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RESEARCH ARTICLE

PLC AND HMI FOR CONVEYOR MONITORING AND FAULT DETECTION

Mrunal Deshkar and Dipanjali Padhi

Department of Electrical Engineering, Jaywantrao Sawant College of Engineering, Pune, India.

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Abstract

The conveyor is usually used in industries to transport the commodity from one end to another, and can use it anywhere. As the occurrence of faults can affect the entire generation of power, the monitoring and security of these conveyors is important. Using relay logic methods, which have many drawbacks, the safety of the conveyors is carried out, and a new method is therefore required. This paper focuses on the monitoring, control, and safety of conveyors against different types of conveyor faults using a programmable logic controller (plc). This work considers four significant types of faults that commonly occur in conveyors, such as belt sway fault, pull chord fault, zero speed fault, and fire safety.

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Introduction:-

Automation will dramatically improve the conveyor's protection, speed, and control characteristics in real time without needing manpower. Because of the advent of PLC automation, the versatility, durability, and performance of the conveyor can be effectively achieved. The DVP series of Delta programmable logic controllers have high-speed, stable, and extremely efficient applications in all forms of industrial automation technology. In addition to swift logic operation, abundant instructions, and multiple feature cards, the cost-effective DVP-PLC supports multiple communication protocols, connecting Delta's AC motor drive, servo, human-machine interface, SCADA, and temperature controller through the industrial network into a complete Delta Solution for all operators. In general, the induction motor plays a key role in the sequence of power generation in a thermal power plant. High-power induction motors power the conveyors that transport coal from the mine to the boiler. For running fans, blowers, and centrifugal pumps, induction motors are also used. There are some drawbacks to the traditional relay logic system used for the safety of induction motors and it could be replaced by a programmable logic controller that has a high degree of safety, precision and ease of maintenance and monitoring. PLC was used to track and operate induction motors under normal and trip situations, and the results were found to be highly effective as compared to the V/F control scheme. PLC was designed so that any changes in programming can be made without disrupting the electronic circuits. The example, in the control and monitoring of servomotors with a two degree freedom of movement capability, PLC and SCADA were used. The interconnection between the servo motor and the PLC was achieved using the web protocol of Device-Net. A Programmable Logic Controller is used to automate packaging and material handling. In coal mines, PLC and SCADA were used to track belt conveyors and identify belt tear-ups, oil level fluctuations, and the incidence of fire in the conveyors. Using PLC and SCADA, various faults such as overloading, the moisture content in the belt conveyor and wear out of belts are treated. The Siemens PLC s7-300 series was designed to power the belt conveyors in the steel plant using a semiconductor. This paper focuses on the monitoring use of the Programmable Logic Controller (PLC), how the conveyor belt was built, textile materials and structures used for conveyor belt manufacturing, and the advantages of the fabric conveyor belt over the steel conveyor belt. The paper primarily highlights Kevlar fiber, which has excellent tensile and chemical resistant

Corresponding Author:- Mrunal Deshkar

Address:- Department of Electrical Engineering, Jaywantrao Sawant College of Engineering, Pune, India.

properties, among the various fibers. It also goes into the techniques and different types of conveyor splicing, which is the most important aspect of conveyor production, and good splicing is essential for improving the performance of a conveyor belt. It also highlights the different aspects of conveyor failure and how they can be minimized. Will you transfer bulk goods or packages from one location to another with ease? An infinite belt, pulleys, idlers, electrical motors, counterweight, solid frame, and other accessories make up conveyor belt systems. Continuous bulk material processing by conveyors is dependent on the use of infinite belts that not only carry the material but also absorb the tensile forces. The belts run on idlers and are powered by pulleys that are circumnavigated by them. A conveyor belt (or belt conveyor) consists of two or more pulleys, revolving around them, with a continuous material loop-the conveyor belt. The pulleys are driven by one or both, pushing the belt and the material on the belt forward. The driven pulley is called the pulley of the motor, while the idler is called the unpowered pulley. Two major industrial types of belt conveyors exist; those typically handling materials such as those moving boxes inside a factory and handling bulk materials such as those used to move industrial and agricultural materials, such as grain, coal, ores, and so on, normally in outdoor locations. The main objectives of this work is to: (i) To minimize human risk of respiratory health diseases, (ii) Monitoring conveyor belt using PLC, (iii) Collecting fiber particles from products of textile industry conveyors, (iv) To automate system of conveyor and collecting fiber particles using PLC.

