The Journey of Parle-G: Understanding Its Product Life Cycle

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ABSTRACT

Several industries utilize sequential industrial process which is respective in nature. For such processes industries have to depend upon use of relays, stepping drum, timers and controls, considerable difficulties experienced in reprogramming necessitated due to change in the nature of production. Often the whole system has to be scrapped and a redesigning is required. To overcome these problems PLC control system was introduced. The PLC can be described as a control ladder comprising a sequence program. PLC sequence program consists of normally open and normally closed contacts connected in parallel or in series. It also has relay coils, which turns ON and OFF as the state of these contacts change. In this paper, about all aspects of these powerful and versatile tools and its applications to process automation has been discussed.

Keywords: Automation, Programmable Logic Controller (PLC), Programming Languages, Process Automation..

I. INTRODUCTION

With the upcoming technologies and availability of motion control of electric drives, the application of Programmable Logic Controllers with power electronics in electrical machines has been introduced in the development of automation systems. The use of PLC in automation processes increases reliability, flexibility and reduction in production cost. Use of PLC interfaced with power converters, personal computers and other electric equipment makes industrial electric drive systems more accurate and efficient [1].;

PARLE is the market leader in the organized biscuit and candy market in India. Biscuit contribute to more than 80% of parle's total turnover. Other product include cookies and candys.

The biscuit market is estimated to be 11mn TPA, valued at rupees 35bn.the unorganized sector account for 50% of market. He market has been growing at a CAGR of 6- 7% per capita consumption of biscuit is estimated at a low 15kgs, reflecting the huge potential for growth. In the organized sector, parle and Britannia only national players with dominant market shares. PLCs have been gaining popularity on the factory floor and will probably remain preponderant in coming years. Most of this is because of the advantages they offer, like

- Cost effective for controlling complex systems.
- Flexible and can be reapplied to control other systems quickly and easily.
- Computational abilities allow more sophisticated control.
- Trouble shooting makes programming easier and reduce downtime.
- Reliable components make these likely to operate for years before failure.

The PLC was contrive in response to the needs of the American automotive manufacturing industry. Automotive industries were the first to adopt programmable logic controllers, where software alteration replaced the rewiring of hard- wired control panels when production models changed. In manufacturing automobiles, earlier, the control, sequencing and the safety interlock logic was accomplished using hundreds or thousands of relays, drum sequencers, cam timers, and closed-loop controllers. The process for updating such facilities for the early model change- over was very expensive and time consuming as electricians have to individually rewire each and every relay. Digital computers, being general- purpose programmable devices, were applied for the control of industrial processes. Early computers required specialist programmers and essential operating environmental control for temperature, cleanliness, and power quality. The general- purpose computer used for process control required protecting the computer from the plant floor conditions. An industrial control computer possess several attributes: it would tolerate the shop- floor environment, it would not require years of training to use, and it would permit its operation to be monitored, it would support discrete (bit - form) input and output in an easily extensible manner. The response time of any computer system must be fast enough to be useful for control; the required speed varying according to the nature of the process [2].

In 1968, the design criteria for the first programmable controller were specified by the Hydromantic Division of the General Motors Corporation. Eliminating the high costs associated with inflexible, relay-controlled systems was their primary goal. The specifications required a solid-state system with computer flexibility able to (a) Survive in an industrial environment, (b) Be easily programmed and maintained by plant engineers and technicians, (c) Be reusable Such control system would reduce machine downtime and provide expandability for the future. The automotive industry is still one of the largest users of PLCs [13].

II. RESEARCH OBJECTIVES

The important objectives study was:

A. increases the manufacturing capacity in the small scale food industry
B. increases the labor integrity in the productivity of food
C. Eliminate the human based operations, reduces the cost and time of the product.

This project proposes an idea about automation of Food Processing plant using the PLC. In this plant biscuit are prepared with the help of raw materials. The objective of this project is to convert the manual project into fully automated plant for achieving higher accuracy & high hygiene, and to save time and raw material. Automated plant also helps to increase the quality of product. The system uses intelligent equipment's on site which deliver physical parameters (Analog/Digital) to PLC for easy monitoring of plant. Automation is not a newer concept. Automation is the use of machines, control systems and information technologies to optimize productivity in the production of goods and delivery of services. 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 light fixtures. Simplification of engineering and precise control of manufacturing process can result in significant cost savings.

PROGTAMMABLE LOGIC CONTROLLERS

Now a days food processing industries are coming up with good quality of products due to automated plants, which are well equipped with PLC's (Programmable Logic Controllers) at every stage. Basically PLC (Programmable Logic Controller) is a device more precisely a system- which can control logical or sequential operation of event s/device along with the associated interlocking conditions applicable for start /stop of that device. Parle Biscuits Ltd. Bahadurgarh, is one of the leading Concerns in biscuit manufacturing. In late seventies with fully mechanical set up where large manpower was required. High power consumption was in demand by plant. Then in mid-eighties they converted the plant into semi-automated plant by replacing mechanical panels with electronics panels but they too were bulky. In mid-nineties, they have emerged with fully automated plant by replacing bulky electronics panel with sophisticated and light weighted PLC panels at every stage of plant right from auto weighting of Maida & sugar to packaging of biscuits in packets and putting packets into boxes. Many companies are active in manufacturing PLC's At Parle Biscuits Ltd.

The programming technique for the first PLCs were based on relay logic wiring schematics. This eliminated the need to teach the technicians, electricians and engineers how to program a computer but this method has stuck and it is the most common technique for programming PLCs today. According to IEC 61131-3 five programming languages is defined for programmable control systems: LD (Ladder diagram), ST (Structured text), SFC (Sequential function chart), FBD (Function block diagram), and IL (Instruction list, similar to assembly language) [13,14].

