A

Project Report

"DESIGN AND DEVELOPMENT OF AUTOMATIC COLOUR SORTING MACHINE FOR CASHEW"

Submitted by

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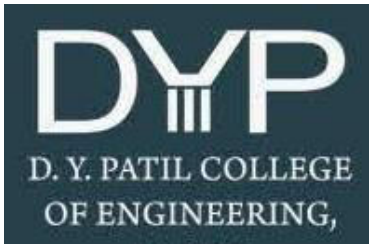

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CERTIFICATE

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Has successfully completed the Project Stage – II entitled “Design And Development Of Automatic Colour Sorting Machine For Cashew” under my supervision, in the partial Fulfilment of bachelor of Engineering – Mechanical Engineering of Savitribai Phule Pune University.

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ABSTRACT

Now a days Object sorting systems is one of the useful systems in Industrial world. In earlier days, man power was utilized for this purpose but the process is time consuming when it comes to sort large number of objects in industries as human brain takes time to process images. Due to sorting operations with some technologies would reduce efforts and gives better results with lesser time. The detection of the particular color is done by a light intensity to frequency the robotic arm is controlled by an Arduino, which controls gear motors. They are programmed to faithfully carry out repetitive actions with a high degree of accuracy.

Keywords- Color Based, Sorting, Machine,Ardiuno

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Abbreviations

Sr. No.	Symbol	Name
1	DOE	Design Of Experiment
2	VR	Velocity ratio
3	ESTRN	Equivalent Strain

CHAPTER 1
INTRODUCTION

Cashew is one of the most popular crops in India. India is one of the leading producers, processor and exporter of cashew in the world. Major portion of the cashew industry still depends on expert employees for sorting. In most of the cashew industries sorting performed manually which is inefficient, expensive, labor intensive and time consuming. So, using computer vision techniques we don't need to waste our time to do the work which is performed by the labor. Machines can perform highly repetitive tasks better than humans. Worker fatigue on assembly lines can result in reduced performance, and cause challenges in maintaining product quality.

Automation is the use of control systems for handling different processes and machineries to replace human efforts. Automated system uses a complicated algorithm which may be increase the cost of the design. But this not only reduces manual efforts, time consumed, but gives more time to work on factors like aesthetics. Using automation also prevents danger which might occur when humans are made to work in hazardous environments. Thus, use of automation is very useful in manufacturing industry. Automated sorting also decreased the labor cost and the production time. The error cased due to human negligence are avoided by the use of automated system by color-based sorting using a color sensor. A sorting machine is more practical and economical method of automation, which transfers material from one point to another. The design is quite simple and of flexible use, means only conveyor belt can be used for material handling.

CHAPTER 2

LITERATURE SURVEY

Literature review provides the scope for the present study. It works as guide to run this analysis. Literature review plays important role to get information about the dissertation work. In this chapter search few selected research paper related to Automated Sorting Machine based on color sensor used for cashew sorting. Some of the surveys have been explained below.

1. Mostafa KhojastehnazhandMahmoud Omid represented a novel approach for development of a sorting system for grading lemon based on color and size. The proposed system consists of two CCD cameras, two capture cards, an appropriate lighting system, a personal computer and other mechanical parts. The algorithm initially extracts the fruit from the background. The samples of different grades of lemon are situated in front of the cameras and are calibrated off-line. Then information on the HSI color values and estimated volumes of fruits are extracted and saved in a database. By comparing the information during sorting phase with the available information inside the database, the final grade of the passing fruits are determined.
2. Ch.Shravani, G. Indira, V. Appalaraju explained working of sorting machine with the help of tcs 3200 color sensor which detects the color of material and seperates it into good or bad slot. On this paper a compact records close to arranging of articles based totally totally on shading has been implemented making use of TCS3200 shading sensor with SERVOMOTORS associated with AURDINO UNO.
3. S. V. Rautu, A. P. Shinde, N. R. Darda,A. V.Vaghule, C. B.Meshram, S.S.Sarawade explained about system which would increase the production rate and accuracy of material handling systems with the use of PLC. The proposed system is able to sense, sort and count objects based on their colours and to display them in LCD display and stored using Cloud.

4. Sanjay Prakash Dabade studied main task of sorting components according to the sizes which consist of conveyor belt, which reduces the efforts of material handling. The automatic sorting machine using conveyor belt is basically useful for sorting the products in the industry specifically large scale industries where mass production is carried out. The machine also reduces the efforts of the workers by reducing the time spent for material handling. The application area of this machine is very wide in industries where automation is built.
5. Aseem Bhope, Nikita Deshmukh, Upendra Sai, Ms. Mousami Vanjale[2020] conclude that cashews will be sort according to its shape and size with the help of image processing. In image processing we have used python to have better performance. Servo motor is being used for the sorting of cashews in different containers. As compared to the other systems the efficiency is 95%.
6. The author Jyotsna U Bailoor, Mathias Christen Sunny, Karthik R Anchan, Melston Joyel Tauro, Mr. Ganesh Shetty studied Segregation of Cashew Kernel and Areca Nut by Using Advanced Color Sorting Mechanism. Various external features of the cashew kernel such as color, texture, shape and size are extracted from the captured image. For the classification to be done first the different types of cashews and areca nut are stored in the database by taking pictures of the cashew and areca nut on the conveyor belt using the same webcam and the features are extracted. The conveyor belt is the carrying medium of the conveyor belt system. A belt conveyor system consists of two or more pulleys with endless loop of carrying medium that rotates about them.

Hence from above survey it is evident that designers should move to other design techniques. Most of the designers focused on different method to reduce the time and efforts of the worker. The proposed system is simple and easy to analyse by everyone to avoid complicated system and focused on less power consumption.

CHAPTER 3

PROBLEM DEFINITION AND OBJECTIVES

3.1 Problem definition

1. To Study the concept of Automatic sensor machine.
2. To Design and develop Automatic colour sorting machine for cashew.

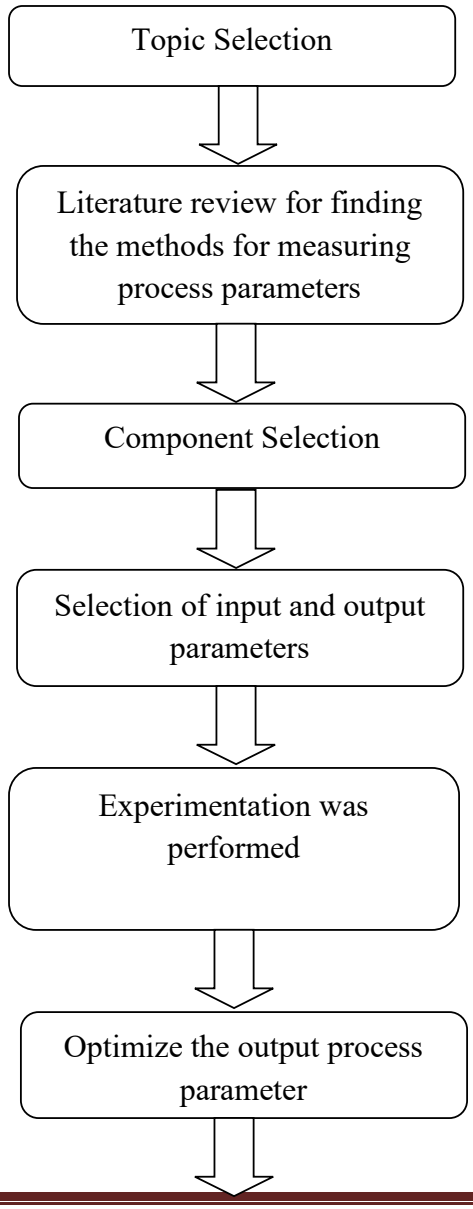
3.2 Objectives of the study

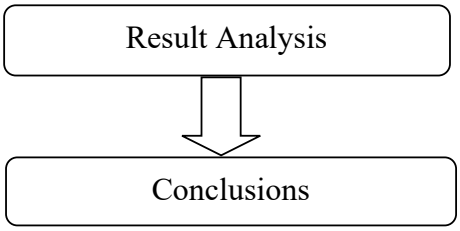
1. The objective of work is to design and develop semi-automated colour sorting machine for cashew which will help the food industry in sorting out the materials effectively.

CHAPTER 4

METHODOLOGY

To perform any project work we have to decide the methodology of that work. During the whole work of project, I am following methodology as given below:





- Proposed Methodology: -

1) Made a search of different topics for capstone project.
2) Had a discussion with our project guide on the topics that we have searched.
3) Short listed three topics for the capstone project with the help of our project guide.
4) Finalized the topic “Design & development of automatic colour sorting machine for cashew”.
5) We had a discussion on the finalized topic with our project guide.
6) Collected different research papers on conveyor belt system
7) Shortlisted some informative papers which are related to our project.
8) Collected the required information for designing our project.
9) Worked on the design parameters which are related to our project
10) Finalizing the material required for the making the project.
11) Work on the actual design sorting machine.
12) Finalizing the dimensions of sorting machine with the help of our project guide.
13) From above information, made the proposal of our project

14) Then we started the fabrication of project.
15) We carried out material cutting operations using different machine-like gas cutting, band saw cutting, etc.
16) After cutting then we fabricated main frame, tray, hoper, piston & roller.
17) Then preparation of drive unit and conveyor belt was done.
18) Finally, assembly of project was done & testing was carried out under the guidance of project guide.
19) After testing we have done small modification as per the instruction of guide.
20) Prepared the final report and presentation for the guides evaluation.

4.1 Component Selection

4.1.1 Arduino mega

Arduino board is an open-source microcontroller board which is based on Atmega 2560 microcontroller. The growth environment of this board executes the processing or wiring language. These boards have recharged the automation industry with their simple to utilize platform wherever everybody with small otherwise no technical backdrop can start by discovering some necessary skills to program as well as run the Arduino board. These boards are used to extend separate interactive objects otherwise we can connect to software on your PC like MaxMSP, Processing, and Flash. This article discusses an introduction to Arduino mega 2560 board, pin diagram and its specifications.

- Pin Configuration

The pin configuration of this Arduino mega 2560 board is shown below. Every pin of this board comes by a particular function which is allied with it. All analog pins of this board can be used as digital I/O pins. By using this board, the Arduino mega projected can be designed. These boards offer flexible work memory space is the more & processing power that permits to work with different types of sensors without delay. When we compare with other types of Arduino boards, these boards are physically superior.

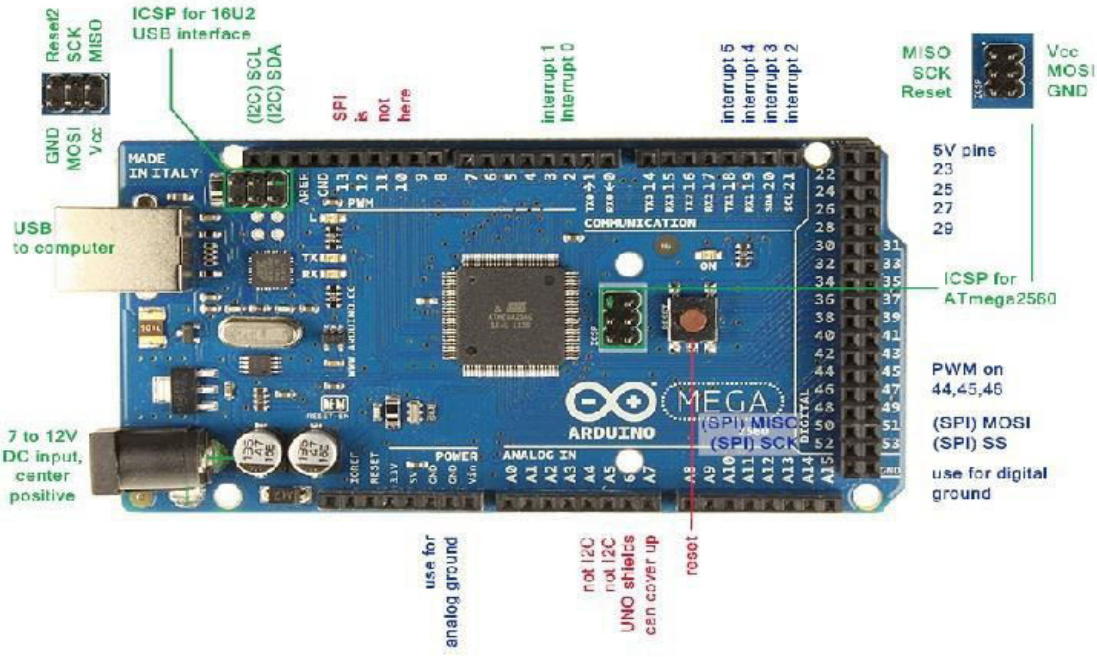


Fig.4.1.1 Arduino-mega 2560-board-pin-diagram

- Pin 3.3V & 5V

These pins are used for providing o/p regulated voltage approximately 5V. This RPS (regulated power supply) provides the power to the microcontroller as well as other components which are used over the Arduino mega board. It can be attained from Vin-pin of the board or one more regulated voltage supply-5V otherwise USB cable, whereas another voltage regulation can be offered by 3.3V0-pin. The max power can be drawn by this is 50mA.

