Material Separation And Counting System

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Smt. S. R. PATEL
ENGINEERING COLLEGE

Prepared By:-

Barot Ravi (120780119003)
Patel Setu (120780119036)
Patel Jenish (120780119031)
Patel Romil (120780119050)

Guided By:-

Prof. Jayendra B. Patel

Group no:-31

CONTENTS

1.Abstract
2.Introduction
3.Objective
4.Different Material Separator
5.Need Of Separation & Counting
6.Parts Used In Separator
7.How Separator Work?
8.Counting And Controlling
9.How Counting Works?
10.Specification Of Apparatus
11.Design Calculation
12.Project Modeling
13.Advantage,Disadvantage & Application
14.Project Flow

ABSTRACT

This project is about to separate two metals with the help of sensor and actuator .

The project is about industrial material separator. Industrial material separator is main heart of the material feeding or managing the row material for the industries. Material separator basically works on identify the metal of any kind or which we want to separate...

Counting and controlling system indicate how much products /material passed by the help of sensor

INTRODUCTION

Today we are going to introduce the project based on industrial defined named industrial material separator and counting. Tune the material separator to we want to separate the material. The motorize actuator is installed in the project for pushing the material which we wants to separate. the actuator gets the force from the motor which is connected to the link via signal the mechanical link is operated by the motor .

Now a days industries grows up very fastly, so it is necessary to increase the productivity with higher accuracy so it is done by automatically counting and controlling

OBJECTIVE

Prime objective of the project is to separate and automatically counting and controlling materials with less human efforts by the help of sensor (which work as per programming) and actuator

DIFFERENT MATERIAL SEPARATOR

- Metal separator
- Eddy current separator
- Trommel separator/drum screens
- Induction shorting
- Near infrared sensor X-ray technologies

WHY SEPARATION & COUNTING ?

➢For the chemical and petroleum refining industries, separation processes are used to separate and purify the products of reactions.

➢ For the aluminum, steel, and metal casting industries, separation processes are used, among other things, to purify molten metal and to sort scrap.

➢for the forest products industry, separations are involved in nearly all process steps of pulping and papermaking.

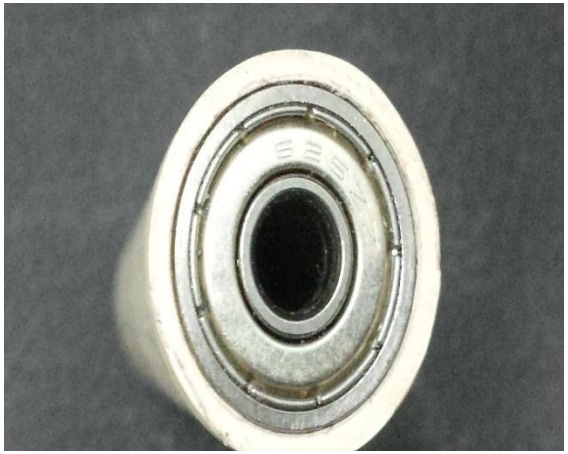
➢In addition to the importance of separation technologies in industrial processes, separation processes also present opportunities for waste reduction and more efficient use of energy and raw materials.

➢Automatic counting helps to know how much products manufacture

➢Controlling is helps to start and stop the production line according to programming for making the batches of product

HARDWARE USED

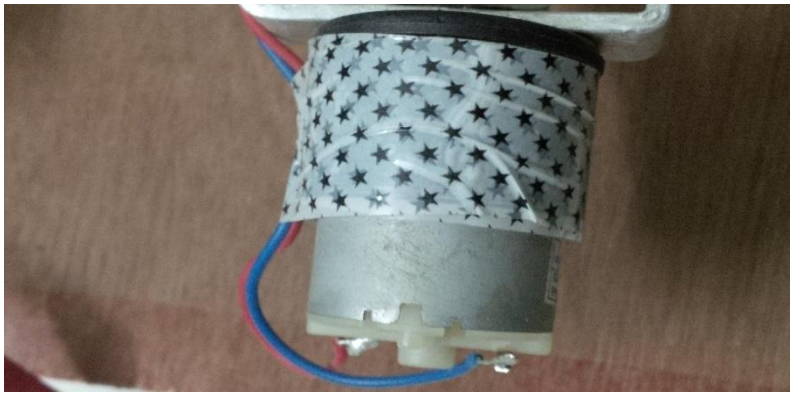
Conveyor belt



Bearing

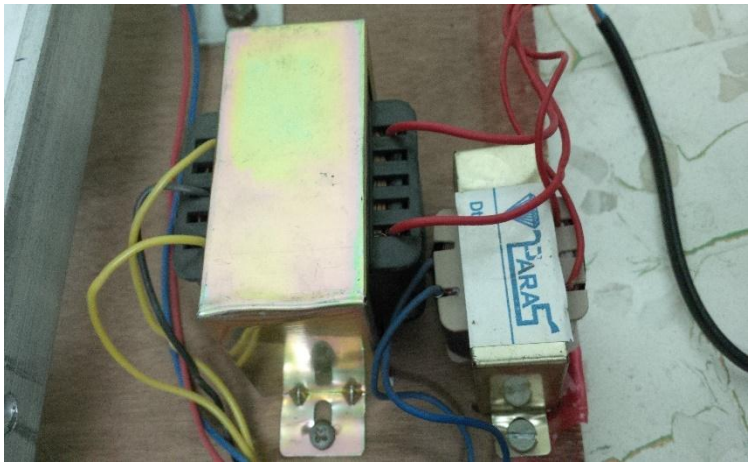
Roller

Shaft



DC Motor

Actuator



Transformer

Relay board

Proximity Sensor

HOW IT WORKS

In this project main power supply is given to dc motor and relay board via transformer and rectifier circuit. The conveyor belt mechanism is connected to the dc motor for material transportation. The metal sensor is kept before some distance of the end of conveyor belt. The metal sensor is connected to the relay board circuit.

