

Greenhouse Automation for Agriculture Using PLC & SCADA

Sheetal K. Bhongle¹Assistant Professor, Department of Instrumentation & Control Engineering, D.Y.Patil College of Engineering Akurdi,
Pune, India

ABSTRACT: Greenhouse automation for agriculture using PLC & SCADA can bring a revolution in agriculture. Introducing this system can help in increasing the cultivation in a controlled environment. Greenhouse environment, used to grow plants under controlled climatic conditions for efficient production, forms an important part of the agriculture and horticulture sectors. Appropriate environmental conditions are necessary for optimum plant growth, improved crop yields, and efficient use of water and other resources. Automating the data acquisition process of various parameters that govern plant growth allows information to be collected with less labor requirements. Existing element management systems are bulky, very costly, difficult to maintain. This project is design by using PLC where the temperature, humidity and illumination conditions are analyzed.

KEYWORDS: PLC, SCADA, Greenhouse, cultivation.

I. INTRODUCTION

Farmers are unaware about the exact conditions of weather so the activity performed by them is not precise. They perform their activity as per their feeling and observation so every time it may not give the accurate result. So to give accurate result about what activity should performed in green house by the farmers in different environment conditions this system is used. By using greenhouse automation we can increase the productivity.

This system is based on monitoring and control the parameter which play important role in green house. When sensors reach a certain threshold it will send the signal to microprocessor, microprocessor will process that signal and perform appropriate actions. For the proper and fast growth of different plants various parameters around them are important. The growth of the plant depends on parameter such as soil moisture, humidity, temperature etc. These parameters are controlled artificially in the green house to provide suitable environment for the growth of the plant. This system is design in such a way that which automatically controls the different parameters such as temperature, humidity etc. This technique is one of the smart agriculture techniques. If the temperature, pressure, PH of soil etc changes then this system is help to maintain or set that value in proper manner. This system reduces the manual overheads of monitoring different parameters and in process it reduces the percentage of the errors occurring due to the manual operations. Green houses are climate controlled. Green Houses have a variety of applications, the majority being, off-season growing of vegetables, floriculture, planting material acclimatization, fruit crop growing for export market and plant breeding and varieties improvement. 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. Three environmental parameters temperature, humidity and light are sensed by sensors and transmitted to the PLC (Programmable Logic Controller) where data are stored in data base and displayed on PC.

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II. LITERATURE SURVEY

The explanation given in most sources for the warmer temperature in a greenhouse is that incident solar radiation (the visible and adjacent portions of the infrared and ultraviolet ranges of the spectrum) passes through the glass roof and walls and is absorbed by the floor, earth, and contents, which become warmer and re-emit the energy as longer-wavelength infrared radiation. Glass and other materials used for greenhouse walls do not transmit infrared radiation, so the infrared cannot escape via radiation transfer. As the structure is not open to the atmosphere, heat also cannot escape via convection, so the temperature inside the greenhouse rises. This is known as the "greenhouse effect". The greenhouse effect, due to infrared-opaque "greenhouse gases", including carbon dioxide and methane instead of glass, also affects the earth as a whole; there is no convective cooling as air does not escape from the earth. However, R. W. Wood in 1909 constructed two greenhouses, one with glass as the transparent material, and the other with panes of rock salt, which is transparent to infrared. The two greenhouses warmed to similar temperatures, suggesting that an actual greenhouse is warmer not because of the "greenhouse effect" as described in the previous paragraph, but by preventing convective cooling, not allowing warmed air to escape. More recent quantitative studies suggest that the effect of infrared radiation 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. RELATED WORK

This system control temperature, humidity and light intensity. Input includes sensors and transmitters and output includes bulb and solenoid valve. Overall project is control by programmable logic controller. Power supply is taken from supply lines (230 V AC) and it is converted to 24 V DC for PLC by means of SMPS. HT7S11 is a temperature as well as humidity sensor and transmitter. Programmable Logic Controllers (PLCs) have become an integral part of the industrial environment. As a technician involved with the processes controlled by PLCs, it is important to understand their basic functionalities and capabilities. A programmable logic controller (PLC) is a digital computer used for automation of electromechanical processes, such as control of machinery on factory assembly lines, amusement rides, or lighting fixtures. PLCs are used in many industries and machines. Unlike general-purpose computers, the PLC is designed for multiple inputs and output arrangements, extended temperature ranges, immunity to electrical noise, and resistance to vibration and impact. Programs to control machine operation are typically stored in battery-backed or non-volatile memory. A PLC is an example of a real time system since output results must be produced in response to input conditions within a bounded time, otherwise unintended operation will result.