III. INDUSTRIAL AUTOMATION SYSTEMS

Industrial automation is the use of computer and machinery aided systems to operate the various industrial operations in well controlled manner. Based on the operations involved, the industrial automation systems are majorly divided into two types; (a) Manufacturing automation and (b) Process plant automation systems.

IV. BASIC ARCHI TE CTURE OF A PLC

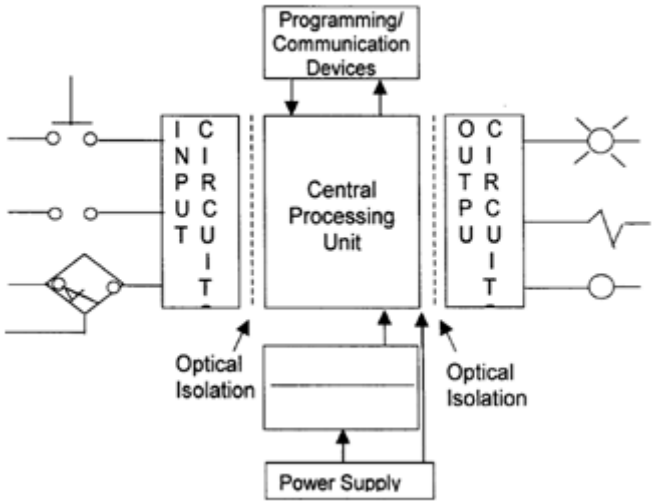

Figure 0.1circuit diagram of PLC

APLC sy st em comprises of :
- INPUTS
- OUTPUTS
- CENTRAL PROCESSI NG UNI T
- MEMORY FOR PROGRAM AND DATA STORAGE
- POWE RSUPPLY
- PROGRAMMING DEVI CES
- OPERATOR INTERFACES

All PLC's from micro to very large, use these same basic component s and are st ruct ured in t he similar f ashion asshown below.

Inputs:
The input screw t erminals on a PLC f orm t he int erf ace which f ield connect s devices t o t he PLC. I nputs include items such as pushbuttons, thumbwheel switches, limit switches, selector swit ches, proximity sensors and photoelectric sensors. These are all discret e devices t hat provide an on or of f st at us t o t he PLC. The elect rical signals t hat field devices send to the PLC are typically unfiltered 120V ac or 24V dc

Outputs:
The out put s connect ed t o t he out put t erminals of the PLC are devices like solenoids, relays, contractor, motor st art ers, indicator lights, values and alarms. Out put circuit s operat e in a manner similar t o input circuit s: signals f rom t he CPU pass t hrough an isolation barrier before energizing output circuits.

Central proce ssing unit (cpu):
The CPU made up of a microprocessor and a memory sy st em f orms t he primary component of the PLC. The CPU reads the inputs, executes logics as dictated by the application program, performs the calculations and cont rols t he out put accordingly . PLC uses work with two areas of the CPU, program files and data files.
Program files st ore a user's application program, subroutine files and error files.

Dat a f iles st ore dat a associat ed wit h t he program such as **I /O** St at us, t imer counters, preset and accumulated values and ot her st ored const ant s or variables. Together these two areas are called the applicat ion or user memory .

Types of m emory:
Programmable Logic Cont rollers have programmable memory t hat allows users t o develop and modif y t he cont rol programs. M emory is a phy sical space inside t he CPU where t he program and dat a f iles are stored and manipulated.

M mory t y pes f all in t wo cat egories:
Volat ile memory can be easily alt ered or erased and it can be
Written to and written from however without proper back up, a power loss can cause a loss of programmed cont ents.

Non- Volat ile memory ret ains it s programmed cont ents wit hout batt ery or capacit or backups even if power is lost.

Ope rat ng cycle :
All t he components of t he PLC system come into play during t he operating cycle, which consists of operations performed sequentially and repeatedly. The major elements of an operating cycle are:

the input scan: During t he input scan, t he PLC examines t he ext ernal input device f or a volt age present or absent t hat is ON/OFF st at e. The st at us of t he input s is t emporarily st ored in an " input image" memory f ile.

program scan: During the program scan, the PLC scans the instructions in the ladder logic program, uses t he input st at us f rom t he input image f ile and determines if an output will or will not be energized. The resulting status of the output is written in the " out put image" memory f ile.

output scan: Based on t he dat a in t he out put image f ile, t he PLC energiz es or de- energiz es t he out put circuit s, cont rolling ext ernal devices.

Power supplies:
The Power Supply provides power t o t he cont roller's internal electronics, converts the incoming voltage to a usable from and prot ects t he PLC components from volt age spikes A PLC can operat e f or several milli seconds wit hout t he power bef ore t he power, supply signals can no longer provide adequat e dc power t o t he system. Unt il recently, all micro PLCs operat e on 24 V dc. However several micro PLC manuf act urers now offer products that operate either on 120 V ac, 220 V ac or 24V dc.

V. FUTURE SCOPE

The project is designed in such a way t hat it is a simple and reliable can be used by local indust ries. However wit h lit t le modif icat ion, it can be used more efficiently and effectively, some of t he modifications suggested are

- Less operating time.
- High flexibility
- Absence of moving part s increases reliability
- Low power consumption
- Easy maintenance due to modular fabrication.
- Easy fault finding and diagnostic.
- Capable of handling of complicat ed logic
- Operations.
- Good documentation and data collecting Facilities
- Easy to interface with the process computers.
- Analog signal handling and close loop cont rol programming.
- Timer, count er and comparat or can be programmed.

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