Component Used In The Proposed Work

In this work, the PLC (DVP-PLC which is delta brand series) is used to automate the system while Proximity sensors are used to sense the parameters. DC-motor-60 12v dc gear, geared motor 60 rpm is used. It is Very easy to use and available in a standard size. An internally threaded shaft with a nut and threads for linking it to a wheel. The specifications of the same include 60 RPM 12v DC motors with gearbox 6mm shaft diameter with internal hole 125gm, weight stall torque = 1. 5 kgcm, torque no-load current = 60 ma (Max), load current = 300 ma (Max). For visualization and control of application HMI is used, by using resources such as I/O, SoftPlc, CoDeSys or Ethercat, and operating systems, it allows you to communicate with any production scheme. Depending on the programme, a push button switch is used to shut or extend an electrical circuit. The operator pushes the Start button to start a belt conveyor. This supplies power to a relay coil for a brief period of time. When the relay coil is energized, it closes its normally-open link, allowing power to flow to both the relay coil and the conveyor via the normally-open relay contact. The circuit is complete and power is supplied to the conveyor as long as the relay is energized.

A switched-mode power supply is used which is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently, also it gives higher power conversion efficiency (up to 96%). Like other power supplies, an SMPS transfers power from a DC or AC source (often mains power) to DC loads, such as a personal computer, while converting voltage and current characteristics.

Working Of The System

The project's aim is to remove dust contaminants from the garment industry's manufacturing lines. A linear motion conveyor is used to obtain a linear motion conveyor that is equipped with a sensor and a dust collector fan. The conveyor is powered by a DC motor operated by a PLC. The sensor acts as the sensing input for the conveyor's extreme end in order to stop motion. During the conveyer moment, the dust collector fan collects dust from the production side. The exhaust fan at the far end of the conveyors triggers as the dust collection assembly approaches its end. The dust collector fan is switched off, and the dust gathered by the conveyor is exhausted using the end terminal fan at either end. In this work, there are four inputs and five outputs, i.e.

Table 1:- Input and Output data of the system.

INPUT	OUTPUT
START	FORWARD MOTOR
STOP	REVERSE MOTOR
FORWARD/REVERSE	INLET DUST COLLECTOR FAN
POSITION SENSOR	EXHAUST FAN-1
	EXHAUST FAN-2

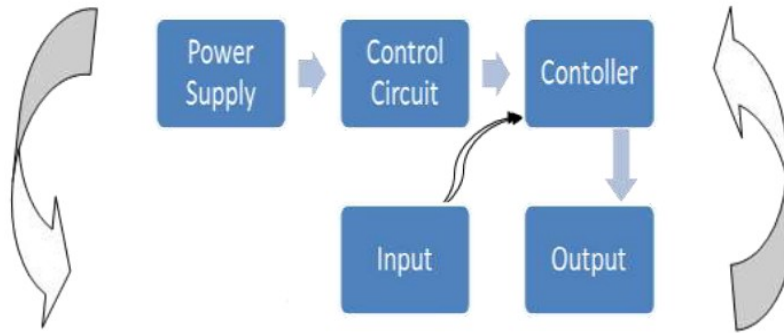


Figure 1:- General Block Diagram.

Figure 1 displays a general block diagram of the method. With the aid of these inputs and output instructions, the mechanical assembly (Fig.2) operates according to the circumstances and their function.