When mixed material (plastic & metal) passes on the conveyor belt the sensor senses the metal. The sensor gives signal to the circuit and relay operates the mechanism. This mechanism works like actuator. It pushes metal down and plastic passes through. That’s how we separate plastic and metal

COUNTING

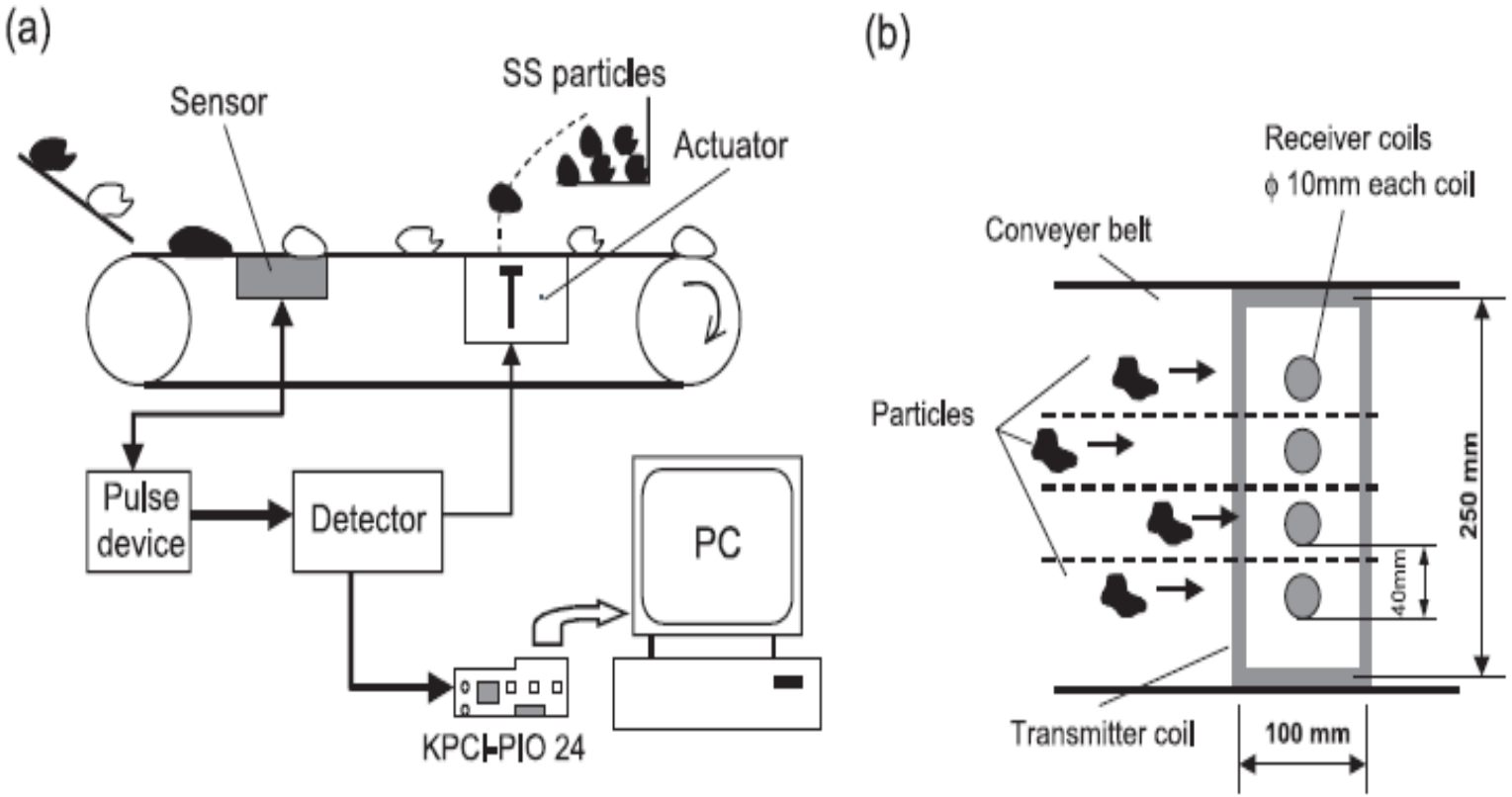
AND

CONTROLLING

HOW IT WORKS

Now an infrared proximity sensor is connected to both sides of conveyor belt for counting the production. This sensor output is connected with microcontroller based circuit. The LCD in microcontroller kit is show the number of production counted by the sensor. When the product passes in front from the sensor, the sensor count the products. Now if you want to control the production you have to set the specific number of production in LCD by using microcontroller kit. When the required production is done microcontroller stops motor of conveyor belt. The conveyor belt stops passing material. That’s how we can control the production.

