

Motor Controlling in Industries using Programmable Logic Controller

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Abstract— Industrial Automation is rationalizing with contemporary devices and technologies to expand their productivity, accuracy and reliability, by replacing with Conventional time relays and contractor logics for the brisk management system. To expertise the production dynamically with the reduction of human intervention and scope of errors, high grade programmable logic is required in industries which are able to do multifunctional operations in any fields. This paper represents the monitoring and controlling of motors using programmable logic controller in industries with a module comprising of software and hardware with respect to time.

Keywords— Automation, Programmable logic Controller, Timers.

1. INTRODUCTION

Automation mainly cope up with new technologies for controlling the system with the ply of smart devices, advanced machine integrations, establishing a dynamic communication protocol system which are able to enhance the production and authenticity in industries[1]. Automation can sense the conditions of temperature, humidity, gas, distance and pressure concurrently, these can be explore in many domains like Paper, Chemical, Electrical and Mechanical by the control and monitoring mechanism system [2].

A. Main Stages of Automation in Industries [2]:

- Recognizing of the device
- Data collection from required device
- Synthesis and Analyzing the data
- Error detection ,if any fault occurs
- Rectification of Error using devices as per industry requirement(Feed back system)
- Product Dispatch as per schedule

B. Advantages of Automation in Industries [2]:

- Substituting the machines in place of workers at dangerous areas.
- Production will increases due to continuous evaluation with respect to time.
- Improves the safety and quality in industries
- Manual controlling, monitoring and feedback will increases.

In Industrial Automation, Programmable Logic Controllers (PLC) is one of the predominately using smart devices over relay and Contractor logics because relays are Electro-Mechanical device; it can be operated manually with respect to time by using SPST and SPDT switches in a system. If a fault exists more than relay switching time, total system will be in danger condition and manually it will be not be in a controlling mode[3]. So, to overcome the manual controlling devices problems, industries looking forward t automatic controlling and monitoring devices like PLC's.

2. PROGRAMMABLE LOGIC CONTROLLER

Programmable Logic Controller (PLC) is like a computer which performs on programmable logic in an internal storage of system with many sequential inputs and outputs (I/O) [3]. Additionally by using timers, counters and arithmetic logics; it can operate many electrical motors, hydraulic machines, magnetic coils and solenoids [4] by using digital and analog switches.

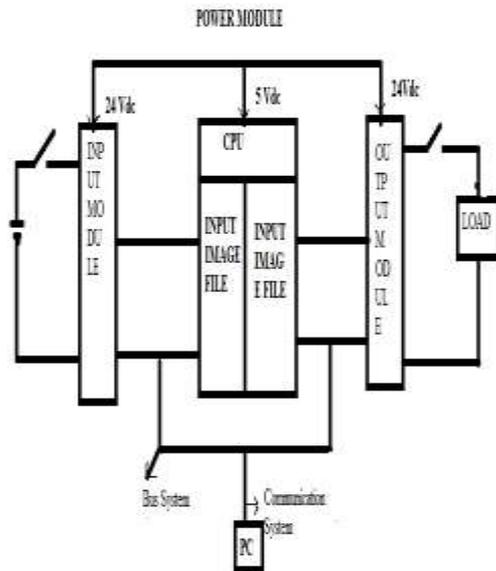


Fig.1. Block Diagram of PLC

PLC incorporates with mainly Central Processing Unit (CPU), Input and Output modules, Programming Device through communication system (Bus system) [5].

A DC supply will be given to CPU to sense the data from many sensing devices as an input module and also from programmable device through communication cable. CPU will enact the program internally, correspondingly it will explore to output devices as per the need to the system. To perform any operation through PLC, input devices will be taken as push buttons, toggle switches, sensing devices; likewise output devices will be taken as motors, Electric buzzers, Lights and Fans. So, internally in Personal computer, input will sense the processor and it will converts that into PLC language to get the output in selected device.

Programming logic or ladder diagram can be given to the personal computer with specific software. This can be tested in output PLC device through any communication cable like RS232.

Scan Cycle and Scan Time: PLC depends on recurring process to get the output in proper manner with respect to time.

