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Low cost Automation in Polyhouse

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Abstract: *Agriculture is the backbone of our country. The available management is not sufficient to that of requirement. Today the farmer themselves manages all the things which crop requires, but every person do not have the exact knowledge of the quantity and the time to apply to the crop. So here we have developed the system that will manage the temperature and intensity of Pesticides for the crops using the Micro-Controller, Every seeds manufacturing company as well as regional agricultural colleges provide the yearly scheduled for the crop. Our system will take this as the input through the program and then it will maintain temperature and intensity of pesticides in poly-house. We can achieve desire results with the help of Micro-Controller. Using Micro-Controller, we want to develop an automated continuous process system for maintaining the house. Though the process seems to be simple but degree of automation is higher for proper operation of a system. In this journal, we are discussing how we are going to develop this system, what is the basic theme of this journal? How our ideas will be applicable to the theme. We have designed a control system. We are detailing areas which are more important to instrumentation and control engineer. The purpose of the journal is to grow a crop in any climatic conditions at any time. Proper design, selection, construction and management of the poly-house and upgrading construction of poly-house using sensors will give effect to house.*

Keywords: *Temperature control, Intensity of Pesticides, Micro-Controller, Poly-house*

I. Introduction

Greenhouses are a great way to make plants available all year round, however their effectiveness depends on the weather conditions which vary constantly. Although we are able to predict the weather to a high degree, the predictions are not always 100% accurate and so planning ahead would not help all of the time. Some of the problems that can occur are frost, condensation and overheating which can lead to damage the plants.

Environmental factors on which life and quality of flower depends.

- Temperature (Day: 18-28 and night: 15-18 C)
- Light (Photoperiod over 12 hours and intensity: 6000-8000 foot candles)
- Relative humidity (50-60 %)
- Aeration (Good in air and soil)

The automated greenhouse in this paper is meant for domestic use. This means that the greenhouse will be somewhat small, about 150cmx100cmx100cm. If it was made to be bigger, more components would be needed in the greenhouse in order to obtain the desired climate.

II. Controlling Parameters

2.1 Temperature

Temperature sensing can be accomplished by two different methods, either with contact or non-contact. Contact temperature sensors require physical contact with the substance or object that is being sensed. This type of sensor can be used on solids, liquids and gases. Non-contact type of temperature sensors detects the emitted infrared energy from an object or substance and can be used on solids and liquids. The focus will therefore be put on contact temperature sensors seeing as non-contact temperature sensors cannot be used on gases. The most common contact temperature sensors, such as thermocouples, use either voltage signals or resistance values to determine the temperature.A thermocouple uses voltage signals to measure the temperature. It consists of two junctions of dissimilar metal wires. The temperature is measured at the junction where the wires are welded. A voltage signal is generated when the junction experiences a temperature change. The temperature can then be calculated using thermocouple reference tables to interpret the voltage. Thermocouples can determine temperatures ranging from below −200°C to about 2000°C, making it the sensor with the widest range of temperatures. A thermistor is a thermally sensitive resistor that uses resistance values to determine the temperature. It is made of a semiconductor and changes its physical resistance when exposed to temperature changes. The price of a thermistor is relatively low and the accuracy is high within its operating range. Thermistors generally have a NTC (Negative Temperature Co-efficient), which means that it decreases its

resistance with an increased temperature. They can, however, also have a PTC (Positive Temperature Co-efficient). Due to the fact that thermocouples have a wide range of temperature, they are well suited for both high and low temperatures as well as highly fluctuating temperatures. Thermistors have a much smaller range of temperatures than thermocouples. They are on the other hand highly sensitive, which gives a high accuracy.

2.2 Content of pesticides

During preparation and application of the pesticides, it may leak into the surface water. There are various rules for preparation and cleaning the spraying equipment. Remains of pesticides should not be discharged in the sewer or the ditch, but saved until the next spraying. When filling the spraying tank, the pesticides should be takenfirst and then the water. It often happens that foam develops, runs out of the tank. It is better to make the solution in a half-filled tank, or prepare a stock solution and add this to the water and mix it.In water-collection areas and their immediate surroundings the rules for the application of certain pesticides are stricter. The method of application affects the emission to air, water and soil. The Research Station carries out research into how effectively pesticides can be used and how the emission to the soil can be reduced. The application equipment should be properly adjusted, so that unnecessary use of pesticides is prevented. For High Volume equipment testing is obligatory for field sprays. Such a test will also be implemented for glasshouse horticulture. Important points to check up on are the right nozzles (no wear; correct emission) and pressure. In addition to the effect of the equipment the density of the crop is important. The denser the crop less compound will end up on the ground. The deposition on glasshouse roof and walls is minor when compared to that on the ground. With application of an LVM (Low Volume Mist) more compounds reaches the ground than with spraying. The small droplets from the LVM (Low Volume Mist) combined with the air movement result in a less 'filtering' effect of the crop and more compounds reach the soil.In the application technology the following classification are made in Low Volume techniques such as

- LVM(Low Volume Mist)
- Fog
- Spray master
- Electrostatic spraying

1. Design Approach

ArduinoMicro-controllers were chosen due to familiarity with the C-language, and the wide variety and availability of peripheral devices. By having access to components in a timely manner the work schedule set out in the proposal was adhered. This left adequate time to react to challenges and make changes to the design while still meeting the journal deadline. To allow for easier development of the journal among group members a modular design approach was chosen. The journal was broken down into monitoring system & control system.

