www.ijiarec.com

ISSN:2348-2079

Volume-7 Issue-1

International Journal of Intellectual Advancements and Research in Engineering Computations

PLC Based Automated Shrink Bundling Machine for Packing in Paper Industry

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ABSTRACT

This project is mainly implemented in paper industry for bundling purpose. Here the existing relay logic automation is replaced by PLC based automated technology is implemented where the speed of the process is enhanced with better accuracy and finishing with good reliability.in the existing method mechanical relays are high in numbers where the replacement technology reduces those relays with PLC. In this process the paper bundles are bounded together with a polyethylene sheet as a wrapper to bind around the paper bundles. Later the polyethylene sheet is sealed and bundle is passed through the heating tunnel by the conveyor. The heating tunnel produces thermal radiation (heat energy) by induction heating. Later the finished product is obtained which can be dispatch for marketing through logistics.

INTRODUCTION

In this project, the existing relay logic method is replaced by PLC with ladder logic program. In this relay logic mechanical relays are more in numbers and noise is produced due to switching of relays. In this process the paper bundles are bounded together with a polyethylene sheet as a wrapper to bind around the paper bundles. PLC is connected to photo sensor which feeds as input to the PLC and output from PLC is feeded to thin film sealer and Later the polyethylene sheet is sealed and bundle is passed through the heating tunnel by the conveyor [1-3].

Literature Survey

In the olden days lot of industries and plants are using conventional relay logic system for do their work in the industry. Like this in the existing method of shrink bundling method they are using relay logic for operating the mechanical element for bundling the shrink.in that they are facing lot mall functions in the relay logic it may cause mechanical stress and in that type of relay logic system mechanical parts are high and contactors are high in numbers .and due to the mall function of relay logic system the production will affect.in that systemthe maintenance is high and cost is high due to the maintenance [3-6]

PROPOSED SYSTEM

The industrial automation that made with relay logic method is replaced by Programmable Logic Controllers (PLC) which is getting more popular among other automation techniques in this industrial period, where PLC can be programmed by various programming methods like ladder logic, structural programming, instruction set in those we have selected the simplest LADDER LOGIC type of programming.in this the moving and mechanical

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parts are low in numbers and there is no mall function due to low mechanical parts, and the reliability and high, and the production is high it will help to grow up the industry in the economic status [7].

SYSTEM ARCHITECTURE

Block Diagram

Depending upon the mechanical setup and the electronic circuit the conceptual diagram is given below.

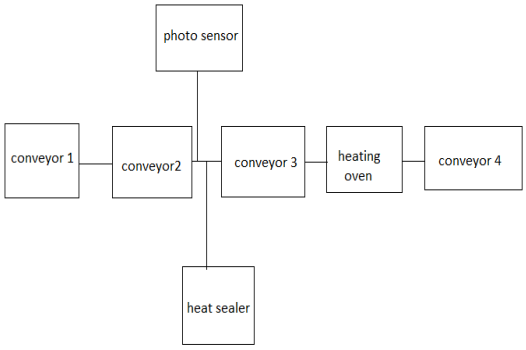


Fig: 1 Block Diagram

In this conceptual diagram the four conveyors are available, for the purpose of starting of the process and till the end of the process (till dispatch of the shrinked bundle). the conveyor available are conveyor 1, conveyor2, conveyor3, conveyor 4.and the photo sensor, heat sealer, electric actuator and oven. The conveyor 1 is used to carry the unshrinked bundle to the conveyor 2.in the end of the conveyor 2 the photo sensor is fixed to detect the unshrinked bundle ,then the unshrinked bundle is move to conveyor 3 from conveyor 2,after the some time interval the heat sealer is seal the poly leaf after the sealing of poly leaf the bundle is move to the conveyor four and the oven is to heat the poly leaf and the mechanical arm is to correct the edges of the bundle.

EQUIPMENT

Hardware Equipment

- PLC
- Photo sensor
- Electric actuator
- Sealing unit
- Oven
- Conveyor

PLC (Programmable Logic Controller)

Programmable Logic Controller (PLC) is a digital computer used for the automation of various electro-mechanical processes in industries. These controllers are specially designed to survive in harsh situations and shielded from heat, cold, dust, and moisture etc. **PLC** consists of a microprocessor which is programmed using the computer language.The program is written on a computer and is downloaded to the PLC via cable. These loaded programs are stored in non – volatile memory of the PLC. During the transition of relay control panels to PLC, the hard-wired relay logic was exchanged for the program fed by the user. A visual programming language known as the Ladder Logic was created to program the PLC.in this we are using the DELTA PLC for the programming and automotive products. We are using the PLC for the controlling of the shrink machine.