- GND Pin

The Arduino mega board includes 5-GND pins where one of these pins can be used whenever the project requires.

- Reset (RST) Pin

The RST pin of this board can be used for rearranging the board. The board can be rearranged by setting this pin to low.

- Vin Pin

The range of supplied input voltage to the board ranges from 7volts to 20volts. The voltage provided by the power jack can be accessed through this pin. However, the output voltage through this pin to the board will be automatically set up to 5V.

- Serial Communication

The serial pins of this board like TXD and RXD are used to transmit & receive the serial data. Tx indicates the transmission of information whereas the RX indicates receive data. The serial pins of this board have four combinations. For serial 0, it includes Tx (1) and Rx (0), for serial 1, it

includes Tx(18) & Rx(19), for serial 2 it includes Tx(16) & Rx(17), and finally for serial 3, it includes Tx(14) & Rx(15).

- External Interrupts

The external interrupts can be formed by using 6-pins like interrupt 0(0), interrupt 1(3), interrupt 2(21), interrupt 3(20), interrupt 4(19), interrupt 5(18). These pins produce interrupts by a number of ways i.e. Providing LOW value, rising or falling edge or changing the value to the interrupt pins.

- LED

This Arduino board includes a LED and that is allied to pin-13 which is named as digital pin 13. This LED can be operated based on the high and low values of the pin. This will give you to modify the programming skills in real time.

- AREF

The term AREF stands for Analog Reference Voltage which is a reference voltage for analog inputs

- Analog Pins

There are 16-analog pins included on the board which is marked as A0-A15. It is very important to know that all the analog pins on this board can be utilized like digital I/O pins. Every analog pin is accessible with the 10-bit resolution which can gauge from GND to 5 volts. But, the higher value can be altered using AREF pin as well as the function of analog Reference ().

- I2C

The I2C communication can be supported by two pins namely 20 & 21 where 20-pin signifies Serial Data Line (SDA) which is used for holding the data & 21-pin signifies Serial Clock Line (SCL) mostly utilized for offering data synchronization among the devices

- SPI Communication

The term SPI is a serial peripheral interface which is used to transmit the data among the controller & other components. Four pins like MISO (50), MOSI (51), SCK (52), and SS (53) are utilized for the communication of SPI.

- Dimensions

The dimension of Arduino Mega 2560 board mainly includes the length as well as widths like 101.6mm or 4 inch X 53.34 mm or 2.1 inches. It is comparatively superior to other types of boards which are accessible in the marketplace. But, the power jack and USB port are somewhat expanded from the specified measurements.

4.1.2 TCS3200

The TCS3200 Color Recognition Sensor Module uses a high-quality light sensor allowing you to sense any color through a combination of Red, Green, and Blue. The module provides all of the pins of the TCS3200 on convenient 0.1″ headers – ideal for use with PCBs, breadboard or strip board.

Four white LEDs provide plenty of light for the color sensor and allow you to use the module in any ambient light.

The module requires only a single supply voltage between 2.7V and 5.5V – making it compatible with nearly all common microcontrollers, including *PICs*, AVRs, ARM, *Arduino* and more!

Header one on the left side of the board

- S0: *Output frequency scaling selection input (along with S1)*
- S1: *Output frequency scaling selection input (along with S0)*
- OE: *Output Enable – if held low, the output of the module is turned on*
- GND: *Ground – connect to 0V*

Header two on the right side of the board

- S3: Photodiode type (along with S2)
- S2: Photodiode type (along with S3)
- OUT: Output – A square wave appears here showing the intensity of the detected color
- VCC: Power – connect to 2.7V-5.5V

The Photodiode type pins allow you to pick which color light you are currently detecting:

Table: 4.1.2 Photodiode Pin Selection

S2	S3	Photodiode Type
Low	Low	Only red light

Low	High	Only blue light
High	Low	No filter
High	Green light	

4.1.3 Relay module

Let's first discuss the pinout and pin configuration details of the 5V single channel relay module. The following diagram shows its pinout diagram. It is known as a single channel because only one relay is used and it operates on 5V.

At the heart of the module is a 5V relay covered in blue color plastic. Maximum operating current and voltage for both AC and DC load are also mentioned at the top of the relay cover. SRD-05VDC-SL-C is part number and it shows the operating voltage. It is known as a 5V relay module. Because the relay operates at 5V DC. In other words, a 5V active high or low signal activates the relay by energizing its coil. As mentioned earlier, internally a 5V relay consists of a NC, NO, COM terminals and a coil.

Fig.4.1.2 Relay Module

- Pin details

Relay module consists of six pins such as normally open pin , normally closed, common , signal, Vcc and ground pins.

- Signal Pin :

  It is used to control the relay. This pin can be active low or active high. In case of active low, the relay will activate when we apply an active low signal to the signal pin. But usually, these modules work on an active high signal. This signal will energize the relay coil to make contact with the common terminal with the normally open terminal.

- Vcc Pin :

  As its name suggests, it is a 5V relay. That means it requires 5V DC to operate. Hence, connect the 5v DC power supply to this pin.

- Ground Pin :

Connect it with the ground terminal of 5V power supply. Furthermore, if you are driving a relay module with a microcontroller, also connect this pin with the ground terminal of the microcontroller.

- Common Pin:

  This terminal is connected with the load that we want to switch with the relay module.

- NC Pin :

  As the name of the normally close terminal suggests, it is normally connected with the COM pin and forms a closed circuit. But this normally closed connection breaks when the relay is activated by applying an active high or active low signal to the signal pin of the relay module from a microcontroller.

- NO Pin:

  This pin is normally open unless we apply an activation signal to the signal pin of the 5V single channel relay module. In this case, the COM pin breaks its connection with the NC pin and makes a connection with the NO pin.

4.1.4 MOTOR

Rhino Heavy Duty Planetary Geared motors are a game changer for the machinery industry. The high quality base motors are coupled with a robust and sturdy metal gearbox with 3 stages. For the 200 rpm motor you can run the motor continuously upto approx 15 Kgcm load with maximum efficiency. You may increase the load till 60 kgcms which is the stall torque of the motor but not recommended for continuous use. We would recommend to limit the current to 5 - 7 A for preventing any damage to the motor.

These motors have better performance than the Johnson motors and other High Torque motors as the gear box being provided is a Metal Planetary Gear Box. The gearbox in the Johnson Motors and other High Torque Geared Motors is Spur Gear Box. The sturdy metal planetary gearbox of Rhino Planetary Geared DC motor has multiple stages which helps in distributing the load over multiple gears and not putting the load on a single part. Compared to spur gearbox the number of parts in a planetary gear box is much higher which results in even distribution of load and better performance at higher torque and higher speed applications. The planetary gear boxes are also better at retention of lubrication which results in better performance. The planetary gearbox will also provide a more silent operation as compared to Spur gear for high torque or high speed applications considering the construction and retention of lubrication.

The Rhino Heavy duty motors are also provided with a back shaft to mount the requisite encoders for monitoring number of revolutions or for DC servo applications. This makes the motor suitable for multipurpose use as per the industrial application or for Mobile Robot applications with distance and path planning.

Even the mounting of the motors is very simple with 4 bolts along with the clamps provided in the accessories section. Just make sure you are using the correct length of the bolts as a longer bolt can damage the gear box top plate.

Over and above all the performance features being provided by the Rhino Heavy Duty Planetary Geared Motors, these are provided at Category Best Prices for the performance provided. These motors are providing unbeatable performance for industrial applications requiring continuous operations at high torques or at higher speeds.

4.1.5 SOLENOIDE ACTUATOR

Solenoids are basically electromagnets: they are made of a big coil of copper wire with an armature (a slug of metal) in the middle. When the coil is energized, the slug is pulled into the center of the coil. This makes the solenoid able to pull (from one end) or push (from the other). This solenoid in particular is fairly small, with a 30mm long body and a 'captive' armature with a return spring. This means that when activated with up to 12VDC, the solenoid moves and when the voltage is removed it springs back to the original position, which is quite handy.

Many lower cost solenoids are only push type or only pull type and may not have a captive armature (it'll fall out!) or don't have a return spring. This one even has nice mounting holes, its a great all-purpose solenoid. To drive a solenoid from an Arduino or any other microcontroller, you will need a power transistor and a diode. You can also use our relay boards to control the solenoid from an Arduino.

You will need a fairly good power supply to drive a solenoid, as a lot of current will rush into the solenoid to charge up the electro-magnet, about 1500mA, so don't try to power it with a 9V battery!

- Overall Material Selection

Table 4.1 Overall Material selection

Sr. No.	Name of Components	Name of Resources/material
1	Belt Conveyor	Rubber
2	Conveyor frame	Aluminum Alloy
3	Roller	Polyethylene
4	Hoper	Aluminum Alloy

5	DC Motor	-
6	Pneumatic piston	Aluminum Alloy
7	Metal Tray	Aluminum Alloy
8	Aluminum Plate	Aluminum Alloy
9	Nut and Bolts	Carbon Steel
10	Screws	Stainless Steel
11	Connecting wires	Copper
12	IR sensors	-
13	RDNO	-
14	Microcontroller	-

4.2 PROPOSED DESIGN

A designed experiment is an efficient approach for improving a process because you can change more than one factor at a time to quickly obtain meaningful results and draw conclusions about how factors interact to affect the response. The word experiment is used in a quite precise sense to mean an investigation where the system under study is under the control of the investigator. This means that experiment is the process in which purposeful changes are made to the input variables of process or systems, so that we may observe and identify the reasons for changes that may be observed in the output response. For investigate or discovers something about any process there are number of experiments are required for finding response of desire output in condition of large input. Therefore to reduce the number of Experiments and to obtain good quality of investigation the term named Design of experiments (DOE) is highly useable method in all over

the world. The purpose of design of experiment is to plan, design and analyze the experiment so that the valid and objective conclusions can be drawn effectively and efficiently.

The actual proposed design view is as follows in different manner.

