A Minor Project Report on

“Braille Printing Machine”

Bachelor of Engineering in

Mechanical Engineering

Submitted by

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Under the Guidance of

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CERTIFICATE

This is to certify that Capstone Project entitled **"Braille Printing machine"** submitted by **Naveen F Walmiki (01FE20BME037), Siddu Hebballi (01FE20BME034)**,**Nagaraj Belur (01FE20BME096),Prakash Bidarakundi (01FE20BME106),Shanmuk Chinmalli (01FE20BME050),Vivek Hebsur(01FE20BME010)** to the **KLE Technological University**, Hubli-580031, towards partial fulfillment for the award of the degree of Bachelor of Engineering is a bona-fide record of work carried out by him/her under our supervision. The contents of project report, in full or in parts, have not been submitted to any other institute or university for award of any degree or diploma.

Prof. Shivaprasad M

Guide

Dr. B. B. Kotturshettar

Head of department

ACKNOWLEDGEMENT

The successful completion of any task would be incomplete without mentioning the people who made it possible and whose guidance and encouragement has made our efforts successful.

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We also thank **Dr. B. B. Kottursheṭtar** for his encouragement in undertaking the task of this project.

We express our sincere regard and gratitude to our project coordinators **Prof Gururaj Fattepur** and course mentors **Prof Nagaraj Ekbote, and Prof. Arun Patil** School of Mechanical Engineering, KLE Tech, Hubli

We also thankful to all faculty members, Maker Space staff of the Mechanical Engineering Department of KLE Technological University, for helping us directly or indirectly in different stages of our project work.

Student signatures

Naveen F Walmiki

Siddu Heballi

Prakash Bidarakundi

Nagaraj Belur

Vivek Hebsur

Shanmukh Chinmalli

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Phase 1
Refined problem statement

Customer: Annappa		**Interviewer(s)**: Naveen, Siddu, Shanmuk **Date**:27/03/2023
Profession: Head master Of govt school for blind children Hubli		Ph. No:9945731984
Question/Prompt	**Customer Statement**	**Interpreted Need/ Expectations**
Typical uses	To make a several copy of a notes.	
	To print a question papers or some reading materials.	
Likes-current methods followed (traditional techniques)	Presently using manual method that means by the help of braille slate and braille stylus.	
Dislikes-current methods followed (traditional techniques)	It tooks more time for printing.	
	Not accuracy.	
	More time consuming.	
Suggested Improvements	It must be automatic.	
	Which must involve average speed	

Customer: Pradeep Ajjanagouda Karigoudra **Student**		**Interviewer(s):** Prakash, Nagraj, Vivek **Date:**27/3/2023
Question/Prompt	**Customer Statement**	**Interpreted Need/ Expectations**
Typical uses	To study regular study practices.	To make Several Copy of notes
	To print question Booklet on exams.	
	To read the content.	
Likes-current methods followed (traditional techniques)	It should be Accurate.	
	It should proper speed.	
Dislikes-current methods followed (traditional techniques)	Not a proper stylus dot spot for showing the sensible touch	Time consuming.
	Manual By using the braille slate and Braille stylus	More usage of the papers per print.
Suggested Improvements	There is a proper distance/space between the alphabet.	
	It should be proper Braille stylus spot touch.	
	Less time required to complete the print.	

Customer: Praveen Ravi Chakalabbi **Student**		**Interviewer(s):** Shanmuk,Prakash,Siddu **Date**:28/3/2023
Question/Prompt	**Customer Statement**	**Interpreted Need/ Expectations**
Typical uses	To study regular study practices.	To make Several Copy of notes
	To print question Booklet on exams.	
	To read the content.	
Likes-current methods followed (traditional techniques)	It should be Accurate.	
	Less speed for productivity.	
Dislikes-current methods followed (traditional techniques)	Not a proper stylus dot spot for showing the sensible touch	Time consuming.
	Paper is not suitable for touch it was having the smoother	
Suggested Improvements	There is a proper distance/space between the alphabets.	It converts the Braille readings to voice assistant.
	It should be proper Braille stylus spot touch.	

Customer: Gururaj Kempannanavar
Student

Interviewer(s): Naveen, Vivek, Nagaraj
Date:28/3/2023

Question/Prompt	Customer Statement	Interpreted Need/ Expectations
Typical uses	To study regular study practices.	
	To print question Booklet on exams.	
	To read the content.	
Likes-current methods followed(traditional techniques)	It should be Accurate.	Less cost and investment.
	Less speed for productivity.	
Dislikes-current methods followed (traditional techniques)	Not a proper stylus dot spot for showing the sensible touch.	
	Time consuming.	
Suggested Improvements	Multi language printer machine.	It converts the Braille readings to voice assistant.
	It should be proper Braille stylus spot touch.	

Customer: Yallappa Ningappa Pyati **Student**	**Interviewer(s):**Prakash, Vivek, Nagaraj **Date:**28/3/2023	
Question/Prompt	**Customer Statement**	**Interpreted Need/ Expectations**
Typical uses	To study regular study practices.	To make Several Copy of notes
	To print question Booklet on exams.	
	To read the content.	
Likes-current methods followed (traditional techniques)	It should be Accurate.	Less maintains and repair
	More speed for productivity.	
Dislikes-current methods followed (traditional techniques)	Not a proper stylus dot spot for showing the sensible touch	Time consuming.
	Paper is not suitable for touch it was have the more smooth	It will create the damages to the fingers.
Suggested Improvements	There is a proper distance/space between the alphabets.	It converts the Braille readings to voice assistant.
	It should be proper Braille stylus spot touch.	Wi-Fi Assistant and Bluetooth module to printer.

Customer: Mohamad rafi nabisab
Student

Interviewer(s): Siddu, Shanmukh, Vivek
Date:28/3/2023

Question/Prompt	Customer Statement	Interpreted Need/ Expectations
Typical uses	To study regular study practices.	To make Several Copy of notes
	To print question Booklet on exams.	
	To read the content.	
Likes-current methods followed (traditional techniques)	It should be Accurate.	Less maintains and repair
	More speed for productivity.	
Dislikes-current methods followed (traditional techniques)	Not a proper stylus dot spot for showing the sensible touch	Time consuming.
	Paper is not suitable for touch it was have the more smooth	It will create the damages to the fingers.
Suggested Improvements	There is a proper distance/space between the alphabets.	It converts the Braille readings to voice assistant.
	It should be proper Braille stylus spot touch.	Wi-Fi Assistant and Bluetooth module to printer.

Phase 2

2. Product Benchmarking

Products (Images or name)	Specifications	Cost	Advantage	Limitations	Availability
 Human ware D V5 Tractor Fed	Voltage 240 V AC Weight 65.2 kg Brand Human ware Characters Per Second Up to 300 Pages Per Hour Up to 1000 Dimensions 72 x 90 x 71 cm Paper Weight 180 gram/m2 Braille Fonts 2.5 mm Max. Power 400 W	2.5 Lakh	High speed Low maintenance High maneuverability excellent dots	High cost	yes
 Index Braille Basic-D V5	High-Speed Double-Sided Braille Embosser 140 characters per second Dot forming height 0,58 mm Braille and text labeled control panel Tractor-fed paper	2.5lakh	Easily can used User friendly Less time	High cost	yes

 Braillo300	double-sided (interpoint) Braille Printer.		Easy		
 BRAILLO 300 S2 Braille Printer	Prints both 6 and 8 dot Braille Single / Interpoint Less Noise levels Less power consumption Works with PC and Apple operating systems Wi-Fi, USB, Ethernet	2.8 lakh	Portable User friendly Time saving	High cost	Yes Must import from America.
IRIE Braille Buddy 	25 characters/second – the fastest embosser at the price Quality single-sided Braille High-resolution tactile graphics – multiple dot heights for greater detail Multiple paper options – use tractor or single cut-sheet paper Portable personal embosser – small and compact to take with you	1.5 lakh	Portable Very fast	Average cost	Yes Must import from other country.

2.2 Patent search

Patent Name/ Number/ Date	Information
Braille Printer CN211808486U IPC -B41J3/32; 30-10-2020	Braille is a text character created to allow the blind to read and write. It is sometimes referred to as Braille or Braille. It is a gadget that helps the blind read and learn. By touching the Braille, the blind may read information and get pertinent data. A lower body and an upper body are both components of a Braille printer. The lower body has a groove in the middle of the upper surface for holding printing paper, while the higher body is positioned on top of the lower body. The upper body has six through holes that are evenly spaced in two rows and pierce up and down for a pressing plate suited to the groove. The through holes have pressing and self-locking Braille points.
Portable Braille Printer System for the Visually Impaired People WO2022132100A1 21-01-2021	The current invention relates to a portable Braille printing system that consists of hardware and software components and allows for the automation of the manual creation process of the embossed marks that are formed by pressing the Braille pen on the paper placed on the Braille plate and that are understood by those who are blind. Those who are blind or visually challenged can read letters made as embossed marks on paper using any technique by touching them. Braille plate (tablet) and Braille pen are tools used in one technique for embossing marks on paper. The Braille plate has small pits spaced out at regular intervals. To create the Braille alphabet characters, these pits are created as separate rectangles
Braille Type Writer Robert C. Lokey, Box 75356, Tamal, Calif. 94.964 July-16-2014	The main goal of this invention, which relates to a Braille typewriter, is to provide a simple, affordable, lightweight, portable, and reliable method by which a person who is blind or sighted can easily and quickly print all of the Braille

	alphabet's letters and symbols on a piece of paper in raised characters. The provision of such a device with means for automatically advancing the carriage by a single space corresponding to a Braille cell as well as a conveniently located spacebar to advance the carriage as desired is an additional goal of the invention. The provision of means for clamping the paper in relation to the die plate to ensure proper alignment of the paper is another goal of the invention.
Automatic Braille reading material printing quality inspection system and device YANG YANG; WO SHUPING; LIU HONG; WANG YANPING IPC-G06F16/33; G06T7/00; 2019-09-27	If the Braille word is incorrect, it will significantly damage the blind reader's reading and understanding because of the braille's undulating arrangement and the spelling characteristic of the overall Braille scheme. The computer-compiled electronic books of Braille readings must go through numerous proofreading stages before publication to guarantee that the mistake rate is under one thousandth before delivery. The Braille electronic manuscript is presented on different substrates like paper, plastic, or metal using a variety of mechanical and electronic devices, such as foaming ink embossing printing, thermoforming, UV dispensing, screen printing method, inkjet printing method, or by using a printing machine or a marking machine, using mechanical devices.

2.3 Literature survey

Literature details	Gathered Information
Braille Keyboard and Printer Interfaced (Presented solution is low cost, it is portable to carry everywhere)	There is variety of brands devices available in the market for visually impaired people to help them in educational activities and to bridge the communication gap between visually impaired people and people with sight. According to World Health Organization (WHO), about 89% of world's visually impaired live in developing countries and majority of the people are living with the lowest pay as the national salary i.e. the average salary if the person is so low that. Most of the devices in the market are too costly and not so comfortable to use, or Braille scanners, yet a low-cost Braille system is not available in the market for visually impaired persons in the developed countries where braille reading and writing can be teacher without a Braille teacher. Braille Keyboard: A Self-Learning Braille System for Visually impaired at cheap price, easy to use, low-power, portable, self-learning, and user-friendly Braille writing and reading tutor with the capability of reading documents and works on text-to-speech technology which is the helpful technology for visually impaired individuals. The presented solution is low cost. It is portable to carry everywhere. It is user friendly and easy to use. It is based on text to speech concept -User would be able to hear what they type
Design and Implementation of a Low-Cost Printer Head for Embossing Braille Dots on Paper	Visually impaired people face countless difficulties in their daily lives. This is especially true for activities such as environment understanding, urban mobility, reading, computer access, object finding, among others. In particular, to address the reading and computer access challenges, three solutions have been explored so far with the aim of improving digital text accessibility: screen magnifiers, voice synthesizers, and Braille terminals. Screen magnifiers perform screen magnification for those who still have some

	degree of remnant vision. Voice synthesizers literally read the text displayed on the computer screen and Braille terminals display the text on the screen in Braille code Audio books are perhaps the simplest and fastest way to convey text to visual impaired people. Entire print books are recorded while being read out loud. They can be reproduced by standard music players such as desktop component systems or wearable headsets. Audio books are considered a simple, inexpensive, and non-Braille reading alternative for visually impaired people.