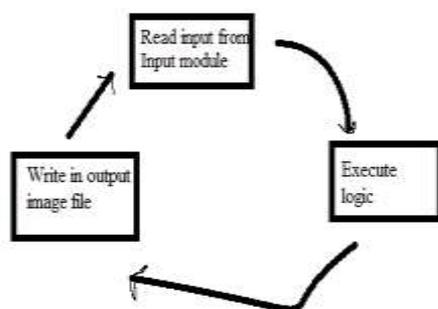


Fig.2. Diagram of Scan Cycle

Processor will read the logic as input from one to many modules and performs the operation from starting to ending of the logic. After reading every module, it will transfer the data to output module. So, output will be updated regularly based on the inputs, due to any issues, data will be given to input module again. So, this recurring process of Input-Output (I/O) module is termed as Scan cycle and time taken to complete one cycle is meant by Scan time. Scan time depends on Inputs modules proportionally. Minimum time to complete one cycle is 1-2ms for regular working operations and maximum time for high-end operations is 100-200ms [3].

Applications of Programmable Logic Controller [4]:

1. Industrial Automation
2. Bottle conveyor process
3. Variation of motor Speed control
4. Banking Security system
5. Home Automation system
6. Traffic controlling system
7. Automated Irrigation system
8. Food and Beverages

Case Study of using L series PLC control in Mitsubishi Electric [6]:

In 2009, VC999 packaging systems opt to develop i-series Thermo former which is very adaptable in manufacturing process of bubble packs and plastic coaster in pharmacy, food and retail industries, explicitly in thermoforming unit process. In this, advanced servo-driven in feed-roller, a two stage die-lift machine fragments are integrated with Ethernet based field bus to upgrade the efficiency and safety for customers automatically. To explore this i-series thermo former in VC999 packaging systems, Mitsubishi Electric Automation bring forth with L-series Programmable Logic Controller (PLC) module which imparts rack free design with CC-Link IE field connection for brisk Ethernet speed i.e., 1 Gigabit per 1 second and reduces the complexity while installation process.

With amalgamation of L-series and Mitsubishi MR-J3 servomotors and E700 variable frequency drives (VFD), entire thermo former machine process reliability and safety will improve due to index control discharge station of servos and trim wind up motor control by VFD's. This L-series single-CPU module architecture will be adopt as control platform for the thermo former machine segments.

So, with the L-series PLC usage, overall VC999 is

comes in a best packaging section in improvement of communication network between the machines with high speed with warranty.

Case Study of PLC Controlled Automatic Food Packaging Machine [7]: In packaging industries, mainly its process depends on vibrator, load cell, weight controller and Programmable logic controller (PLC) with correlation with Human Machine Interface (HMI) by using asynchronous serial communication RS232. Generally, the output production should be more in industries but in packaging section, due to manual checking of product weight, speed of production may delay. So, with the combination of HMI and PLC with all equipments like vibrator, Reset, door and manual integrating with HMI, this problem will overcome. At this moment, HMI authorize easy graphical interface with user and machine at a discrete task. Due to the sustained real time data acquiring and fault detecting, complete production packaging efficiency will upgrades.

3. LOGIC FOR CONTROLLING THE MOTOR

Controlling of motor in industries can be done by providing Programmable Logic Controller (PLC) with WPL Delta simulation software by integrating with Hardware PLC module. By writing logic in software simulation, motor output can be controlled by analog switches on PLC DVP14SS2. Devices and its working that are controlling the motor are listed in tabular column [8].

| Device | Functioning of Device |
|--------|---|
| X0 | NO input switch which is used to turn ON the motor |
| X1 | NC input switch which is used to turn OFF the motor |
| X2 | NO input switch used as a controller |
| M0 | Memory unit for Timer T0 |
| M1 | Memory unit for Timer T1 |
| Y0 | Motor output |

Table.1. Tabular column for motor devices
The below figure shows the logic circuit for Controlling the motor with all devices and their working with respect to time.

