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Review of Automation Mechanisms Used in Closed Environmental Control for Cultivation of Agricultural Products

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ABSTRACT:Automation and innovation havea close and conjoined relationship with environmental science development. In a rapidly evolving age, the concept of automation has gained significant importance. For instance, to improve the conditions and cultivation of crops under Greenhouse many research projects have been concluded. Some such projects relate to the mass cultivation of mushrooms,and areindependent of geographic location or time of the year. The performance and productivity of the mushroom-productionplant, is criticallydependent on the information management infrastructure from the environment. The key objective of this research paper is to propose the design of sensor-based automated monitoring and controlling system for a mushroom-production plant,which can manage end-to-end input to output cycle with minimal to no human intervention.The system consists of sensors, and PLC&PID controller as its fundamental constituents. By using the output signals from various sensors,PLC will help in maintaining the appropriate conditions conducive to the growth of mushrooms or any other plants. A PLC-based circuit will play a key role in monitoring and recording the continuously changing values of various parameters like temperature, humidity, soil moisture, sunlight, etc. The circuit will also control these parametersto optimize them forbetter plant growth and maximum yield. The objective of this design is to tune the control parameters by means of evolutionary computation and to minimize the error. This makes the complete system an economical, convenient, andlow-maintenancesolution for cultivation of agricultural products across rural areas in general, and for small scale agriculturists in particular.

KEYWORDS*:* Mushrooms, PLC,PID controller, Sensor, Temperature.

I. INTRODUCTION

Mushrooms are very nutritious products that can be generated from lingo cellulosic waste materials; and are in rich in crude fibre and protein. PLC is more or less a small computer with a built-in operating system (OS). This OS is highly specialized andoptimized to handle incoming events in real time, i.e., at the time of their occurrence. The PLC has input lines, to which sensors are connected to notify of events (such as temperature above/below a certain level, liquid level reached, etc.) , and output lines, to which actuators are connected to effect or signal reactions to the incoming events (such as start an engine, open/close a valve, and so on). The system is user programmable. It uses a language called "Relay Ladder" or RLL (Relay Ladder Logic). The name of this language implies that the control logic of the earlier

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days, which was built from relays, is being simulated. The scope of work is classified into hardware development and programming. The hardware structure includes the designing of the mechanical structure and electronic circuits. The software sections include the program design to control the automated machine.
PID controller is implemented by using ladder diagram in PLC Nexgene 1000.A Proportional-integral-derivatives controller will increase the system stability, reduce the overshoot, and improve the transient response. Most important significance is we can improve quality of our product, better quality standard and reducing man power. A temperature control unit temperature transmitter is also used where the temperature control unit is a special I/O unit that receives inputs directly from temperature transmitter, to perform PID control. Desired temperature or set point (SP) is set by the user using the Human Machine Interface (HMI) and the controller within the PLC will try to maintain the current Temperature base on the set point temperature set by the user.The main motivation of this design are to help the user to take care of their plant or to reduce the time needed by the user for checking situation the status of the mushroom plant. With the intelligent features installed, the system will have the ability to react to specific weather.

II. RELATED WORK

In [1] authors used embedded technology to develop monitoring and controlling system for the digital greenhouse using AT89C51 ,It control the value of temperature, humidity, light intensity, and soil moisture that are continuously modified and controlled in order to optimize them to achieve maximum plant growth and yield. Sometimes robot also placed in farm to monitor the farming status with the help of sensors.In[2] authors proposed the greenhouse auto control system based on wireless sensor network. It collects the environment information in the greenhouse. To create an optimal environment, the climate and environment parameters need to be controlled. An automated system for greenhouse using Supervisory Control and Data Acquisition (SCADA) tool like Lab view is described in [3] by S.H. Sadati, A.M. Sahari. In [4] DavidWhiting, Scott Johnson has outlined the factor that willaffect the plant growth. One of the most important factors that they proposed is temperature. Temperature consideration directly affects the outcome of a plant growth. [5] The Greenhouse system is a time-varying, extremely non-linear andmultivariable. In [6] the recent inventions in high rise manner in search of solution to susceptible effects of climate change in Australia have been discussed. The vertical Architecture Studio (VAST) shown by selected projects for a prototypical vertical garden city is useful and differs significantly from other built-upforms.In [7] Embedded based greenhouse monitoring system using PIC 16F877A microcontroller is used. Which deals with simple , easy to install , microcontroller –based circuit to monitor and record the value of temperature, humidity, soil moisture and sunlight of the natural environment that are continuously modified and controlled in order to achieve maximum plant growth and yield but the performance of the system can be further improved in terms of the operating speed , memory capacity , and instruction cycle period of the microcontroller so for this reason PLC controller are used in this project by which the number of channels can be increased to interface more number of sensors which is possible by using PLC.

