

# AUTOMATIC OBJECT SORTER: FABRICATION OF METAL SORTING OUT MACHINE

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## ABSTRACT

*Our project deals with the design and fabrication of object removal machine with conveyer setup and proximity sensor to detect metals. We use sensors to sense the metals that come along with the food materials in the conveyor. The output from the sensor is given to the micro controller and the microcontroller is used to control the conveyor and the actuator. The actuator is used to remove the food materials that contain the metals. The inspection conveyor is very useful in food processing industries. The sensors are located at the top of the conveyor mechanism for the simple construction purpose. By implementing the project the manual errors in food processing industries can be reduced. It also reduces the inspection time and the manual inspection error.*

## 1. Introduction

A metal sorting out machine is a common piece of mechanical handling equipment that moves the food 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. Many kinds of conveying systems are available and are used according to the various needs of different industries.

The various departments involved in an industry are the design, production, assembly and quality. The major portion of the industries' success depends upon the quality department. They inspect the machined product and separate them based on the acceptable level and rejection. Quality Control and Inspection are the most important things in the factory design. Automation plays a vital role in mass production of a product, the machining operations decide the sequence of machining. The machines designed for producing a particular product are called transfer machines. Conveyor Automation is a specialized activity for a modern manufacturing concern. It has been estimated that about 60-70% of the cost production is spent in material transferring activities.

### 1.1 LITERATURE REVIEW

Conveyors are durable and reliable components used in automated distribution and warehousing. In combination with computer controlled pallet handling equipment this allows for more efficient retail, wholesale, and manufacturing distribution. It is considered a labor saving system that allows large volumes to move rapidly through a process, allowing companies to ship or receive higher volumes with smaller storage space and with less labor expense.

This project combines the usage of conveyor system and the sensors for inspecting the products that are manufactured in an industry. The sensors sense the dimension of the work piece and sends signals to the control unit which in turn actuates the pneumatic cylinder through the solenoid valve. The control unit controls the actuation mechanism based on the signals received by them from the sensors. This project is a semi-automated system where the partial human effort is also involved. The project can be made fully automated where the construction of the project and the fabrication becomes more complicated.