Phase 3

3. Design Specifications

4. 3.1 Brainstorming

Keywords	
Braille Braille paper Braille translation software Braille display	Braille keyboard Tactile graphics Braille printer Assistive technology

3.2 OFMC Chart

Keywords	Objectives	Functions	Constraints	Means
Detection of key.	-	✓	-	-
Should translate normal letters to braille letters.	-	✓	-	-
Creation of braille cells.	✓	-	-	-
Accuracy in braille cells.	✓	-	-	-
Size of braille cell.	-	-	✓	-
Space between two letters.	-	-	✓	-
Force required for braille dot.	-	-	✓	-
Speed of typewriter.	-	-	✓	-
Braille typewriter should be more accessible.	✓	-	-	-
Provides equal spacing between words.	-	✓	-	-
Time duration to print one word.	-	-	✓	-
Movement of typewriter pin	-	✓	-	-
Communicates between man and braille typewriter.	✓	-	-	-
It should support modern education.	✓	-	-	-
Easy to use, lightweight.	-	-	✓	-
Maintenance and repair.	-	-	✓	-
Tactile technology to produce	-	-	-	✓
Provide output on LCD screen.	-	-	✓	-
Letters should print on papers.	-	-	✓	-
Affordable.	✓	-	-	-
Computer or mobile for input.				✓

3.3 Objectives

Objectives	
Creation of braille cells.	It should support modern education.
Accuracy in braille cells.	Helps to communicates between man and braille typewriter.
Braille typewriter be more accessible.	It is affordable.

3.4 Constraints

Constraints	
Size of braille cell	Space between two letters.
Force required for braille dot.	Speed of typewriter.
Easy to use and lightweight.	Time duration to print one word.
Maintenance and repair.	

OFMC Table

OBJECTIVE	FUNCTION	MEANS	CONSTRAINTS
Creation of braille cells.	Detection of key.	Tactile technology to produce braille on paper or other surface	Size of braille cell
Accuracy in braille cells.	Should translate normal letters to braille letters.	Computer or mobile device to convert digital text into braille.	Space between two letters.
Braille typewriter be more accessible.	Provides equal spacing between letters.		Force required for braille dot.
It should support modern education.	Movement of typewriter pin.		Speed of typewriter.
Helps to communicates between man and braille typewriter	Provide output on LCD screen.		Time duration to print one word.
It is affordable.	Letters should print on paper.		Easy to use and lightweight.
			Maintenance and repair

3.5 Objective tree (affinity diagram)

O#	Objectives	First level objectives	Second level objectives
1	Creation of braille cells	• Six dot cells. • Eight dot cells.	
2	Accuracy of braille cells.	• Grade 1 braille • Grade 2 braille	• Uncontracted (only common alphabets) • Contracted (Numbers, punctuation etc)
3	Should support modern education.	• Reading and Writing • Easy to communicate	
4	It should be accessible.	• Should be easily available • User friendly	
5	Communication between man and braille typewriter.	• QWERTY keyboard • Braille keyboard • Voice recognition • Image recognition	
6	Affordable.	• Lesser cost • Fulfil customer needs	

4.6Design Specifications:

Si.	Engineering Specifications	Units
1	Dimension of typewriter	55cm*55cm
2	Weight of typewriter	Around 5Kg
3	Braille dot size	0.3mm
4	Gap between words	10mm
5	Tactile graphic resolution	1mm/Dot
6	Maximum words (words/type)	1 word/minute
7	Voltage	12V
8	Power	24W
9	Paper type	210mm*297mm 297mm*420mm
10	Cost	<10,000Rs

5. 3.7 Competitive Benchmarking:

Metric #	Metric	Units	Competitive Products		
			Product 1 Human ware fanfold Dv5	Product 2 Braillo 300 s2	Product 3 Irie Braille buddy
1	Dimension of typewriter	Cm	72 x 90 x 71	93.98 x 68.58 x 63.5	28.5 x 35.9 x 15.9
2	Weight of typewriter	Kg	65.2	105	5
3	Braille dot size	mm	0.3	0.3	0.3
4	Gap between words	Cm	1	1	1
5	Tactile graphic resolution	dpi	50		
6	Maximum words (words/type)	Cps (character per second)	300	300	
7	Voltage	V	100-240	230 V	220-240 V
8	Power	Watt	5	76	4-85
9	Paper type	mm	210 x 297 297 x 420	210 x 297 297 x 420	77-216
10	Cost	Rupees	2.5 lakh	2.8 lakh	1.3 lakh

Phase 4

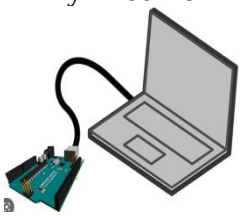
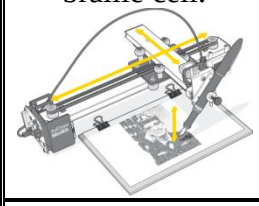
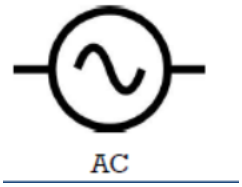
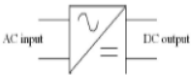
4.1 Concept Generation

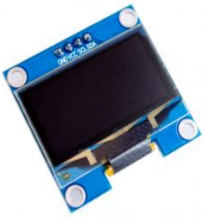
Defining Functions

Si.	Functions
1.	Start type writer.
2.	Providing input.
3.	Detection of key.
4.	Normal to braille latter conversion.
5.	Moment of stylus. (braille pen)
6.	Pressing desired input.
7.	Braille letters on paper.

4.2 Morphological Chart

Functions ▼	Means ►	Means 1	Means 2	Means 3	Means 4
Inserting paper		By manual 	By load roll paper 		
Providing input		By laptop/computer 	Via WIFI 		

Converting Software	By Arduino 	Raspberry pi 		
Transfer data	USB 3.0 	USB 2.0 	Pen drive 	
Printing method	Pointer moving Towards first braille cell. 	Manually paper moving 		
Type of stylus	Wood stylus 	Plastic stylus 	Metal stylus 	
Power device		AC Rectifier 	Battery 	USB 
Motors Used	Servo motor 	Stepper motor 	DC Motor 	

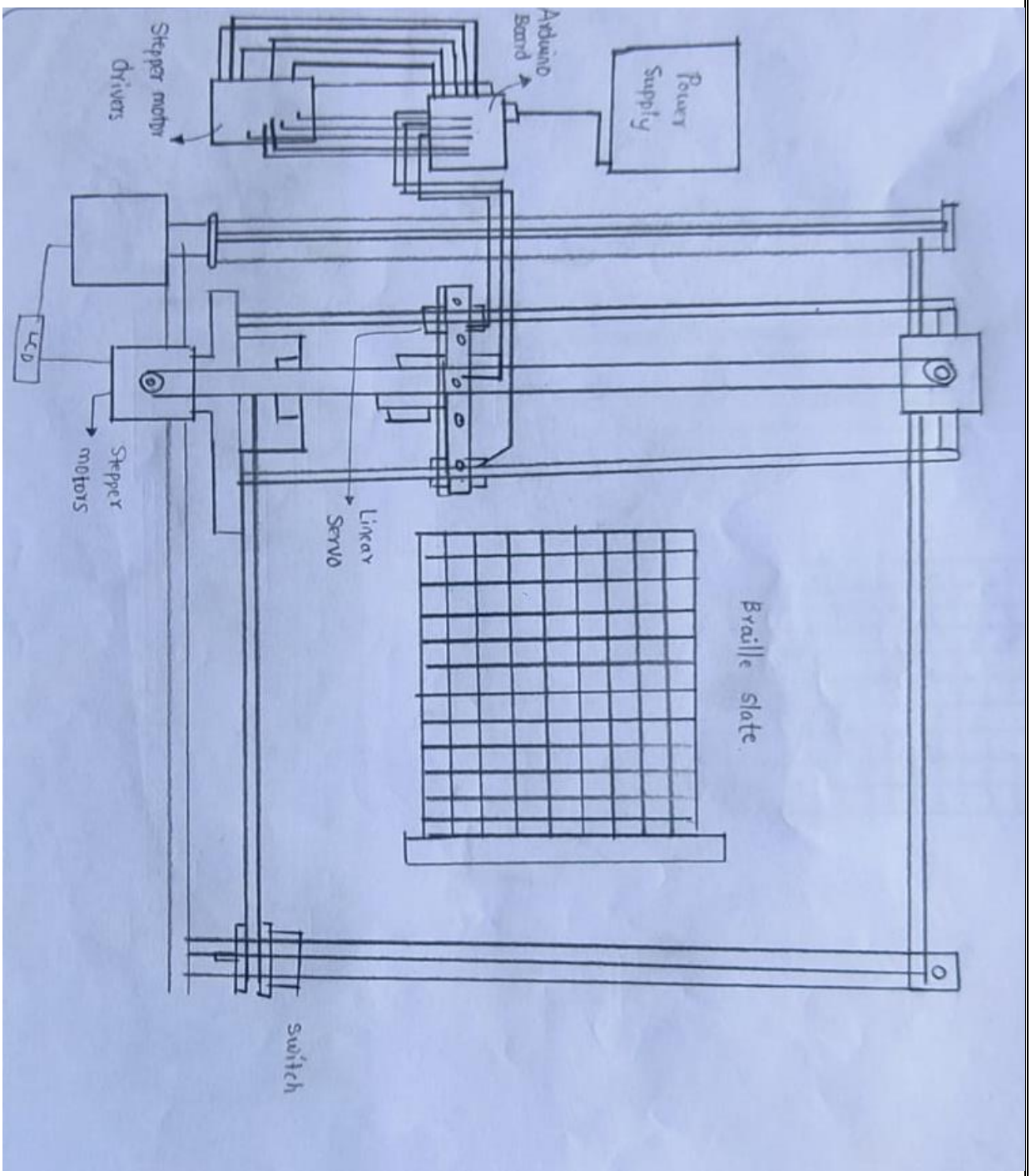
Types of paper	GSM 11*9 	Aluminum foil sheet 	Bond sheets 	
Types of display	OLED display 	LCD display 		

4.3 Generating design alternatives

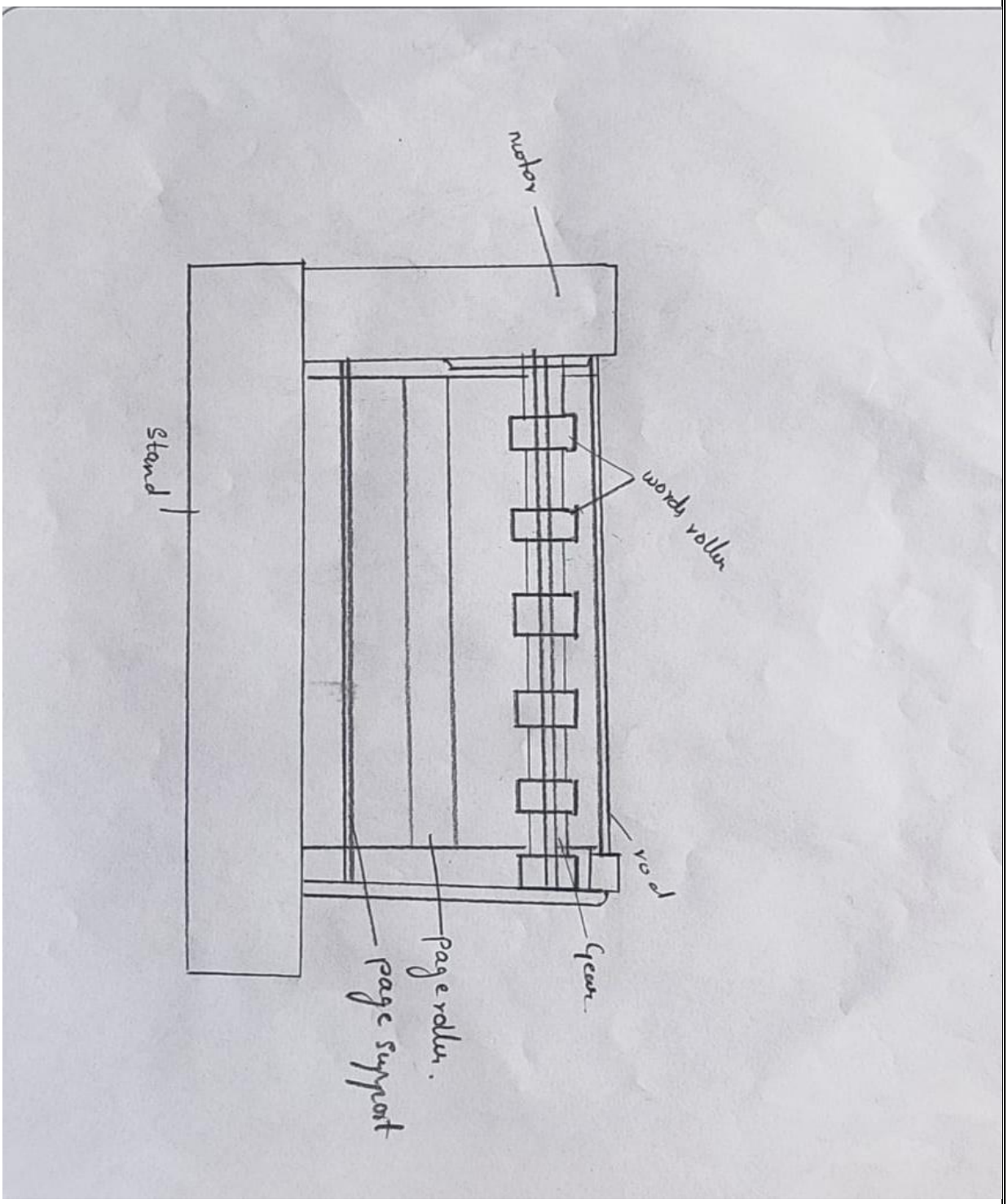
Identified Design Alternatives:

