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Automatic Metal Separation Using PLC

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Abstract: The presentation is about automatic metal separation using plc. The basic idea of this project is to design a small belt system and an easy and automated process to separate different metal sizes using the PLC. In earlier in the industries metal was separated manually. But now a days with the help of automation system the task of separating metal has become easier. This automatic metal separation system has the advantage of smooth and efficient operation of the metal separator. It usually works on metallic identification of any size or that we want to separate. This work will provide high accuracy and flexibility to the system and at the same time it will save the overall time. The central idea of this project is to design a small belt system which is a automated process to separate different metal sizes using the PLC. The electronic sensors are used to provide information to the controller. High flexibility is the main requirement of industry to increase production. The different processes of sorting are controlled by the PLC. PLC is the heart of this project which is controlled by a PLC program.

Keywords: eco-friendly, flexible,reliable, automatic.

I.INTRODUCTION

The development of the manufacturing industry depends on the manufacturing process and the alteration of new products. It is said that countries with low productivity are considered undeveloped, whereas countries with high production rates are developing. Sorting is a process of systematic alignment of elements also it has two meanings: ordering, grouping.Generally, the manufacturing industry continues to produce the same model, with small variation in height, color, shape, and hence sorting plays an important role here. Earlier it was possible to carry out manual work to sort such objects. Today, to increased production and to reduce labour costs for such unskilled work, the industry cannot afford the labour use for sorting of metals. This is forcing the industry to automize the sorting process. As the economy is always an important factor in the development of the industry, it is essential to create cost-effective automation for an exact sorting of products. In the automotive industry, innovation, finding effective ways to increase productivity and reduce operational costs are key to success. We have to provide a low-cost automatic solution for sorting metals. The project focuses on sorting three different objects. Here, we used proximity sensors and DC motors attached to the logic controller (PLC). This DC motor is used to push the object from the conveyor to a sorted bin. PLCs are programmed for sorting products of different sizes. This system is built using 3 sensors used to detect the presence of objects and the size of the location. In our model, we used conveyor arrangements. The function of the conveyor is to feed the objects in front of the sensor.

II.PROPOSED WORK

In this project, we have developed a low-cost automation system for sorting metals. The project focuses on sorting three different objects using proximity sensors and DC motors attached to the logic controller (PLC). This DC motor is used to push the object from the conveyor to a sorted bin. PLCs are programmed with different logic for sorting products of different sizes. This system has nearly 3 sensors used to detect the presence of objects and the size of the location. In our model, we have conveyor arrangements. The function of the conveyor is to feed the objects in front of the sensor. The conveyor system is powered by 24V DC power. Three wooden plates were used to hold the sensors. The system is designed to sort four different sizes of metals. The entire phenomena of sorting is done using conveyor belt sensors and ejector motor. In this project we have made arrangements such that metal with higher height will be ejected first, then slight smaller one respectively. We had designed prototype such that it can start sort three different sizes of metals using proximity sensor. The entire structure is made of wooden to give strength and also it will be easier to move. The value for timer is decided such that it is based on speed of conveyor i.e. time taken by object to travel distance between sensing module and ejector module. In this model we had made arrangement such that, unless the conveyor motor is not started the entire process will not start. Hence, we have to start conveyor motor using toggle switch. The object with larger height will be ejected first, as the sensor 1 senses the object, signal is given to PLC, the timer 1 starts for definite time, after that the ejector motor will operate i.e. the signal is received by relay coil, hence forward relay coil is energized after time delay