## 2. BLOCK DIAGRAM

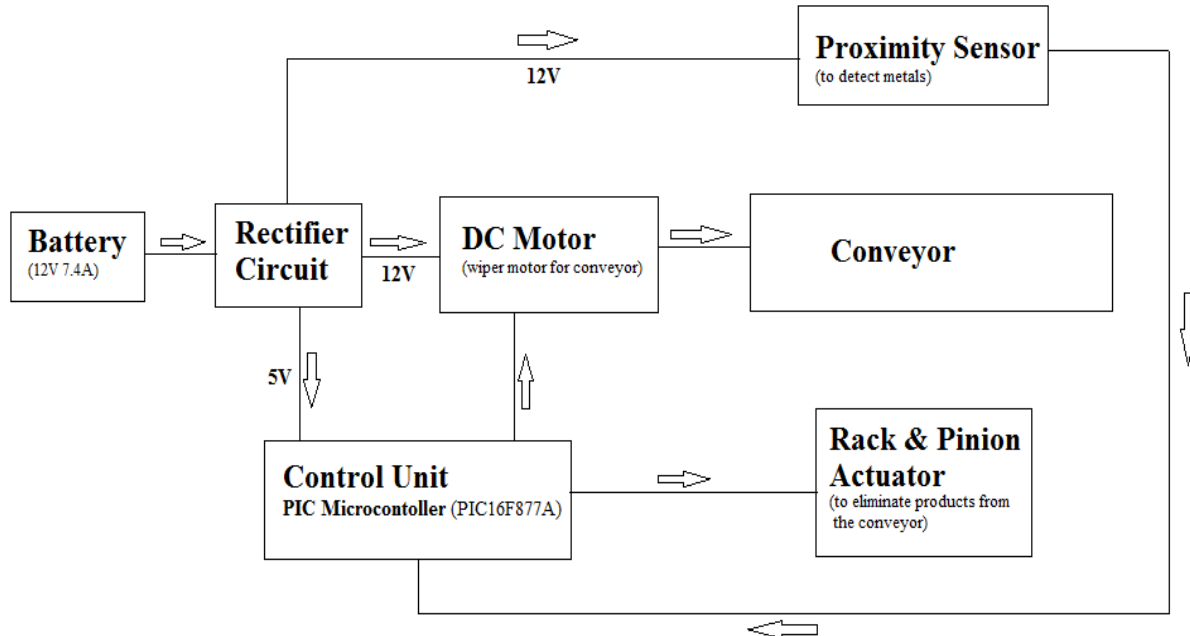


Fig. 1. Block Diagram.

## 3. COMPONENTS AND DESCRIPTION

### D.C. MOTOR (PERMANENT MAGNET)

An electric motor is a machine which converts electrical energy to mechanical energy. Its action is based on the principle that when a current-carrying conductor is placed in a magnetic field, it experiences a magnetic force whose direction is given by Fleming's left hand rule.

When a motor is in operation, it develops torque. This torque can produce mechanical rotation. DC motors are also like generators classified into shunt wound or series wound or compound wound motors.

### CONVEYOR BELT AND ROLLERS

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. 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.

### LEAD-ACID WET CELL

Where high values of load current are necessary, the lead-acid cell is the type most commonly used. The electrolyte is a dilute solution of sulfuric acid ( $H_2SO_4$ ). In the application of battery power to start the engine in an auto mobile, for example, the load current to the starter motor is typically 200 to 400A. One cell has a nominal output of 2.1V, but lead-acid cells are often used in a series combination of three for a 6-V battery and six for a 12-V battery. The lead acid cell type is a secondary cell or storage cell, which can be recharged. The charge and

discharge cycle can be repeated many times to restore the output voltage, as long as the cell is in good physical condition. However, heat with excessive charge and discharge currents shortens the useful life to about 3 to 5 years for an automobile battery.

### **RACK AND PINION:**

A rack and pinion is a type of linear actuator that comprises a pair of gears which convert rotational motion into linear motion. A circular gear called "the pinion" engages teeth on a linear "gear" bar called "the rack"; rotational motion applied to the pinion causes the rack to move relative to the pinion, thereby translating the rotational motion of the pinion into linear motion.

For example, in a rack railway, the rotation of a pinion mounted on a locomotive or a railcar engages a rack between the rails and forces a train up a steep slope. For every pair of conjugate involute profile, there is a basic rack. This basic rack is the profile of the conjugate gear of infinite pitch radius.

### **PROXIMITY SENSOR**

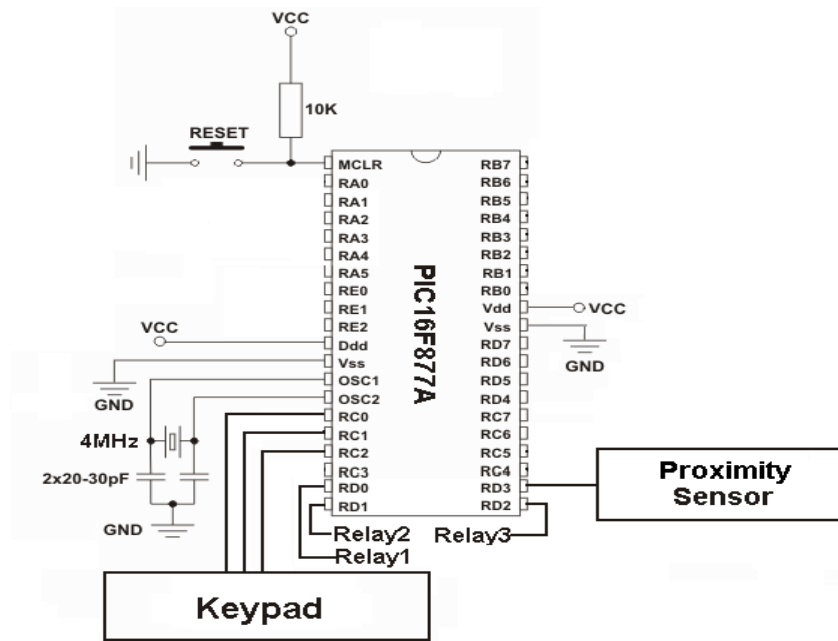
A proximity sensor is a sensor able to detect the presence of nearby objects without any physical contact. A proximity sensor often emits an electromagnetic field or a beam of electromagnetic radiation (infrared, for instance), and looks for changes in the field or return signal. The object being sensed is often referred to as the proximity sensor's target.