Fig. 1: Programmable Logic Controller

All PLCs have the same basic components. These components work together to bring information into the PLC from the field, evaluate that information, and send information back out to various field. Without any of these major components, the PLC will fail to function properly. The basic components include a power supply, central processing unit (CPU or processor), co-processor modules, input and output modules (I/O), and a peripheral device.

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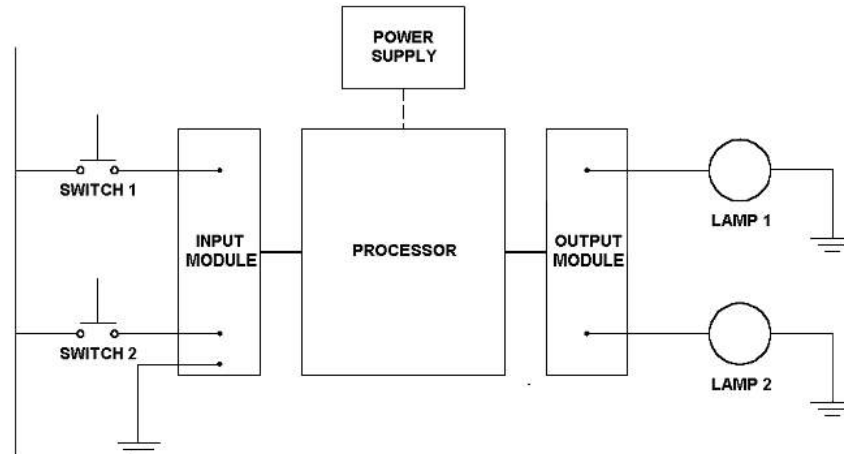


Fig.2: Wiring Diagram of PLC

The type of input modules used by a PLC depends on the type of input device. For example, some respond to digital inputs, which are either on or off while others respond to analog signals. In this case, analog signals represent machine or process conditions as a range of voltage or current values. The PLC input circuitry converts signals into logic signals that the CPU can use. The CPU evaluates the status of inputs, outputs, and other variables as it executes a stored program. The CPU then sends signals to update the status of outputs.

Output modules convert control signals from the CPU into digital or analog values that can be used to control various output devices. The programming device is used to enter or change the PLC's program or to monitor or change stored values. Once entered, the program and associated variables are stored in the CPU. In addition to these basic elements, a PLC system may also incorporate an operator interface device to simplify monitoring of the machine or process.

HT7S11 is basically 2-wire, current loop transmitter that transmits the relative humidity input and temperature into a two separate 4-20 mA current outputs. The relative humidity input is typically from 0 to 100 % RH. The temperature is typically from 0 to 50°C. (Different ranges are also available please check with factory). A miniature circuit breaker is used in new constructions instead of the older types of fuses. Circuit breakers are small devices used to control and protect the electrical panel and the other devices from overflowing of electrical power. They are used to maintain and ensure safety and quality of the energy provided. A three phase supply is given to SMPS from MCB. When there are any problems with 240 V AC supply MCB switches off and saves all circuitry from damage. A centrifugal fan is a mechanical device for moving air or other gases. These fans increase the speed of air stream with the rotating impellers, which circulates the air and provide cooling. In this project we are using fan for cooling purpose. When pressure exceeds fan will get on automatically. A light bulb is a device that produces light from electricity. In addition to lighting a dark space, they can be used to show an electronic device is on, to direct traffic, for heat, and many other purposes. Here in this project to increase temperature bulb were used. When temperature goes down from set point bulb will glow to increase temperature by using 240 V bulb. Solenoid valves are highly engineered products that can be used in many diverse and unique system applications. The valve is commonly used to replace a manual valve or where remote control is desirable. A solenoid is operated by opening and closing an orifice in a valve body that permits or prevents flow through the valve. The orifice is opened or closed through the use of a plunger that is raised or lowered within a sleeve tube by energizing the coil. The bottom of the plunger contains a compatible sealing material, which closes off the orifice in the body, stopping flow through the valve. The solenoid assembly consists of a coil, plunger, and sleeve assembly. In a normally closed valve, a plunger return spring holds the plunger against the orifice, preventing flow through the valve. When the coil is energized, a magnetic field is produced, raising the plunger and allowing flow through the valve. In a normally open valve, when the coil is energized, the plunger seals off the orifice, stopping flow through the valve.