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III. DETAIL SYSTEM DESCRIPTION

BLOCK DIAGRAM

The proposed system is used for controlling the parameters like temperature, soil moisture, humidity of mushroom production plant which is shortly describe in block diagram. Temperature is control by using instruments like temperature transmitter, SCADA, PLC, control valve, on-off valve. These all instruments are in system communicated with each other in closed loop system. The project overview is shown in Fig. Where the block diagram of this project, showing how PLC, Temperature sensor, soil sensor, control valveand temperature transmitter arerelated to each other to form a closed loop system.

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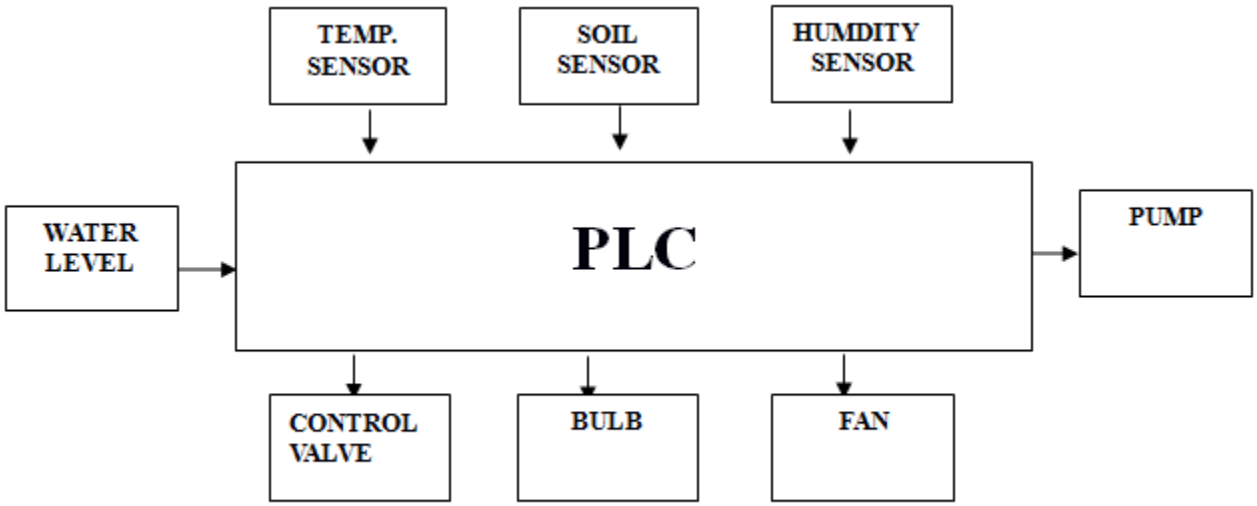

Different sensors are kept inside the mushroom plant which senses any variations in Parameters which are being monitored inside the plant and the sensors outputs are continuously compared with set point that of the standard conditions required for the mushroom plant. The output of the comparator is given to the PLC and the PLC switches on the corresponding actuators according to the program written in it .Thus the parameters required inside the mushroom plant are maintained automatically.

IV. CONCLUSION AND FUTURE WORK

This kind of system can be a great value-add to control and monitor farming facilities withvery littlemanual tackling. It will also have a substantial impact on the quality and productivity of the facility. Several parameters like temperaturelight intensity,soil moisture and motion detection inside a mushroom plantmonitor and control by using PLC.The circuit can be improved in many ways and used in wide applications. It canbe placed and operated in any of the environmental conditions. Non-conventional energy sources such as solar panels, or wind mills can be used to supply power to the automatic mushroom production plant. The system can be connected to communication devices such as modem, cellular phones or satellite terminal to enable the remote collection of record data or alarming of certain parameters.
The buzzer/beeper –based alarm could be replaced with a speaking voice alarm. The device can be made to perform even better by providing the power supply with the help of battery source which can be rechargeable (such as solar energy) or non-rechargeable, to reduce the requirement of main AC power.

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