Industry 4.0 technologies incorporated with Delta PLC based Smart Home Automation for Rural Development

'Sarangapani E', Narmadhai N, Santhosh N

1Assistant Professor, Department of EEE, Bannari Amman Institute of Technology
2Professor, Department of EEE, Government college of Technology, coimbatore
3Assistant Professor, Department of EEE, Bannari Amman Institute of Technology
4sarangapani@bitsathy.ac.in, 2narmadhai@gct.ac.in, 3santhoshn@bitsathy.ac.in

Abstract. The Programmable Logic Controller (PLC) is commonly used for electromechanical process automation. A home automation system is being developed using PLC. The proposed control module will consist of Model Functional Blocks device emulation. Upgrading human standards of living is the most important source of inspiration for the continuation of technological advances. Technology innovation directly and indirectly offers and enhances the protection and comfort of human beings. The advancement of technology for this reason directly affects the quality of living through the design of smart home systems. Smart home systems can be classified as local and remote in two ways. In this research, a smart home automation system design was carried out by using Delta PLC (Programmable Logic Controller). The control module provides fault detection, tolerance and switching on or off in sensitive areas for multiple components. Combining the PLC model with other devices, such as GSM is also possible. By supplying voice control and protection products, such a form of application would be highly helpful for the elderly and disabled persons. World is developing increasingly across the Internet of Things (IoT). In this paper, we are designing a system that will track home appliances automatically and generate email or messenger notifications or make smart decisions using the IoT model. The key contribution of this paper is that it summarizes the use of IoT to track and regulate the market in industries with artificial intelligence. By optimizing the entire hardware assembly and software algorithms, the Delta PLC device is adjustable to satisfy demands, incorporating distinct home appliances in a short time. The PLC will become the epic center for many new applications, as it is new but more powerful than previous systems.

Keywords: IoT (Internet of Things), Delta PLC, GSM, Internet connectivity port, RS232 and Rungs.

Introduction

Automation is called the method of managing or running different machines, machinery, manufacturing processes, and other devices using different control systems and usually with little or no human
involvement. There are different forms of automation that can be classified as home automation, industrial automation, autonomous automation, building automation, etc. Let us explore wireless home automation including IOT in this paper (Internet of Things).

General Overview of Home automation:

While there were several products in the home automation industry. In order to address the deficiency of such projects and improve productivity and minimize costs, management of PLC software devices reduces the efficiency and expense. Complexity in programming and increasing the number of inputs. One of the advanced PLC technologies can create delays for more than a month or year using the Delta PLC, which may solve the disadvantages of earlier versions. Economical regulation of complex processes would be a PLC technology. It can easily and rapidly be re-applied to monitor other systems. With computational skills, sophisticated control can be achieved. Programming is simpler and by troubleshooting capability, reduces downtime. Component reliability and longevity make PLCs likely to run for years. Regulation of household appliances such as water heaters, air conditioners, exhaust fans, lights etc. Without human interference, as shown in Figure 1. For instance, if there is darker or inadequate light in the room, the sensor senses it and orders the PLC to turn the light on. Likewise, if the smoke is recognized, the exhaust fan will be turned on.

1 Model Control blocks:

![Figure 1: Proposed Model diagram](image)

1.1 Home Automation (Existing system)

For Existing Home automation is the method of using different control system to automatically control home appliances But there is no automatic problem rectification. It is possible to control the electrical and electronic equipment in the house, such as fans, lamps, exterior lights, fire alarm, kitchen timer, etc., using
different control techniques. But here the proposed method is to overcome the problems in automatic mannan with the help of Delta plc. Because Delta plc is very compact and user friendly.

![Image of existing home automation without IoT]

**Figure 2: Existing Home automation without IoT**

2. **Internet of things with Automation:**

There are various techniques for controlling home appliances, such as cloud-based IOT home automation, WiFi home automation via Mobile apps from any smart phone, Arduino-based home automation, android-based remote control home automation, digital control home automation, RF-based home automation system, and home automation based on touch screen. But the Plc Based automation is best suitable for high power handling and automatic problem rectification with fast response.[1]

![Image of current technology home automation with IoT]

**Figure 3: Current Technology Home automation with IoT**

2.1 **Programming In Plc:**

The ladder diagrams are based on the most common approach used for programming PLCs. Writing a program is then equal to drawing a switching circuit or similar. The diagram of the ladder consists of two vertical lines on each side that represent the positive and neutral power rails. Circuits are connected between these two rails on the horizontal rungs of the ladder. Originally, Ladder logic was a written system to chart the design and Relay rack construction, as used in manufacturing and process control. A symbol on the ladder diagram with connections between those devices shown will indicate each device in the relay rack. Moreover the ladder diagram will also display other things external to the relay rack, such as pumps, heaters, and so on. Ladder logic is a programming language that describes a
program in the form of a graphic diagram based on relay logic hardware circuit diagrams and used in applications for industrial control[2]. As it resembles a ladder with two vertical rails on either side with a set of horizontally connected rungs between them the name Ladder Logic is apt. The scheme will be programmed into the PLC in the ladder diagram form. It can be tracked during execution in the Diagram Workspace once the programs have been imported into the PLC[3]. The Delta PLC offers a simple user interface for installing the software, uploading the program, and returning to online mode to see the desired state of the program. In this document, as shown in the flow charts, the PLC controls each home appliance.