ACCORDING TO RESEARCH PAPER PUBLISHED BY:-DENIS SOKOLOV



SPECIFICATION OF APPARATUS

1.Base

-length=122 cm

-width= 30cm

2.Belt stand

-length=91.5cm

3.Roller

-length=12.3cm

Diameter=2.3cm

4.Shaft

-Length=15.1cm

-diameter=0.5cm

5.Bearing

-Inner diameter=0.6cm

-outer diameter=2cm

6.Belt

-length=177cm

Electrical Components

1.Microcontroller

- Microprocessor 8051

2.Big Transformer

-Voltage 230V(input) 12V(output)

-Current:3A

-Step-down type

3.Small Transformer

-Voltage 230V(input) 3V(output)

Current:1A

4.motor

RPM=45

Voltage=12v

Hardware Design

→ **Speed of the belt**

$$v = \frac{\pi DN}{60} \text{ m/s}$$

$$= \frac{\pi * 0.230 * 45}{60}$$

$$= 0.541 \text{ m/s}$$

→ **Length of the belt**

$$L = 2C + \frac{\pi(D+d)}{2} + \frac{(D-d)^2}{4C}$$

$$= 2 * 0.85 + \frac{\pi(0.230+0.230)}{2} + \frac{1}{4*0.85}(0.230 - 0.230)^2$$

$$= 1.7 \text{ m}$$

→ **Angle of contact**

$$\theta = \pi + 2\sin^{-1}\left(\frac{D-d}{2C}\right)$$

$$= \pi + 2\sin^{-1}\left(\frac{0}{2*0.85}\right)$$

$$= \pi \text{ rad}$$

→ **Angle of Lap**

$$\theta = \pi - 2\alpha$$

$$= \pi \text{ rad}$$

