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Slat Chain Conveyor with V-Block Assembly

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Abstract: *Chain conveyors are used for moving products down an assembly line and/or around a manufacturing or warehousing facility. Chain conveyors are primarily used to transport heavy unit loads, e.g. pallets, grid boxes, and industrial containers. These conveyors can be single or double chain strand in configuration. The load is positioned on the chains, the friction pulls the load forward. Chain conveyors are generally easy to install and have very minimum maintenance for users. Aimed to provide most segmented consumption and sales data of different types of Chain Conveyor, downstream consumption fields and competitive landscape in different regions and countries around the world, this report analyzes the latest market data from the primary and secondary authoritative source. The report also tracks the latest market dynamics, such as driving factors, restraining factors, and industry news like mergers, acquisitions, and investments. It provides market size (value and volume), market share, growth rate by types, applications, and combines both qualitative and quantitative methods to make micro and macro forecasts in different regions or countries.*

Keywords: Chain Conveyor, Assembly Line, Controlled Indexing, Proximity sensor

I. INTRODUCTION

A conveyor system is a fast and efficient mechanical handling apparatus for automatically transporting loads and materials within an area. This system minimizes human error, lowers workplace risks and reduces labor costs — among other benefits. They are useful in helping to move bulky or heavy items from one point to another. A conveyor system may use a belt, wheels, rollers, or a chain to transport objects. The main purpose of a conveyor system is to move objects from one location to another. The design allows for movement of objects that are too heavy or too bulky for humans to carry by hand. Conveyor systems save time when transporting items from one location to another. As they can be inclined to span multiple levels, they make it simpler to move items up and down floors, a task that, when performed manually by humans, causes physical strain. [6] Inclined belts can automatically unload material, eliminating the need for someone to be on the opposite end to receive pieces. You can probably imagine a large warehouse filled with conveyors using belts and rollers to move boxes and other heavy equipment, but this is just one of several types of conveyor systems. You'll also find conveyor systems in airports, where they're used to transport luggage. Other examples include escalators and ski lifts. These apparatuses still use a belt or chain and pulleys to move heavy items from one point to another

II. SPECIFICATIONS

2.1 Delta TP70P-32TP1R

In this project we are using TP70 series controller. It is industrial programable logic controller. The TP70P-32TP1R PLC has 32 digital inputs and outputs. It has 32 bit CPU. It operates on operating voltage ranging from 24v DC. It has USB port to upload program, RS232 module, it has 128MB flash ROM. [4] Thus this PLC is widely used in industrial automation projects. This controller is ideal for industrial, Appliances and customer applications.[4] Thus we are using Delta PLC.

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Figure 1: Delta TP70P-32TP1R PLC.

2.2 Inductive Proximity Sensor

A proximity sensor is a sensor able to detect the presence of nearby objects without any physical contact. A proximity sensor often emits an electromagnetic field or a beam of electromagnetic radiation (infrared, for instance), and looks for changes in the field or return signal. The object being sensed is often referred to as the proximity sensor's target. Different proximity sensor targets demand different sensors.[3] For example, a capacitive proximity sensor or photoelectric sensor might be suitable for a plastic target; an inductive proximity sensor always requires a metal target

Proximity sensors can have a high reliability and long functional life because of the absence of mechanical parts and lack of physical contact between the sensor and the sensed object. Hence we are using proximity sensors.

Figure 2: Inductive Proximity Sensor.

2.3 Variable Frequency Drive

A variable-frequency drive (VFD) is a type of motor drive used in electro-mechanical drive systems to control AC motor speed and torque by varying motor input frequency and, depending on topology, to control associated voltage or current variation.[7] VFDs may also be known as 'AFDs' (adjustable-frequency drives), 'ASDs' (adjustable-speed drives), 'VSDs' (variable-speed drives), 'AC drives', 'micro drives', 'inverter drives' or, simply, 'drives'.

Figure 3: Variable Frequency Drive.

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VFDs are used in applications ranging from small appliances to large compressors. An increasing number of end users are showing greater interest in electric drive systems due to more stringent emission standards and demand for increased reliability and better availability.[6] Systems using VFDs can be more efficient than those using throttling control of fluid flow, such as in systems with pumps and damper control for fans.[7] However, the global market penetration for all applications of VFDs is relatively small.

Over the last four decades, power electronics technology has reduced VFD cost and size and has improved performance through advances in semiconductor switching devices, drive topologies, simulation and control techniques, and control hardware and software. VFDs are made in a number of different low- and medium-voltage AC-AC and DC-AC topologies.

2.4 Induction Motor

An induction motor or asynchronous motor is an AC electric motor in which the electric current in the rotor needed to produce torque is obtained by electromagnetic induction from the magnetic field of the stator winding.[7] An induction motor can therefore be made without electrical connections to the rotor. An induction motor's rotor can be either wound type or squirrel-cage type.

Three-phase squirrel-cage induction motors are widely used as industrial drives because they are self-starting, reliable and economical. Single-phase induction motors are used extensively for smaller loads, such as household appliances like fans. Although traditionally used in fixed-speed service, induction motors are increasingly being used with variable-frequency drives (VFD) in variable-speed service. VFDs offer especially important energy savings opportunities for existing and prospective induction motors in variable-torque centrifugal fan, pump and compressor load applications. Squirrel-cage induction motors are very widely used in both fixed-speed and variable-frequency drive applications.

