# Smart Green House using PLC with Irrigation and Fertilizer Feeding

**R.Arunraj[1] S.Motheeswaran[2] M.Venkatesan[3] M.Karthik[4] K.Raja[5]**
[1,2,3,4]Student [5]Assistant Professor
[1,2,3,4,5]Department of Electrical & Electronics Engineering
[1,2,3,4,5]Knowledge Institute of Technology, Salem, India

*Abstract*— In current scenario number of farmers and available land space decreases day-by-day. On the other hand, increasing population increases the need of production. Though these controversies exist, all demands are satisfied with the help of hybrid varieties and Greenhouse systems. Our proposal aims to improve the features of conventional greenhouse systems by extending existing with irrigation and fertilizer feeding system, CO2 content monitoring and supply system and pneumatic controlled automatic open/ close roof. Conventional systems uses micro controller which has minimum durability, less high power withstanding capability and it can't be used for the control of more than 2 plants. Besides, conventional systems uses always closed room which consumes more power for heating process. Proposed system uses temporarily opened/closed roof which can utilize natural heat for the purpose of maintain room temperature. This reduces power consumption. To avoid these inconveniences proposed system uses PLC which controls multiple plants at a single time and ladder diagram can be replaced easily when comparing to the microcontroller. Humidity, temperature, CO2, moisture, rain sensors and load cell are used to measure real time parameters of the environment of green house.

***Key words:*** Greenhouse, Irrigation, Fertilizer, Pneumatic, PLC, Sensors, Automatic roof

## I. INTRODUCTION

Urbanization converts agricultural lands as flats, buildings and wastelands. As agricultural work is very difficult, time consuming and requires more labors, interest of people on these decreases rapidly along with the increase in population. Increasing population possess great demand for production. In current scenario, possible amount of demand is satisfied by using hybrid varieties, green house systems and etc. Green house system is a closed loop structure inside which plants will be grown among artificially made and controlled environment. This gives solution to grow seasonal plants during its non-seasonal periods of a year and increases productivity. Artificially made environment controls all parameters like humidity, temperature, moisture and other parameters for the healthy growth of plants in the greenhouse systems. If any parameter measurement is not under the control range proper control method like activating heater or cooler will be initiated by the control unit. Conventional greenhouse systems use many different techniques for the purpose of controlling parameters to maintain the room condition constant which is required for the plant growth. The control methods used in the conventional system are microcontroller, fuzzy logic, ZIGBEE and etc. These methods consume more power and are not suitable for multiple plant controls. Proposed system uses PLC which is suitable for multiple plant controls and power consumption can be reduced by using pneumatic controlled roof.

## II. LITERATURE SURVEY

Aji Hanggoro, Rizki Reynaldo's "Green House Monitoring and Controlling Using Android Mobile Application" [1] says complete system used to monitor and control the humidity inside the Greenhouse. The analysis result of this system showed in android mobile phones by using android application. These connections established through Wi-Fi to central sever which connect the microcontroller and humidity sensor via serial communication.

K. Rangan, T. Vigneswaran's "An Embedded Systems Approach to Monitor Green House" [2] explains An Embedded systems approach to monitor and control the greenhouse. Here the following parameters are measured Humidity, Water pH, Soil wetness, Light intensity and temperature by sensors are located at different places, where measured, processed, controlled and updated to owner through SMS using GPS modem.

Chang-Sun Shin, Yong-Woong Lee, Meong-Hun Lee's "Design of Ubiquitous Glass reins Houses" [3] says Ubiquitous glass Greenhouses Management System (U-GHMS) based on USN (Ubiquitous Sensor Network) which can be real-time monitoring and controlling of Green house's facilities by collecting environment and soil information with environment and soil sensors, and CCTV camera. The system can remotely monitor and control green house by considering environment information. The system includes the Sensor Manager and the CCTV Manager to gather and manage greenhouse information with the soil and the environment sensors, and camera. Also the system has the Green House Database storing greenhouse information and the Green House Server transmitting greenhouse information to the GUI and controlling green house. Finally, the GUI showing greenhouse condition to users exists in our system. To verify the executability of the U-GHMS, after developing a greenhouse model, we confirm that our system can monitor and control the greenhouse condition at remote GUI by applying the U-GHMS's components to the model.