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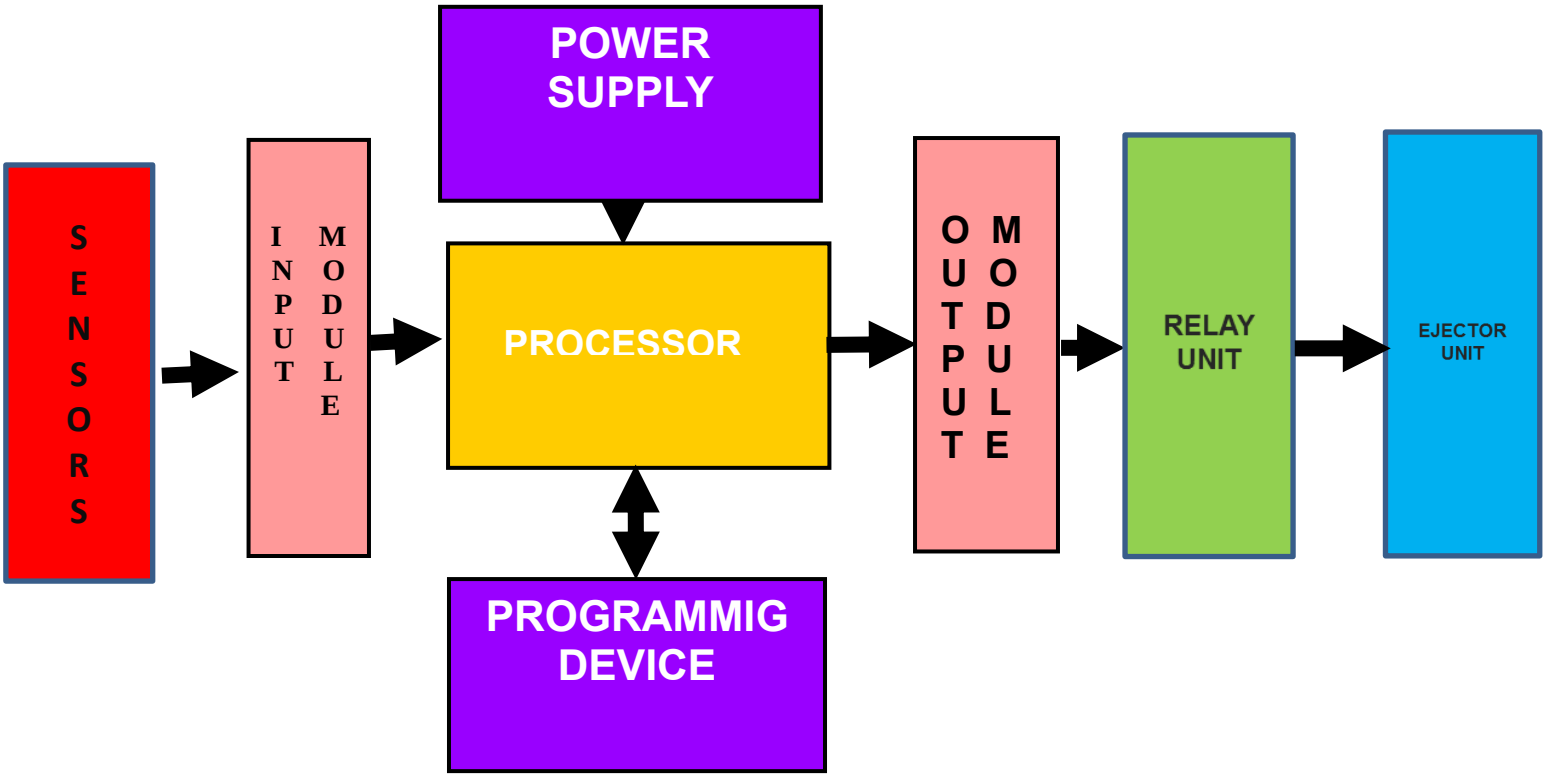
of 3 seconds. Similarly reverse relay coil is energized after 5 seconds and ejector motor will regain its original position. If sensor 1 does not senses the object, the object is carried forward through conveyor for further process i.e. for different height measurements, hence if sensor 1 fails to sense the object it is further checked for different sizes.



III.IMPLEMENTATION DETAILS

Programming Logic Controller:

MicroLogix 1100 programmable controller contains a power supply, input and output circuits, a processor, an isolated combination RS-232/485 communication port, and an Ethernet port. The input to PLC is 24 Volt DC. Each controller supports 18 I/O points (10 digital inputs, 2 analog inputs, and 6 discrete outputs). The memory size is upto 128 kilo bytes for data logging. It has 4k words user program memory and 4k words user data memory. It has one 40 kilo Hz embedded high speed counter.