1. Isometric View

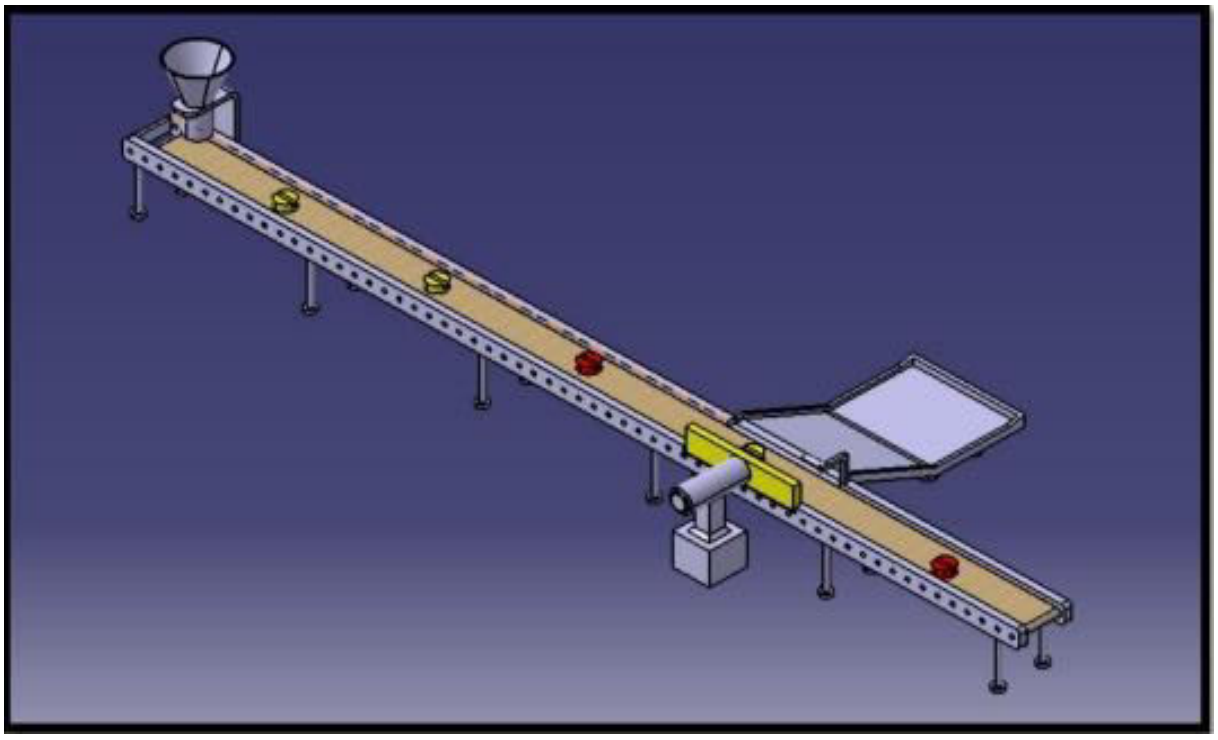


Fig. 4.2.1 Isometric View of Proposed Design

2. Top View

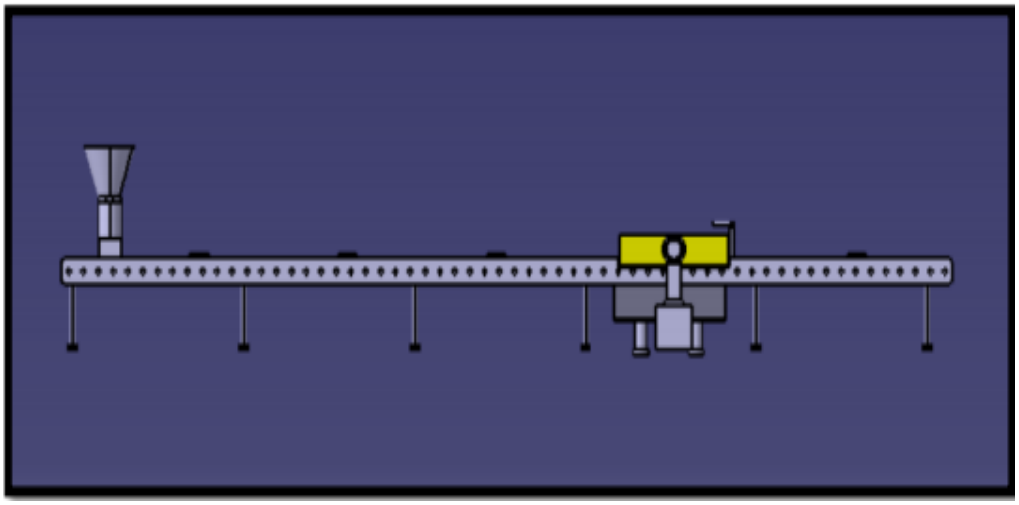


Fig. 4.2.2 Top View of Proposed Design

3. Back View

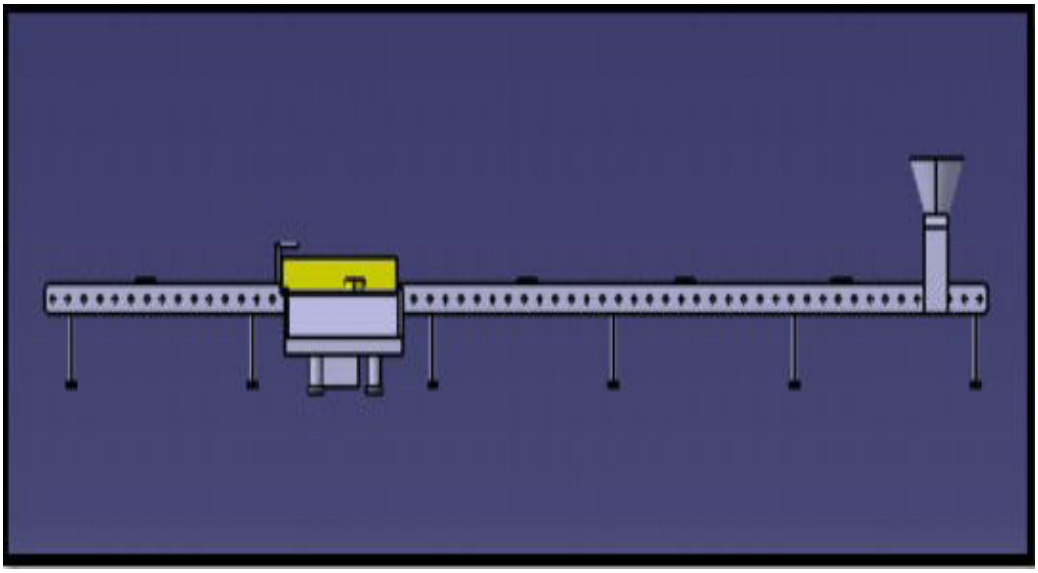


Fig. 4.2.3 Back View of Proposed Design

4. Left Side View

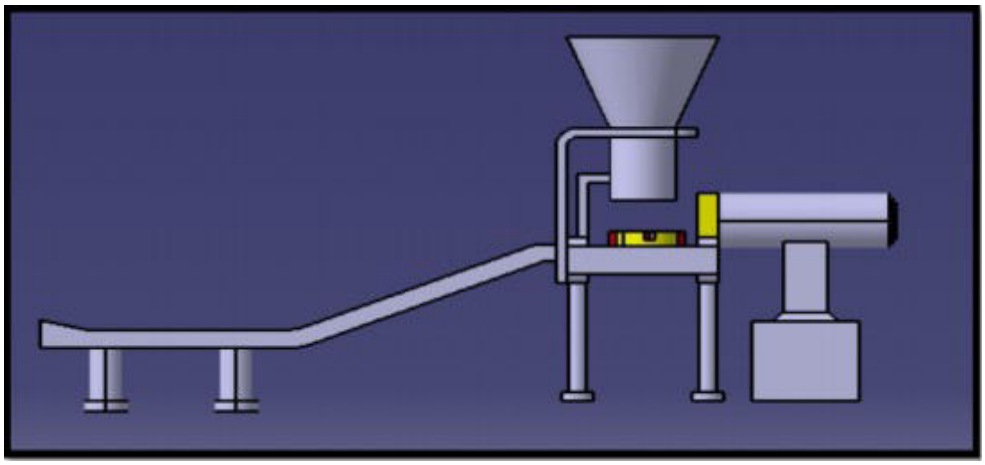


Fig. 4.2.4 Left Side View of Proposed Design

5. Right Side View

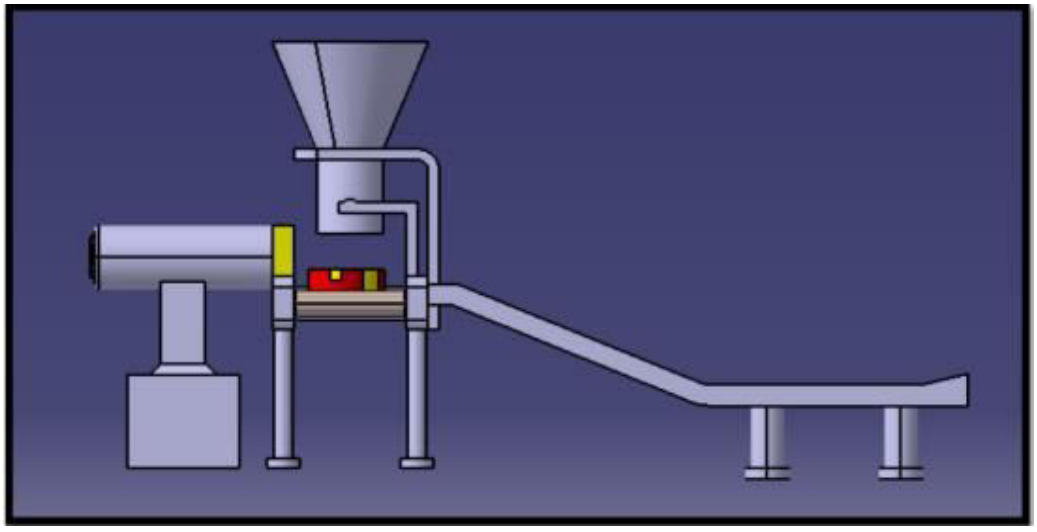


Fig. 4.2.5Right Side View of Proposed Design

6. Top View

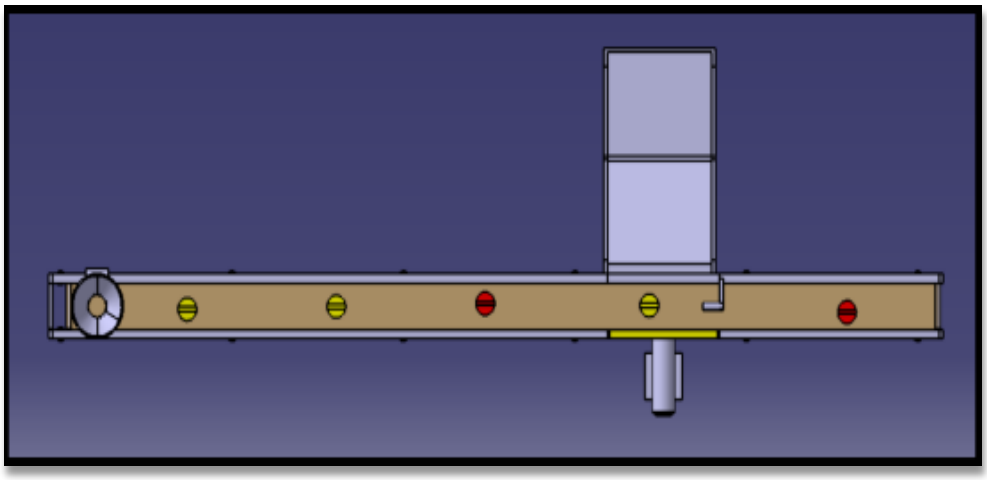


Fig. 4.2.6 Top View of Proposed Design

7. Down View

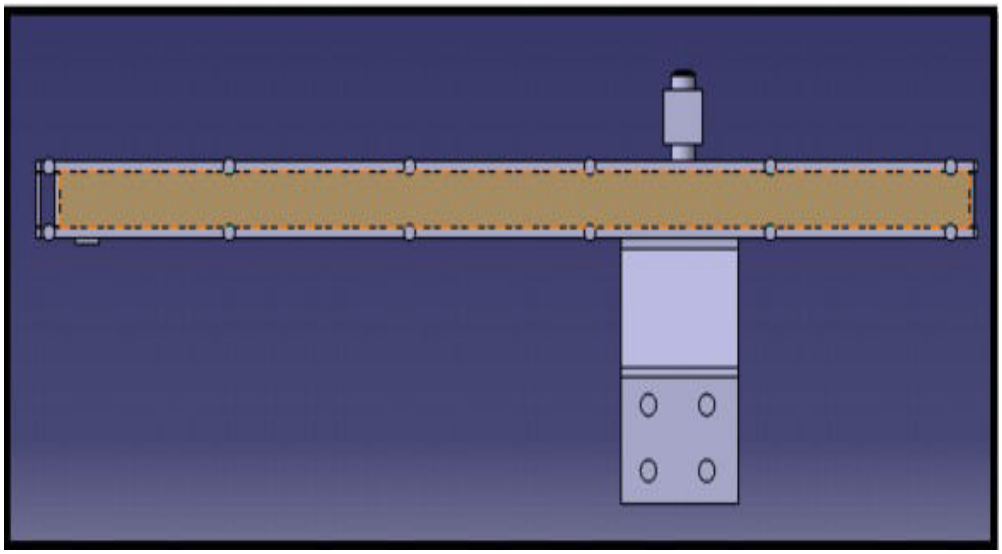


Fig. 4.2.7 Down View of Proposed Design

8. Combined View

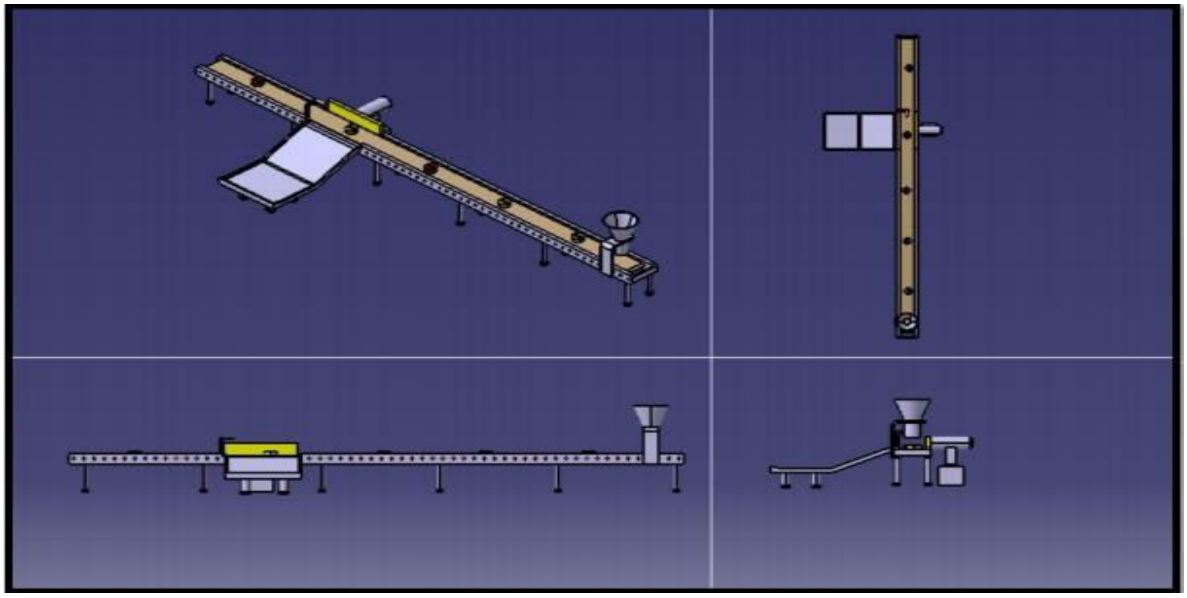


Fig.4.2.8 Combined View of Proposed Design

4.3 CIRCUIT DIAGRAM:

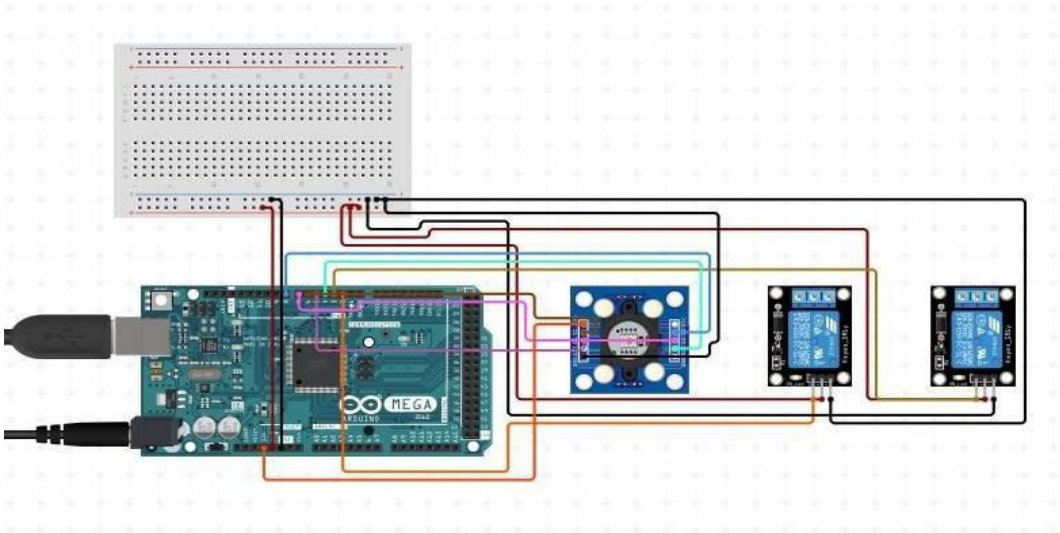


Fig. 4.3.1 Circuit Diagram of Proposed Design

4.3.2 WORKING OF PROPOSED DESIGN

The TCS230 senses color light with the help of an 8 x 8 array of photodiodes. Then using a Current-to-Frequency Converter the readings from the photodiodes are converted into a square wave with a frequency directly proportional to the light intensity. Finally, using the Arduino Board we can read the square wave output and get the results for the color.

To TCS3002D, then choose a color filter, it can allow only one particular color to get through and prevent another color. For example, when choosing the red filter, the Only red incident light can get through, blue and green will be prevented. So we can get the red light intensity. Similarly, when choosing other filters we can get blue or green light.

TCS3002D has four photodiode types. Red, blue, green, and clear, reducing the amplitude of the incident light uniformity greatly so that to increase the accuracy and simplify the optical. When the light project to the TCS3002D we can choose the different types of photodiode by different combinations of S2 and S3. Look at the form as follows.