2. System Overview

This journal utilizes Arduino microcontrollers in a master configuration to obtain sensor readings and operate the greenhouse temperature controls. For the master controller an Arduino UNO R3 was chosen which is responsible for collecting and transmitting data. This includes temperature, humidity and light intensity readings as well as receiving and relaying control signal input by the user to the motor controller. The controller is also connected to an LCD screen which displays the readings from the monitoring system locally.

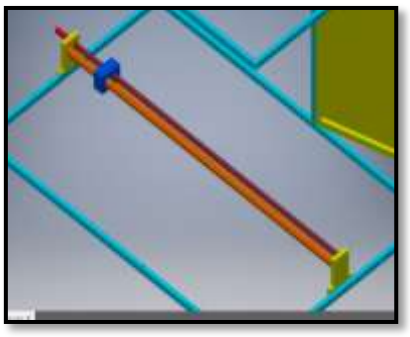

Fig.1

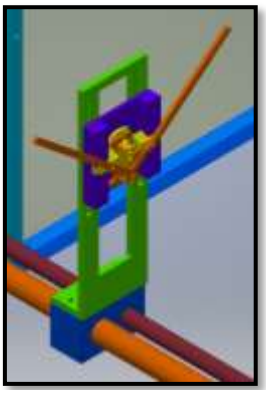

Fig.2

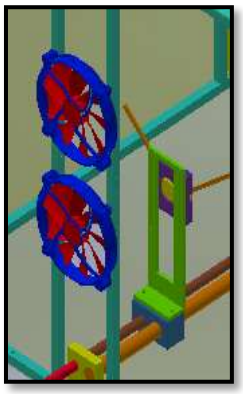

Fig.3

3. Monitoring System

The main purpose of the monitoring system is to obtain temperature readings from the greenhouse. Additionally the system has been expanded to include humidity and light intensity monitoring as desired parameters. These parameters are feed back to control system to allow automated control. Currently the control system only has the ability to control temperature due to the limitations of the existing hardware in the greenhouse, but in future projects automated humidity and lighting control could be readily implemented. The design components of the monitoring system are broken down into two main sections: hardware and software.

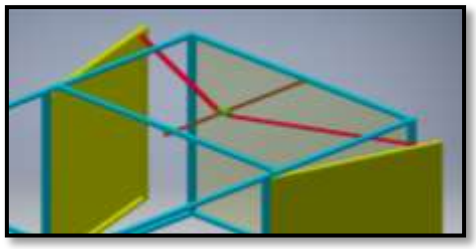

Fig.4

4. Control System

The temperature control in the greenhouse involves automatically opening and closing of the doors. The main purpose of the control system is to allow the doors to be controlled remotely using an electric motor to turn the manual crank. The secondary purpose is to automate this process where the doors are opened or closed without human interaction. This is achieved by using the temperature readings obtained by the monitoring system. When the temperature or humidity increases above the specified limit both the blower and the vent door opening motor operates together. At first the when the motor of the door opening mechanism operates it turns the crank of the link such that the door open in the outward direction thereby creating way for the hot air out. Now blower blows the hot air out of the poly house though open vent door and fresh cold air enters the poly house that dilutes the inside poly-house to bring down temperature and humidity back to normal or desired value.

5. Hardware

The monitoring system consists of four sensors that interface with the Arduino UNO microcontroller. These sensors include: a temperature sensor, humidity sensor, light intensity sensor and two contact switches that determine if the window is open or closed. Sensor data is relayed to the Arduino

Arduino UNO

The Arduino UNO is an open-source microcontroller board based on theMicro-chip ATmega328P Micro-controller and developed by Arduino.cc.The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.[1] The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable.[4] It can be powered by a USB cable or by an external 9 volt battery, though it accepts voltages between 7 and 20 volts.

Fig.5

Technical Specifications - Microcontroller: Microchip ATmega328P

- Operating Voltage: 5 Volt
- Input Voltage: 7 to 20 Volts
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 6
- DC Current per I/O Pin: 20 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB
- SRAM: 2 KB
- EEPROM: 1 KB
- Clock Speed: 16 MHz
- Length: 68.6 mm
- Width: 53.4 mm

Humidity Sensor

DHT11 Temperature & Humidity Sensor features a temperature & humidity sensor complex with a calibrated digital signal output. By using the exclusive digital-signal-acquisition technique and temperature & humidity sensing technology, it ensures high reliability and excellent long-term stability. This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component, and connects to a high performance 8-bit microcontroller, offering excellent quality, fast response, anti-interference ability and cost-effectiveness.

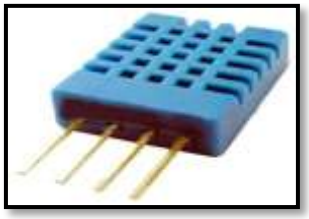

Fig.6

Temperature Sensor

The DS18B20 digital thermometer measuresand has an alarm function with non-volatile user-programmable upper and lower trigger points. In addition, the DS18B20 can derive power directly so there is no need for an external power supply.