Figure 4: Induction Motor.

III. Implementation Methodology

3.1 Block Diagram

The figure shows the block diagram of slat chain conveyor with v-block mounting:

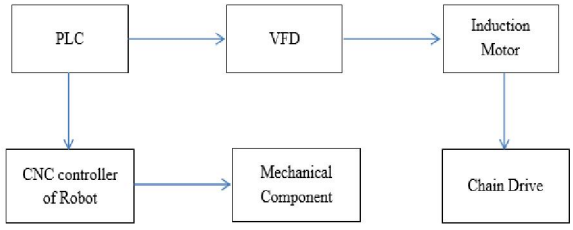

Figure 5: Block diagram of slat chain conveyor.

3.2 Working

In our proposed work, the entire system is done by using Delta PLC. Once we set PLC in Auto mode by selector switch then PLC follows the instructions as mentioned in ladder program [3] If we turn selector switch in to Auto mode side and mount metal component on conveyor, proximity sensor detects the components and send signal to PLC after that PLC sends command to VFD to run the motor. [4] If once conveyor starts moving it will run till proximity sensor of end side detects

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the component. Once component detected by end side proximity sensor then PLC sends signal to VFD to stop motor and this procedure will done within the 10 micro seconds.

IV. RESULTS

In our project, the total idea of design and simulation is done with help of Auto Cad Electrical software which is used for all circuit design work. All the programming work is done by using WPL soft which is developed by Delta Corporation.

4.1 Circuit Design

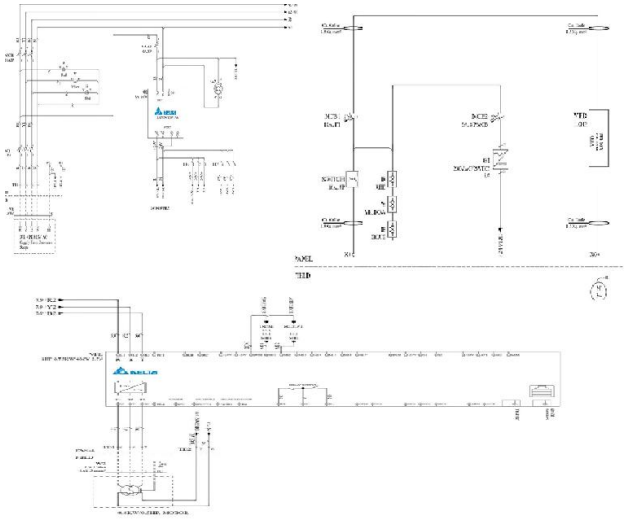

Figure 6: Circuit Design using Auto cad Software.

4.2 Ladder Logic

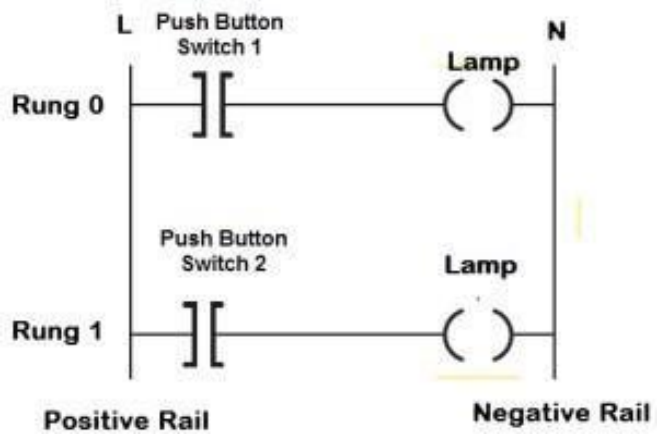

Figure 7: Logic Development using WPL soft Software.

Among several programming languages ladder logic diagram is the most basic and simplest form of programming the PLC. The below figure shows the hardwired-ladder diagram wherein the same lamp load is controlled by two push button switches, in case if any one of the switches gets closed, the lamp glows. Here two horizontal lines are called rungs which are connected between two vertical lines called rails. Each rung establishes the electrical continuity between positive (L) and negative rails (N) so that the current flows from the input to output devices. Some of the symbols used in ladder logic programming are shown in the figure.

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V. CONCLUSION

In this project, we have done PLC programming, learn interfacing of VFD to PLC. We also get knowledge of mechatronics components like Proximity sensors, reflective type photo sensor. In this paper we addressed the optimization problem of Drag Chain Conveyor System which arises due to overweight.

Particularly at the micro modeling level of detail, the accurate representation of conveyors and the equipment interfacing with them comprises numerous challenges. Meeting these challenges requires close attention to operational specifications and detail of the equipment, plus keen awareness of the capabilities of the simulation modeling tool chosen for use. This paper surveys these' challenges

VI. FUTURE ENHANCEMENT

In the future there will be large scope. In this project, we can interface this conveyor with industrial robotic arm for pick and place heavy components. This project can also be monitor and controlled through SCADA software by interfacing PLC in to SCADA network. Different types of sensors and wireless sensor network are used for collecting information such as condition of loading chain and monitoring of vibrations of the system. This information will be transmitted to concern person who is managing the maintenance work; accordingly, this person can take immediate preventive actions to maintain system healthy. Owners and managers of the organization are connected through wireless network and aware of conditions of system at anytime and anywhere in the world.

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