Si.	Design Alternatives
1	Design 1
2	Design 2
3	Design 3
4	Design 4

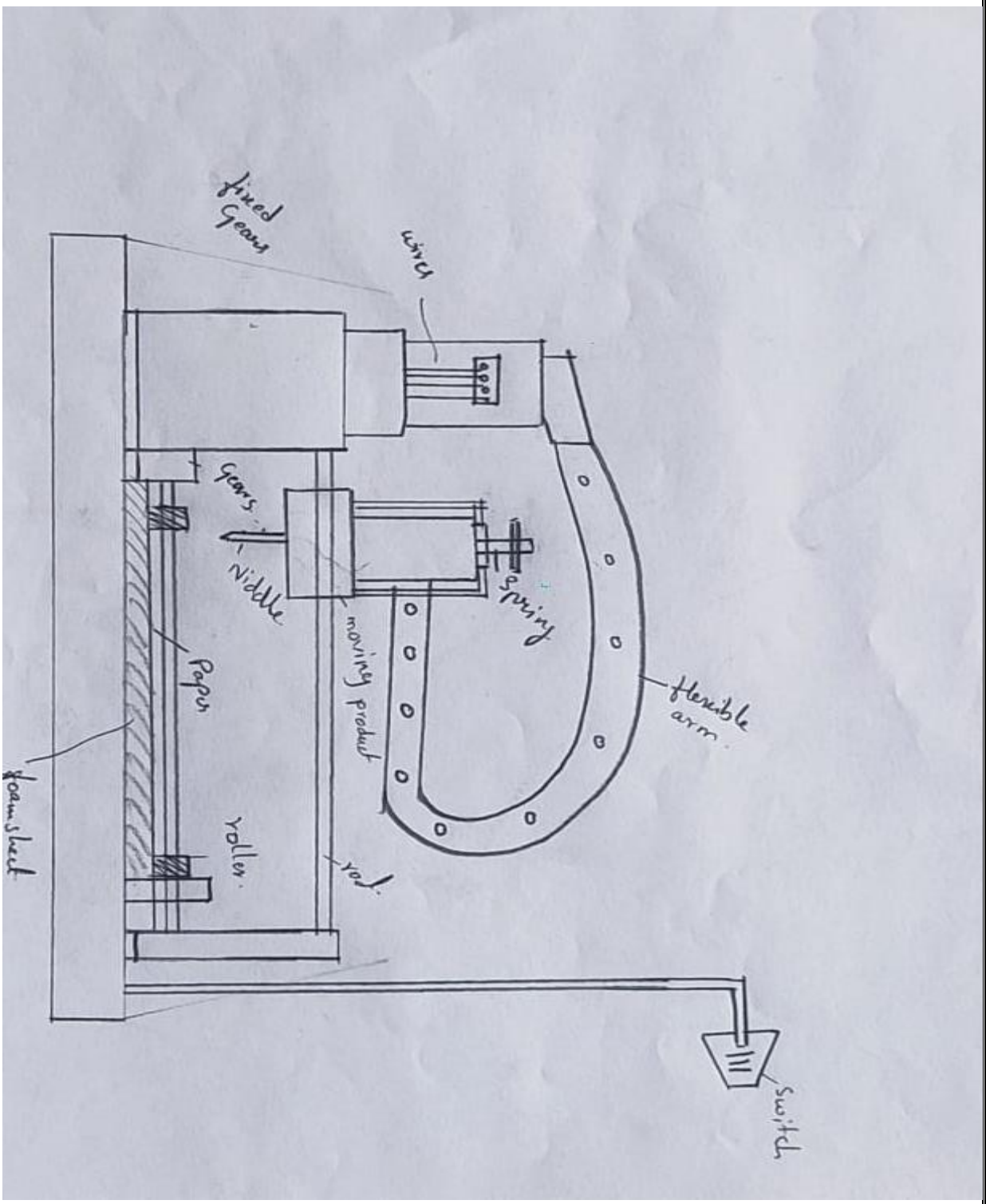
Conceptual Design

Design Alternative 1


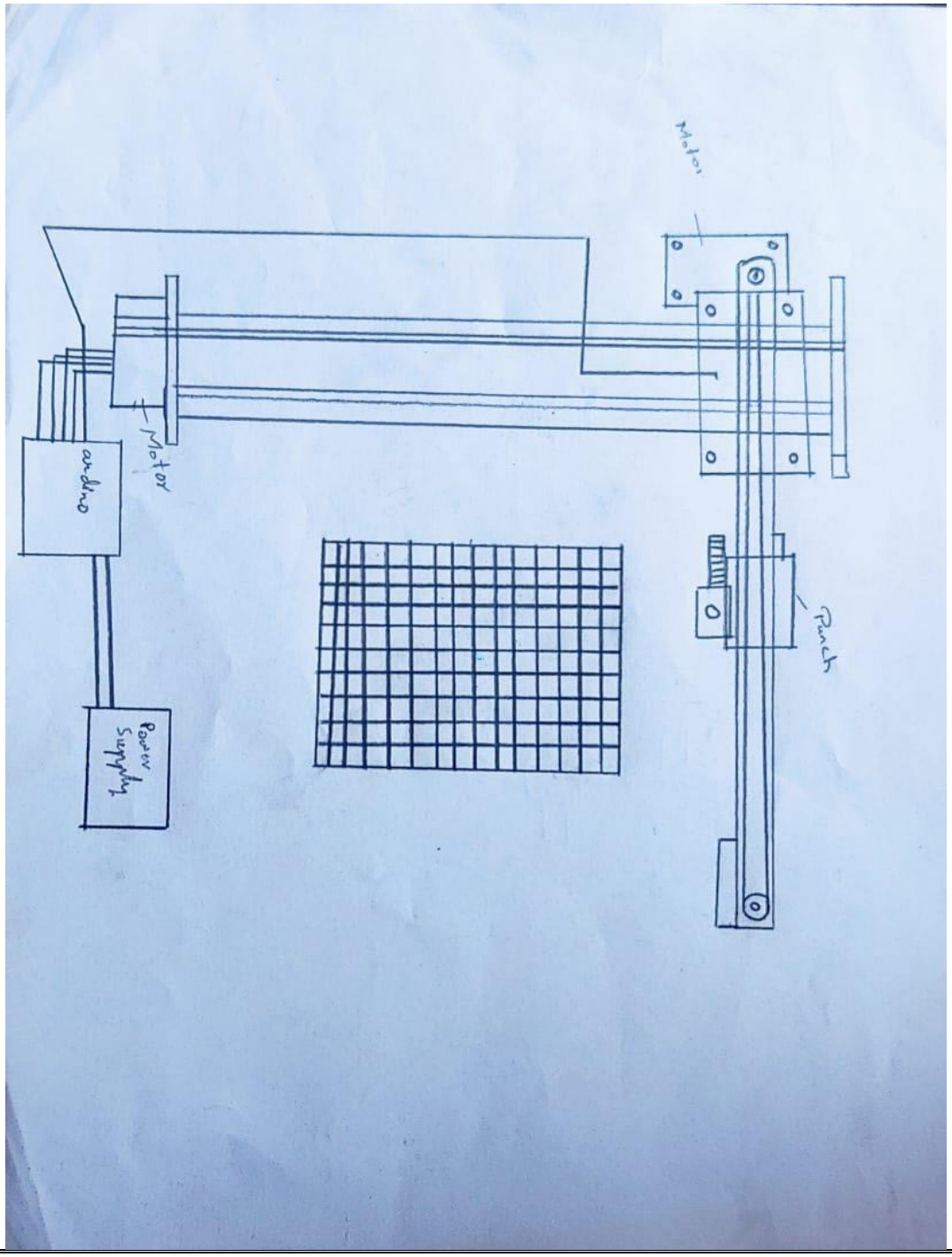
Design Alternative 2



Design Alternative 3



Design Alternative 4



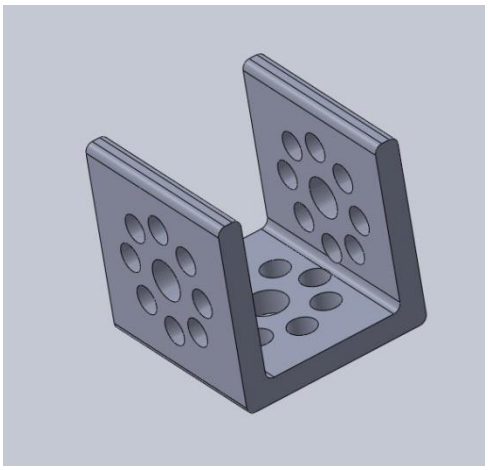
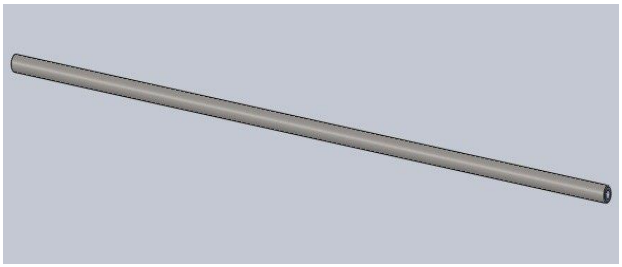
4.4 Selecting Design Alternative (Using Pugh Chart)

Requirements	Weight	Design 1	Design2	Design3	Design 4	Design5	Design6	Reference (blista braille typewriter)
Portable	7	+	+	+	+	+	-	0
Economical	8	-	-	+	+	-	-	0
Efficiency	8	+	+	+	-	+	+	0
Accuracy	8	+	+	0	0	+	-	0
Light weight	8	-	-	+	+	-	-	0
Safety	9	+	+	+	+	0	+	0
Aesthetic	8	+	+	-	-	+	+	0
User friendly	8	-	0	+	+	+	+	0
Durability	7	0	+	+	+	+	+	0
Pluses		6	6	7	6	6	5	
Sames		1	1	1	1	2	0	
Minuses		3	2	1	2	4	4	
Overall Total		40	47	55	47	46	40	
Weighted Total		16	31	47	31	30	09	0
Yes / No								

Selected Design Alternative : Design 03

Phase 5

5.1 3D Model

Part Model 1

Part Model 2

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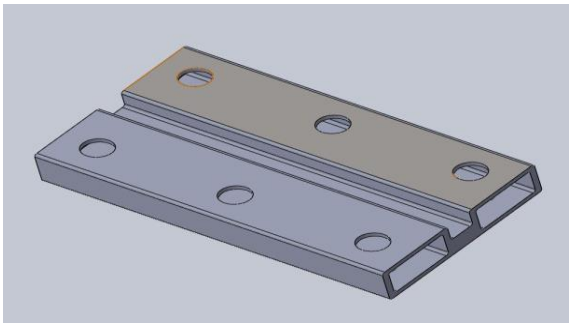