"**Fig.7"**

Absolute Maximum Ratings:	Voltage Range on Any Pin Relative to Ground	-0.5V to +6.0V
Operating Temperature Range	-55°C to +125°C	

Blower

A blower pushes air out of a poly-house and forces it outside, through an opening in the roof. This causes a positive pressure differential, forcing air out through vents, while at the same time producing a negative pressure differential inside the living areas which draws air in through open windows. Intake air comes directly from outside, instead of from the house interior. Typical diameters are 24 inches (61 cm), 30 inches (76 cm), and 36 inches (91 cm), having motors of ¼ to ¾ horsepower (0.19 to 0.56 kW), and using approximately 190 to 560 watts of electric power at high speed.

Fig.8

DC Motors

Brush less DC Motor rotates continuously when DC voltage is applied to their terminals. The stepper motor is known by its property to convert a train of input pulses (typically square wave pulses) into a precisely defined increment in the shaft position. Each pulse moves the shaft through a fixed angle. Stepper motors effectively have multiple "toothed" electromagnets arranged around a central gear-shaped piece of iron. The electromagnets are energized by an external driver circuit or a micro controller. To make the motor shaft turn, first, one electromagnet is given power, which magnetically attracts the gear's teeth. When the gear's teeth are aligned to the first electromagnet, they are slightly offset from the next electromagnet. This means that when the next electromagnet is turned on and the first is turned off, the gear rotates slightly to align with the next one. From there the process is repeated. Each of those rotations is called a "step", with an integer number of steps making a full rotation. In that way, the motor can be turned by a precise angle. The circular arrangement of electromagnets is divided into groups, each group called a phase, and there is equal number of electromagnets per group. The number of groups is chosen by the designer of the stepper motor. The electromagnets of each group are interleaved with the electromagnets of other groups to form a uniform pattern of arrangement. Electromagnets within the same group are all energized together. Because of this, stepper motors with more phases typically have more wires (or leads) to control the motor

Fig.9

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Relay

A relay operates as an electromagnetic switch. It can control a high voltage circuit by using only a low voltage control signal. The building components of anElectro-mechanical relay are basically a fixed coil, a movable armature, a spring and contacts. The number of contacts varies from one pair to several. The coil generatesa magnetic field when a low voltage control signal has been sent. As a consequenceof this, the

armature is attracted by the magnetic field so that it pushes the contact pair towards each other. This completes the high voltage circuit. The spring is attached between the coil and the armature. When the control signal is no longer sent to the circuit the spring pulls the armature back to its original position. Electromechanical relays are categorized into two types, Normally Open (NO) and Normally Closed (NC). The contacts on a NO relay are only closed when a current is sent through the relay. In a similar way, the contacts on a NC relay are only open when a current is sent through the relay

Fig.10

A NO relay is preferred when the controlled circuit will be off most of the time and a NC is preferred when the circuit will mostly be on. The number of pins depends on the required connections for the circuit. When AC is used, both of its leads have to be connected to the relay since the current can flow in either direction.

Sprayer & Nozzle

A **sprayer** is device used to spray a liquid, where sprayers are commonly used for projection of water, weed killers, crop performance materials, pest maintenance chemicals, as well as manufacturing and production line ingredients. In agriculture, a sprayer is a piece of equipment that is used to apply herbicides, pesticides, and fertilizers on agricultural crops. Sprayers range in size from man-portable units (typically backpacks with spray guns) to trailed sprayers that are connected to a tractor, to self-propelled units similar to tractors, with boom mounts of 4-30 feet up to 60–151 feet in length depending on engineering design for tractor and land size.

Fig.11

Fig.12

A **spray nozzle** is a precision device that facilitates dispersion of liquid into a spray. Nozzles are used for three purposes: to distribute a liquid over an area, to increase liquid surface area, and create impact force on a solid surface. A wide variety of spray nozzle applications use a number of spray characteristics to describe the spray. Spray nozzles can be categorized based on the energy input used to cause atomization, the breakup of the fluid into drops. Spray nozzles can have one or more outlets; a multiple outlet nozzle is known as a compound nozzle. Spray nozzles range from heavy duty industrial uses to light duty spray cans or spray bottles.

III. Conclusion

In this paper we realize that environment control processes is not easy as it seems. If temperature inside Poly-house is increased from 28 degree to 40 degrees within two hours the flowers will lose its value by Rs120 (150 – 30) per bunch of flowers which is very high, hence by this setup we are saving the loses due to environmental changes. It also eliminates the risk of the poly-house not being kept at crop specified conditions due to human error. It also minimizes the labour costs crop involved in maintaining a poly-house.It needs to be very precise and well controlled. For controlling the environment parameters we should have a firm understanding or knowledge of the processes. This will also increase the knowledge of farmers regarding farming using latest technologiesand everyone who thinks that farming is for village people or illiterate people they will also do farming.

Conflict of interestthe authors declare that there is no conflict of interests regarding the publication of this paper.

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