Real Time Monitoring of Temperature And Humidity In Green House

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Abstract-*Data acquisition is a process of collecting signal samples to measure physical phenomena and converting the information to a computer program. RH + T indicator with RS485 communication is a sensor which is used to detect the temperature and humidity. The sensed values can be read to the HMI through RS 485 communication.The touch screen has the provision to enter the set values also we can monitor the present values of both temperature & humidity. The soil moisture sensor is controlled with arduino if it detects the moisture of the soil and if the moisture is low then the sprinker is on, if the moisture of the soil is high the fan in on.The measuring probe is connected to the PLC& HMI through Modbus communication. As per the program done in HMI, we can take the required datas By connecting a pendrive to the HMI and can monitor the same by connecting it to a PC (in excel format). So that one can analyze the total functioning of the plant which can be used for future reference.*

Keywords*-HMI, Arduino, Data acquisition.*

I. INTRODUCTION

Today monitoring environmental parameters have gained more importance due to the increasing security and regulatory compliance needs. So the measurement of such parameters becomes critically important. Temperature and humidity monitoring system can be applied to the food industry, archives management, greenhouses, animal breeding, medicine store, the tobacco industry and the industrial site and other industries.

A greenhouse is a structure with walls and roof made chiefly of transparent material, such as glass, in which plants requiring regulated climatic conditions are grown. These structures range in size from small sheds to industrial-sized buildings. A miniature greenhouse is known as a cold frame. The interior of a greenhouse exposed to sunlight becomes significantly warmer than the external ambient temperature, protecting its contents in cold weather. 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. Real time monitoring of temperature and humidity system is used in many industries. For example, horticulture facility. In this case one have to monitor the temperature, humidity, ph etc for the proper growth of plant . While the idea of a greenhouse is, of course, to provide plants with a little warmth and shelter, you can have too much of a good thing. Overheating and scorching can cause a surprising amount of damage – especially to young, tender plants – in a relatively short time, so it is well worth taking a few precautions to avoid this problem. Two things are involved in ensuring your plants' safety – ventilation and shading. There can never be too many ventilators in a greenhouse, after all, do not have to open every single one just because they are there, but should the temperature really begin to rise, can do something about it.

While some plants – notably begonias, fuchsias and African Violets – are particularly prone to scorching, most plants will need some degree of protection from the direct summer sun. Some form of shading – and there are many types available – applied across the roof and down the side which gets the full afternoon sun will stop your seedlings from being scorched and also help to reduce overheating.
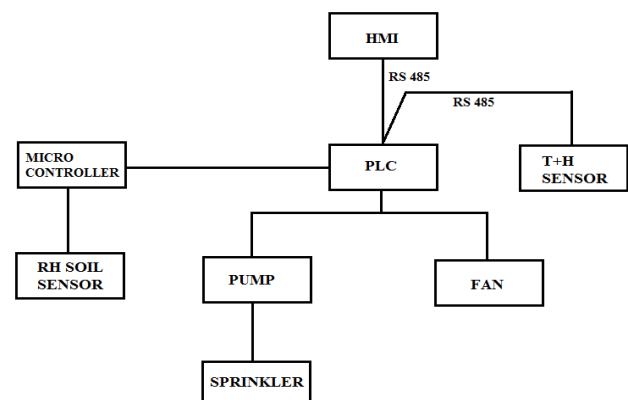
II.BLOCK DIAGRAM

Fig 1: Block diagram

Data acquisition is a process of collecting signal samples to measure physical phenomena and converting the information to a computer program. RH + T indicator with RS485 communication is a sensor which is used to detect the temperature and humidity. The sensed values can be read to the HMI through RS 485 communication. The touch screen has the provision to enter the set values also we can monitor the present values of both temperature & humidity.

The soil moisture sensor is controlled with arduino if it detects the moisture of the soil and if the moisture is low then the sprinkler is on, if the moisture of the soil is high the fan in on. The measuring probe is connected to the PLC& HMI through Modbus communication. As per the program done in HMI, we can take the required datas By connecting a pendrive to the HMI and can monitor the same by connecting it to a PC (in excel format). So that one can analyze the total functioning of the plant which can be used for future reference.