Table. 4.3.2 Frequency Scaling

S0	S1	OUTPUT FREQUENCY SCALING (fo)
L	L	Power down
L	H	2%
H	L	20%
H	H	100%

TCS3002D can output the frequency of a different square wave (occupies empties compared 50%), different color and light intensity correspond with a different frequency of the

square wave. There is a relationship between output and light intensity. The range of the typical output frequency is 2HZ~500KHZ. We can get different scaling factors by different combinations of S0 and S1. Look at the form as follows.

Table 4.3.3 Photodiode Type

S2	S3	PHOTODIODE TYPE
L	L	RED
L	H	BLUE
H	L	Clear (no filter)
H	H	GREEN

We create a condition in the program such that if the S2 is HIGH and S3 is also HIGH in the program the condition becomes true and the solenoid actuator get trip by the relay for 1 sec and again comes to it initial position by seperating out the raw cashew .

4.4 PROGRAM OF PROPOSED DESIGN

```
const int s0 = 8;
const int s1 = 9;
const int s2 = 10;
const int s3 = 11;
const int out = 12;

void setup()
{

  pinMode(s0, OUTPUT);
  pinMode(s1, OUTPUT);
  pinMode(s2, OUTPUT);
  pinMode(s3, OUTPUT);
  pinMode(out, INPUT);
```

```
  digitalWrite(s0, HIGH);
  digitalWrite(s1, HIGH);
pinMode(4,OUTPUT);//solenoid actuator
}

void loop()
{
  if (green < red && green < blue)
  {
   delay(4000);
  digitalWrite(4,HIGH);
delay(1000);
digitalWrite(4,LOW);
  }
  else
{

  digitalWrite(4,LOW);
 }
  }
void color()
{
  digitalWrite(s2, LOW);
  digitalWrite(s3, LOW);
  //count OUT, pRed, RED
  red = pulseIn(out, digitalRead(out) == HIGH ? LOW : HIGH);
  digitalWrite(s3, HIGH);
  //count OUT, pBLUE, BLUE
  blue = pulseIn(out, digitalRead(out) == HIGH ? LOW : HIGH);
  digitalWrite(s2, HIGH);
  //count OUT, pGreen, GREEN
  green = pulseIn(out, digitalRead(out) == HIGH ? LOW : HIGH);
}
```