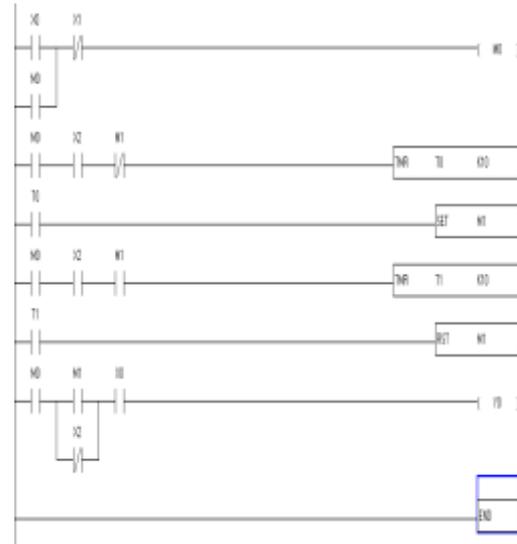


Fig.3.Logic Circuit for controlling of motor

4. RESULT AND DISCUSSION

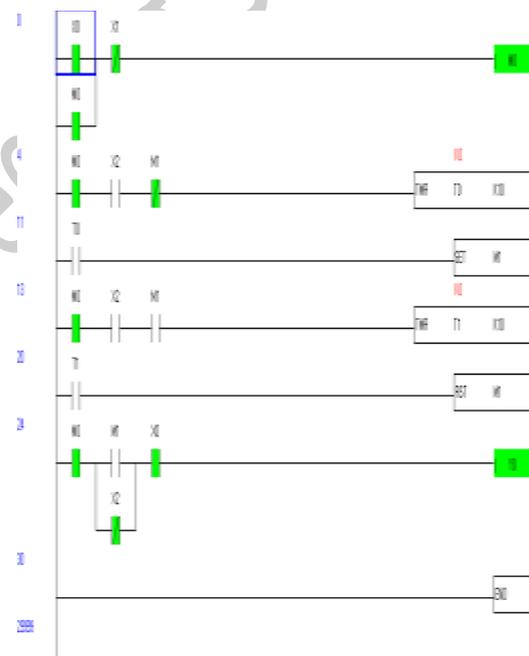


Fig.4.1. When X0 and X1 Switches are ON

When X0 and X1(closed switch) is on, current will flows to motor and data will stores in memory unit (M0) correspondingly, motor starts rotating in WPL software in PC(Simulator).

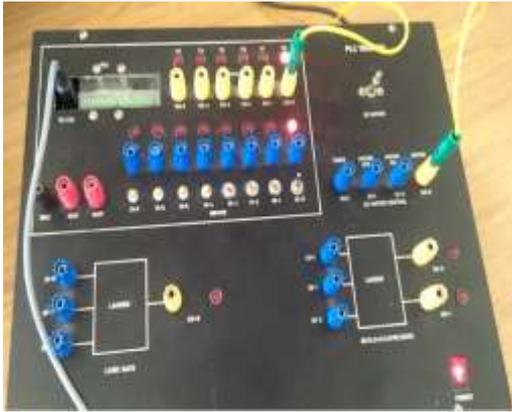


Fig.4.2. Running Condition of Motor on PLC controller device (DVP14SS2)

After interfacing the PC and PLC, results can look over by using the Hardware unit also. From figure, X0 and X1(Toggle switches) are in ON condition, Motor will runs without any time delay.

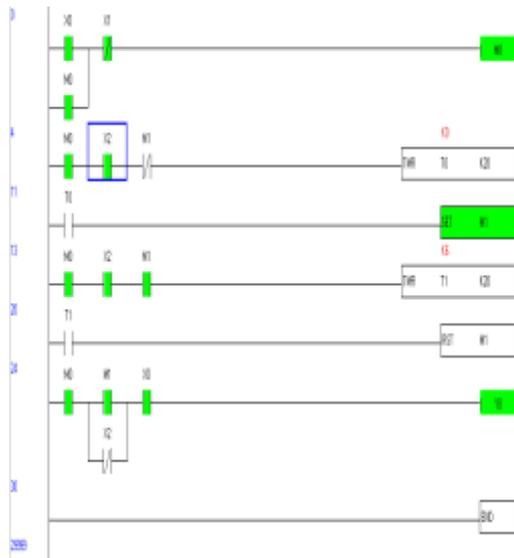


Fig.4.3. When X0, X1 and X2 switches are ON

As Motor is in running condition by X0 and X1 switches, with switching X1, motor will starts rotating as per the timer given(In this, 20sec delay time will be given to SET and RESET the motor). Here, the output of X0 and X1(latch circuit) will be stored in M0, data from M0 represents the memory input for timers T0 (set the motor) and M1 for timer T1 (Reset the motor). Finally, by using X2 latch with M1 and M0 data, motor will rotates with respect to input switch X0.

