A Smart Green House Monitoring and Control Systems

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Abstract - **Monitoring and control of greenhouse environment play an important role in greenhouse production and management. To monitor the greenhouse environment parameters effectively, it is necessary to design a monitor and control system. The objective of this project is to design a simple, easy to install, microcontroller-based circuit to monitor and control the values of temperature, soil moisture and sunlight of the natural environment that are continuously modified and controlled in order optimize them to achieve maximum plant growth and yield. The controller used is a low power, cost efficient arduino uno. It communicates with the various sensor modules in real-time in order to control the light, aeration and drainage process efficiently inside a greenhouse by actuating a cooler, fogger, dripper and lights respectively according to the necessary condition of the crops. Also, the use of easily available components reduces the manufacturing and maintenance costs. The design is quite flexible as the software can be changed any time. It can thus be tailor-made to the specific requirements of the user. This makes the proposed system to be an economical, portable and a low maintenance solution for greenhouse applications, especially in rural areas and for small scale agriculturists**

keywords - **Sensors, Automations, Greenhouse, Microcontrollers, Aurdino**

I. INTODUCTION

A greenhouse (also called a glasshouse) is a structure with walls and roof made mainly of transparent material , such as glass , in which plants requiring regulated climatic conditions are grown . A more scientific definition is " a covered structure that protects the plants from extensive external climate conditions and diseases , creates optimal growth microenvironment , and offers a flexible solution for sustainable and efficient year-round cultivation .

" A modern greenhouse operates as a system , therefore it is also referred to as controlled environment agriculture (CEA) , controlled environment plant production system (CEPPS) , or phytomation system.Many commercial glass greenhouses or hothouses are high tech production facilities for vegetables or flowers . The glass greenhouses are filled with equipment including screening installations , heating , cooling , lighting , and may be controlled by a computer to optimize conditions for plant growth . Different techniques are then used to evaluate optimality-degrees and comfort ratio of greenhouse micro-climate (i.e., air temperature , relative humidity and vapour pressure deficit) in order to reduce production risk prior to cultivation of a specific crop. Greenhouses allow for greater control over the growing environment of plants . Depending upon the technical specification of a greenhouse , key factors which may be controlled include temperature , levels of light and shade , irrigation , fertilizer application , and atmospheric humidity

. Greenhouses may be used to overcome shortcomings in the growing qualities of a piece of land , such as a short growing season or poorlight levels , and they can thereby improve food production in marginal environments . Greenhouses in hot , dry climates used specifically to provide shade are sometimes called "shadehouses".

Greenhouses are often used for growing flowers , vegetables , fruits , and transplants . Special greenhouse varieties of certain crops , such as tomatoes , are generally used for commercial production . Many vegetables and flowers can be grown in greenhouses in late winter and early spring , and then transplanted outside as the weather warms .The relatively closed environment of a greenhouse has its own unique management requirements , compared with outdoor production .Pests and diseases , and extremes of heat and humidity , have to be controlled , and irrigation is necessary to provide water . Most greenhouses use sprinklers or drip lines . Significant inputs of heat and light may be required

, particularly with winter production warm weather vegetables .

II. LITERATURE SURVEY

1. The warmer temperature in a greenhouse occur because incident solar radiation passes through the transparent roof and walls and is absorbed by the floor , earth , and contents , which become warmer . As the structure is not open to the atmosphere , the warmed air cannot escape via convection , so the temperature inside the greenhouse rises . This differs from the earth-oriented theory known as the "greenhouse effect" .

2. Quantitative studies suggest that the effect of infrared radiative cooling is not negligibly small , and may have economic implications in a heated greenhouse . Analysis of issues of near-infrared radiation in a greenhouse with screens of a high coefficient of reflection concluded that installation of such screens reduced heat demand by about 8% , and application of dyes to transparent surfaces was suggested . Composite less-reflective glass , or less effective but cheaper anti-reflective coated simple glass , also produced savings.