4.5 STRUCTURAL DIAGRAM

1. Hoper

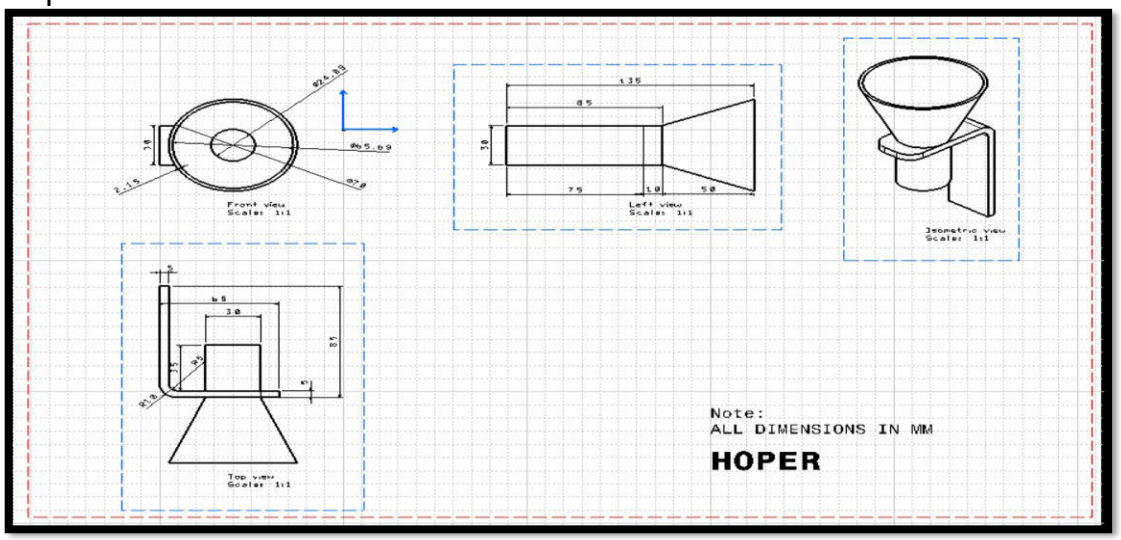


Fig. 4.5.1 structural Diagram of Hoper

1. Roller

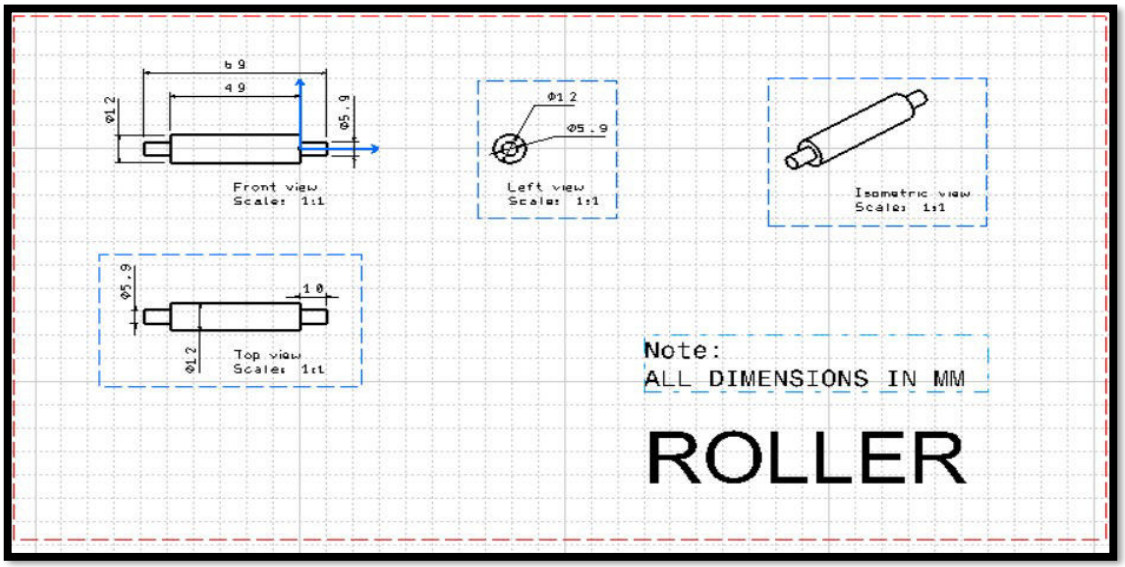


Fig. 4.5.2 structural Diagram of Roller

3.Piston Rod

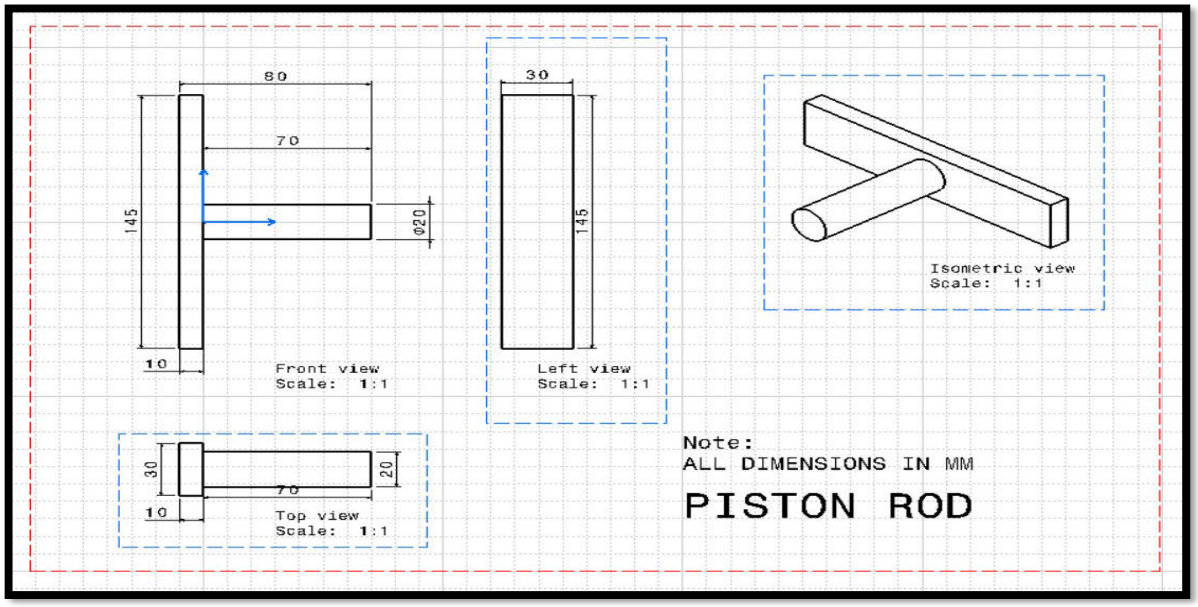


Fig. 4.5.3 structural Diagram of Piston Rod

4. Piston Base

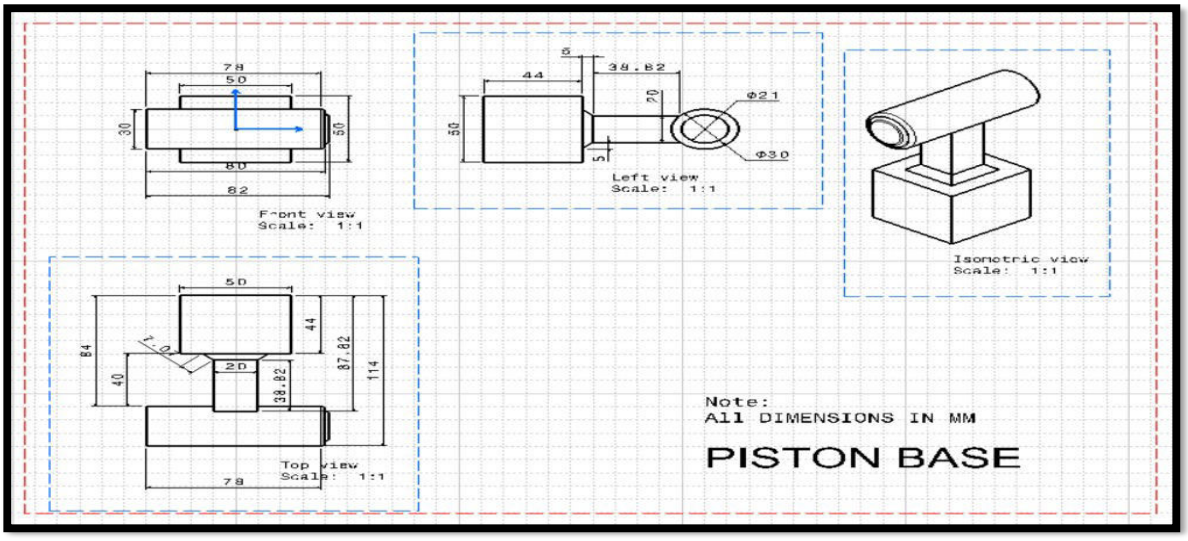


Fig. 4.5.4 structural Diagram of Piston Base

4.Tray

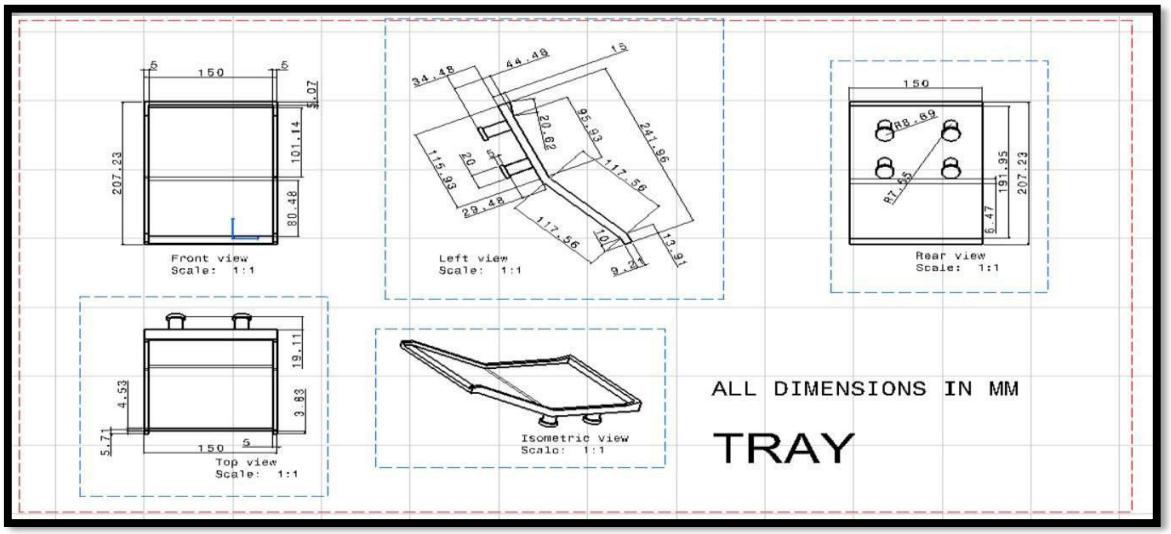


Fig. 4.5.5 structural Diagram of Tray

5.Conveyer Belt

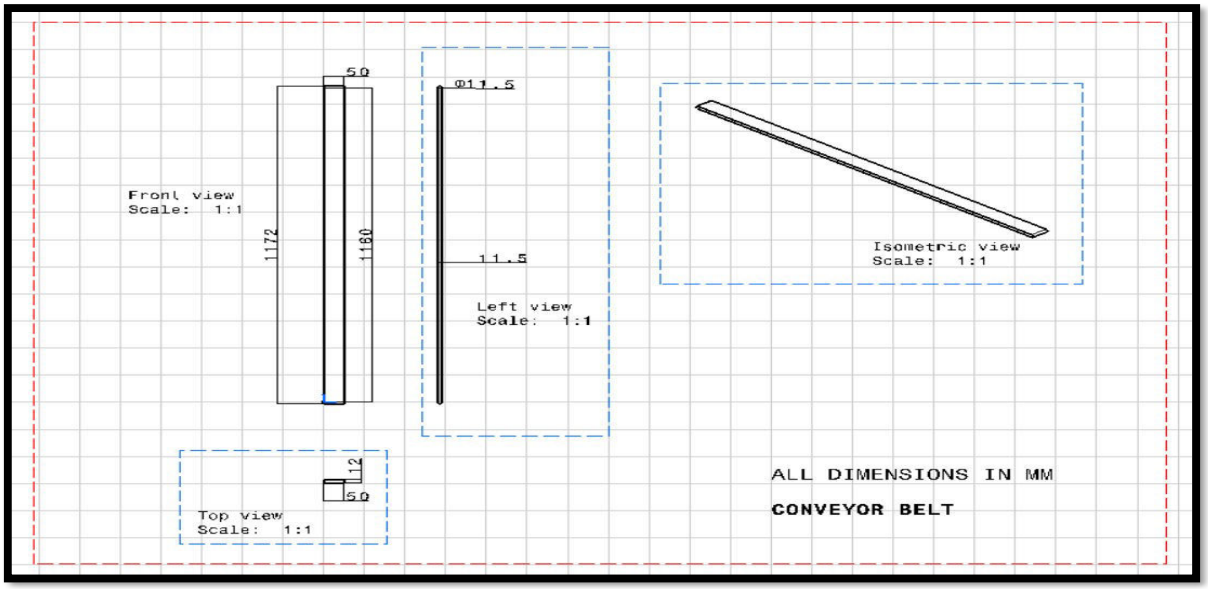


Fig. 4.5.6 structural Diagram of Conveyer Belt

7.Block

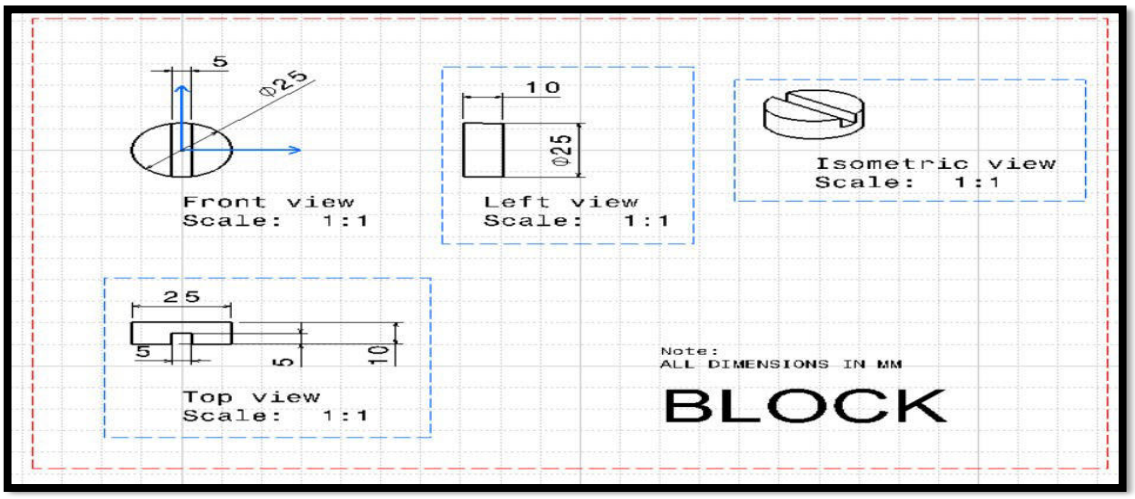


Fig. 4.5.7 structural Diagram of Block

8.Base

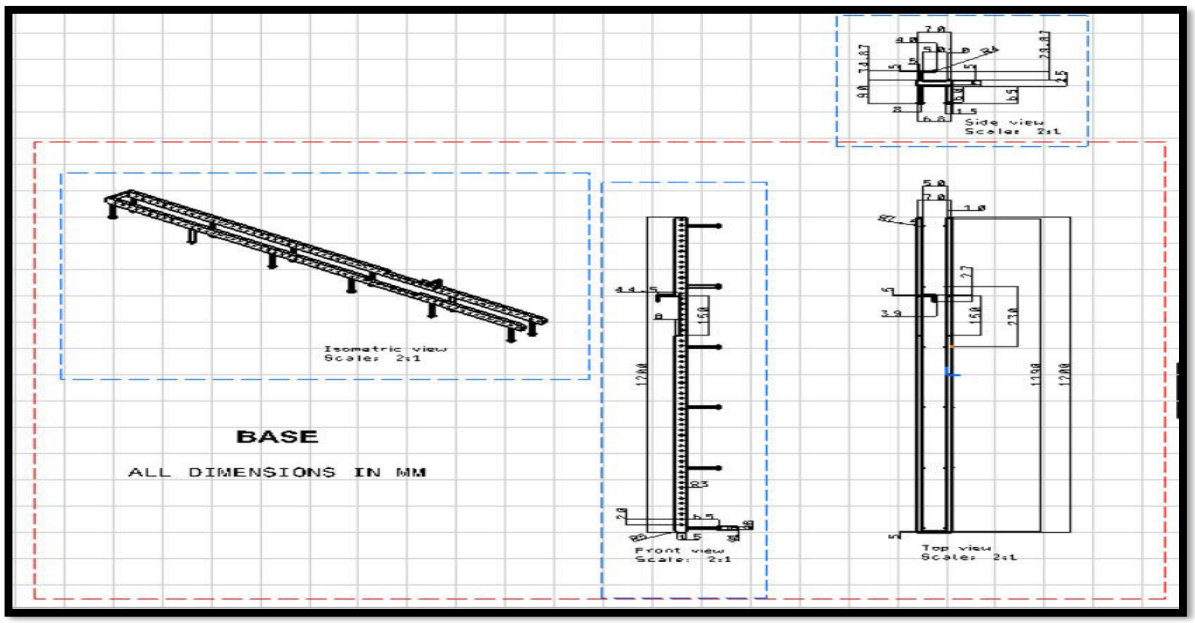


Fig. 4.5.8 structural Diagram of Base

4.6 DESIGN OF INDIVIDUAL COMPONENT

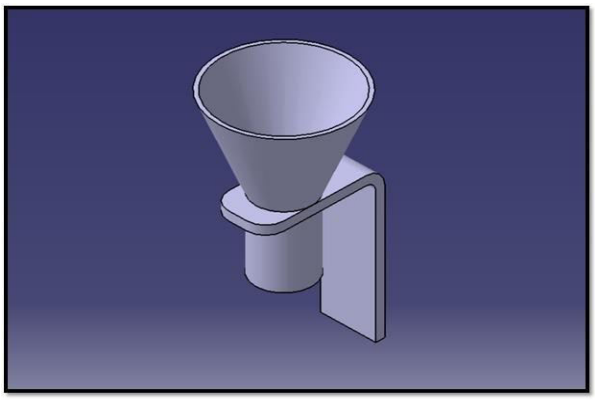


Fig.4.6.1 Hoper

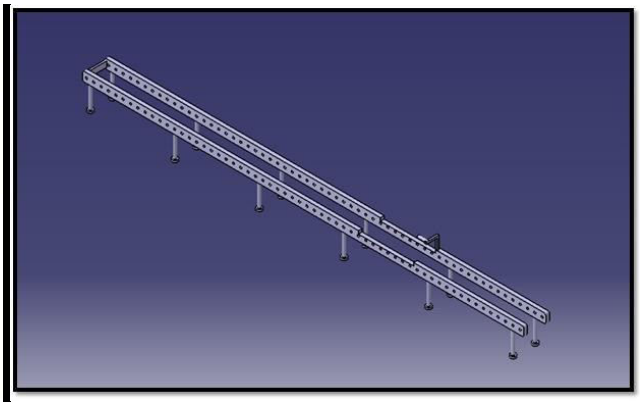


Fig.4.6.2 Base

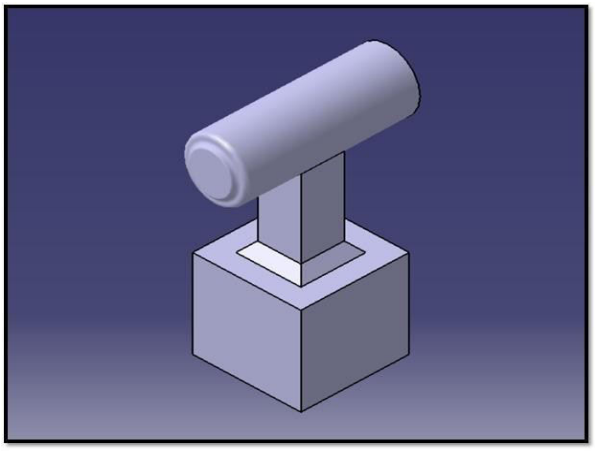


Fig.4.6.3 Piston Base

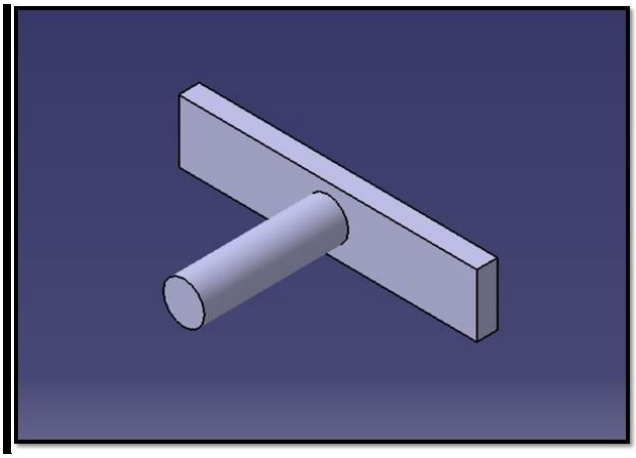


Fig.4.6.4 Piston Rod

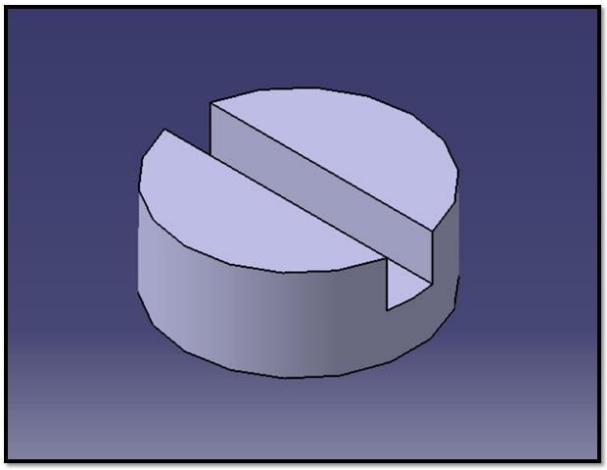


Fig.4.6.5 Block

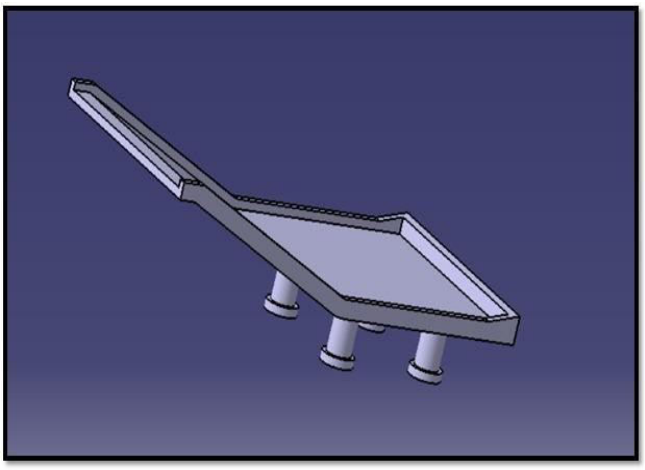


Fig.4.6.6 Tray

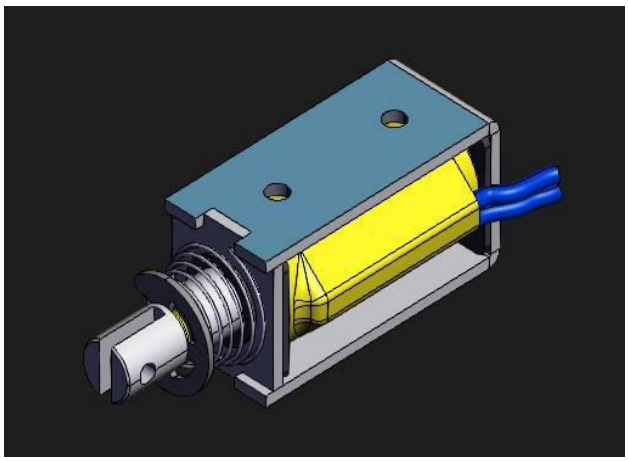


Fig.4.6.7 Solenoid Actuator

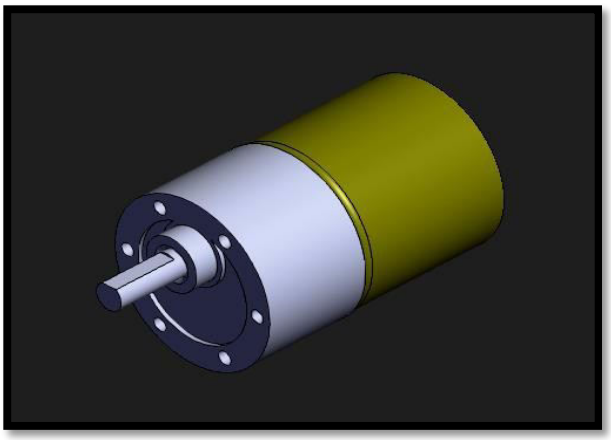


Fig.4.6.8 Gear Motor

4.7 POWER MANAGEMENT

- Arduino mega

Table 4.7.1 Arduino Mega Specification

icrocontroller	ATmega1280
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	54 (of which 15 provide PWM output)
Analog Input Pins	16
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	128 KB of which 4 KB used by bootloader
SRAM	8 KB
EEPROM	4 KB
Clock Speed	16 MHz
Wattage	0.27 watts

- TCS3200

- Supply voltage, VDD 6 V.
- Input voltage range, all inputs, VI −0.3 V to