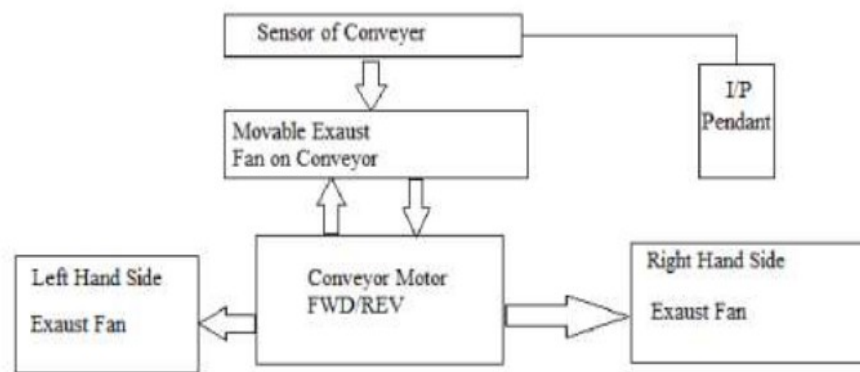


Figure 2:- Mechanical Block diagram.

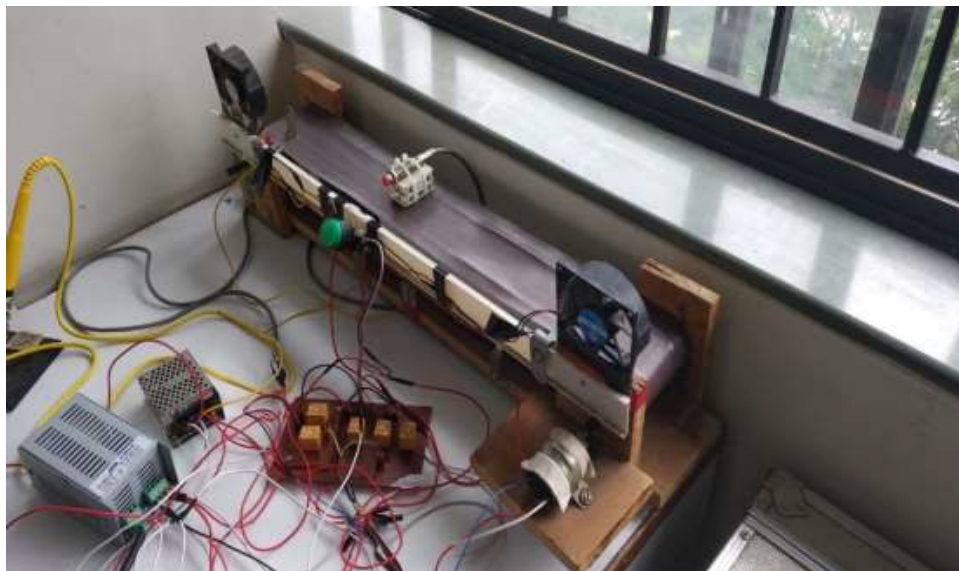


Figure 3:- Hardware Working Model.

Programming Of Motor Speed Control

The software is generated in the computing device before being moved to the PLC's memory machine. DVP-14SS2 is a DELTA PLC, so Delta WPLSoft is the programming platform for DELTA PLCs. WPLSoft software is used to build a Ladder Diagram of the whole programme. The RS-232 cable is also used for connectivity between my PC

and the PLC in order to pass the programme into the PLC memory. The Human Machine Interface (HMI) serves as a link between the operation and the operators, essentially serving as a dashboard for the operators. HMI is a computer or programme that enables a user to connect with machines and manufacturing plants by converting a large volume of complicated data into easily understandable information.

