling, information process so that The green house monitoring is a very complex system.

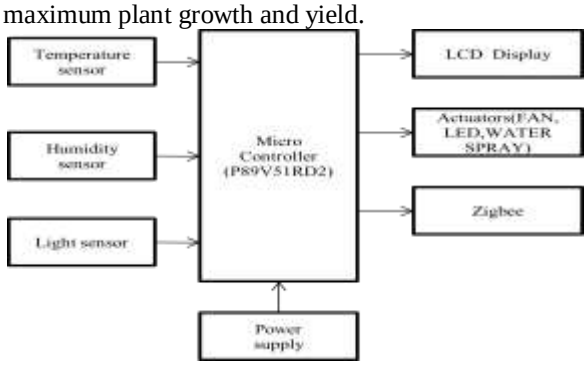
The factors such temperature, humidity, light, soil moisture are affect the crops growth. These factors are continuously monitored by flexible sensors. The sensors collect the signals from inside the green house. The collected date is send to microcontroller and it processes the required control actions. Wireless sensor network is

an effective method to avoid the complexity of cables, interference and improve efficiency. The WSN is built of nodes from a few to several hundreds or even thousands, where each node is connected to one or more sensors. Here the green house management is implemented with WSN .It consists of two modules such transceiver and receiver which connected with microcontroller and PC.

The factors such temperature, humidity, light are displayed in LCD display. Solar panel is implemented to avoid the electricity problem and add energy itself. This design accessible has the advantage of Zigbee technology.

II SYSTEM ARCHITECTURE

The proposed hardware of this system includes microcontroller, Zigbee, temperature, humidity and light sensors, relay and actuators. Actuator such as ventilation fan, water sprayer and LED is used. Our proposed system aim is to design a microcontroller-based circuit to monitor and control the values of temperature, humidity and light of the natural environment that are continuously modified and it is get controlled in order optimize them to achieve maximum plant growth and yield.



A POWER SUPPLY MODULE

In order to solve the trouble of energy supply of sensors nodes, we adopted solar energy supply system. The solar cell or photovoltaic cell (PV) is a device that converts light into electric current using the photovoltaic effect. The energy is stored in the battery. It provides the energy at night time or cloudy seasons. The battery is adopted to supply power in the long absence of light or in case of emergency for the system. Solar power does not lead to any harmful emission during operations. It provide the continuous availability of energy.

B MICROCONTROLLER

The microcontroller is the heart of the proposed embedded system. It constantly monitors the digitized parameters of the various sensors and verifies them with the predefined threshold values and checks if any corrective action is to be taken for the condition at that instant of time. In case such a situation arises, it activates the actuators to perform a controlled operation

C ACTUATORS

An array of actuators can be used in the system such as relays, contactors, and change over switches etc. They are used to turn on Ac devices such as motors. Coolers, pumps, fogging machines, sprayers. For the purpose of demonstration relays have been used to drive AC bulbs to simulate actuators and AC devices. A complete working system can be realized by simply replacing these simulation devices by the actual devices.

D DISPLAY UNIT

A Liquid Crystal Display is used to indicate the present status of parameters locally. The information displayed is continuously updated in REAL-TIME for monitoring any changes in the parameters.

E TEMPERATURE SENSOR MODULE

The LM35 is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature. The sensor circuit is sealed and not subject to oxidation, etc. The LM35 generates a higher output voltage than thermocouples and may not require that the output voltage be amplified. It has an output voltage that is proportional to the Celsius temperature. The LM35 does not require any external calibration or trimming and maintains an accuracy and temperature. The device is used with single power supplies, or with plus and minus supplies. It is suitable for remote applications.

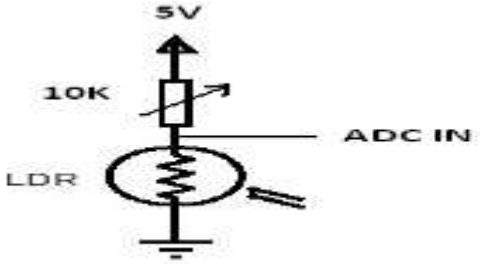
F HUMIDITY SENSOR

Humidity sensor can be used not only to measure the humidity in an atmosphere but also to automatically control air conditioners for humidity adjustment. A capacitive humidity sensor detects humidity based on a change of capacitance between two detection electrodes provided on semiconductor substrate. The capacitance type humidity sensor detects humidity by measuring the change in the electrostatic capacity of an element corresponding to the ambient humidity. A resistive humidity sensor detects relative humidity by measuring the change in the resistance of an element corresponding to the ambient humidity. A humidity sensor has a sensing portion which usually comprises a humidity-sensitive resistor composed of an organic polymer.