III. PROPOSED WORK

In today's greenhouses , many parameter measurements are required to monitor and control for the good quality and productivity of plants . But to get the desired results there are some very important factors which come into play like Temperature , Light and Water , which are necessary for a better plant growth . Keeping these parameters in mind we have built an Automatic Green House Controlling and Monitoring System using Arduino . This system is very efficient for growing good quality plants . The other important part of this project is that it is fully automatic . Arduino automatically turns on and turns off the appliances .The proposed system is an embedded system which will closely monitor and control the microclimatic parameters of a greenhouse on a regular basis round the clock for cultivation of crops or specific plant species which could maximize their production over the whole crop growth season and to eliminate the difficulties involved in the system by reducing human intervention to the best possible extent . The system comprises of sensors , Analog to Digital Converter , microcontroller and loads . When any of the above mentioned climatic parameters cross a safety threshold which has to be maintained to protect the crops , the sensors sense the change and the microcontroller reads this from the data at its input ports after being converted to a digital form by the ADC . The microcontroller then performs the needed actions by employing relays until the strayed-out parameter has been brought back to its optimum level . Since a microcontroller is used as the heart of the system , it makes the set-up low-cost and effective nevertheless . Thus , this system eliminates the drawbacks of the existing set-ups and is designed as an easy to maintain , flexible and low cost solution .

IV. BLOCK DIAGRAM

V.BLOCK DIAGRAM DESCRIPTION: ARDUINO

The Arduino Uno is a microcontroller board based on the ATmega 328(datasheet) . It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator , a USB connection , a power jack , an ICSP header , and a reset button . It contains everything needed to support the microcontroller ; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started .

LDR

A light sensor , as its name suggests , is a device that is used to detect light . A photocell or photo resistor for example , is a small sensor that changes its resistance when light shines on it ; they are used in many consumer products to determine the intensity of light Operating temperature : - 20° C to 75° C .
Wavelength Measurement Range : 400nm to 1100nm .

SOIL MOISTURE SENSOR:

- Soil moisture sensor measure the water content in soil .

- This basic cheap soil moisture sensor consists of two probes (the metal rods) held apart at a fixed distance by some insulating materials.

VI. WORKING

LM35 Temperature Sensor: Description:

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling. The LM35 device does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full −55°C to 150°C temperature range. Lower cost is assured by trimming and calibration at the wafer level. The low-output impedance, linear output, and precise inherent calibration of the LM35 device makes interfacing to readout or control circuitry especially easy. The device is used with single power supplies, or with plus and minus supplies. As the LM35 device draws only 60 µA from the supply, it has very low self-heating of less than 0.1°C in still air.

Light dependent sensor: Description:

A photoresistor decreases with increasing incident light intensity ; in other words , it exhibits photoconductivity . A photoresistor can be applied in light-sensitive detector circuits , and light-activated and dark-activated switching circuits .A photoresistor is made of a high resistance semiconductor . In the dark, a photoresistor can have a resistance as high as several megohms (MΩ), while in the light , a photoresistor can have a resistance as low as a few hundred ohms . If incident light on a photoresistor exceeds a certain frequency , photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band .The resulting free electrons (and their hole partners) conduct electricity, thereby lowering resistance . The resistance range and sensitivity of a photoresistor can substantially differ among dissimilar devices . Moreover, unique photoresistors may react substantially differently to photons within certain wavelength bands .

Soil Moisture Sensor

Description

Soil moisture sensors measure the volumetric water content in soil . Since the direct gravimetric measurement of free soil moisture requires removing , drying , and weighting of a sample , soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil , such as electrical resistance , dielectric constant , or interaction with neutrons , as a proxy for the moisture content . The relation between the measured property and soil moisture must be calibrated and may vary depending on environmental factors such as soil type , temperature , or electric conductivity. used for remote sensing in hydrology and agriculture . Portable probe instruments can be used by farmers or gardeners . Soil moisture sensors typically refer to sensors that estimate volumetric water content . Another class of sensors measure another property of moisture in soils called water potential ; these sensors are usually referred to as soil water potential sensors and include tensiometers and gypsum blocks.

VII. HARDWARE RESULT

VIII.CONCLUSION AND FUTURE WORK

A step – by –step approach in designing the microcontroller based system for measurement and control of the four essential parameters for plant growth , i.e . temperature, humidity , soil 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 shortcomings of the existing systems by reducing the power consumption ,maintenance and complexity ,at the same time providing a flexible and precise form of maintaining the environment. The continuously decreasing costs of hardware and software ,the wider acceptance of electronic systems in agriculture ,and an emerging agricultural control system industries in several areas of agricultural production ,will result in reliable control systems that will address several aspect of quality and quantity of production.

Further improvements will be made as less expensive and more reliable sensors are developed for use in agricultural production .Although the enhancements mentioned in the previous chapter may seem far in the future ,the required technology and components are available ,many such system have been independently developed , or are at least tested at the prototype level.

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