The MicroLogix 1100 controllers provide two communications ports, an isolated combination RS-232/485 communication port and an Ethernet port. The MicroLogix 1100 supports Ethernet communication via the Ethernet communication. Connecting controller to a local area network provides communication between various devices at 10 Mbps or 100 Mbps.The MicroLogix 1100 controllers have screw-cage clamps on the input and output terminal blocks. With screw-cage clamp terminal blocks, there is no need to attach additional hardware such as a spade lug to the wire, or use a finger-safe cover.

Sensors:

Sensors are devices that are frequently used to detect and respond to electrical or optical signals. A Sensor converts the physical parameter (for example: temperature, blood pressure, humidity, speed, etc.) into a signal which can be measured electrically. 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. 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.

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A proximity sensor adjusted to a very short range is often used as a touch switch. The sensor is inductive type p-n-p normally open contact. It has ranging distance of 8 mm, current rating of 10 mA and voltage rating is about 10-30 volt. It consists of 3 wire i.e. green, red, black. Green wire is connected as a input to PLC whereas the two are connected to positiveand ground.

Relay

The relay used is of 24 volt, 8 pin DPDT relay. Relay coils are used for the forwarding and reversing of motor. Two relay coils are used for each motor and hence the operation is performed. Relay is divided into two sections i.e. input and output. The input part comprises of 2 pins which are in connection to input signal and ground. The output part comprises of contactors which implies switching process. The output section has 6 contacts with set of 2. Individual set has three contacts, i.e. normally open (NO), normally close (NC), and common (COM). When the supply is off, the common is connected to NC contact. When the supply is on, the relay coil gets energized and the common coil changes contact to NO.

DC MOTOR

DC motor is a rotating machine that converts electrical energy into mechanical energy as shown in Fig.5.3.3. The most common types are based on the force generated by the magnetic field. Almost all DC motors have internal mechanics, electronically as well as electronically, to change the direction of current in the engine sector. The first DC motor is widely used as it can be powered by an existing power distribution system.The speed of the DC motor can be controlled over a wide range using either a supply voltage or a change in current in its air. We had used motor of rating 24 volt, 100 rpm for ejector motor and 3.5 rpm for conveyor motor.

Conveyor Belt

A conveyor belt is the carrying medium of a belt conveyor system (belt conveyor). A belt conveyor system is one of many types of conveyor systems. A belt conveyor system consists of two or more pulleys (sometimes referred to as drums), with an endless loop of carrying medium, the conveyor belt that rotates about them. One or both of the pulleys are powered, moving the belt and the material on the belt forward. The powered pulley is called the drive pulley while the unpowered pulley is called the idler pulley. The weight of rubber conveyor is less as compared to chain conveyor. The size of rubber conveyor is 3 feet long and its width is 6 inches and is connected through the roller to motor of 3.5 rpm. One side of conveyor is powered whereas the other side consists of bearing arrangement. The conveyor is supported by a wooden block surrounding it.

Switched-Mode Power Supply

Switched-mode power supply (SMPS) shown in Fig.5.3.6 is an electronic power supply having switching regulators which effectively convert AC power to DC power. SMPS while converting the voltage and current characteristics transfer the electrical power from the main power source to the load. SMPS spend a little time on high dissipation transition thereby it saves energy. Ideally, SMPS dissipates no power. By varying the ratio of on-to-off time, we can regulate the voltage of SMPS. On contrary output voltage of linear power supply is regulated by continual power dissipation in pass transistor. The most important advantage of SMPS is the high power conversion efficiency. In our model, we are converting 230 V AC to 24 V DC, 2 A. We need an SMPS because our PLC runs on 24V DC supply.

V.CONCLUSION

We have developed an automatic metal separating system using a PLC. This system meets the need for high-speed production. This system also ensures the precision and accuracy of the metal bars. It offers many advantages as it can be easily manipulated and easy to operate .In our project, the technology for logic controllers to separate the different sizes of the metal is carried out In some industries, separation plays an important role so that by efficient sorting of particular object they may get a huge profit in the way of productivity and turnover of the industries.

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