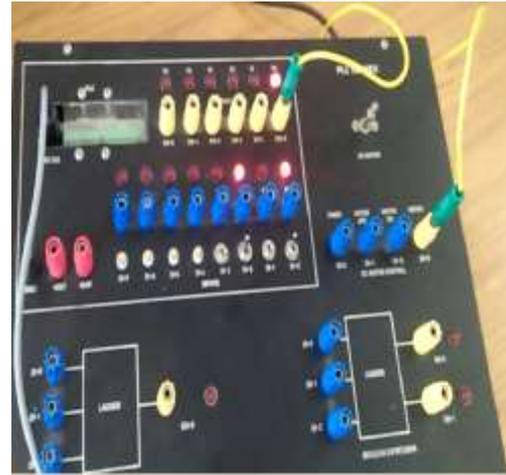


Fig.4.4. Running condition of motor with X2 ON

When motor is in running condition, to make use of controller switch X2, motor will rotates with time delay. At this condition, both X0 and X1 are in ON condition, by switching the toggle switch X2, motor will starts rotating 20 sec and automatically stops at 20 sec. So, this process will recur until the X2 switch is closed.

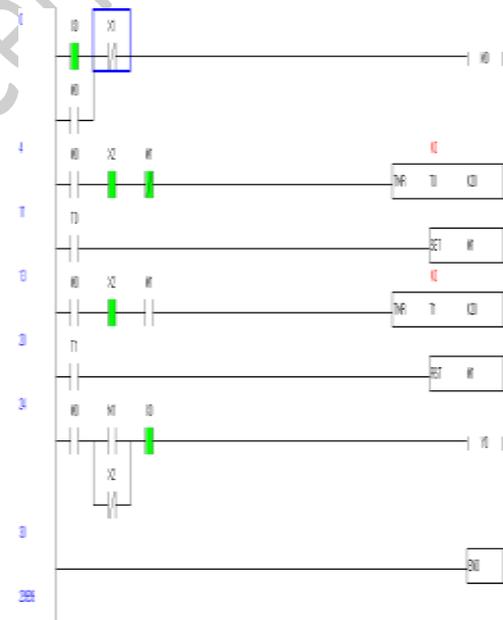


Fig.4.5. Motor is in OFF condition

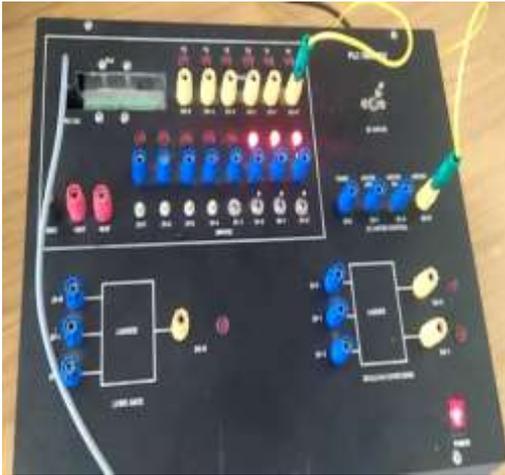


Fig.4.6. When X1 is in ON Condition

By ply of X1 switch, directly motor will stops rotating along with deletion of data stored in memory (M0 and M1). So, from the above results and discussion, it is clearly shown that PLC can ascendance any equipment (DC motors, Induction motors) and Industrial (Production, Manufacturing) process by wield with logic (ladder diagram) setting communication between PC and PLC. This process can be done through the utility of different

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input switches (Toggle or Push buttons) on Hardware PLC unit.

5. CONCLUSION

From this paper, it is conclude that without Human Intervention, by availing one of the new technology like Programmable logic Controller (PLC), production will enhance by adopting automation in Industries. By composing proper logic as per the requirement, process can be done automatically without any interruption. As motor is controlling with timers by exerting the PLC in this paper, likewise this can be extended too many real time applications in future like Home Automation, Banking Security system, Traffic controlling system and Irrigation system.

REFERENCES: