Automation of Sustainable Industrial Machine using PLC

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Abstract. At present, the machine gets operated manually and also by command raised by computer artificially, but mostly conventional machines operation done by humans. This leads to seeking attention keenly by humans for the operation which also increases time consumption to drill or milling of certain objects. Our project completely weeds out the physically cabled connection present in conventional BFP160 machine by introducing the PLC control technique. This design implements machine operation using the PLC control technique for trouble-free changes and error rectification in the system by reducing the number of contractors held by relays. The physically complicated control wiring using relay logic was replaced by a swift, compact Programmable Logic Controller (PLC). The entire logic and interlocks were incorporated into PLC. This wipes out the breakdown to the lesser time thus increasing the operating speed and overall equipment efficiency (OEE) of the machine. An existing conventional machine gets automated using PLC which gets programmed using the ladder logic programming with the processor for increased automation to peak level. Here the machine availability gets increased as the breakdown time gets reduced and efficiency of the certain machines is particularly improved thus initiated to greater production in set out manner. All additional considerations employed by Variable frequency drive (VFD) for speed control of feed motor by eliminating electromagnetic clutches along with telescopic brushes responsible for the movement of axes to drill or milling of the certain workpiece by the conventional machine. Our design proposes for the instant signal whether any part which gets interrupted while operation. Here this logic gets programmed and simulated using PLC software which is available based on a number of inputs and outputs.

Index Terms– PLC, OEE, Conventional, VFD, BFP160, Relay Logic.

1. Introduction

With the onset of new technologies, the functionality of the conventional BFP160 machine can be amplified by restoring the complete reduction of the cabled interrelation by the intrusion of the PLC control technique. This actually weeds out the operation of breakdown to be less and reduces the work of man force by enabling the time reduction. Enhancing this technique also saves the installation cost and also magnifies the speed of the machine which successively ignites the efficiency of the machine to a higher level. This design is incorporated by the interfacing of various electrical and mechanical components with PLC. This also implements the complex buttons by implementing the control principles like ON/OFF or switching control via PLC. This completely eliminates the manual seeking of controlling the position of the work piece which in turn said here as the automation of the conventional machine. This said to be the step response for the evolution with
upcoming onset technologies. This design works out to be the best one for a conventional to automated workout. This serves to be the endeavour for the upcoming technological outcome for this present on set of automation. Our project simulation control design adduced with the entire automation of the conventional machine and thereby increasing the efficiency and also the breakdown time to be lesser and also the entire maintenance becoming reduction oft time.

2. Existing System
The existing systems comprise of high burden content of relay logic which is enrolled for any machine operation in a certain manner. The difficulties in identifying and commemorating further operations after the occurrence and rectification of the faults take quite a longer duration in manual operation. The time required for hold on to a certain machine is quite large time which also wastes time and also the efficiency of a machine reduced and also the manpower which also getting increased and which collapses the entire production in delay. If any fault persists in the machine it is typically difficult for us to identify and what makes fault is unable to sense as it involves a complex wiring, relay, and several contactor arrangements. This involves quite a long time for fault detection and then rectification. In this meantime, the corresponding machine is to be halted for maintenance & repair work and so the machine’s efficiency gets faded down and which incorporates manual interventional losses with the entire production in delay which affects the entire economy designed for a certain machine.

3. Block diagram

![Block Diagram](image)

**Figure 1.** Block Diagram Representation.
4. Description

4.1 Power Supply :
A power supply initiates the direct current to the central processing unit (CPU) and other modules in the rack present. They are accessible in various power ratings and sizes incumbent on the PLC itself. However, most PLCs are premediated with a backup battery to furnish energy to the CPU for a specific duration in circumstances like power outage or supply failure.

4.2 Input/output Modules :
These modules accept the processor to associate to the field devices. They build a connection between PLC and field devices namely control valves, pressure transmitters, flow transmitters, and analyzers. The control over these entered to input and output modules respectively Emergency control switches, Lubrication limits, axis control, starter controls, coolant tor control, operations like cutting, inching either in forward or reverse direction for the job piece to be produced accordingly in X-axis or Y-axis or Z-axis or along spindle axis for an appropriate selection switches to be selected in PLC and to be programmed earlier in specified manner and can be loaded either through online mode or USB or Ethernet cable can be used along the PC as a transmitting media which when aligned as an operating panel which executes the portrayed logic as a control of entire machine as an automated one.

4.3 Processor:
Here a programmable logic controller (PLC) is the hardware that is accustomed to sway the manufacturing processes or any pursuit that needs logic, counting, timing, and network communications works as a processor. Here DELTA DVP-SE Series is incorporated along with fast logic operation, lavish instructions and numerous function cards, the cost-effective DVP-PLC also bear various communication protocols, connecting Delta's AC motor drive, servo, human machine interface and temperature controller through the industrial network in to a complete "Delta Solution" for each and every every users.