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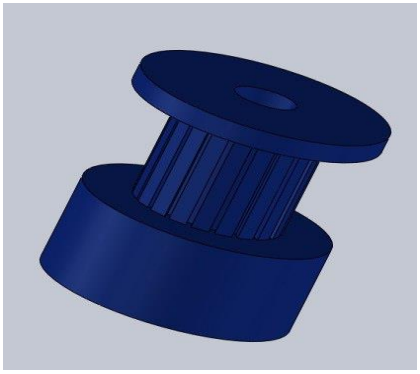
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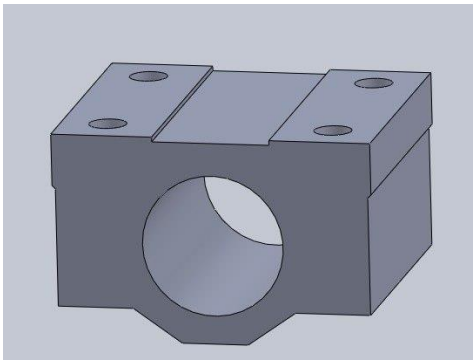
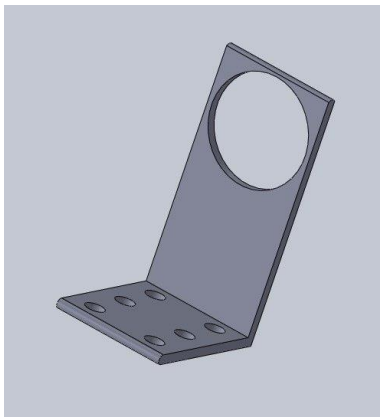
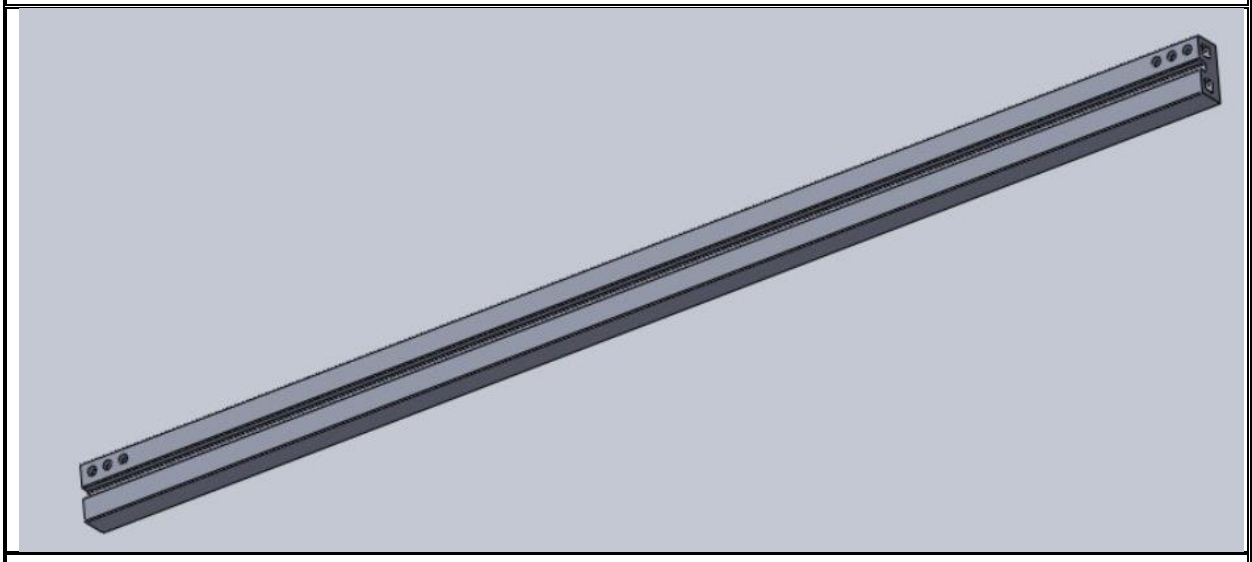
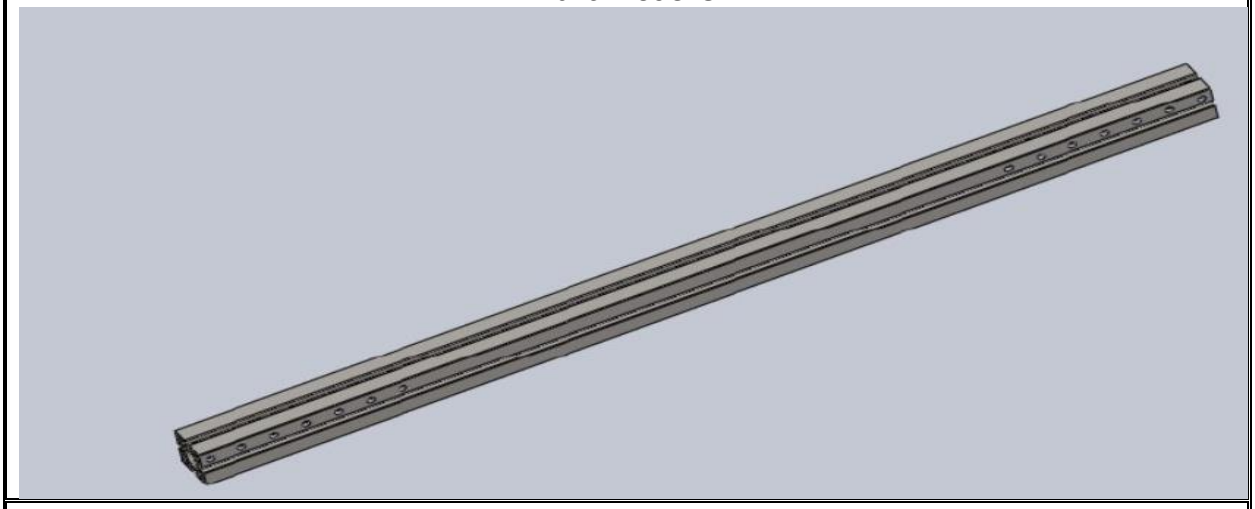

Part Model 6


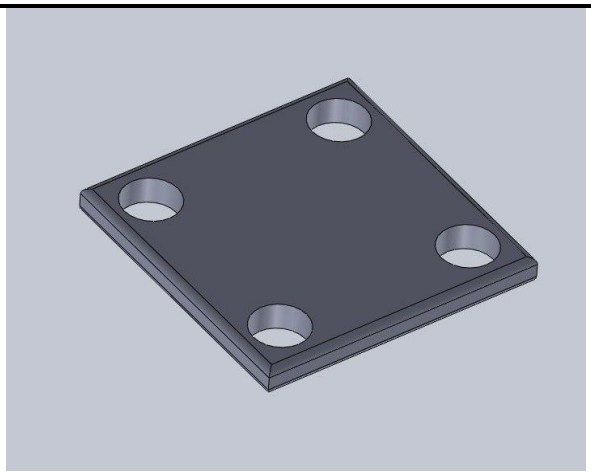
Part Model 7



Part Model 8



Part Model 9



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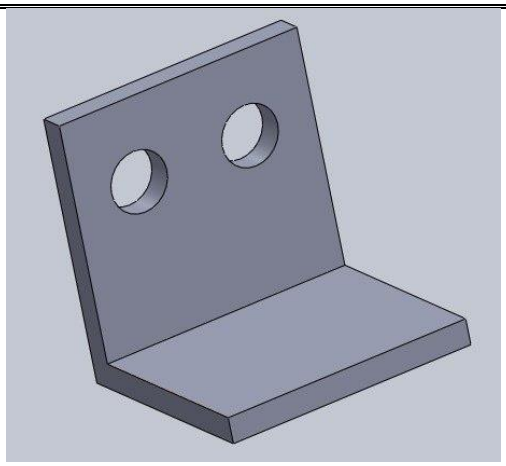
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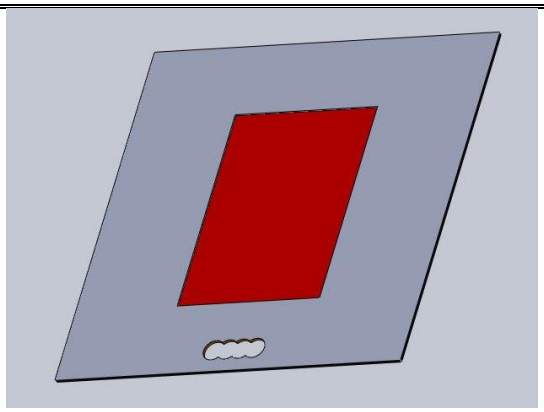
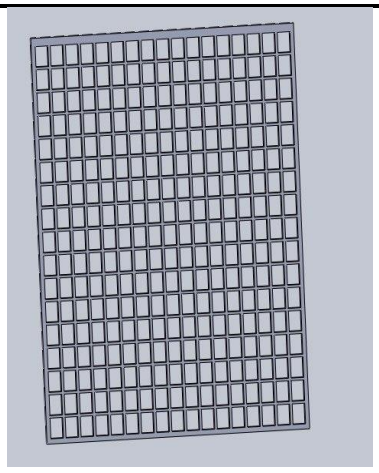
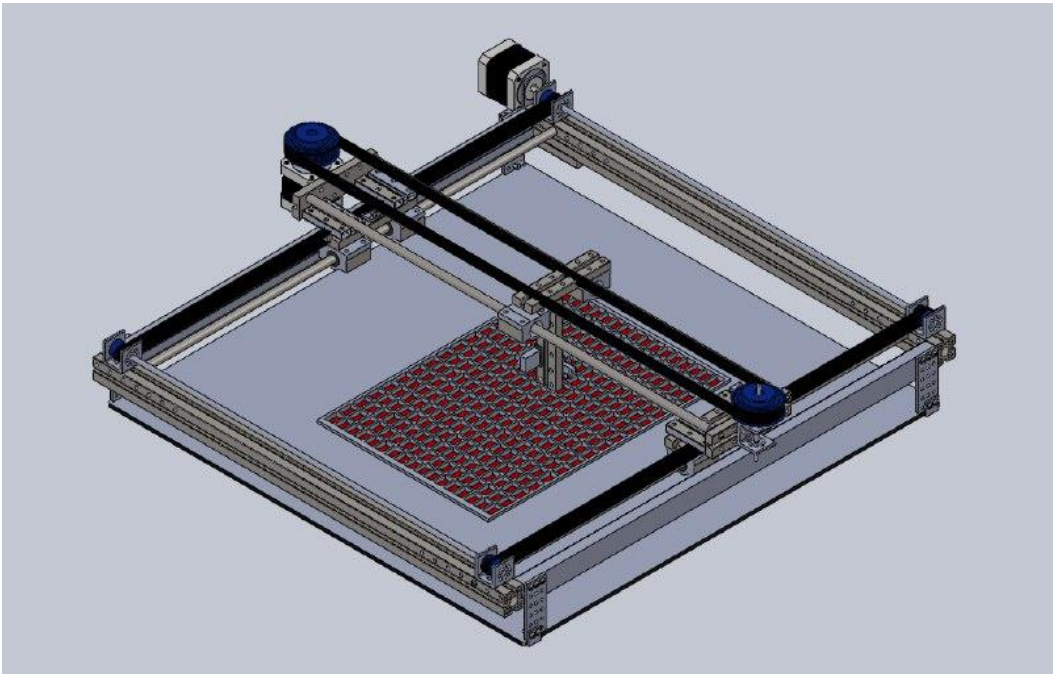
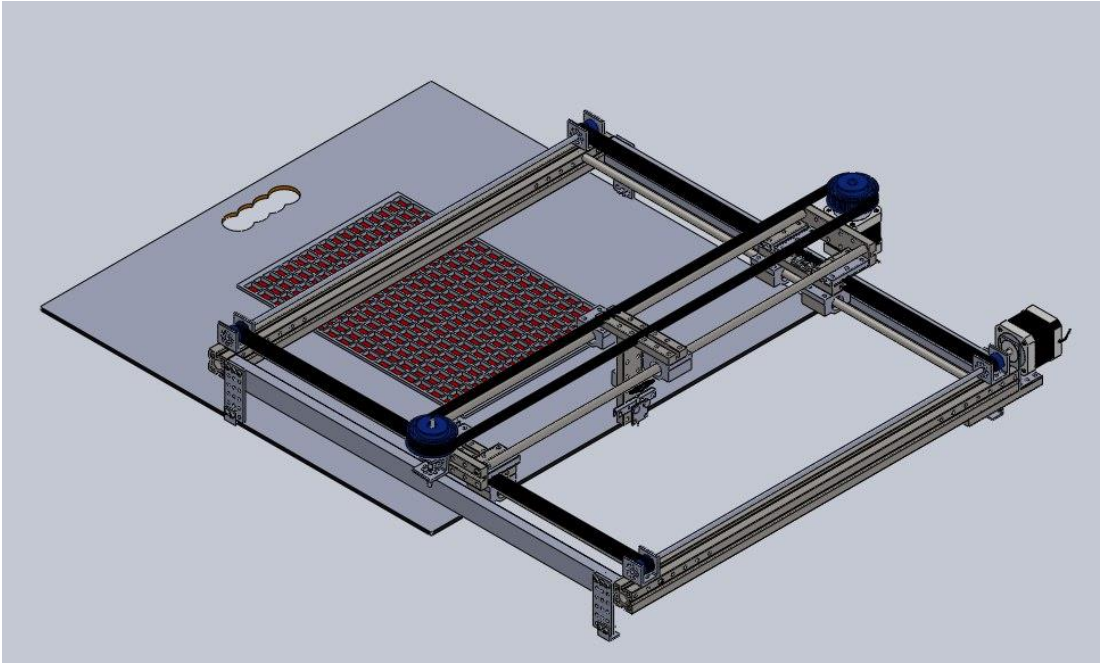
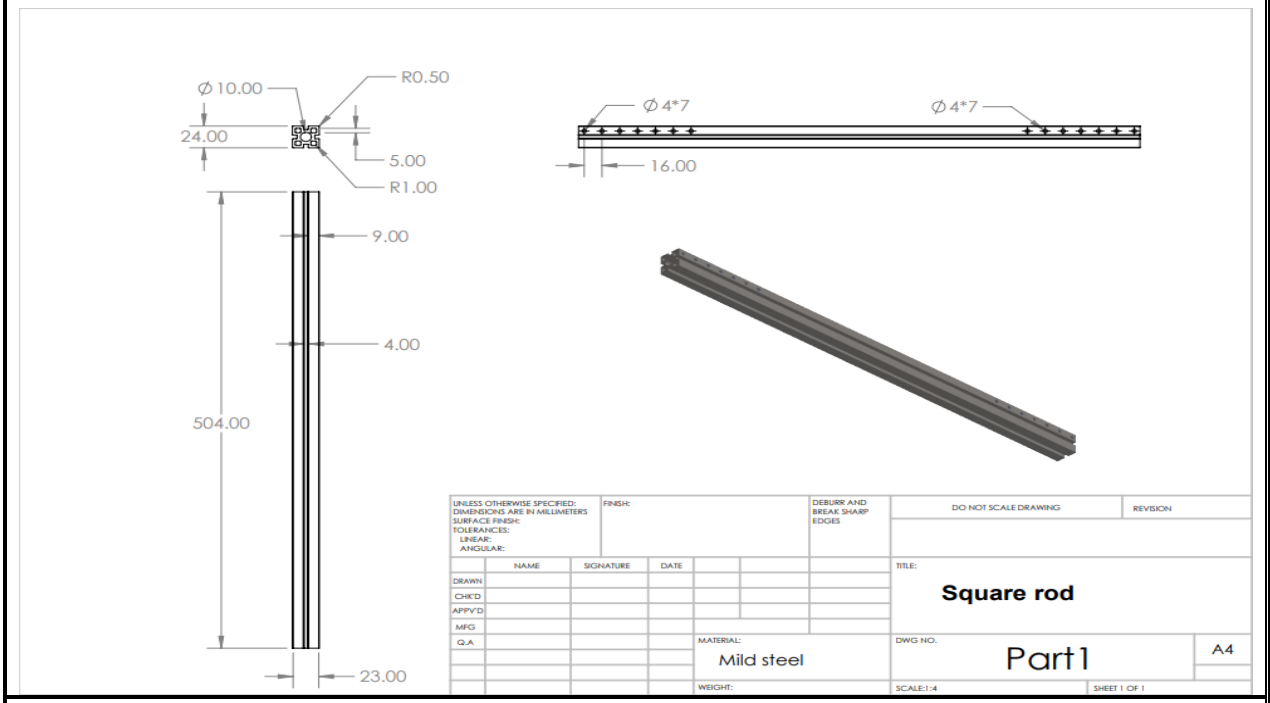