$$\alpha = \sin^{-1}\left(\frac{D-d}{2C}\right)$$

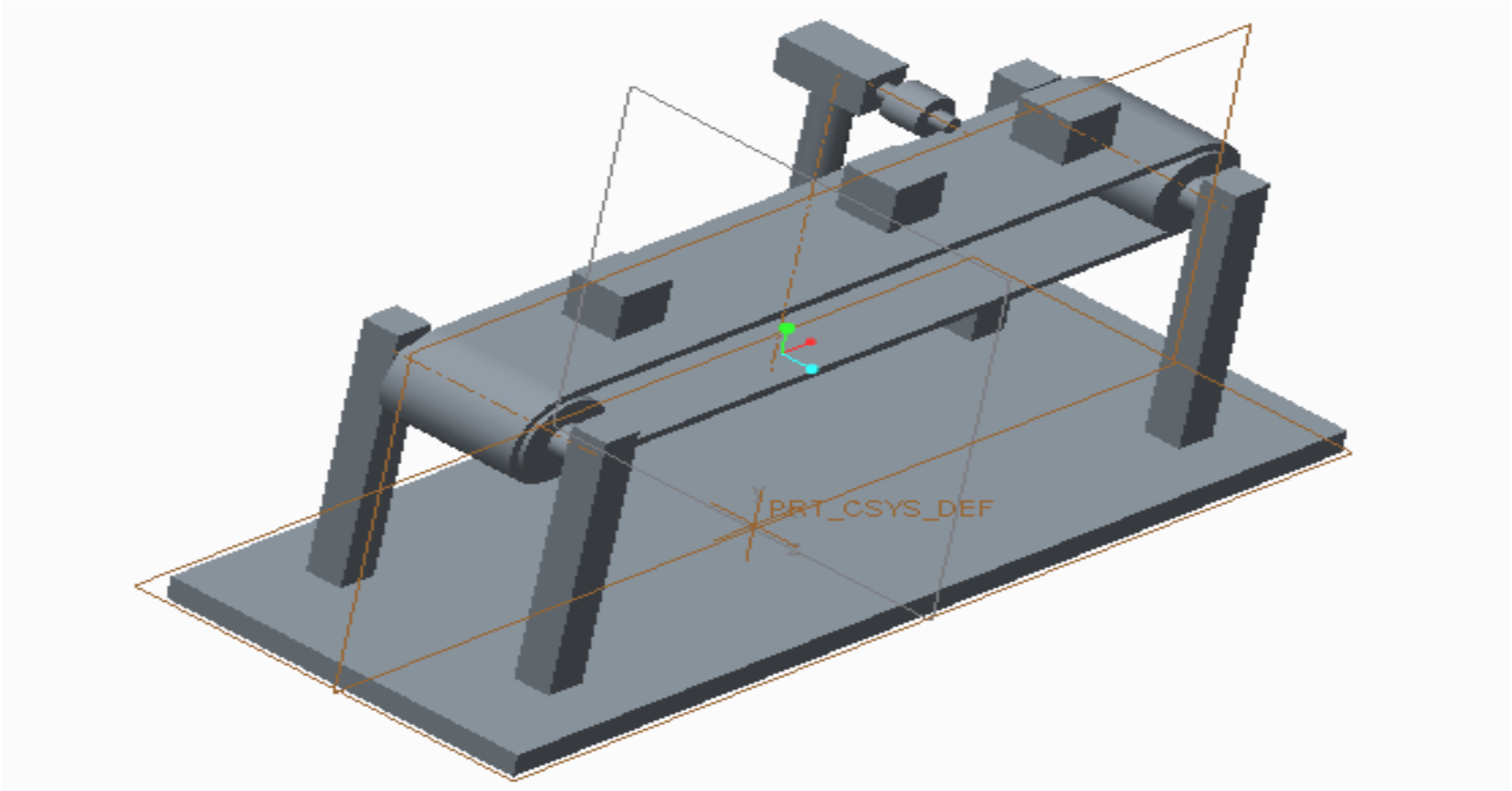
→ **Motor**

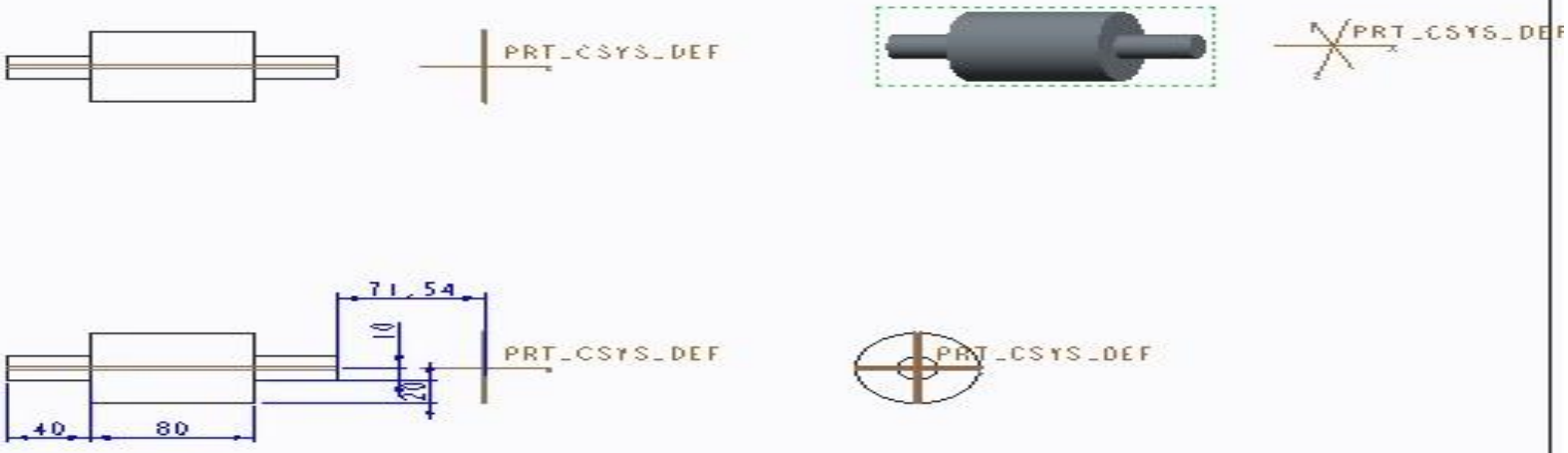
Range = 6v to 12v

Rpm = k1*voltage applied

K1=Induced Voltage Constant

PROJECT MODELING

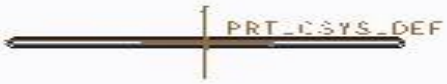



PRT_CSYS_DEF
PRT_CSYS_DEF
71.54
10
20
40
80
PRT_CSYS_DEF
PRT_CSYS_DEF

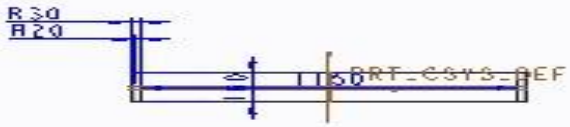
Roller

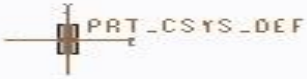
PRT_CSYS_DEF
PRT_CSYS_DEF
PRT_CSYS_DEF
PRT_CSYS_DEF

Base


PRT_CSYS_DEF

PRT_CSYS_DEF

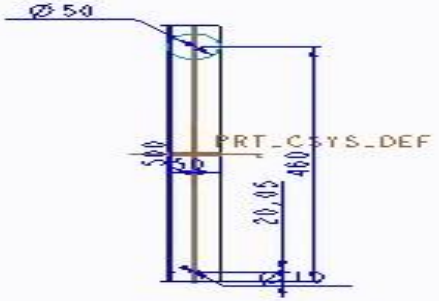

R30
R20
PRT_CSYS_DEF


PRT_CSYS_DEF

Belt

50
PRT_CSYS_DEF

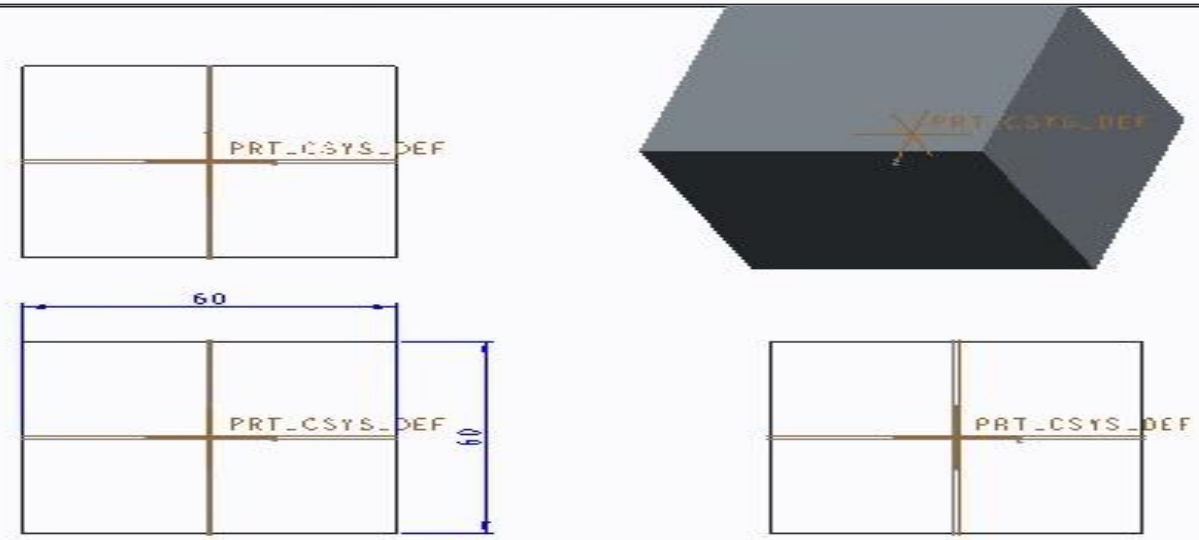
PRT_CSYS_DEF


Ø 50
PRT_CSYS_DEF
460
20.05

PRT_CSYS_DEF

Stand

Stand2



Workpiece

ADVANTAGE

- Recycling materials like aluminum and glass can greatly reduce the pressure on energy resources.
- Processing raw materials consumes a considerable amount of energy resources.
- Manufacturing plastics and paper from recycled material, requires less amount of energy as compared to making them from new.
- Reduce the human effort
- higher accuracy
- promote the industrial automation J-