Zhang Feng Yulin, Yulin's "Research on water-saving irrigation automatic control system based on Internet of things" [4] explained to improve irrigation water use efficiency, reduce cost of irrigation water, this paper discussed the design of wireless sensor network and Internet technology of farmland automatic irrigation control method. Emphasis on an analysis of the routing protocol of sensor network nodes to achieve the system hardware and software design, middleware, and applications such as mobile phone or wireless PDA of internet of things, will constitute a variety of sensors intelligent network, thus enhancing the overall automation system and monitoring levels. The final analysis of the network in the Internet based on the agricultural plants of farmland water-saving irrigation system integrated approach. User use mobile phones or wireless PDA can easily soil moisture content of online monitoring and control to realize the irrigation automation.

 

Application results show that system through the embedded control technology complete intelligent irrigation, improve the agricultural irrigation water use efficiency and irrigation system atomization is generally low status, can well realize water saving.

## III. HARDWARE DESCRIPTION

Humidity and moisture sensors will be fixed inside the room where one is on the wall and the other is under the soil to measure wetness of air and soil. Internal and external temperature sensors are placed inside and outside the room to measure temperatures of respective places. Rain sensor is fixed on roof, to detect whether it is raining or not. CO2 sensor is fixed inside the room to measure the CO2 content. PLC will monitor all sensor values and with the threshold values set by the end user. If any value is not in the range of set threshold value respective control action will be taken as below.

If humidity and moisture value decreases below the threshold value, irrigation supply will be turned ON by activating water tank's solenoid valve. If internal temperature value decreases below the threshold value and external temperature is not below the threshold value, roof will be closed and heater will be turned ON to increase the room temperature. If external temperature is not above the set value, it will indicate night time and roof will not be opened. Just heater will be turned ON.

If internal temperature increases above the threshold value, roof will be closed and cooler will be turned ON. If rain sensor gives input, roof will be closed whatever the condition is. CO2 sensor checks the amount of CO2 present inside the room. If it is below the set value, CO2 valve will be opened to supply CO2 from the reserve. Pneumatic cylinders are activated to open/ close the roof.

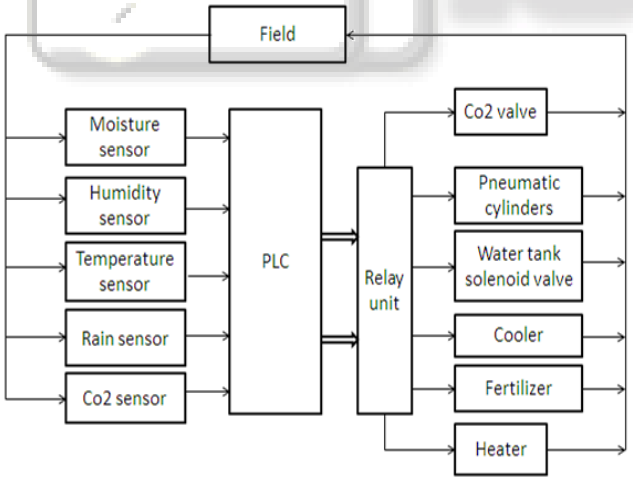


Fig. 1.1: Block Diagram

If end user switches fertilizer unit, controller will get the amount of fertilizer to be supplied to the plants. Then it will switch weight sensor and compare its output with the value set by the user. It will turn off weight sensor, if both the values are equal. Likewise all weight sensors will be controlled and the measured quantity will be sent to the mixture.

If all measured quantities reaches fertilizer unit, mixer motor will be turned ON. After mixing it will be sent through the irrigation pump to the plants. This operation is done to mix no. of fertilizers like potassium, sulphur etc. which are required for the healthy growth of plants. The following figure1.1 shows the block diagram of the proposed project.

## IV. SIMULATION USING PORTEL1.0

Simulation of the proposed project has been done using Portel1.0 software to test the sequence and output of the project. The following figure1.2 shows ladder diagram of the simulation for PLC.

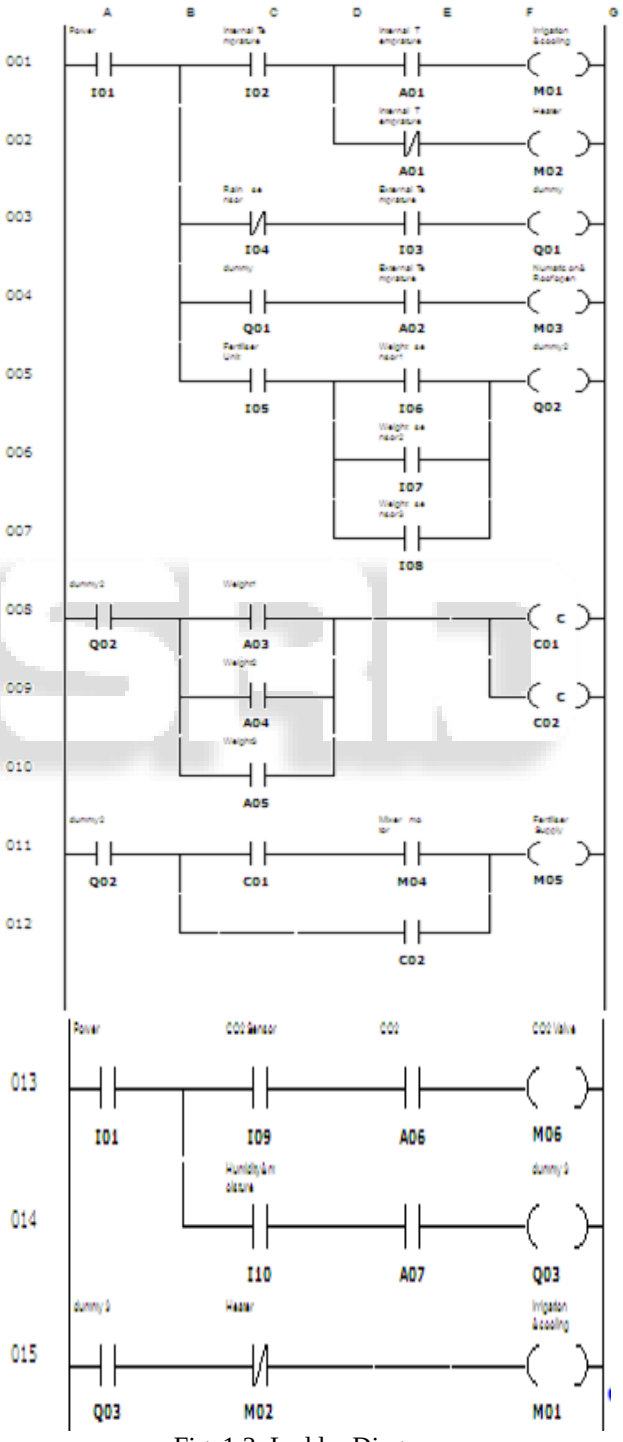


Fig. 1.2: Ladder Diagram

## V. SIMULATION OUTPUT

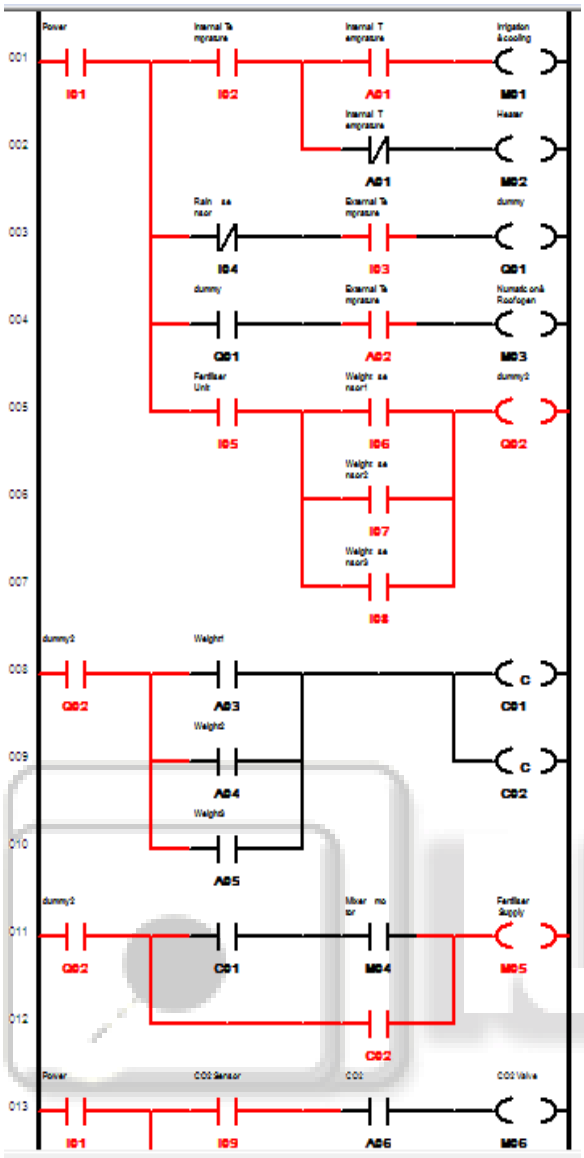

Fig. 1.3: Result


Fig. 1.4: Output of Simulation

Figure1.3 shows output of simulation in terms of ladder diagram. Figure1.4 shows state of output coils. Green button indicates that particular output is in ON/ working condition. In the above output result heater is ON which indicates internal temperature is low; hence heater is activated to maintain the room temperature. At the same time roof is not opened. It shows that external temperature is very low which is not sufficient to increase room temperature. Fertilizer supply is in ON condition which indicates user activates this circuit and gives input of fertilizer quantity for fertilizer supply. CO2 valve is opened which shows amount of CO2 inside the room is very less. If external temperature is above the threshold value then roof will be opened using pneumatic control along with the heater.

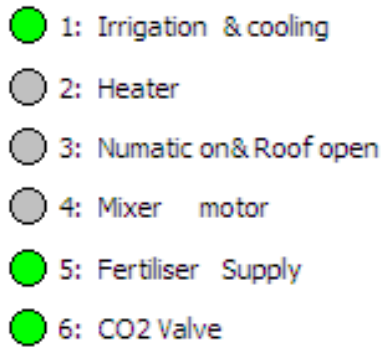


Fig. 1.4: Output of PLC

Figure1.4 shows the output of PLC which shows the status of various functions where irrigation supply, cooler, fertilizer supply and CO2 valve are in activated condition.

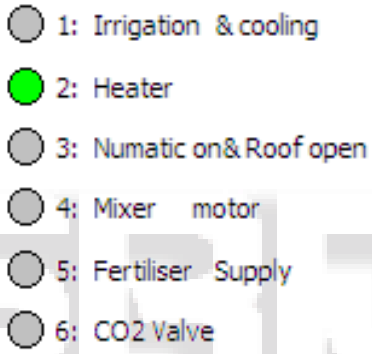


Fig. 1.5: Activated State of heater

The above figure1.5 shows activated state of heater where all others functions are not in the operating condition.

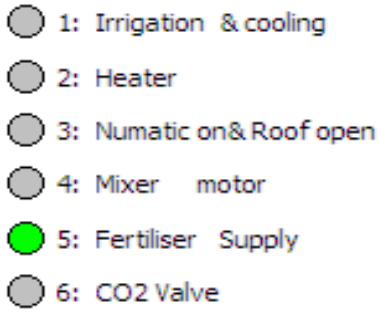


Fig. 1.6: fertilizer supply all other functions are in OFF

In the above figure1.6, except fertilizer supply all other functions are in OFF condition which means room temperature is normal, $CO_2$ level is sufficient and roof is closed which indicates external temperature is not sufficient or it might be raining or night time. If more than one fertilizer supply is turned ON, mixer motor will be switched to mix all fertilizers together and then mixed with water and supplied through irrigation supply line.

## VI. CONCLUSION

In current scenario, population is increasing along with food demand. But interest on agriculture is decreasing. Hence some advanced solutions are required to improve production

in addition to the conventional systems. Proposed system is very helpful to increase production. A simulation result shows the working of the proposed system and its control parameters based on which testing has been done. Further development of the system by including mechanical setup to cut, extract and store vegetables of the plant grown will reduce manual work and time consumption.

## REFERENCE

[1] Design of Wireless Sensor Network-Based Greenhouse Environment Monitoring and Automatic Control System, Juanli Ma, Xianjin Zhang and Yuan Feng Yongxian Song School of Electronic Engineering, Huaihai Institute of Technology, Lianyungang, China Juanli Ma, JOURNAL OF NETWORKS, VOL. 7, NO. 5, MAY 2012 (http://ojs.academypublisher.com/index.php/jnw/article/view/jnw0705838844)

[2] The Use of ZigBee Wireless Network for Monitoring and Controlling Greenhouse Climate Ibrahim Al-Adwan, Munaf S. N. Al-D International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-2, Issue-1, October2012 (www.ijeat.org/attachments/File/v2i1/A0733092112.pdf)

[3] Greenhouse Management through Can Network And PLC On A Touch Screen System. Dr. R. Barbagallo Computer Engineering Department, University of Catania Catania, Italy. (guap.ru/guap/nids/pdf_2010/barbagallo.pdf)

[4] Digitally Greenhouse Monitoring and Controlling of System based on Embedded System. Kiran Sahu, Mrs. Susmita Ghosh Mazumdar. International Journal of Scientific & Engineering Research, Volume 3, Issue 1, January-2012 1 ISSN 2229-5518 (http://www.ijser.org/paper/Digitally-Greenhouse-Monitoring-and-Controlling-of-System-based-on-Embedded-System.html)

[5] A wireless solution for greenhouse monitoring and control system based on ZigBee technology. ZHANG Qian, YANG Xiang-long, Journal of Zhejiang University SCIENCE AISSN 1673-565X (Print); ISSN 1862-1775 (www.zju.edu.cn/jzus/2007/A0710/A071008.htm)

[6] Design of Greenhouse Control System Based on Wireless Sensor Networks and AVR Microcontroller, Yongxian Song, Chenglong Gong, Yuan Feng, Juanli Ma and Xianjin Zhang, JOURNAL OF NETWORKS, VOL. 6, NO. 12, DECEMBER 2011. (http://ojs.academypublisher.com/index.php/jnw/article/viewFile/jnw061216681674/4018)

[7] Development of Greenhouse Monitoring using Wireless Sensor Network through ZigBee Technology, A. Salleh1, M. K. Ismail2, N. R.Mohamad3, M. Z. A Abd Aziz4, International Journal of Engineering Science Invention ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726 www.ijesi.org Volume 2 Issue 7 ǁ July. 2013 ǁ PP.06-12 (http://www.ijesi.org/papers/Vol%202%287%29/Version-5/B027506012.pdf)

[8] Greenhouse Monitoring with Wireless Sensor Network, Teemu Ahonen, Reino Virrankoski (http://lipas.uwasa.fi/~rvir/greenhouse_mesa08.pdf).

[9] Green House Monitoring and Automation using GSM, B.VidyaSagar, International Journal of Scientific and Research Publications, Volume 2, Issue 5, May 2012 1 ISSN 2250-3153 , (http://www.ijsrp.org/research_paper_may2012/ijsrp-may-2012-29.pdf)

 