Part Model 12


5.2 Assembly models

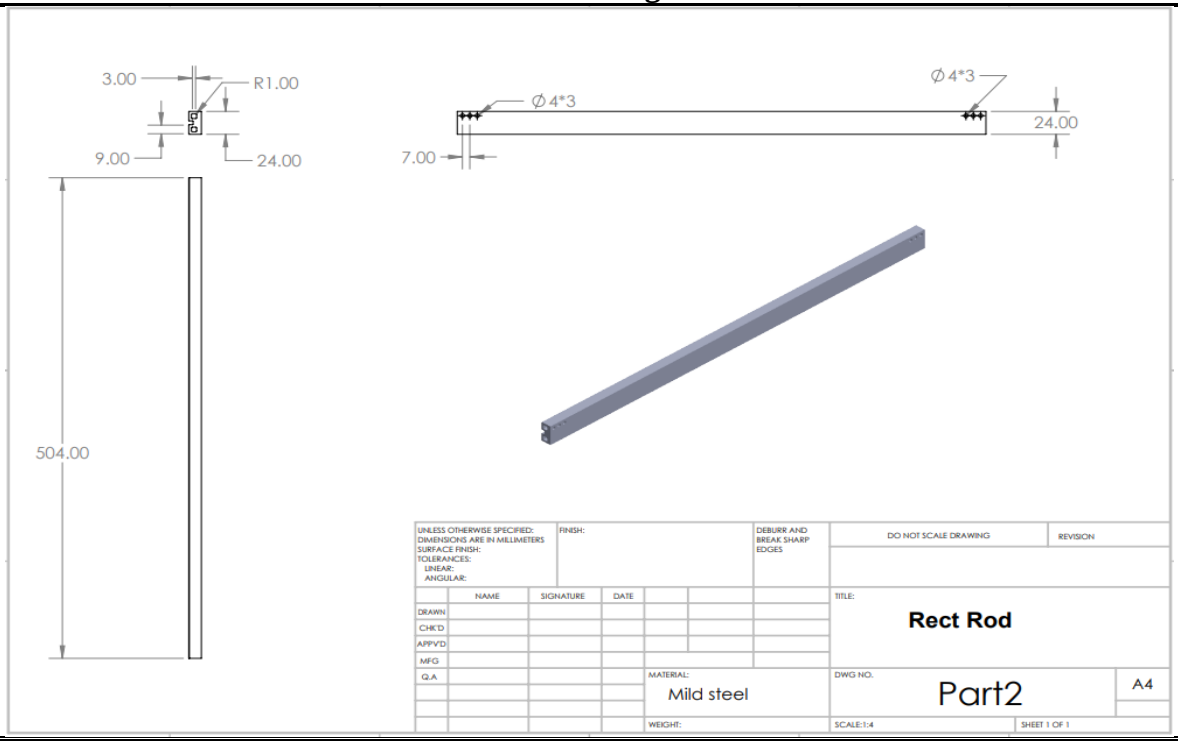
Assembly Model



5.3 2D Drawings

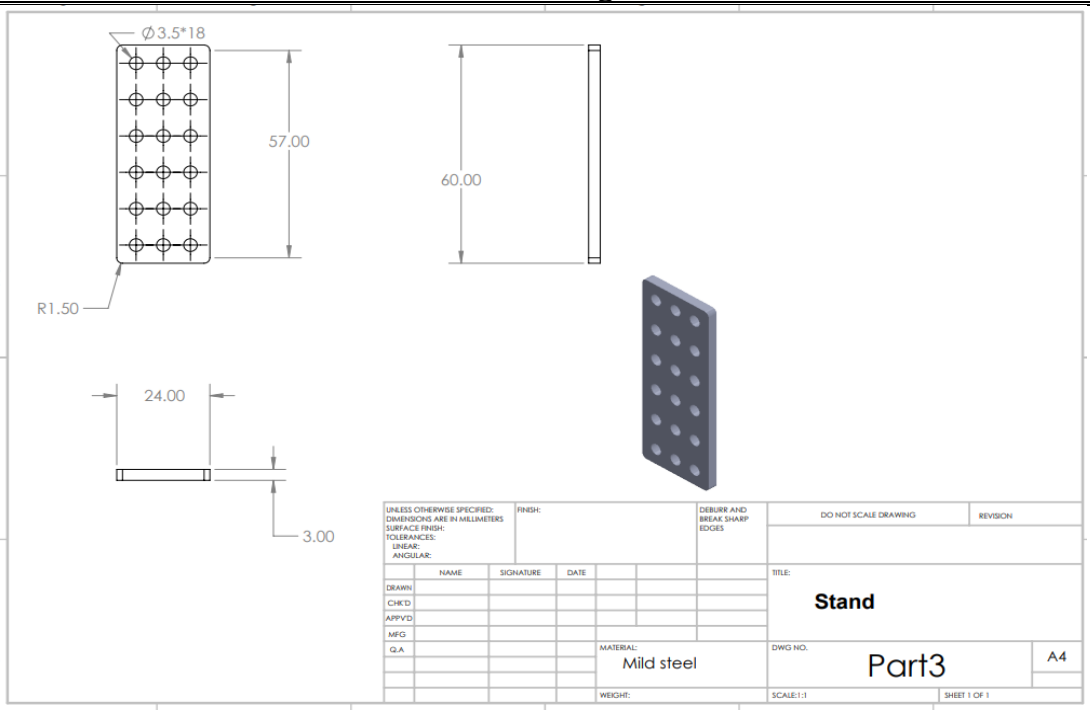
2D Drawing 1



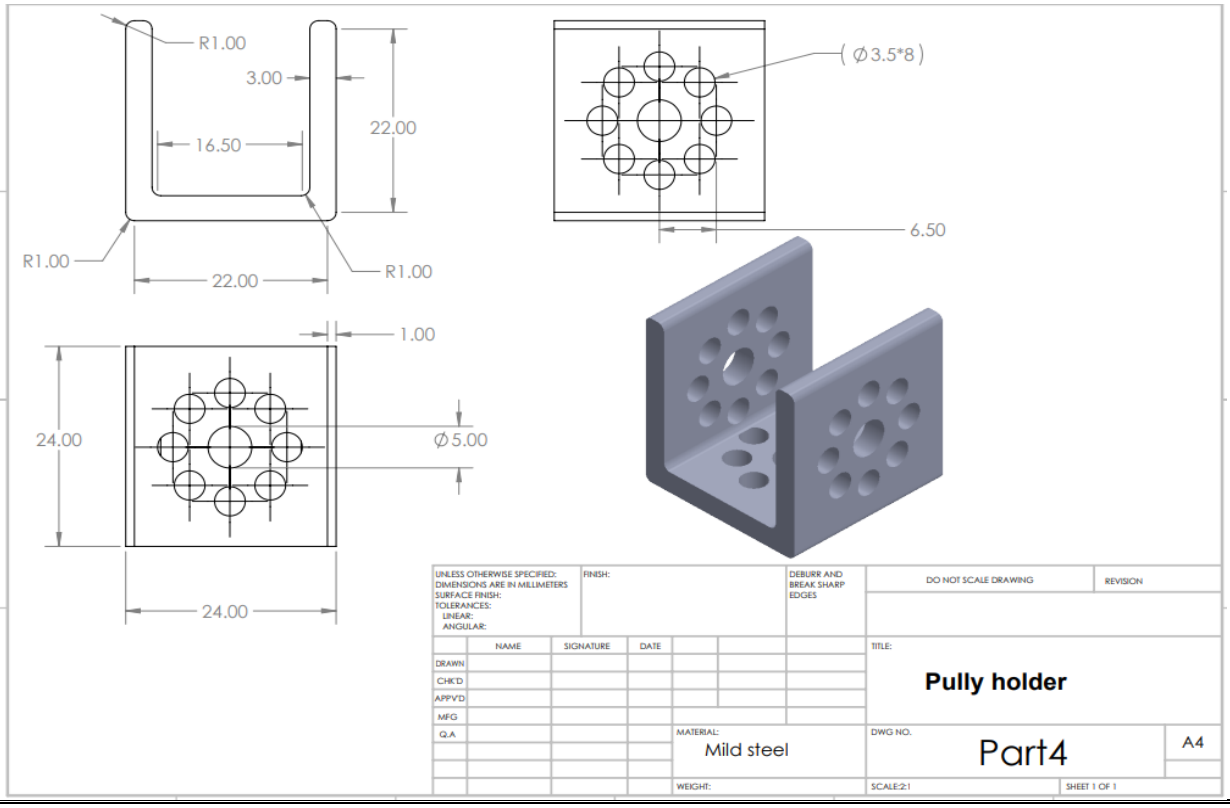
2D Drawing 2



2D Drawing 3



2D Drawing 4



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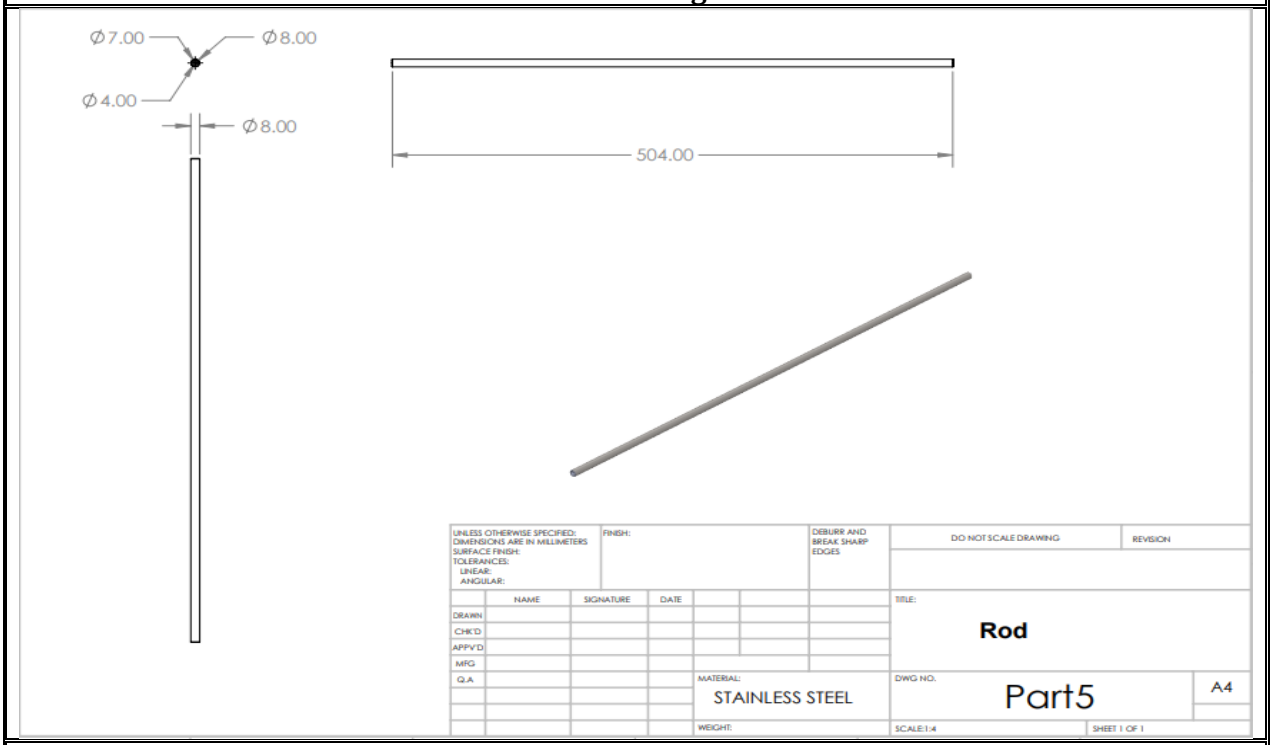
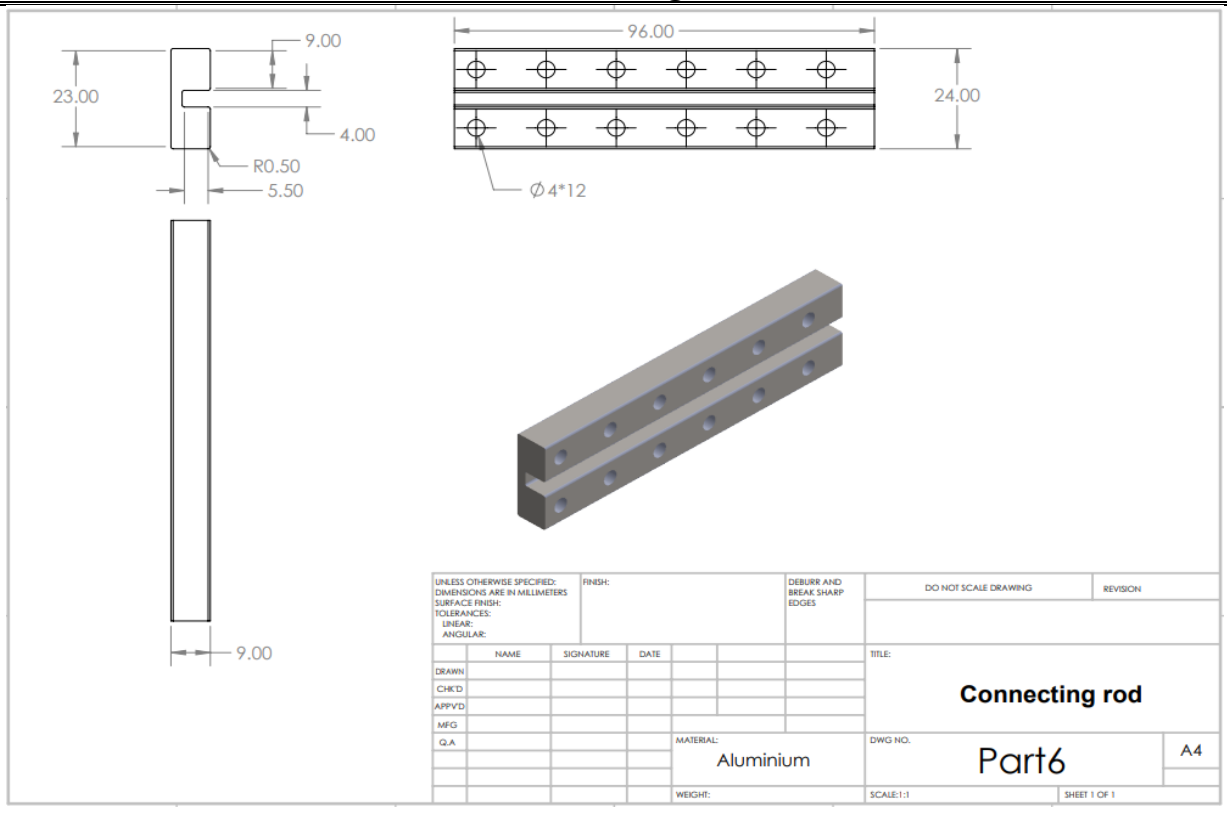
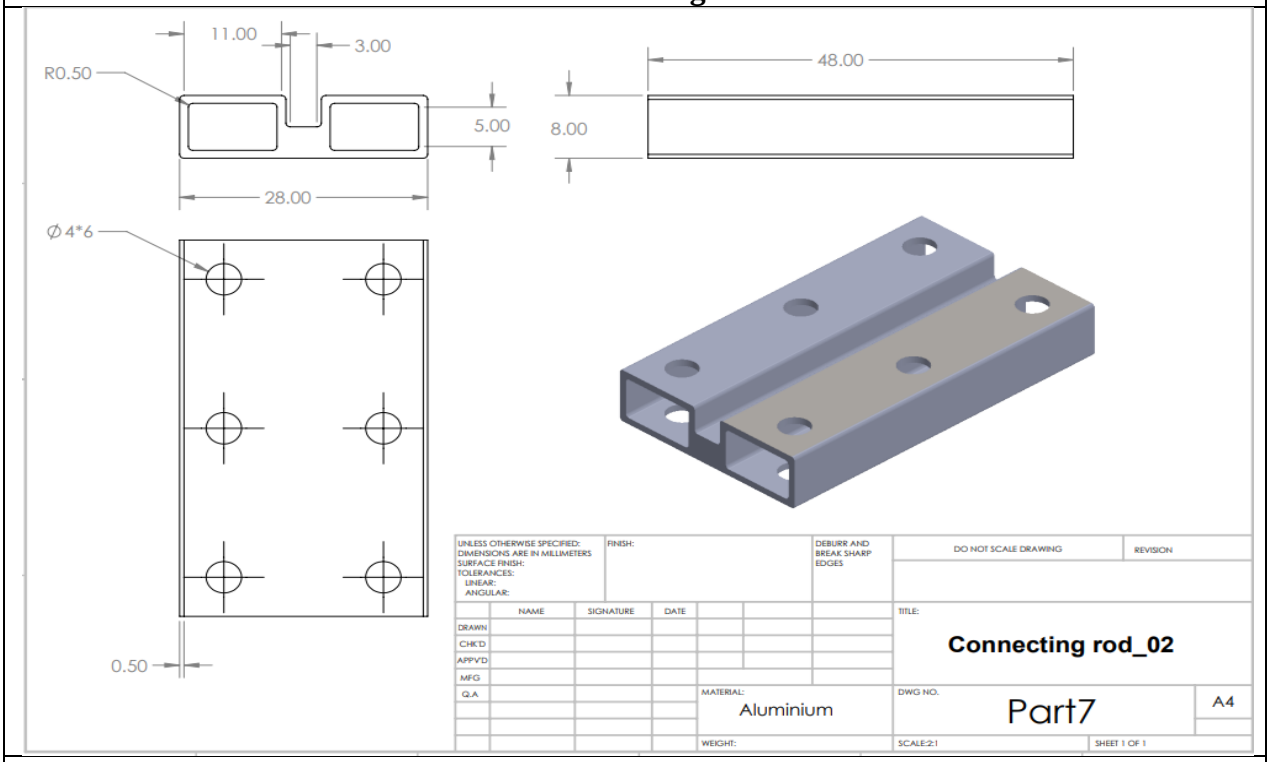


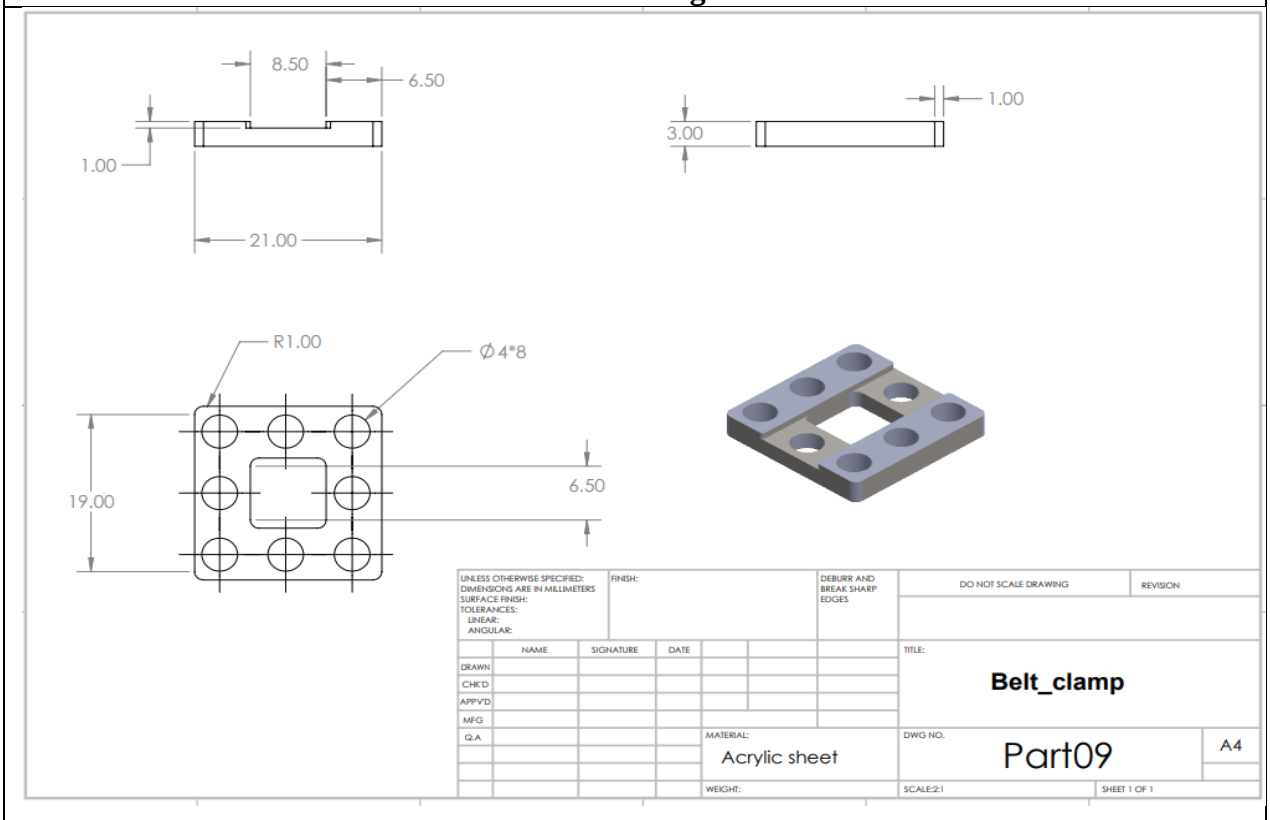
2D Drawing 6



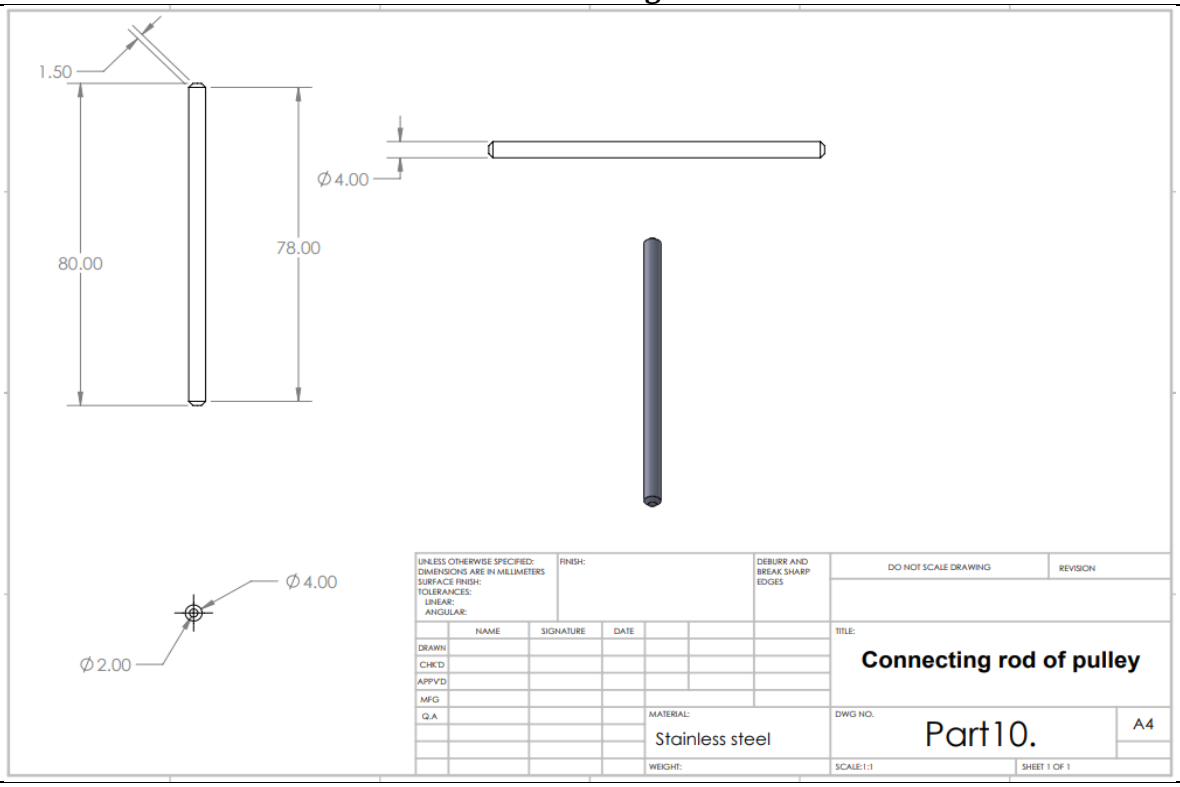
2D Drawing 7



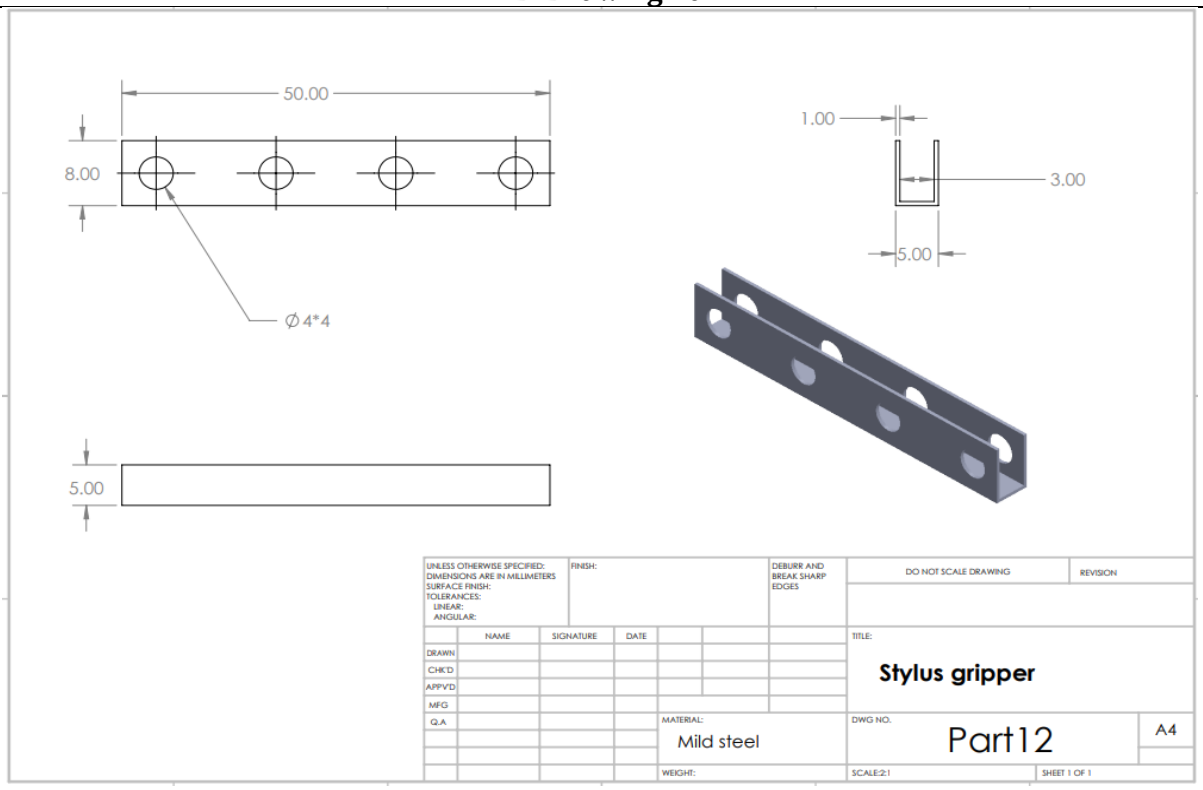
2D Drawing 8



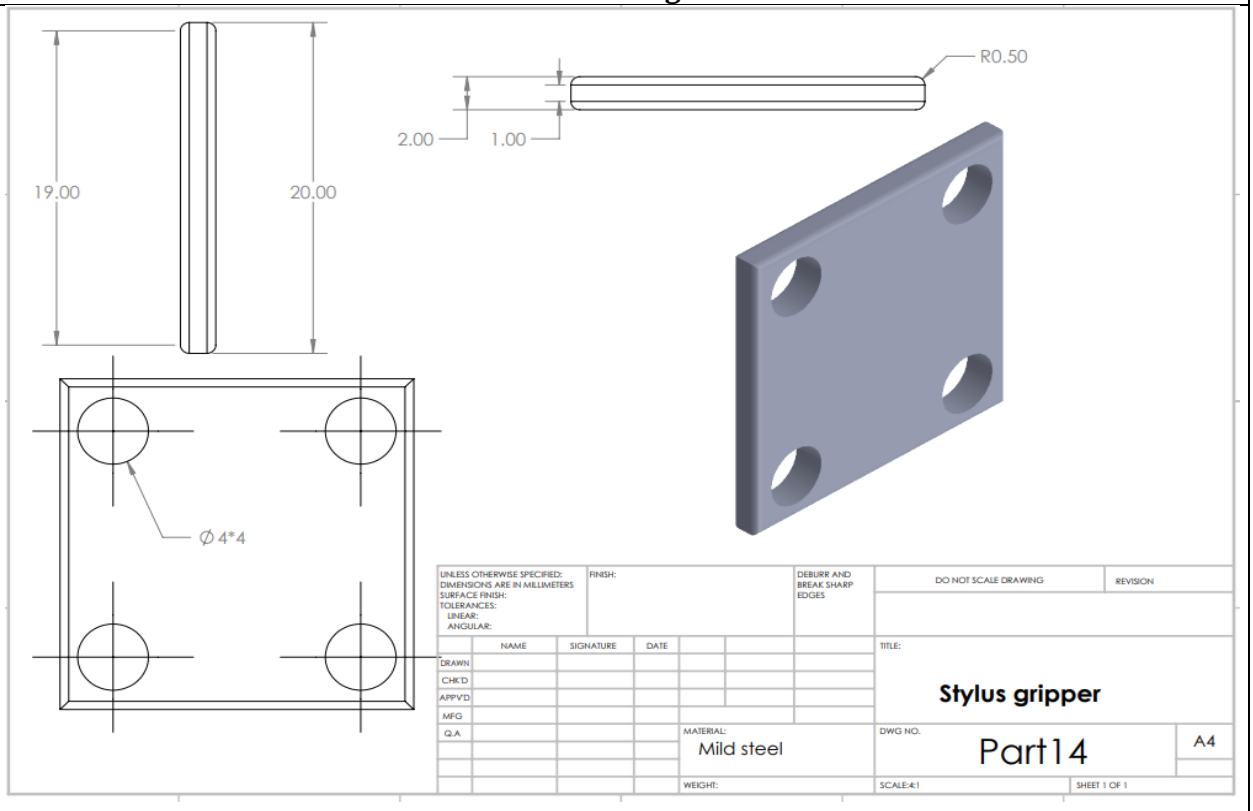
2D Drawing 9



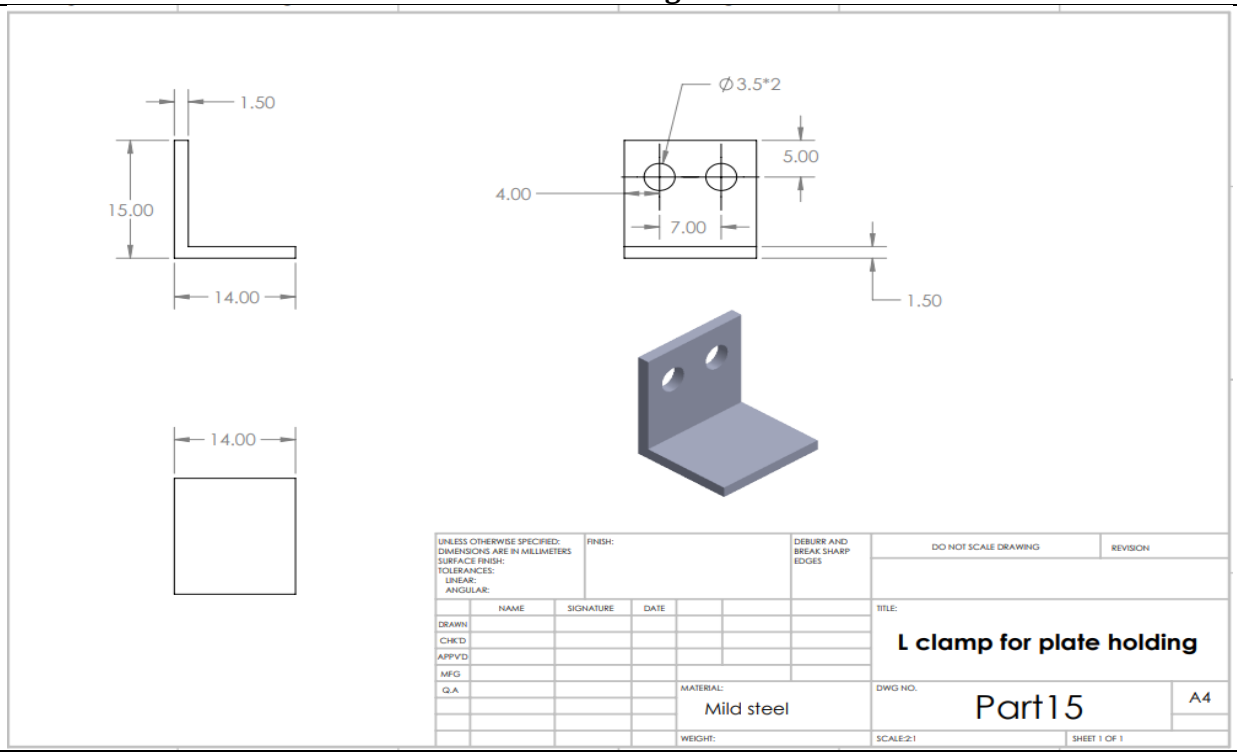
2D Drawing 10



2D Drawing 11



2D Drawing 12



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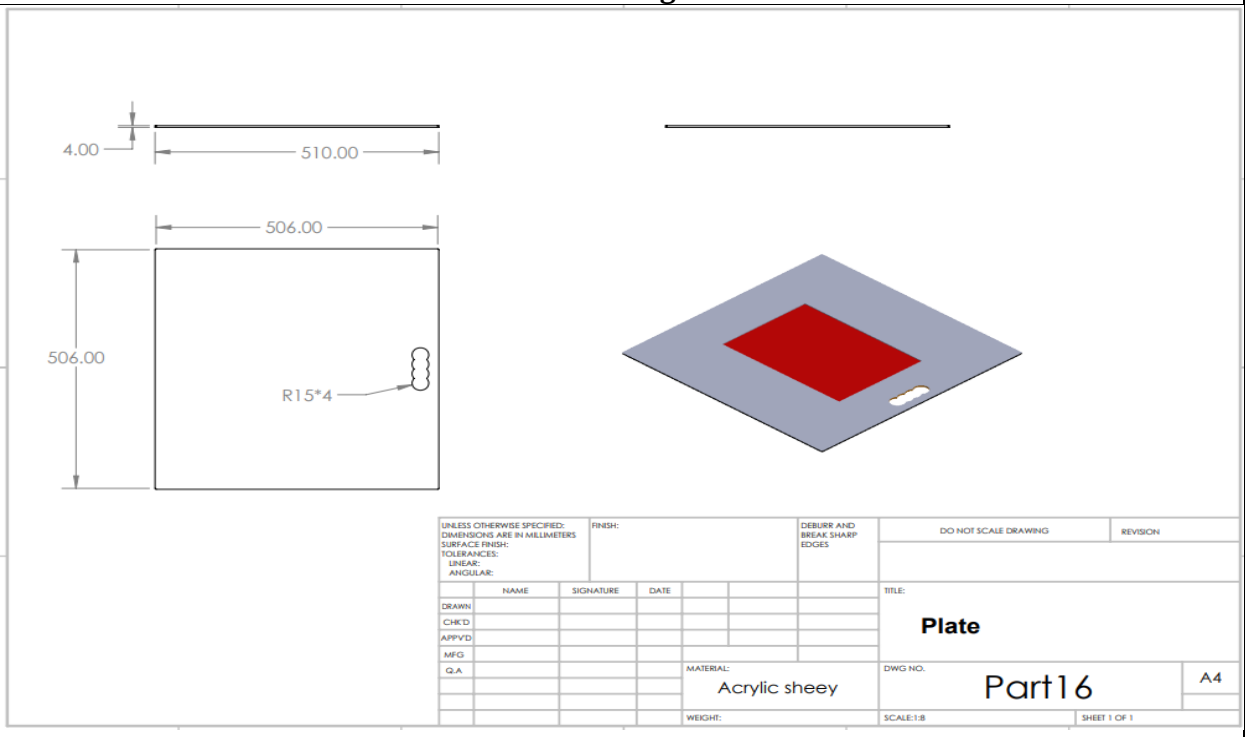
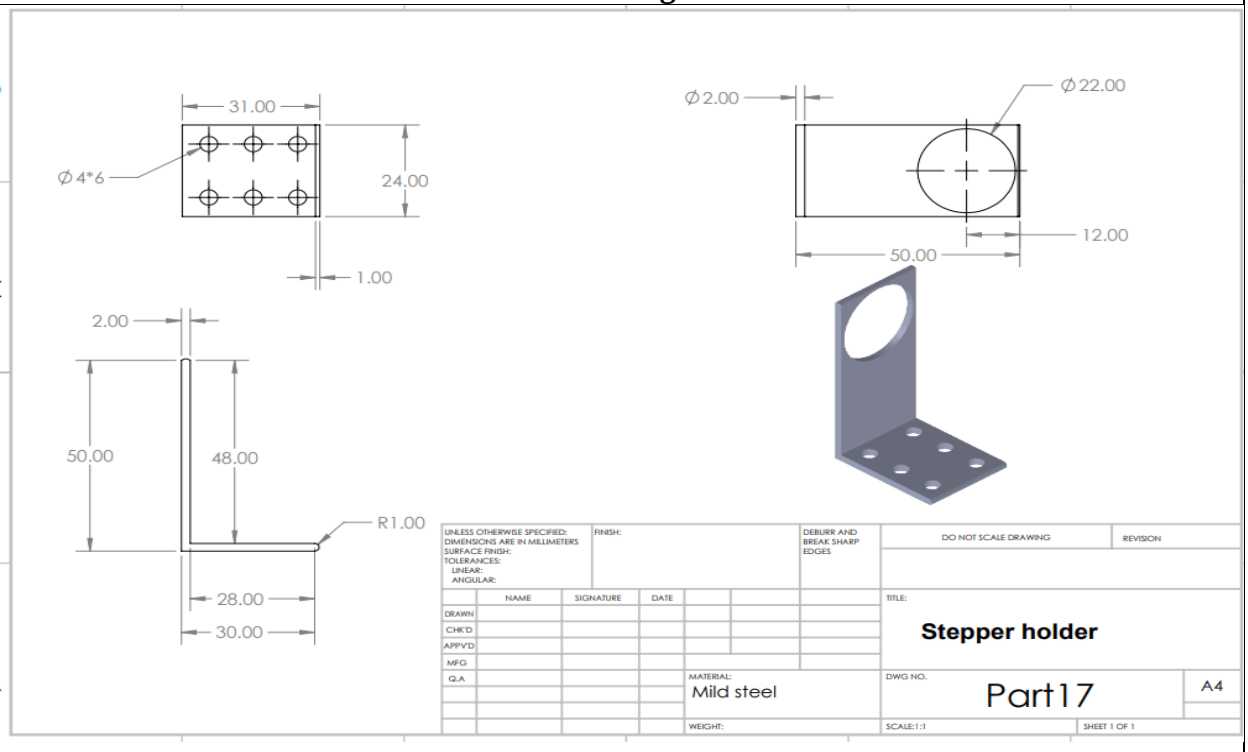


2D Drawing 14



5.4 Design Calculations

Design Calculations

You may scan and paste your design calculations here (clear image) or you may opt to type the calculations here as well.

1)STEPPER MOTOR:

- How many pulses to move 3''?

  Screw pitch=0.2inch
  i.e., 1 rotation=0.2inch
  =3inch*(1Rev/0.2inch) *(2000pulse/Rev)
  =30,000 Pulses. (To travel 3'' 30,000 Pulses required)
  CROSS CHECK: Can our controller handle that?
  =30,000pulses/1.5 sec