The proximity sensor switch is vertically fixed on the limit sensor frame stand by means of rack and pinion arrangement. This sensor is used to sense the presence of metal parts in food product. The rack and pinion is used to adjust the limit switch up and down. This arrangement is used to set the height of the material.

The IR transmitter and IR receiver circuit is used to sense the minute variations of the material. It is fixed to the frame stand with a suitable arrangement. This mechanism is also adjustable with the help of bolt and nut. The pneumatic cylinder is fixed to the frame stand by right angles to the proximity sensor frame stand. The rack and pinion arrangement is used to remove the material with inappropriate dimensions from the conveyor.

### **PIC MICROCONTROLLER**

A Pic microcontroller is a 40 pin controller that controls the devices like conveyors and others through the output signals generated as a result of the various logics written in the code. When the sensor senses the metal, the Pic controller will make the conveyor to stop for a few seconds and will turn on the actuator (the motor with the rack and pinion) which will push the detected material out from the conveyor. Along with the Pic microcontroller relay components are connected to drive the wiper motor which is to drive the conveyor and the other dc motor is used to drive the rack and pinion actuator. Totally three relays have been used, one is for the wiper motor, one is for the forward motion of the rack and pinion setup and the other is for the reverse motion of rack and pinion setup. The diagram of the Pic microcontroller along with its additional components is shown below,



**Fig 2. PIC Microcontroller Setup in System.**

#### 4. WORKING PRINCIPLE

The project metal sorting out machine which we fabricate is easy to construct and simple in operation. The 12 volt power supply is used to drive the permanent magnet D.C motor. The two conveyor roller is fixed to the two ends of the frame stand with the help of an end bearing (6202) with bearing cap. The conveyor roller shaft is coupled to the D.C. permanent magnet motor with the help of spur gear mechanism. This total arrangement is used to transfer the food product from one place to another place with the help of conveyor.

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**Fig. 3. Photo of Constructed System.**

### 3. ADVANTAGES, DISADVANTAGES AND APPLICATIONS

#### ADVANTAGES

- The Inspection Conveyor is more efficient in the technical field.
- Quick response is achieved.
- Simple in construction.
- Easy to maintain and repair.
- Cost of the unit is less when compared to the other equipment's.
- There are chances of fire hazard problems due to over loading.
- Comparatively the operation cost is less.
- Continuous operation is possible without stopping.

#### DISADVANTAGES

- Noise occurs while the machine is in operating condition which may disturb the environment.
- A silencer may be installed for arresting the noise but it may make the cost and manufacturing of the project more complicated.

#### APPLICATIONS

These types of projects have a wide range of applications in many of the industries for the following purposes.

- In large food processing industries like Nestle, Dan – D Foods, Aavin, Amul, etc.
- In Toys used by children where a presence of metal pieces would be lethal.
- In large water bottle industries like Tata water plus, Qua , Kingfisher, etc.

#### 4. CONCLUSION

A strong multidiscipline team with a good engineering base is necessary for the Development and refinement of advanced computer programming, editing techniques, diagnostic Software, algorithms for the dynamic exchange of informational different levels of hierarchy.

We are proud that we have completed the work with the limited time successfully. The “**FABRICATION OF METAL SORTING OUT MACHINE**” is working with satisfactory conditions. We are able to understand the difficulties in maintaining the tolerances and also quality.

We have done to our ability and skill making maximum use of available facilities. In conclusion remarks of our project work. Thus we have developed a “**FABRICATION OF METAL SORTING OUT MACHINE**”. By using more techniques, they can be modified and developed according to the applications.

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