Advantages

They are user friendly and easy to operate, they eliminate the need for hard wired relay logic, they are fast, it is suitable for automation in industries, its input and output can be extended depending upon the requirements.

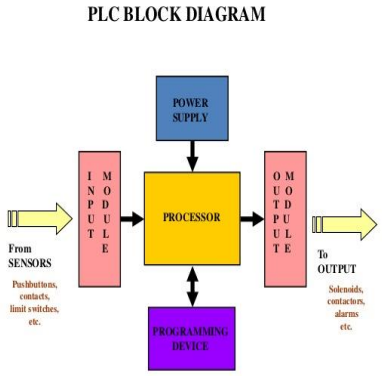


Fig: 2 PLC Block Diagram

PHOTO SENSOR

A photosensor is an electronic component that detects the presence of visible light, infrared transmission (IR), and/or ultraviolet (UV) energy. Most photosensors consist of semiconductor having a property called photoconductivity , in which the electrical conductance varies depending on the intensity of radiation striking the material. The most common types of photosensor are the photodiode, the bipolar phototransistor, and the photo FET (photosensitive field-effect transistor). These devices are essentially the same as the ordinary diode , bipolar transistor , and field-effect transistor , except that the packages have transparent windows that allow radiant energy to reach the junctions between the semiconductor materials inside. Bipolar and field-effect phototransistors provide amplification in addition to their sensing capabilities.

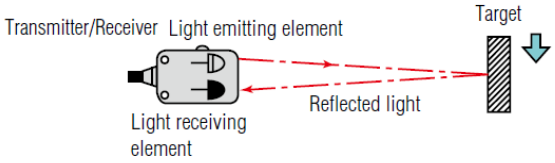


Fig: 3 Photo Sensor

ELECTRICAL ACTUATOR

Basically, an electric actuator is one kind of gear motor which can be of various voltages and is the main torque producing component. To stop extreme current draw, electric actuator motors are generally set with a thermal overloadsensor fixed in the motor windings. This sensor is energetic in series with the power source and unlocks the circuit should the motor be excited, then locks the circuit when the motor attains a secure operating temperature.

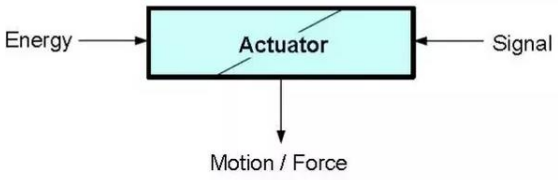


Fig: 4 Electrical Actuator

An electric motor consists of an armature, an electrical winding, and a gear train. When power is supplied to the winding, a magnetic field is generated causing the armature to rotate. The armature will turn as long as there is a control to the windings when the power is cut, the motor discontinues. Typical end of travel limit switches, which are essential for an electric actuator, handles this mission.

SEALING UNIT

A heat sealer is a machine used to seal products, packaging,air based sealing andother thermoplastic materials using heat. This can be with uniform thermoplastic monolayers or with materials having several layers, at least one being thermoplastic. Heat sealing can join two similar materials together or can join dissimilar materials, one of which has a thermoplastic layer. Heat sealing is the process of sealing one thermoplastic to another similar thermoplastic using heat and pressure.[1] The direct contact method of heat sealing utilizes a constantly heated die or sealing bar to apply heat to a specific contact area or path to seal or weld the thermoplastics together. Heat sealing is used for many applications, including heat seal connectors, thermally activated adhesives, film media, plastic ports or foil sealing.

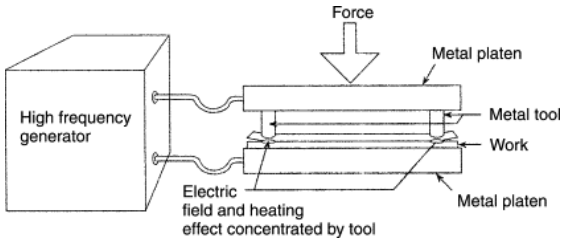


Fig: 5 Sealing Unit

OVEN

An oven is a thermally insulated chamber used for the heating, baking, r drying of a substance,and most commonly used for cooking. Kilns and furnaces are special-purpose ovens used in pottery and metalworking, respectively.