- DD + 0.3 V Operating free-air temperature range, −40 °C to 85°C Storage temperature range (see Note 2) −40 °C to 85°C Solder conditions in accordance with JEDEC J−STD−020A, maximum temperature (see Note 3) 260 . . . °C
- Wattage – 0.0165

- RELAY MODULE

- Contact current 10A and 250V AC or 30V DC.
- Each channel has indication LED.
- Coil voltage 12V per channel.
- Kit operating voltage 5-12 V
- Input signal 3-5 V for each channel.
- Three pins for normally open and closed for each channel.
- Wattage 0.35

- MOTOR

- 200RPM 12V Rhino Heavy Duty Planetary Geared, DC geared motors with Metal Planetary Gearbox and Metal Gears
- 18000 RPM base motor
- 3 stage metal gearbox for optimum high torque operation
- Motor rated Torque is 15kg cm along with gearbox and stall torque is 60 kgcm, however it is recommended to use the motor at rated torque for optimum life and efficiency.
- Shaft is D type with total length of 16 mm and D shape in 12 mm.
- 6mm Dia shaft with M3 thread hole for tight mounting.
- Shaft can be coupled using CNC coupling 6 mm or using fixed coupling as per requirement
- Back shaft length is 9 mm
- Gearbox diameter is 32 mm.
- Motor Diameter 28.5 mm
- Length 70 mm without shaft
- 300gm weight
- Supply Voltage : 12 V DC

- No-load current : 800 mA, Load current : upto 7.5 A(Max)
- Wattage 90w

➢ SOLENIDE ACTUATOR

- 12V DC operation (you can use 9-14 DC volts, but lower voltage results in weaker/slower operation)
- Push or pull type with 10 mm throw
- DC coil resistance: 25 ohms
- 5 Newton starting force (12VDC)
- Size:13(W)15(H)30(L)mm
- Weight:35g
- Initial Force(0mm Travel):5N
- Keeping Force(10mm Travel):500g
- Wattage 4.8w

➢ Widely used in automation equipment, such as Game Machines, Slot Machines, The Ticket Vending Machines, Cash Register, Automatic Office Equipment etc.