III. HARDWARE IMPLEMENTATION

A. Programmable Logic Controller:

A programmable logic controller (PLC) is a special form of microprocessor-based controller that uses a programmable memory to store instructions and to implement functions such as logic, sequencing, timing, counting and arithmetic in order to control machines and processes and are designed to be operated by engineers with perhaps a limited knowledge of computers and computing languages. They are not designed so that only computer programmers can set up or change the programs. Thus, the designers of the PLC have pre-programmed it so that the control program can be entered using a simple, rather intuitive form of language.

Advantages of PLC:

- ➢ Flexible.
- ➢ Faster response time.
- ➢ Less and simpler wiring.
- ➢ Solid state- no moving parts.
- ➢ Modular design-easy to repair and expand.
- ➢ Handles much more complicated systems.
- ➢ Allows for diagnostics "easy to trouble shoot".
- ➢ Less expensive.

The PLC used is TM200C40R.Schneider make PLC with 24 digital inputs and 16 digital outputs. Digital inputs/Digital outputs are extendable up to 128, also if required one can add analog I/O modules to this PLC. The programming software is Somachine basic. Programming language used for programming is ladder logic.

Fig 2: PLC TM200C404

B. Human Machine Interface:

A human machine interface(HMI) is the user interface that connects an operator to the controller for an industrial system. HMIs are usually deployed on windows based machines, communicating with programmable logic controllers(PLC) and other industrial controllers. HMI is a component of certain devices capable of handling human machine interactions. The HMI used is HMIGXU3512. Schneider make has three communication ports such as RS232,RS485 and Ethernet plus one USB port. Programming software used is Vijeo designer basic.

Fig 3: HMIGXU3512

C. Switched mode power supply(SMPS):

The electronic power supply integrated with the switching regulator for converting the electrical power from one form to another form with desired characteristics is called as Switch mode power supply. It is used to obtain regulated DC output voltage from unregulated AC or DC input voltage.

D. RH + T sensor with RS485:

SC808 is a microcontroller based, high performance RH+T RS485 module. Its high reliability industrial design offers some unique functions. The RH+T sensor is integral with the enclosure. It has an integral dual 4-digit LCD display. Communication with PC is possible through RS485 port using MODBUS RTU protocol.

In this model the datas such as present value of temperature and humidity are stored in a particular memory locations. Through RS485 communication one can read those values from the corresponding memory locations. The address

used for temperature is %MW 40003 and the address used for humidity is %MW 40001.

Fig 4:RH + T sensor with RS485

E. Relay(Electromechanical switching decice)

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations. The main operation of a relay comes in places where only a low-power signal can be used to control a circuit. It is also used in places where only one signal can be used to control a lot of circuits.

A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contractor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "protective relays".

Fig 5: Relay

F. FAN

A fan is a machine used to create flow within a fluid, typically a gas such as air. The fan consists of a rotating arrangement of vanes or blades which act on the fluid. The rotating assembly of blades and hub is known as an impeller, rotor, or a runner. Usually, it is contained within some form of housing or case. This may direct the airflow or increase safety by preventing objects from contacting the blades. Most fans are powered by electric motors, but other sources of power may be used, including hydraulic motors and internal combustion engines. Fans produce flows with high volume and low pressure, as opposed to compressors which produce high pressures at a comparatively low volume. A fan blade will often rotate when exposed to a fluid stream, and devices that take advantage of this, such as anemometers and wind turbines, often have designs similar to that of a fan. Typical applications include climate control and personal thermal comfort, vehicle engine cooling systems, machinery cooling systems ventilation, fume extraction, winnowing, removing dust, drying and to provide draft for a fire. While fans are often used to cool, they do not actually cool air but work by evaporative cooling of sweat and increased heat convection into surrounding air due to the airflow from the fans. Thus, the fans may become ineffective at cooling the body if the surrounding air is near body temperature and contains high humidity. The fan used here is a 24v dc fan.

Fig 6: Fan

G. Sprinkler

It is used for supplying the water to the plants. When the pump is actuated water flows from the pump to the sprinkler.