2.2 Proposed Ladder Design with Results:

![Proposed simulation control -1](image)

Figure 4: Proposed simulation control -1

In this paper, the monitoring and control system for real time data acquisition was developed using the Programmable Logic Controller and is highly accurate, powerful and robust. A PLC offering its expandability and competence is connected to a range of input-output modules. The new expansion modules can be either digital or analogue, and digital modules are used in the present work. The simplicity of programming and networking with PLC sensors shows the device's elevated user friendliness. As it easily replaces the old, outdated and cumbersome relay logic, a single PLC can dominate the entire industry[4]. The latest work is therefore of great significance to electrical engineers and designers. Both events that occur during the process can be detected by the machine using Logo PLC. The device needs to be debugged along the way and if necessary, fine-tuned.

3. Relevance of the work:
Through using a variety of technology platforms or protocols, a smart home can be installed in a wide area. Each technology consists of a language of its own. Each language is used to connect the various devices and provide instructions for a function to be performed. The automation of home, housework or household tasks consists of this device. For outlying areas, the smart home system is used only to expand building automation and requires the monitoring and automation of turning on bulbs, heating, ventilation, air conditioning (HVAC), and appliances[5]. The market size of the home automation scheme will be over US$10 billion in the future.

3.1 Simulation Blocks:

The simulation Diagrams are shown in figure. Each rungs have running with 0.2ms timing.

![Figure 5: Proposed simulation control -1(Rungs 1-6)](image)

Rung 1:- Home Main Power supply Indication and control
Rung 2:- Main Board protection circuit
Rung 3:- Entire home current limit circuit breaker
Rung 4:- Protection circuit with main switch
Rung 5:- Main Hall control sensor connection with switch control
Rung 6:- Kitchen appliances control board
4. Conclusion:
IOT powered smart home system will offer more convenience and comfort to people lives. In this proposed simulation work is 100 percentage running with online platform with IoT based control. The PLC based smart home framework interacts through the internet with the local server. To install the smart home application, any supported system can be used. The smart home environment can be managed and monitored using android or PLC-linked device users. Such home automation systems are mandatory because when there is no need to use, people can often forget to turn off the appliances and in this situation and also protect the appliances, the home automation system is used to minimize energy wastage.

References

[1] B. Hamed, “Design & implementation of smart house control using LabVIEW”, International Journal of Soft Computing and Engineering (IJSCE), Volume 1, Issue 6, 2012.

[2] May, P., Ehrlich, H.C., Steinke, T.: ZIB Structure Prediction Pipeline: Composing a Complex Biological Workflow through Web Services. In: Nagel, W.E., Walter, W.V., Lehner, W. (eds.) Euro-Par 2006. LNCS, vol. 4128, pp. 1148–1158. Springer, Heidelberg (2006)

[3] Alagu, M, Ponnusamy, P, Pandarinathan, S, Mohamed Ali, JS. Performance improvement of solar PV power conversion system through low duty cycle DC-DC converter. Int J Circ Theor Appl. 2020; 1–16. https://doi.org/10.1002/cta.2918.

[4] Foster, I., Kesselman, C.: The Grid: Blueprint for a New Computing Infrastructure. Morgan Kaufmann, San Francisco (1999)

[5] Czajkowski, K., Fitzgerald, S., Foster, I., Kesselman, C.: Grid Information Services for Distributed Resource Sharing. In: 10th IEEE International Symposium on High Performance Distributed Computing, pp. 181–184. IEEE Press, New York (2001)

[6] Foster, I., Kesselman, C., Nick, J., Tuecke, S.: The Physiology of the Grid: an Open Grid Services Architecture for Distributed Systems Integration. Technical report, Global Grid Forum (2002)

[7] Sivaraman, P “A New Method of Maximum Power Point Tracking for Maximizing the Power Generation from a SPV Plant” Journal of scientific and Industrial Research Vol.74, No.3 pp.411 - 415 AUG 2015.

[8] P Sivaraman, and P Prem, “PR Controller Design and Stability Analysis of Single Stage T-Source Inverter Based Solar PV System Journal of Chinese Institute of Engineers Vol.40, No. 3 pp. 235 - 245 APR 2017

[9] Dheepanchakkravarthy A Jawahar MR Venkatraman K Selvan MP and Moorthy S 2019 Performance evaluation of FPGA-based predictive current controller for FLDSTATCOM in electric distribution system IET Generation, Transmission and Distribution Vol 13 No 19 pp 4400 – 4409.