CHAPTER 5

SIMULATION

Simulation of Base 02

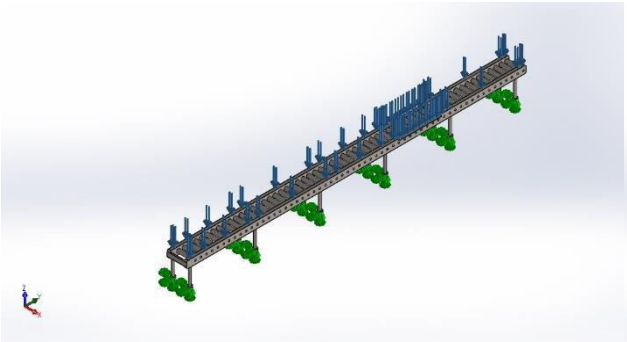
Date: 28 May 2021
Designer: XYZ
Study name: Static 1
Analysis type: Static

of Contents

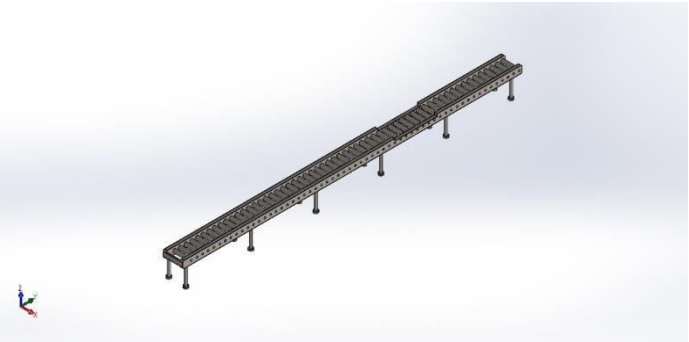
Description

No Data

Assumptions

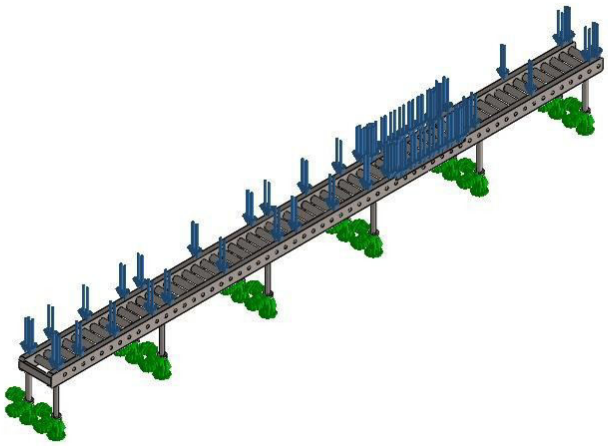


Original Model

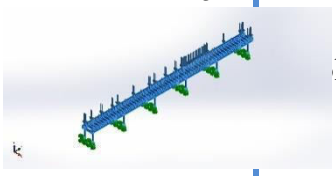


Model Analyzed

Model Information



Model name: Base 02
Current Configuration: Default

Solid Bodies			
Document Name and Reference	Treated As	Volumetric Properties	Document Path/Date Modified
Boss-Extrude5 	lid Body	Mass:7.37728 kg Volume:0.000958088 m^3 Density:7700 kg/m^3 Weight:72.2973 N	C:\Users\Admin\Desktop\solidworks\Makarand\Base 02.SLDPRT May 28 23:14:05 2021

Study Properties

Study name	Static 1
Analysis type	Static
Mesh type	Solid Mesh
Thermal Effect:	On
Thermal option	Include temperature loads
Zero strain temperature	298 Kelvin
Include fluid pressure effects from SOLIDWORKS Flow Simulation	Off
Solver type	FFEPlus
Inplane Effect:	Off
Soft Spring:	Off
Inertial Relief:	Off
Incompatible bonding options	Automatic
Large displacement	Off
Compute free body forces	On
Friction	Off
Use Adaptive Method:	Off
Result folder	SOLIDWORKS document (C:\Users\Admin\Desktop\solidworks\Makarand)

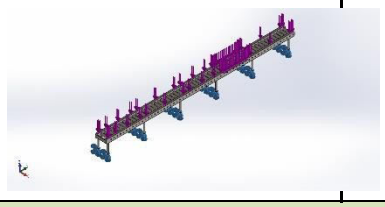
Units

Unit system:	SI (MKS)
Length/Displacement	mm
Temperature	Kelvin
Angular velocity	Rad/sec
Pressure/Stress	N/m^2

Material Properties

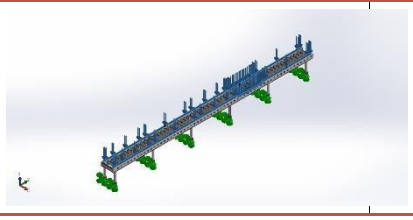
Model Reference	Properties		Components
	Name:	Alloy Steel	SolidBody 2(Boss-Extrude5)(Base 02)
	Model type:	Linear Elastic Isotropic	
	Default failure criterion:	Unknown	
	Yield strength:	6.20422e+008 N/m^2	
	Tensile strength:	7.23826e+008 N/m^2	
	Elastic modulus:	2.1e+011 N/m^2	
	Poisson's ratio:	0.28	
	Mass density:	7700 kg/m^3	
	Shear modulus:	7.9e+010 N/m^2	
	Thermal expansion coefficient:	1.3e-005 /Kelvin	
Curve Data:N/A			

Loads and Fixtures

Fixture name	Fixture Image	Fixture Details
Fixed-1		Entities: 12 face(s) Type: Fixed Geometry

Resultant Forces

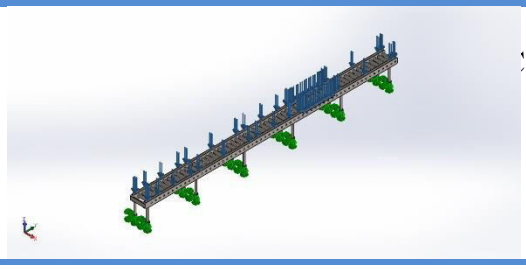
Components	X	Y	Z	Resultant
Reaction force(N)	-0.00136313	0.00883973	3500.02	3500.02
Reaction Moment(N.m)	0	0	0	0

Load name	Load Image	Load Details
Force-1		Entities: 6 face(s) Type: Apply normal force Value: 3500 N

Connector Definitions

No Data

Contact Information

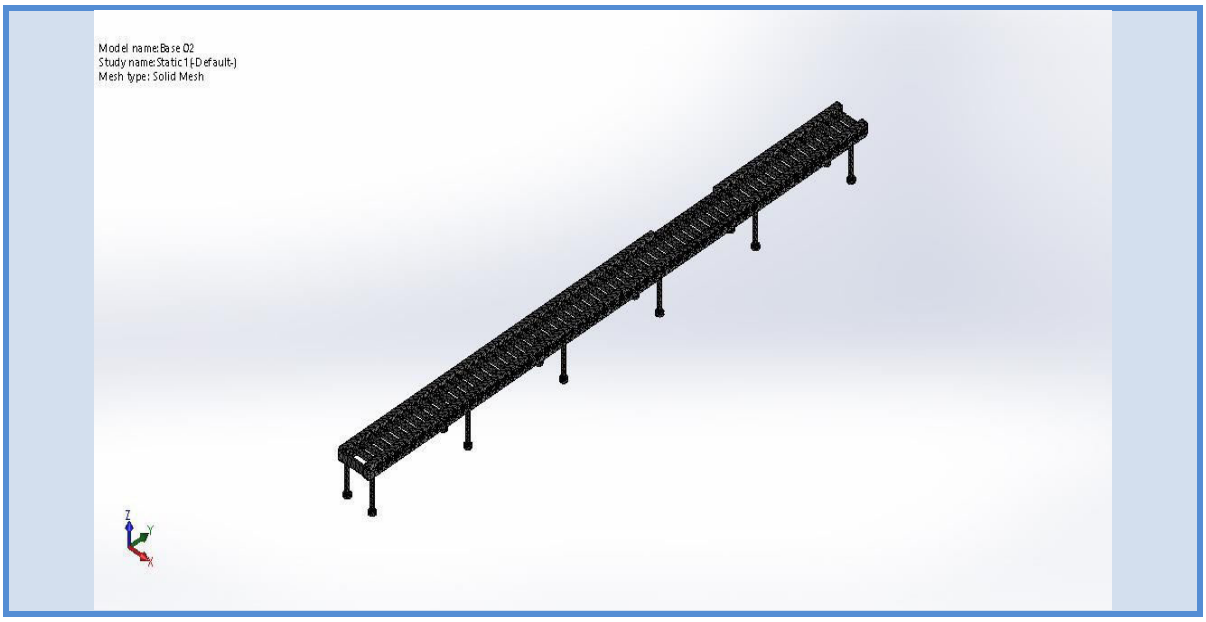
Contact	Contact Image	Contact Properties
Global Contact		Type: Bonded Components: 1 component(s) Options: Compatible mesh

Mesh information

Mesh type	Solid Mesh
Mesher Used:	Standard mesh
Automatic Transition:	Off
Include Mesh Auto Loops:	Off
Jacobian points	4 Points
Element Size	10.7571 mm
Tolerance	0.537854 mm
Mesh Quality Plot	High

Mesh information - Details

Total Nodes	55366
Total Elements	30485
Maximum Aspect Ratio	17.983
% of elements with Aspect Ratio < 3	87.5
% of elements with Aspect Ratio > 10	0.0984
% of distorted elements(Jacobian)	0
Time to complete mesh(hh;mm;ss):	00:00:11
Computer name:	


Model name:Base 02
Study name:Static 1(-Default-)
Mesh type: Solid Mesh

Sensor Details

No Data

Resultant Forces

Reaction forces

Selection set	Units	Sum X	Sum Y	Sum Z	Resultant
Entire Model	N	-0.00136313	0.00883973	3500.02	3500.02

