PLC – A SOLUTION FOR INDUSTRIAL AUTOMATION

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Abstract

Automation is the technique that control the tasks or processes with the help of electronic and electrical devices. PLC based automation replaced the manually control operations by user. PLC is an industrial computer use to control the process or operation of designed application. The invention of PLC overcomes the drawbacks of relay logic control-based operations of industrial applications. Due to various advantages like lesser wiring, easy fault finding, flexibility, reliability, real time controlling etc makes it as an efficient tool for controlling real time automation process. Generally, PLCs are used in an automation to increase consistency of process, reliability, less assistance of human to avoid errors.

Keywords – PLC, Hardware components, Programming language, Input and output devices, System design, Applications.

Introduction

In early, industry uses a human interaction with machines for the purpose of controlling of process but as time passes there is a development in technology and it leads to an invention of various devices and replaced the human based controlling using various electrical, mechanical and pneumatic devices.

After the invention of relay, the industries were used a relay logic control, due to which the ON and OFF controlling of operations were made easier. The relay logic control system uses various components like switches, timers, contactors, actuators, motors etc to perform switching operations efficiently but the basic problem occurs with the wiring of system. As relay logic uses a various component, a huge wiring is there and it is very complex to implement and takes more time too. In case of fault finding, detection of particular fault is not too much easy. After the invention of devices like processor and microcontroller, the problems with the relay logic control-based system were made less and efficient controlling of process was done. But controller updating, software errors, skilled programmer for programming etc are some of the aspect of a system needs further updating in an automation.

After the invention of PLC in 1960's by Richard Morley of MODICON, a solution for the various requirements of industrial applications was found. The PLC has various advantages like easy fault detection, reprogram, easy maintenance, flexibility, less wiring, easy addition of inputs and outputs etc makes it an efficient and useful tool for real time controlling of operations.

Literature Review

Design and Development of Industrial Automated System using PLC – SCADA

Nikhita Nadgunda , Senthil Arumugam Muthukumaraswamy 2019, IEEE 10th GCC Conference and Exhibition (GCC)

In this paper author has explained about the use of PLC and SCADA to design an industrial automation. To improve efficiency, accuracy, flexibility of processes of industrial environment automation is utilized. The paper involved the application of bottle filling industry. The monitoring and controlling are desirable from the remote location. With the help of Barcode technology and crane automation a comparative study between two ware house management techniques was done. Increase in consistency and efficiency of the industry are the two main objectives behind optimisation of warehouse activities.

Water Level Control System using PLC and Wireless Sensors

Cosmina Illes, Gabriel Nicolac Popa, Ioan Filip ICCC 2013 IEEE 9th International Conference on Computational Cybernetics July 8 – 10, 2013, Tihany, Hungary

In this paper author has explained the controlling of water level using programmable logic controller (PLC) and wireless sensors. SIEMENS LOGO, 24 RL PLC, RTX – MID – 3V trans receivers, converters, electrical motor and pump are hardware used to designed the said automation. The various water levels as well as error are indicated by LED connected at the output of PLC

PLC Based System for Remote Liquids Level Control with Radar Sensor

Yuriy Kondratenko, Oleksiy Korobko, Oleksiy Kozlov, Oleksandr Gerasin, Andriy Topalov The 8th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications 24 – 26 September 2015, Warsaw Poland

The author has explained remote liquids level control with radar sensor based on PLC. Level measurement is one of the most important parameter in many production processes. The work includes a designing approach of multifunctional system to control liquid level and physical parameters of liquid products

PLC Based Auto Weighing Control System

Ganesh B. Shinde, Vishal P. Ghadage, Akshay A. Gadhave, Dr. D. K. Shedge International Journal of Engineering and Technical Research (IJETR) ISSN: 2321 – 0869, Volume – 3, Issue – 03, March 2015

In this paper author has described the initial steps to design auto weighing control system using PLC for automation industry. The auto weighing is an important task in industry because of rising demands of products and declining labour availability. Now a days weight of the object can be check using automation system. Faulty jobs are removed and correct one is processed. As demand of product is increasing, increase in speed of production is necessary. But manually weight checking takes more time so it leads to decrease the speed of production. So to complete the purpose of project, an automation technique is used

Development of PLC Based Monitoring and Control of Pressure in Biogas Power Plant Digester

E. Mudaheranwa, A. Rwigema, E. Ntagwirumugara, G. Masengo, Ranjeeta Singh, J. Biziyaremye 978-1-5386-9236-3/19/$31.00 ©2019 IEEE

The author has explained monitoring and control of pressure based on PLC for the application of Biogas power plant digester for safety of plant. The working of the designed system is process through some steps like problem identification, system model, control solution design, implementation and discussion on results. The gas is transfer to the post digester storage so involvement of gas in atmosphere is avoided and a pollution free system is possible.