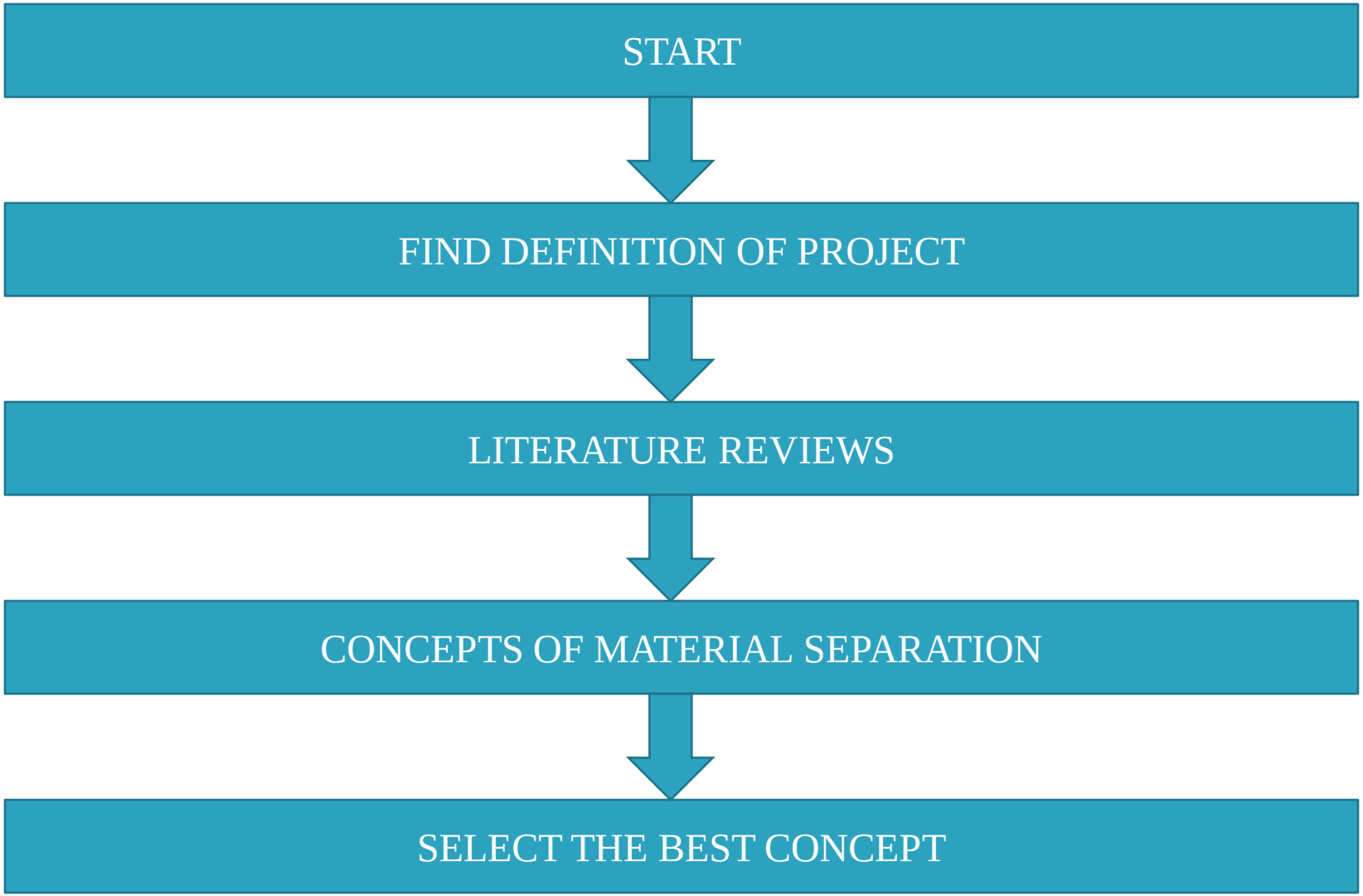
DISADVANTAGE

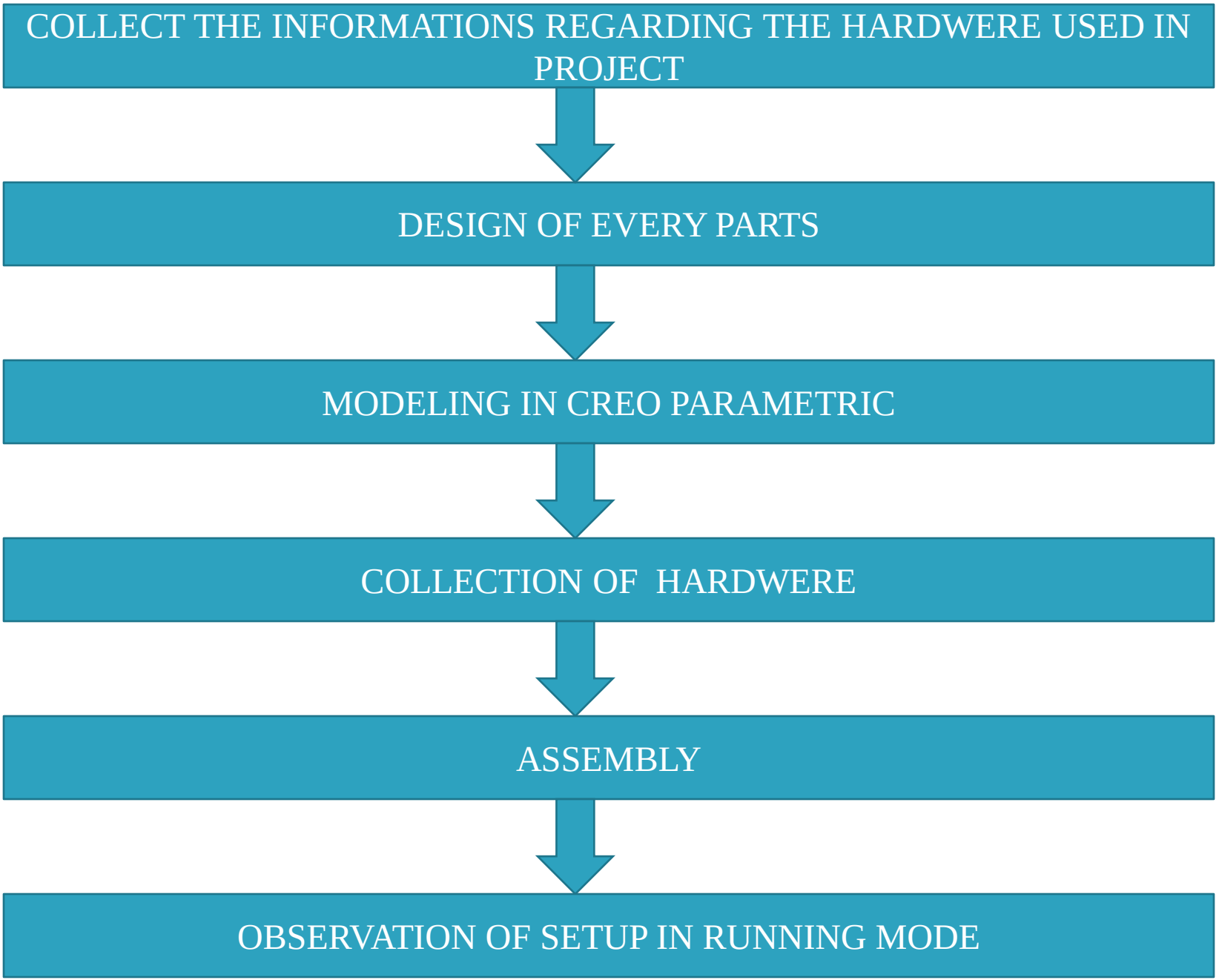
- Separate factories must be set up for the recycling of materials, and this will just cause more pollution and energy consumption for transport, sorting, cleaning and storage
- Pollutants produced by the recycling process itself, including chemical stews when breaking down different products
- initial cost of the system is high

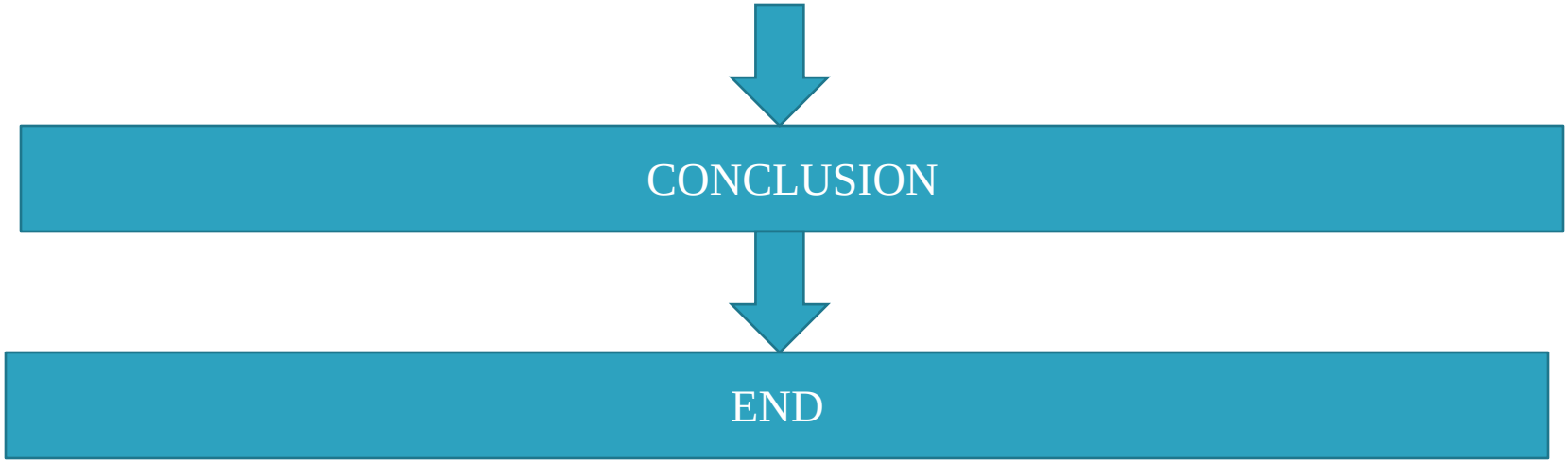
APPLICATION

- In industries for recycling process
- Chemical industries
- Mining
- Forest products
- Petroleum refining
- Energy-Intensive industries
- Metal and plastic separation

WORK FLOW OF THE PROJECT




COLLECT THE INFORMATIONS REGARDING THE HARDWERE USED IN PROJECT
DESIGN OF EVERY PARTS
MODELING IN CREO PARAMETRIC
COLLECTION OF HARDWERE
ASSEMBLY
OBSERVATION OF SETUP IN RUNNING MODE


CONCLUSION
END

PROJECT PLANNING AND SCHEDULING

Sr. No.	TOPIC	JUN	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR
1.	FIND DEFINITION OF PROJECT										
2.	LITERATURE REVIEWS										
3.	CONCEPTS OF MATERIAL SEPARATION										
4.	SELECT THE BEST CONCEPT										
5.	COLLECT THE INFORMATIONS REGARDING THE HARDWERE USED IN THE PROJECT										
6.	DESIGN OF EVERY PARTS										
7.	MODELING IN CREO PARAMETRIC										
8.	COLLECTION OF HARDWERE										
9.	ASSEMBLY										
10.	OBSERVATION OF SETUP IN RUNNING MODE										
11.	CONCLUSION										

Work Completed on 7th semester

Work done on 8th semester

FUTURE SCOPE

➢By modified this apparatus and programming we can separate multiple metal materials / non-metallic materials.

Referances

[1] Improvements In Separation Of Non-Ferrous Scrap Metals Using An Electromagnetic Sensor, By-M.B. Mesinaa, T.P.R. DE Jonga,* And W.L. Dalmijnb

[2] Device For Detecting Metallic Objects In A Flow Of Non-Metallic Material, US- 4563644

[3] Research Review Of Scrap Metals Eddy Current Separation Technology, By- Di WANG Xiushui MA 1 Xiongfei ZHI Shuming ZHANG

[4] Method And Apparatus For Sorting Metal, US 8,158,902 B2

[5] Alspaugh, Mark, Bulk Material Handling By Conveyor Belt Development Bank Description Of The Lafarge Surma Project Conveyor.

[6] Machine Design By-R.S.Khurmi

[7] Progress In Separating Plastic Materials For Recycling, By- G. Dodbiba And T. Fujita

[8] Effects Of Placement Errors On Performance Of Vlf Metal Detector Heads, By- Lawrence J.Carter And Zhuoran Tang

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Mr. Patel Setu R.
Dept. of Mechanical Engg.
S.R.Patel Engineering College
Gujarat - India.

Mr. Patel Jenish B.
Dept. of Mechanical Engg.
S.R.Patel Engineering College
Gujarat - India.

Mr. Barot Ravi B.
Dept. of Mechanical Engg.
S.R.Patel Engineering College
Gujarat - India.

Mr. Patel Romil N.
Dept. of Mechanical Engg.
S.R.Patel Engineering College
Gujarat - India.

Abstract — The paper relates to material separator based on metallic and non-metallic material according to their characteristics that identify the same as belonging to different classes. The paper is about to separate two metals with the help of sensor and actuator .The paper describes about industrial material separator which is the main heart of the material feeding or managing the row material for the industries. Material separator basically works on identify the metal of any kind or which we want to separate also Counting and controlling system indicate how much products /material passed by with the help of sensors.

Keywords—metals, sorting, sensor, counting, Keil programming, micro-controller, conveyor belts.

I. Introduction

Separation processes are used various fields such as the chemical and petroleum refining industries where separation processes are used to separate and purify the products of reactions, the aluminum, steel, and metal casting industries where separation processes are used, among other things, to purify molten metal and to sort scrap, the glass industry where separation processes are essential to the recycling of pre and post-consumer cullet, the forest products industry where separations are involved in nearly all process steps of pulping and papermaking.

In addition to the importance of separation technologies in industrial processes, separation processes also present opportunities for waste reduction and more efficient use of energy and raw materials. New developments in separation technologies are therefore critical for the continued productivity and global competitiveness of these industries.

II. Literature Review

In recent years, applied researchers have become increasingly interested developing new advanced techniques for the sorting of different types of scrap metals. One of the multiple steps in the recycling of non-ferrous metals is the separation of shredded material into different groups.

At present, mechanical separation and manual sorting are widely used in recycling technology. Manual sorting as well as mechanical systems such as eddy current separators (ECS), heavy media separation systems (HMS) or magnets are used to separate metal particles into several fractions. However, manual sorting is labor-intensive and mechanical systems often produce insufficient product quality. Therefore, new methods are being developed to improve the separation process. [1]

A device for detecting metallic objects in a material flow, comprising as sensing member a scanning coil consisting of a primary coil and, for example, two oppositely connected secondary windings arranged symmetrically around the primary winding so that the voltage induced in the secondary winding becomes zero as long as no conducting objects appear in the scanning area. To eliminate irrelevant signals from conducting objects in the vicinity of the scanning coil but not in the material flow or from weakly conducting objects in the material flow, the primary winding is fed with at least two alternating currents having different frequencies. [2]

The eddy current separation is a technology which applied to the field of resources to be recycled and reused that aimed at separating the scrap metals from the nonmetal substance or separating the metals from different types of scrap metals. This paper introduces the theory of eddy current separation technology, analysis the structure, working principle, advantages and disadvantages of eddy current separation equipment for electrical type eddy current separator (ECS), slipway type eddy current separator and so on. Based on the existing problems and shortcomings, discusses the key technology to resolution in the scrap copper separation field, and makes a brief design of the equipment for separation ferromagnetic metal and nonmagnetic metal at the same time and the equipment of separation for the block scrap copper. [6]

Over the last few years, there has been an increase in the application of inductive sensing in industrial automation control systems and other areas. Presently, for many applications there are standard solutions whereby the selection of the probe coils and the parameterization of the devices is carried out using empirical values. In part the signal

evaluation adapts itself to the respective test conditions automatically. With the help of a mathematical modelling approach and the visualization of the measured fields it is possible to optimize all constructive and physical parameters of inductive sensor for the various settings of tasks, e.g. in the field of eddy current crack detection, metal detection in environmental systems, food industry and demining problems of antipersonnel landmines. In order to realize this approach, the engineer can make use of different numerical procedures and software packages. In this paper the boundaries of the analytical method are discussed and the possibilities of modern numeric procedures for the computer-aided draft of inductive sensors for different applications are shown. [8]

III. WORKING OF THE SYSTEM

The system works in two phase: A) Separation B) Counting.

A. Separation

In the separation phase, first of all the power supply is given to dc motor and relay board via transformer and rectifier circuit. The conveyor belt mechanism is connected to the dc motor for material transportation. The metal sensor is kept at certain distance from the end of conveyor belt. The metal sensor is connected to the relay board circuit. The actuator that pushes the metal down from the belt is fixed nearby the magnetic sensor.

When mixed material (plastic & metal) passes on the conveyor belt the sensor senses the metal. The sensor gives signal to the circuit and relay operates the mechanism. This mechanism works like actuator. It pushes metal down and plastic passes through. That's how it separates the plastic and metal materials. Figure 1. Shows the working of the separation process and its various components.

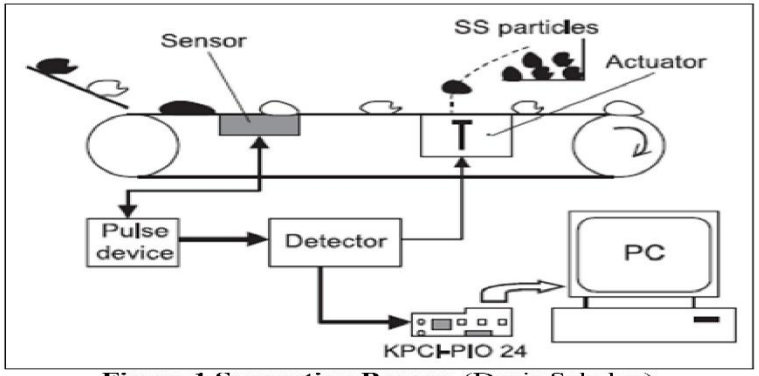

Figure 1 Separation Process (Denis Sokolov)

B. Counting

The final production is coming out on the conveyor belt mechanism. Now an infrared proximity sensor is connected at both side of conveyor belt for counting the production. This sensor output is connected with microcontroller based circuit. The LCD in microcontroller kit shows the number of production counted by the sensor. When the product passes in front of the sensor, the sensor count the products. Now if we want to control the production then we have to set the specific number of production in LCD by using microcontroller kit. When the required production is done microcontroller stops the motor of conveyor belt, the conveyor belt stops passing material. That's how the production can be controlled. Figure 2. Shows the counting process and how its various components works.

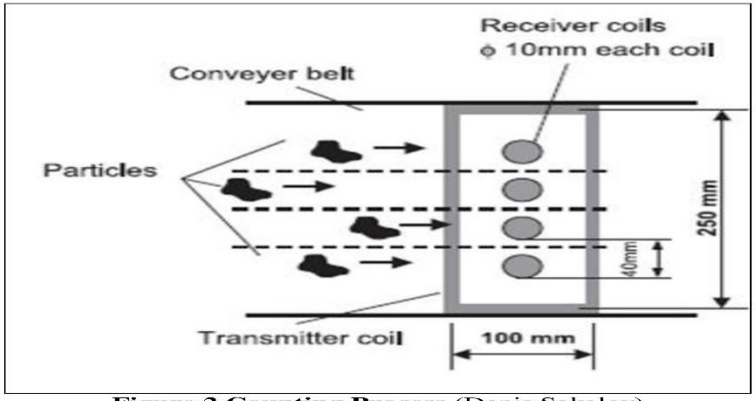

Figure 2 Counting Process (Denis Sokolov)

Figure 3. shows the modeling of the system. It is build up on creo modeling software.

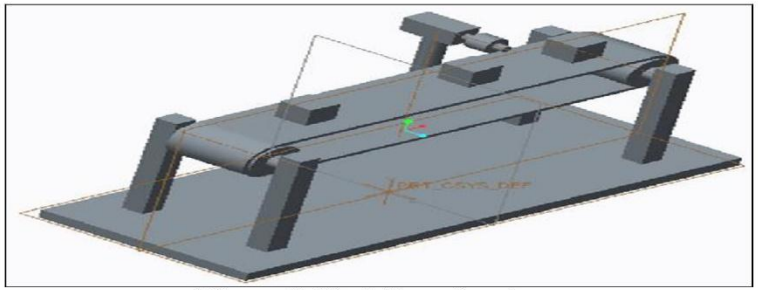

Figure 3 Modeling of system

IV. CONCLUSION & FUTURE WORK

Material separation and counting system, separate the material as per user requirement as well as count and control the number of production. Ultimately it reduces the human efforts and promote the industrial automation. Due to its usage it is widely adopted in the industries. In this paper we have discussed a varieties of separation and counting system, which leads to developing more efficient system in future as per their characteristics. This system basically focuses on the separation of the objects by considering their physical properties like metallic and non-metallic object. In future this can be extended by considering other factors such as temperature variance, color, weight, size, density and many more.

REFERENCES

[1] M.B. Mesinaa, T.P.R. DE Jonga and W.L. Dalmijnb "Improvements In Separation Of Non-Ferrous Scrap Metals Using An Electromagnetic Sensor".

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[3] Alspaugh, Mark, Bulk Material Handling By Conveyor Belt Development Bank Description Of The Lafarge Surma Project Conveyor.

[4] G. Dodbiba And T. Fujita "Progress In Separating Plastic Materials For Recycling".

[5] Lawrence J.Carter and Zhuoran Tang "Effects Of Placement Errors On Performance Of Vlf Metal Detector Heads".

[6] Di WANG Xiushui MA Xiongfei ZHI and Shuming ZHANG "Research Review Of Scrap Metals Eddy Current Separation Technology".

[7] Thomas A. Valerio "Method And Apparatus For Sorting Metal".

[8] Hartmut Ewald and Hendrik Krüger "Inductive Sensors And Their Application In Metal Detection".

MODEL WORKING VIDEO

THANK YOU….