Reaction Moments

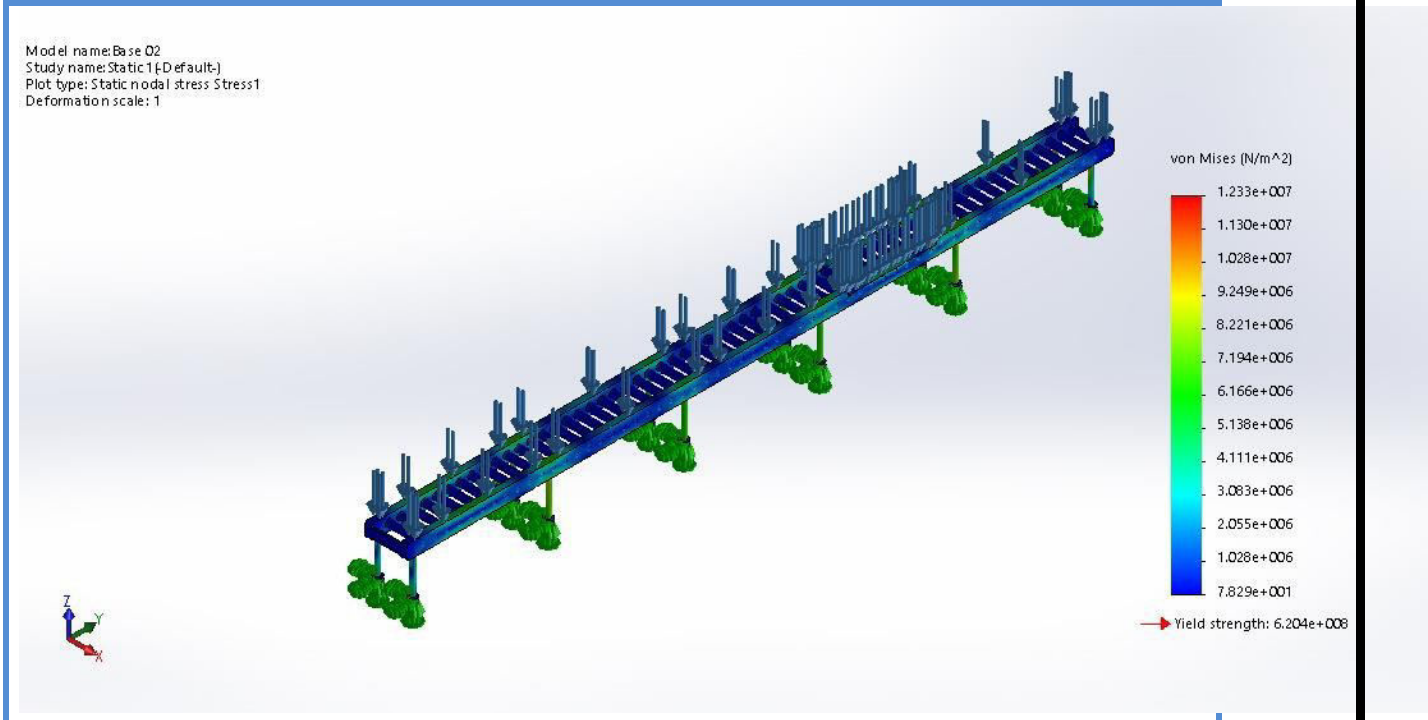
Selection set	Units	Sum X	Sum Y	Sum Z	Resultant
Entire Model	N.m	0	0	0	0

Beams

No Data

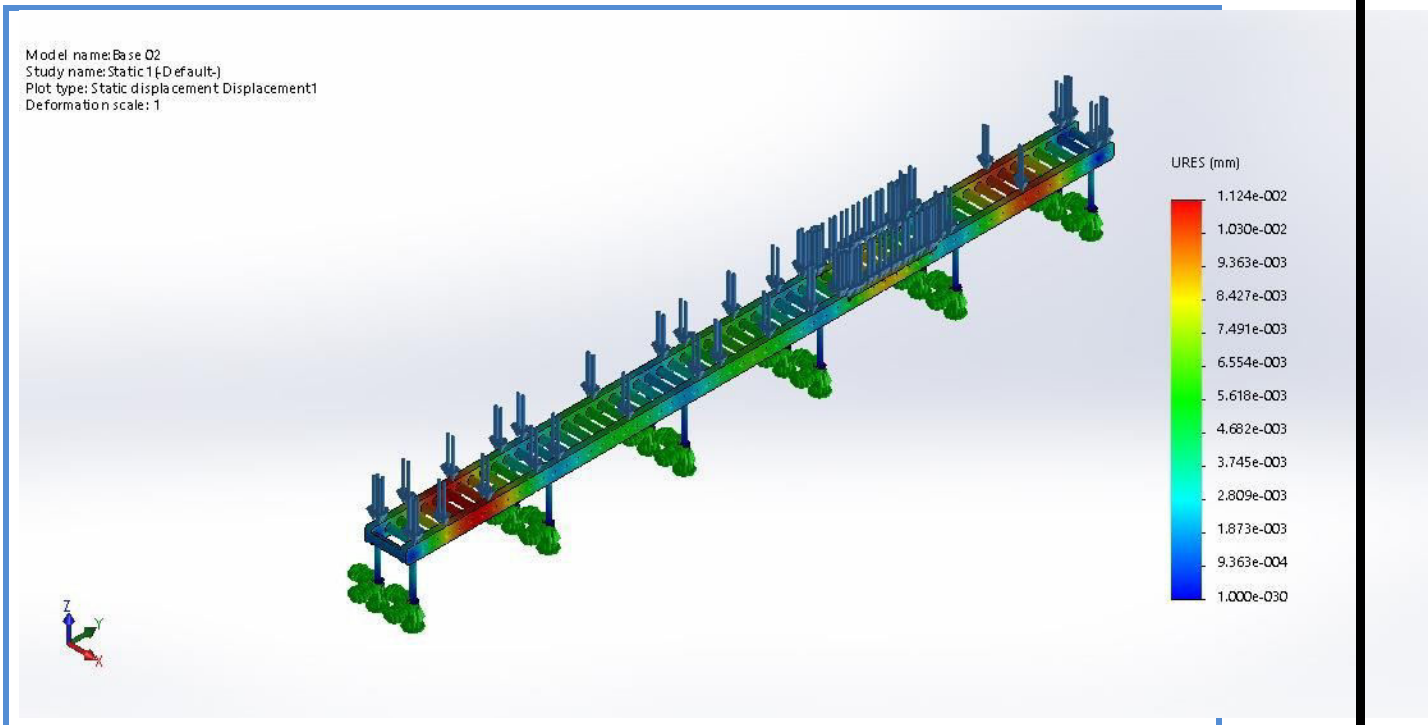
Study Results

Name	Type	Min	Max
Stress1	VON: von Mises Stress	7.829e+001N/m^2 Node: 47579	1.233e+007N/m^2 Node: 39978



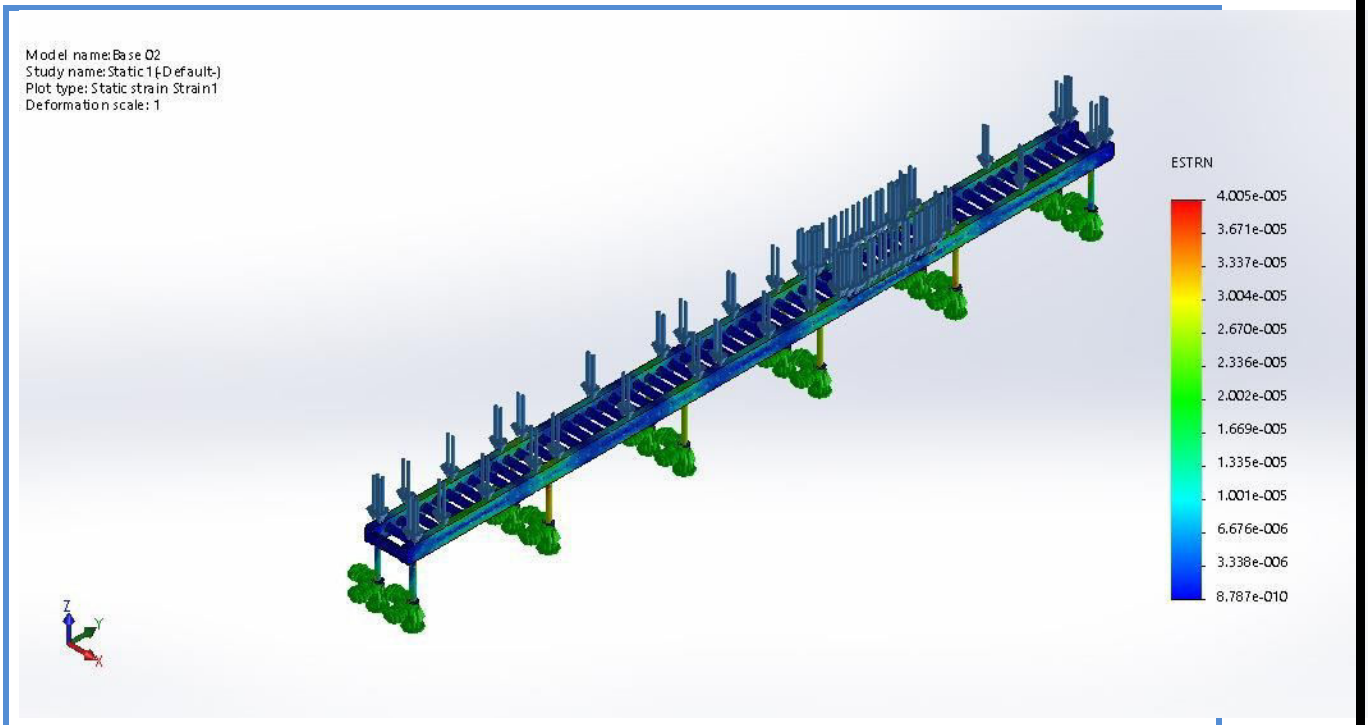
Base 02-Static 1-Stress-Stress1

Name	Type	Min	Max
Displacement1	URES: Resultant Displacement	0.000e+000mm Node: 2645	1.124e-002mm Node: 24683



Base 02-Static 1-Displacement-Displacement1

Name	Type	Min	Max
Strain1	ESTRN: Equivalent Strain	8.787e-010 Element: 1472	4.005e-005 Element: 25173



Base 02-Static 1-Strain-Strain1

CHAPTER 6

RESULT AND DISCUSSION

6.1 TOTAL POWER REQUIRMENT

Arduino Wattage	0.27 watts
Tcs colour sensor Wattage	0.0165w
Relay Wattage	0.35w
Motor Wattage	90w
Solonide Wattage	4.8w

Total = 95.4365 watts

6.2 CALCULATIONS

- Velocity Ratio

  Diameter of Driving Pulley (D1) = 12mm

  Diameter of Driven Pulley (D2) = 12mm

  Thickness of belt (t) = 4mm

  Rotational speed of Driving Pulley (N1) = 30 RPM

  Rotational speed of Drien Pulley (N2) = 22 RPM

  Velocity Ratio (VR) = N2/N1 = D1+t/D2+t

  22/30 = 12+4/12+4

Velocity Ratio = 0.73

- Linear Velocity
  - Linear velocity of Driving pulley

Diameter of Driving Pulley (D1) = 12mm

Rotational speed of Driving Pulley (N1) = 30 RPM

Linear velocity (V1) = πD1N1/60

= π * 0.012 * 30 / 60

V1 = 0.018 m/s

- Linear velocity of Driven pulley

Diameter of Driving Pulley (D2) = 12mm

Rotational speed of Driving Pulley (N2) = 22 RPM

Linear velocity (V1) = πD2N2/60

= π * 0.012 * 22 / 60

V1 = 0.013 m/s

- Slip

Slip = Linear velocity of Driving pulley - Linear velocity of Driven pulley

= 0.018 – 0.013

Slip = 0.005

6.3 ADVANTAGES AND APPLICATIONS:

- Advantages

- Accurate
- Good repeatability
- Reduce labor cost
- Less human interference

- Applications

- In food industry to identify rotted fruits and vegetables, in minor scale and big scale productions, to categorize the products established on the several factors.
- In production units to scan and identify the defects in raw materials.
- In fruits and vegetable farming areas (rural areas) where installation of expensive sorters is very difficult.

CHAPTER 7

CONCLUSION

In this paper we conclude that cashews will be sort according to its Color by using color sensor and Ardiuno . We have developed a sorting machine using ardiuno kit for automatic color sorting, taking in to considering two colors namely Green and yellowThe time and human effort can be reduced by implementing such project in industries like chemical, food, chip manufacturing and so on. By applying the idea of this project an industry can easily sort the required product according to its colour..

CHAPTER 8

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