H. Arduino Uno board

The Arduino Uno is a microcontroller board based on the ATmega328 .It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, 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 a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

Fig 7: Arduino board

I. Soil moisture sensor

This is a simple water sensor, can be used to detect soil moisture Module Output is high level when the soil moisture deficit,or output is low Can be used in module plant waterer device, and the plants in your garden no need people to manage Instructions for Use: Soil moisture module is most sensitive to the ambient humidity is generally used to detect the moisture content of the soil Module to reach the threshold value is set in the soil moisture, DO port output high, when the the soil humidity exceeds a set threshold value, the module D0 output low The digital output D0 can be connected directly with the microcontroller to detect high and low by the microcontroller to detect soil moisture The digital outputs DO shop relay module can directly drive the buzzer module, which can form a soil moisture alarm equipment Analog output AO and AD module connected through the AD converter, one can get more precise values of soil moisture.
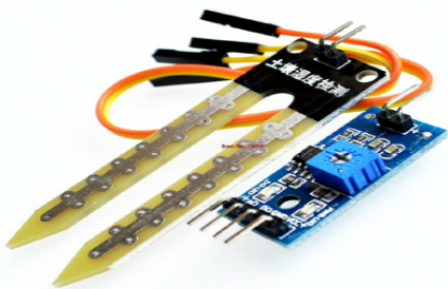

Fig 8: Soil moisture sensor

IV. SOFTWARE USED

A. HMI programming software: Vijeo Designer Basic

Vijeo Designer Basic is a software application with which you can create operator panels and configure operating parameters for the HMIGXU series of target machines. It provides all the tools needed to design an HMI project, from the data acquisition to the creation and display of animated drawings.

Features:

➢ Data reuse
➢ Multi-PLC connectivity
➢ HMI screen creation
➢ Actions
➢ Properties
➢ Multi-language messaging
➢ Editing variables from other applications

B. PLC programming software: Somachine Basic

SoMachine Basic is a graphical programming tool designed to make it easy to configure, develop, and commission programs for logic controllers. It is used for PLC programming.

So Machine Basic uses the following terms:

➢ Project: A SoMachine Basic project contains details about the developer and purpose of the project, the configuration of the logic controller and associated expansion modules targeted by the project, the source code of a program, symbols, comments, documentation, and all other related information.
➢ Application: Contains all parts of the project that are downloaded to the logic controller, including the compiled program, metadata, configuration information, and symbols.
➢ Program: The compiled source code that runs on the logic controller.
➢ POU (program organization unit): The reusable object that contains a variable declaration and a set of instructions used in a program.

C. ARDUINO

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension .ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom righthand corner

of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

Verify:

Checks your code for errors compiling it.

Upload:

Compiles your code and uploads it to the configured board. See uploading below for details.
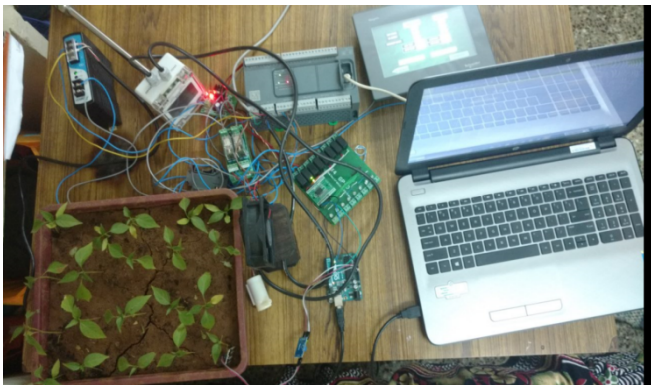
V. RESULTS

Fig 9: Model set up of green house

The above figure shows the set up of the project. When the power is on the relay is actuated. The program should be loaded to the HMI and PLC. Simultaneously the programming done in ARDUINO should also be loaded. After this the PLC controller should be started. As soon as the command is given based on the soil moisture sensor the fan or sprinkler is on.

VI. CONCLUSIONS

Green house is a protected place where one can control environmental factors for optimal plant growth. It can intensify production due to weather conditions, can accelerate the growth of the plants and also allows a greater amount of crop on the surface. Therefore will have a better price and a continuous supply of the product. Ability to grow all the year.

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