G LIGHT SENSOR

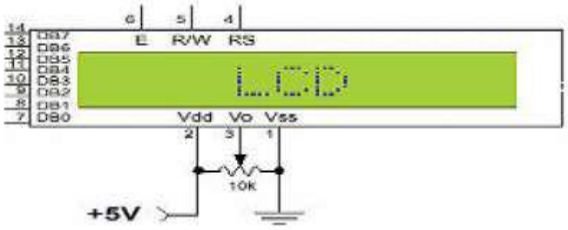
A light sensor generates an output signal indicating the intensity of light by measuring the radiant energy that exists in a very narrow range of frequencies basically called “light”, and which ranges in frequency from “infra-red” to “visible” up to “ultraviolet” light spectrum . It is a passive devices that convert this “light energy” whether visible or in the infra-red parts of the spectrum into an electrical signal output. Light sensor are more commonly

known as "photoelectric devices" or" photo sensors" because the convert light energy(photons) into electricity(electrons).



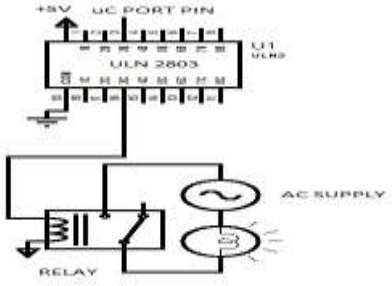
H LIQUID CRYSTAL DISPLAY

A liquid-crystal display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular to each other. Without the liquid crystals between them, light passing through one would be blocked by the other. The liquid crystal twists the polarization of light entering one filter to allow it to pass through the other. Many microcontroller devices use 'smart LCD' displays to output visual information.



I . RELAY

A relay is an electrical switch that opens and closes under the control of another electrical circuit. In the original form, the switch is operated by an electromagnet to open or close one or many sets of contacts. Because a relay is able to control an output circuit of higher power than the input circuit, it can consider to be, in a broad sense, a form of an electrical amplifier



J .ZIGBEE TECHNOLOGY

Zigbee is a radio frequency (RF) communications standard based on IEEE 802.15.4. Zigbee is new short range wireless communication technology, representing a WSN which is highly reliable, secure, low data rate, low power consumption, low cost and fast reaction. Zigbee standardizes both the network and the application layer. The network layer in the charge of organizing and providing rooting over a multi-hop network specifying different network technologies: star, tree, peer-to-peer mesh. Mostly star and mesh topologies are used frequently. Each has its own advantages and disadvantages. The application layer provides a frame work for distributed application development and communication. It is widely used from in home building control, automation, security, consumer electronics personal computer peripherals, medical monitoring and toys. These applications require a technology that offers long battery life reliability, automatic or semiautomatic installations, the ability to add or remove network nodes.

II . FUTURE SCOPE

The performance of the system can be further improved in terms of the operating speed, memory capacity , instruction cycles period of the microcontroller by using other controllers such as AVRs and PICs. The number of channels can be increased to interface more number of sensors which possible by using advanced versions of microcontroller. This system can be connected to communication devices such as modems, cellular phones or satellite terminal to enable the remote collection of recorded data or alarming of certain parameters. The device can be made to perform better by providing the power supply with the help of battery source which can be rechargeable or non-rechargeable, to reduce the requirement of main AC power. Time bound administration of fertilizers, insecticides and pesticides can be introduced. A multi-controlled system can be developed that will enable a master controller along with its slave controllers to automate multiple greenhouse simultaneously.

III . CONCLUSION

A step-by-step approach is designing the microcontroller based system for measurement and control of the four essential parameters for plant growth, i.e. temperature, humidity, soli moisture and light intensity has been followed. The results obtained from the measurement have shown that the system performance is quite reliable and accurate. The system has successfully overcome quite a few shortcoming of the existing system by reducing the power consumption, maintenance and complexity, at the

same time providing a flexible and precise from of maintaining the environment. The continuously decreasing costs of hardware and software, the wider acceptance of electronics systems in agriculture, and an emerging agriculture control system industry in several areas of agriculture production, will result in reliable control systems that will address several aspects of quality and quantity of production. Further improvements will be made as less expensive and more reliable sensors are developed for use in agriculture production. Although the enhancements mentioned in the previous chapter may such systems have been independently developed, or are at least tested at a prototype level .Also, integration of all these technologies is not a intimidating task and can be successfully carried out.

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