4.4 Programming Device:
A personal computer (PC) or Laptop with the suitable software allows users to create, edit, store, and troubleshoot various programs. The PC integrates with the PLC processor via a parallel or serial data communication link. Periodically miniature devices are also used to program small PLCs. Here programmed can be done earlier in specified manner and can be loaded either through online mode or USB or Ethernet cable can be used along the PC as a transmitting media which when aligned as an operating panel which executes the portrayed logic as a control of entire machine as an automated one.

5. Proposed System:
Our proposed system is initiated with advanced automation through an understandable and clear vision of programming language which is via Programmable logic controller PLC. According to the present onset of various technologies in industries, automation took a predominant role in this upgraded technology. This initializes the interfacing for inputs and outputs already inside the controller which in turn weeds out the breakdown time to be lesser and also eliminates the burden of wiring arrangement which also finds difficulty in fault clearance and also the annual intervention. This incorporates all rugged and designed construction to withstand the vibrations, temperature, humidity, etc.
Enhancing this technique also saves the installation cost and also magnifies the speed of the machine which successively ignites the efficiency of the machine to a higher level. Here this logic gets programmed and simulated using PLC software which is available based on a number of inputs and outputs. This design work is done for Programmable Logic Controller (PLC) serves to be a “Workhorse” of industrial automation. This focused on weeding out the relay control logic to automation which is a machine control logic. The outgrowth is operated by physical or a standard ones which abdicate lesser productivity and may not be energy efficient but such practices were inevitable till the advent of the concept of automation. Automation brought the revolution in every field of application to a greater extent incorporating technologies and machines to do activities in an efficient manner by reducing human intervention.

6. Flowchart:

![Flowchart](image)

**Figure 2. Proposed System**

**Figure 3. Working Flow of PLC Logic**
7. Experimental Results:
Our paper adduces a design through a PLC logic inorder to convert an conventional milling machine which intricates with the relays, contactors and certain wiring arrangements to automated machine design. This paper proposes a upgraded automation technology inorder to overcome several drawbacks which are loss in efficiency of a machine which happens because of a breakdown (failure of contactors, relay arrangement, wiring discharge).

To line up this or to avoid this criteria this paper adopts this automation technique. Our paper adduces actually weeds out the operation of breakdown to be less and reduces the work of man force by enabling the time reduction. Enhancing this techniques also saves the installation cost and also magnifies the speed of the machine which successively ignites the efficiency of the machine to higher level. This design is incorporated by interfacing of various electrical and mechanical components with PLC. This also implements the complex buttons by implementing the control principles like ON/OFF or switching control via PLC . This completely eliminates the manual seeking of the controlling the position of the work piece which in turn said here as the automation the conventional machine. Here adopting DVP-SE Series for PLC design logic which controls the machine operations which enrolls Emergency switches for an emergency operation of machine while automatically operated, Lubrication level limits to limit friction which causes overheating in the motors and leads to winding damage, Axes controls for the workpiece to be positioned for an accurant output piece to be delivered and also also gets initially checked in the depicted simulations through DELTA PLC software.

Here DELTA PLC preferred as DVP-SE series is enrolled for the efficient automation of the machine control and the installation of this PLC is inculpated for the machine in mentioned arrangements. This series is preferred as it offers high reliability, high speed for efficient way of machine operation. The main panel descriptions for a conventional machine includes Starters, Axis selection switches, Coolant motor control, Main motor control and the entire operation is initially presented in the PLC DVP-SE series which overall contains 12 inputs which intrudes 8 outputs in which logic –Emergency control switches, Lubrication limits, axis control, starter controls, coolant control, operations like cutting, inching either in forward or reverse direction for the job piece to be produced accordingly in X-axis or Y-axis or Z-axis or along spindle axis for an appropriate selection switches to be selected in PLC and to be programmed earlier in specified manner and can be loaded either through online mode or USB or Ethernet cable can be used along the PC as a transmitting media which when aligned as an operating panel which executes the portrayed logic as a control of entire machine as an automated one. Our design initiates the wiping out the workforce and reducing the number of contactors, wiring arrangements which saves definite time intervals and energy and also weeds out the breakdown time to be less which hikes the efficiency of the machine by smooth operation of machine from conventional to automation. All controlling and monitoring of other important requisites of certain processor are done at same instant. This said to be the step response for the evolution with upcoming onset upgraded technologies. This design enrolls the simulation under ladder logic as it results in easier understanding and also simpler. For instance for carrying out the inching process in forward or reverse which resembles like below in DELTA software with DVP-SE Series.
7.1. Simulating in DELTA DVP-SE:

Figure 4. PLC LOGIC FOR INCHING (MILLING)

8. Conclusion:
PLC programming will change, and now that smaller micro and mini USB connections are available, you can expect to see this feature on more small PLCs. PLCs will continue to develop in the future as networking, hardware, and device infrastructure improves. New industrial automation equipment is propelling businesses forward. We have seen a significant shift in technical advances transform the industrial automation landscape from inception to the advent of collaborative robotics. This emerging automation technology will form the market in the coming year. The global automation industry, on the other hand, has been improving and expanding its capabilities. The threat of security has disturbed curiosity in open-source software, which is maintained by a vibrant group willing to patch bugs.

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