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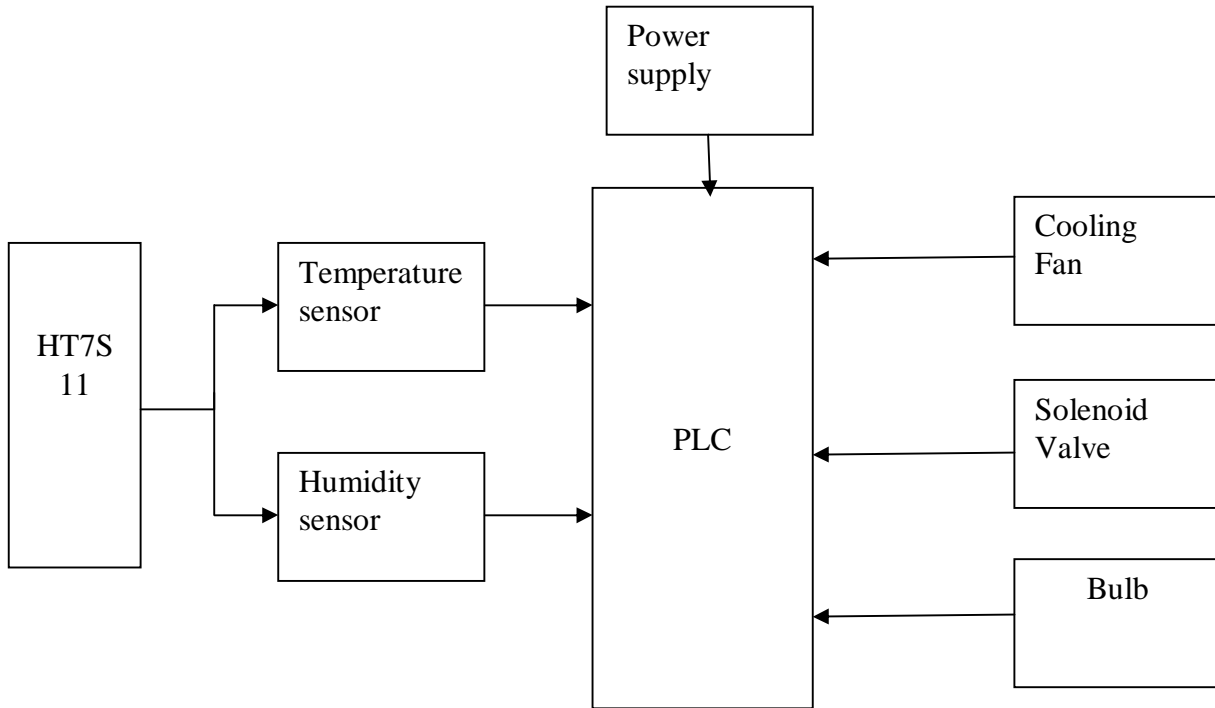


Fig.3: Block Diagram

Fig.3 shows the blocks required in this automation process.

IV. EXPERIMENTAL RESULTS

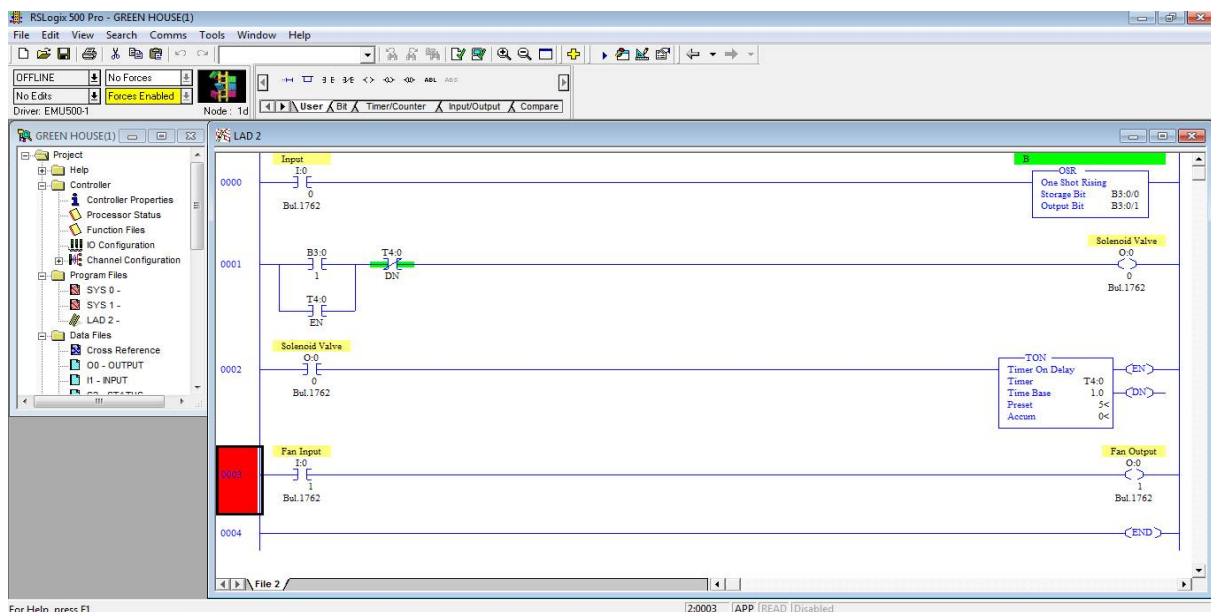


Fig.4: PLC Program

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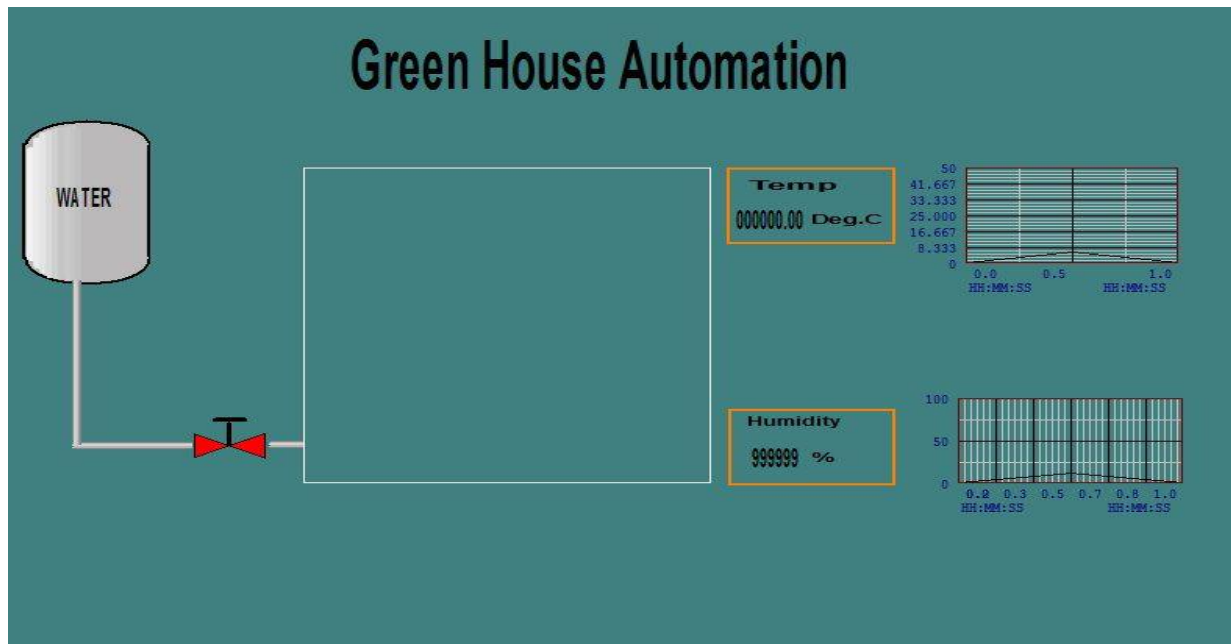


Fig.5: SCADA Screen

Fig.4 & Fig.5 shows the experimental result. Fig.4 shows the program logic to control different parameter in the green house. This is used to control the water supply, temperature & humidity in the green house. Fig.5 is the SCADA screen which displays the reading on computer.

V. CONCLUSION

The greenhouse automation is done with aim of providing specific consistent environment for plants, plants damage from fluctuating environmental conditions. Automation in greenhouse will help to reduce labour work with efficient output. The main aim of the project is to provide healthy atmosphere to unseasonal farming and have control over changing environmental conditions by using various components. This project has large emerging scope in unseasonal or modern farming.

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BIOGRAPHY



Ms. Sheetal Khushal Bhongle Assistant Professor, D.Y. Patil College of Engineering Akurdi, Pune B.E.(Biomedical)(2012) from Dr. Bhausaheb Nandurkar College of Engineering, Yavatmal. Qualified GATE in 2012 M. Tech.(Instrumentation & Control) (2014) from College of Engineering, Pune Published Three national conference and Two international journal papers.