Real- Time Measurement and Monitoring of Industrial Pharmaceutical Chemical Reactor Process Parameters using PLC and SCADA System

Mr. Lavanuru Ashok , Prof. B. Rama Murthy International Journal of Engineering Research and Technology (IJERT) ISSN: 2278- 0181, Vol. 9 Issue 07, July 2020.

In this paper author has described the real time measurement and monitoring system of industrial pharmaceutical chemical reactor process parameters based on PLC and SCADA. Reactor has unique importance in pharmaceutical industry which has a requirement of continuous measurement and monitoring of process parameters like temperature of reactor mass, inner volume level of reactor and internal mass pressure of reactor. At various stages there is possibility of errors as human workers are the part of the system. So there is a requirement of a error free system which avoids failure and this is achieved with the help of PLC and SCADA.

PLC Components
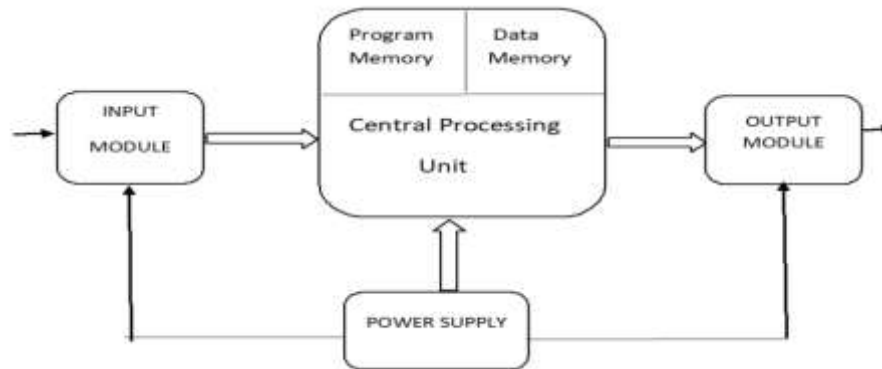
The Basic Components of PLCs are
(1) Input Module
(2) Processor (CPU and Memory)
(3) Output Module
(4) Power Supply

Types of PLC
There are various PLCs are available as per the needs of applications.
(1) Small PLCs
(2) Large PLCs
(3) Safety PLCs
(4) Fixed PLCs
(5) Modular PLCs

PLC Providers (Manufacturers)
There are several PLC providers available in the market.
(1) Allen Bradley
(2) Siemens
(3) Mitsubishi
(4) Delta
(5) OMRON
(6) Schneider Electric
(7) FATEK

PLC Programming Languages
The following are the Programming languages used to program a PLC. The ladder logic is the most common language used for programming
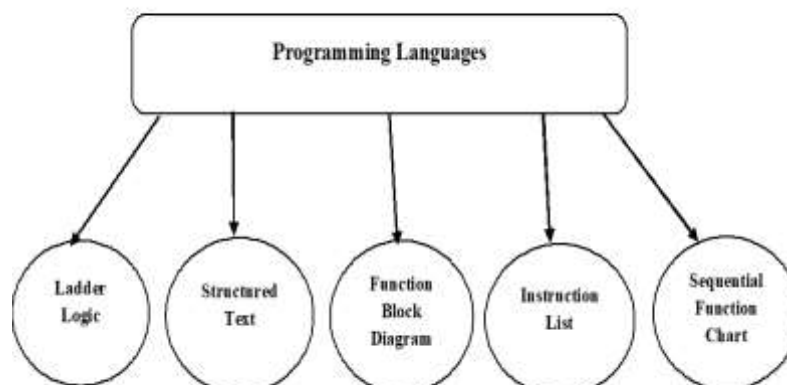
Input and Output Devices Used in PLC-Based Automation
There are various input and output devices are used in PLC-based automation as per the requirement of an application. Some of them are listed below.

| S.N.	Input Devices	Output Devices
1.	Push Buttons	Control Relays
2.	Proximity Sensor	Solenoid Valves
3.	Limit Switches	Fans
4.	Pilot Switch	Horns and Alarms
5.	Photoelectric Sensors	Motor Starter
6	RTD (Resistance Temperature Detector)	Actuators
7	Pressure Switches	Light Indicators

The inputs and outputs used are categorized into two types

Inputs	Outputs
(1) Analog Field Inputs	(1) Analog Field outputs
(2) Digital Field Inputs	(2) Digital Field Outputs