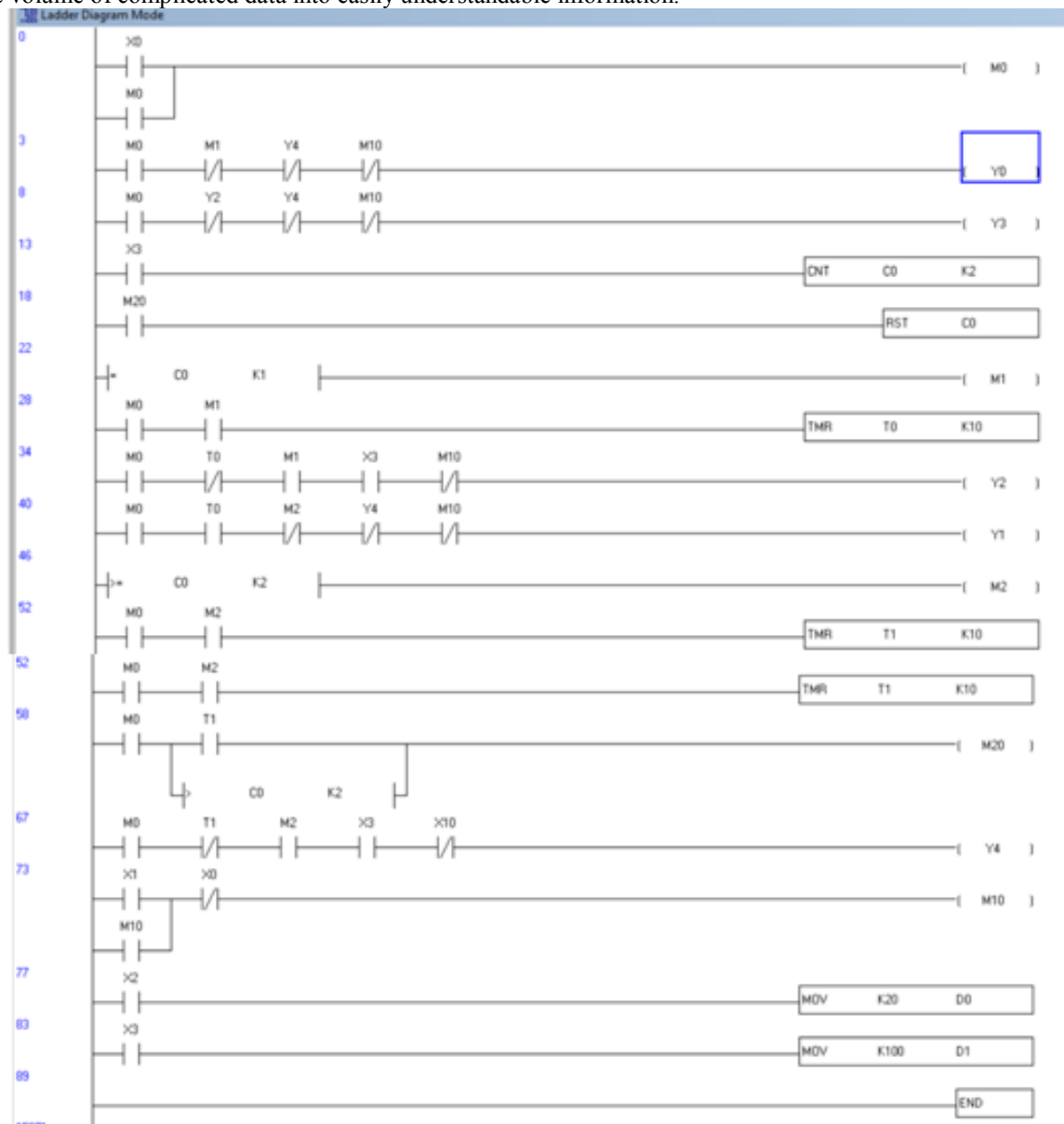


Figure 4:- Programming of motor speed control.

Conclusion:-

The garment industry's belt conveyor for exhausting dust particles will be operated by a programmable logic controller with an exhaust input sensor and a motor as an actuator. PLCs are an important aspect of developing conveyor control operations that are more efficient and use less resources in order to minimize human errors. This work offers greater accuracy and reliability in real-time, where human life is so vital that it saves them from human respiratory health issues. To shield humans from respiratory infections, the management and testing procedure is carried out using PLC and HMI. The proposed work has many benefits, including non-contact detection, which eliminates damage to the sensor head and target, non-contact performance, which ensures a long service life, high response time, and an easy-to-operate, fully integrated device.

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