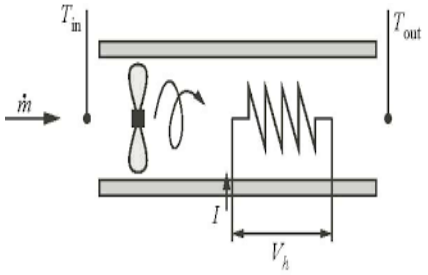
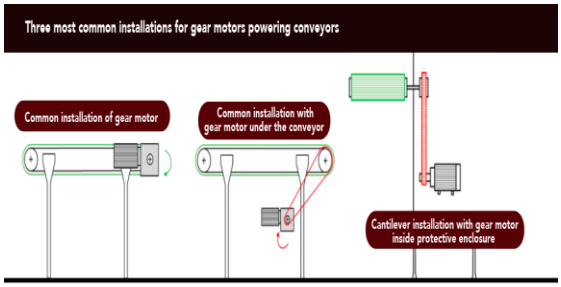


Fig: 6 Oven

CONVEYOR

A conveyor system is a common piece of mechanical handling equipment that moves materials from one location to another. Conveyors are especially useful in applications involving the transportation of heavy or bulky materials. Conveyor systems allow quick and efficient transportation for a wide variety of materials, which make them very popular in the material

handling and packaging industries. They also have popular consumer applications, as they are often found in supermarkets and airports, constituting the final leg of item/ bag delivery to customers. Many kinds of conveying systems are available and are used according to the various needs of different industries. There are chain conveyors (floor and overhead) as well. Chain conveyors consist of enclosed tracks, I-Beam, towline, power & free, and hand pushed trolleys.



Software Equipment

- a)Laptop/PC
- b)WPL Software

Laptop/PC

A laptop is a computer which is easy to carry around. Its user can fold the laptop along its hinge for carrying. The laptop was created mainly for this particular reason. Computer parts were scaled to smaller size so this could happen. A modern laptop is self-contained, with built-in rechargeable battery and peripheral equipment. The user can also plug it in, for longer battery life and additional peripherals.

WPL Software

WPL Software is mainly designed for DELTA PLC hardware. Through this software we can download the LADDER LOGIC program to the delta plc hardware. Through this we can automate the equipment in the industry.

Hardware setup

The hardware setup is given below is used for the wrapping if bundle in the paper and industry. It is the new updated controlling technique in the industry.

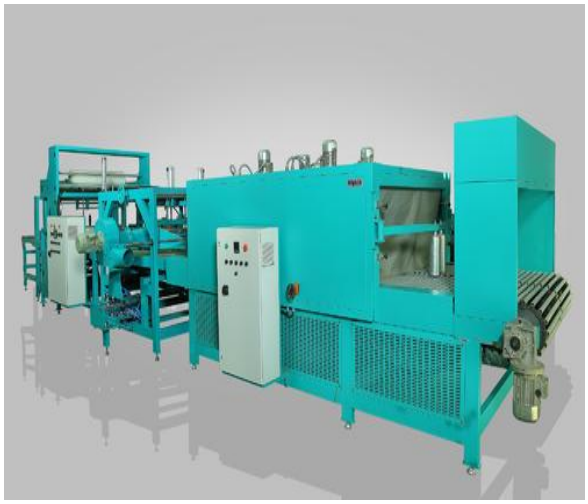


Fig: 7 Hardware setup

OUTPUT

WPL software simulation output is given below depending upon the working of hardware setup ion the paper industry.

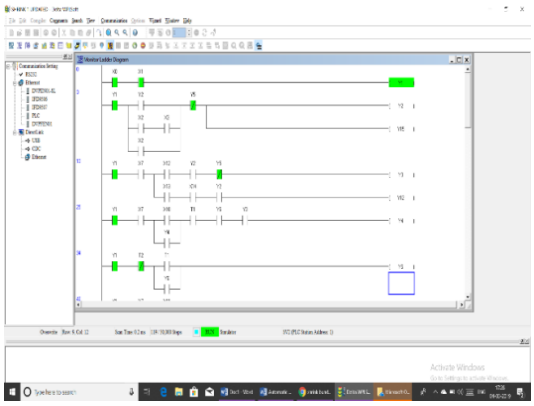


Fig: 8 Simulation output

CONCLUSION AND FUTURE ENHANCEMENT

Problem addressed by this invention

PLC may get damage due to surge voltage due to power fluctuation, lightning and transformer failure.

Solution to a problem

Surge arrestor, opto coupler-based transformer protection devices are the other solutions to the above problem.

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