PLC Based Automation System
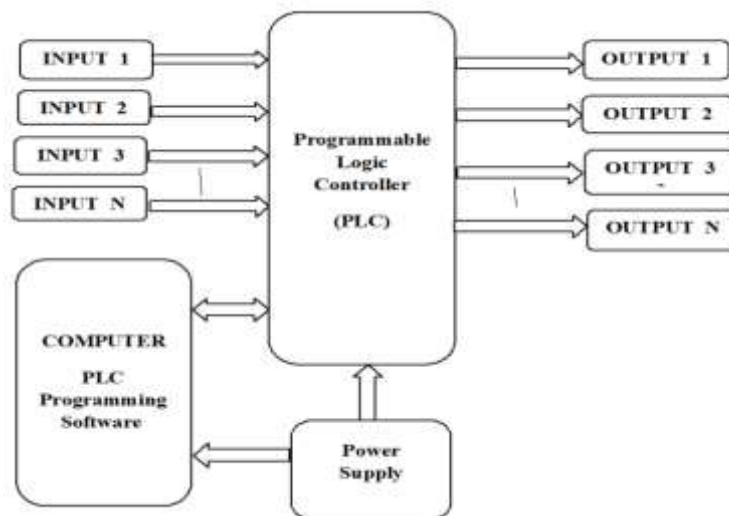
Inputs – It is a device through which information is transferred to the system. In PLC there are two types of inputs i.e. analog and digital. The selection of a particular input depends on the requirement of the application. Various types of sensors, proximity sensors, and switches are examples of inputs.
Programmable Logic Controller – PLC is an industrial computer used to control the process or operation of a designed application. It takes data (information/signal) from inputs and controls the process as per the program. Ladder logic is the most commonly used programming language in the case of PLC. The selection of PLC depends on the requirements of the process. The number of inputs and outputs, types of input – analog/digital, power requirement, and cost are some of the parameters taken into consideration while selecting a PLC for a particular application. The various advantages of PLC make it an efficient tool for automation.
**Outputs –** In the case of PLC, there are two types of outputs i.e. analog and digital. Solenoid valves, actuators, light indicators, and control relays are some of the examples of output devices. Digital outputs are used where controlling devices in only two states is required (i.e. ON and OFF). The continuous signal from PLC to the field devices is referred to as analog output.

Computer – To make a ladder logic program to run a particular application, there is a need to install software and so a computer is needed as a programming device.

Programming Software – Various PLCs are available in the market with their own programming software. So, the selection of particular programming software depends on the selection of a particular PLC.

Power Supply – It is an electrical device that is used to supply electric power to an electrical load. A computer needs 230 V AC signal to start whereas PLCs require various operating voltages as per PLC selection. Both AC and DC voltage-based PLCs are available in the market.

System Design Process
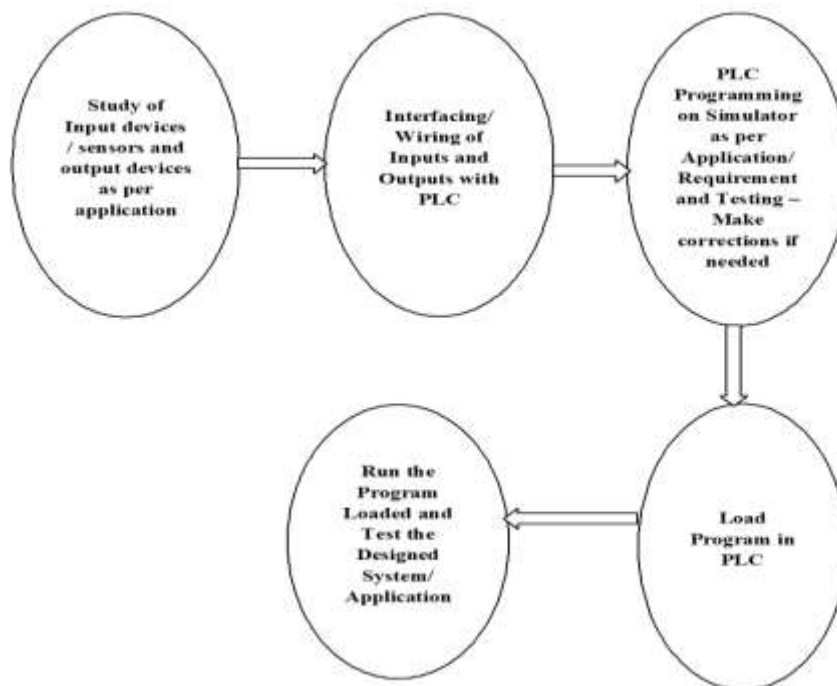
Applications

There are various industries as well as various applications or fields in which PLCs are used. Some of them are listed below.

(1) Automobile Industries

(2) Pulp and Paper Industries

(3) Cement Industries

(4) Glass Industries

(5) Food Processing System

(6) Medical Applications

(7) Production Plants

(8) Agriculture Field Operations

(9) Traffic Light Control System

(10) Elevators

The outcome of PLC Based Automation

❖ Provide automatic control over the process designed for particular applications.

❖ Real-time controlling of output devices will be possible.

❖ Designing various applications, easy fault detection, and corrections if required is possible.

❖ Real-time controlling leads to safety purposes in a plant process,

❖ Low-cost automation for Controlling the number of devices

❖ Handling of simple as well as complex processes will be possible.

Conclusion

Receiving continuous signals through inputs of the designed system and starting the process of controlling as per the program written to run the particular application is possible. Easy fault detection and suitable correction as per requirement is possible.

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