  =20,000pulses/sec. (For the motor driver productivity 2000 it can withstand 1,00,000pulses/sec)
  So, our motor driver is MICRO STEPDRIVER TB6600.
- Positioning accuracy.

  =(0.2inch/Rev) *(1Rev/2000Pulses)
  =0.0001inch/pulses. (Controller sending 2000Pulses per revolution)
- Max Motor speed.

  =3inch*(1Rev/0.2inch)
  =15Rev. (We need 15 revolutions to move 3 inches)
  We assume this can be achieved in 1.5sec.
  =15Rev/1.5sec
  =10RPS.
  TORQUE CALCULATION:
  To calculate the torque, we need to know the weight of the components which is hanging on stainless steel bar.
- Weight of braille pen or stylus=5gms.
- Weight of braille pen holder=100gms
- Weight of linear servo motor=1500gms

TOTAL=1605gms.

M=1.6Kg g=9.81m/s^2.

F=M*g=1.6*9.81=15.68N.

Diameter of SS bar=8mm.

Torque=F*R=15.68*4*10^ (-3) =0.067Nm.

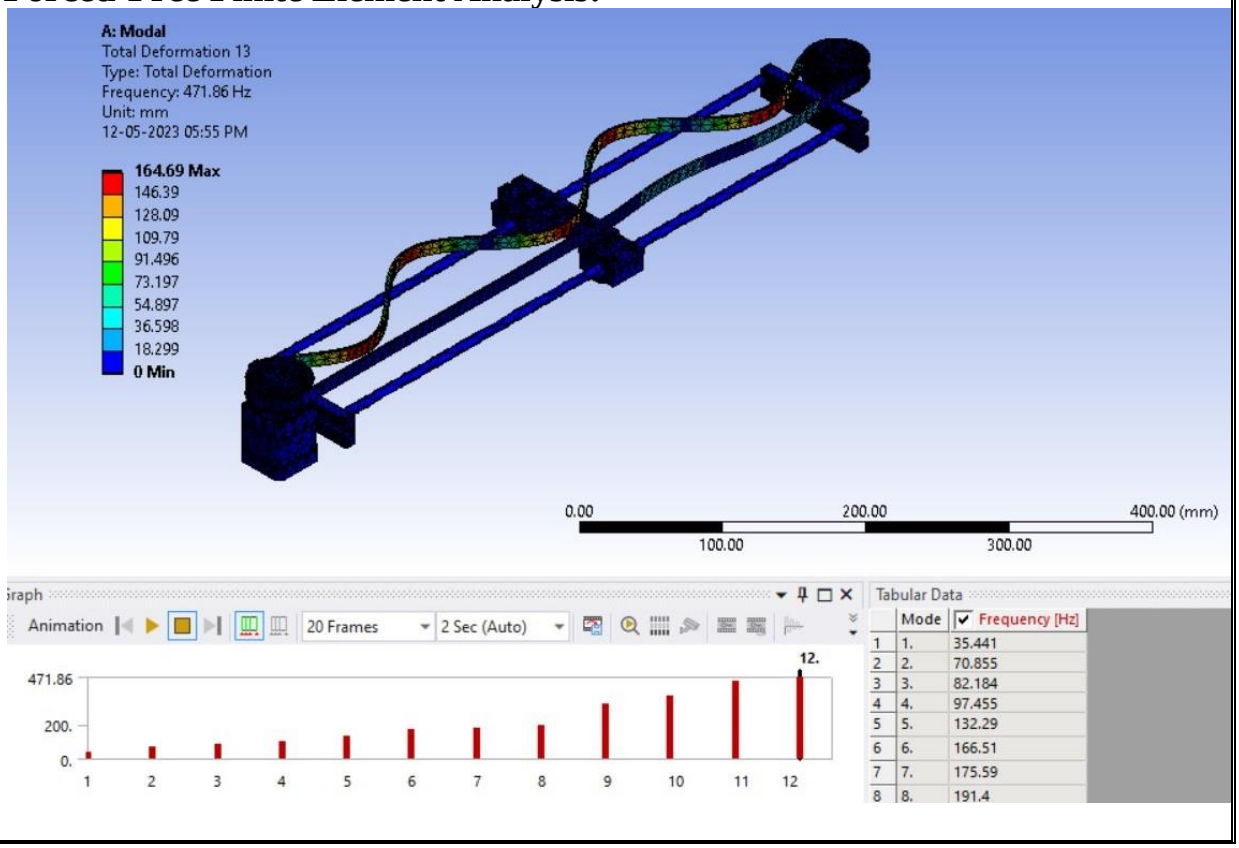
NEMA17 STEPPER MOTOR has Max of 0.4Nm torque. So, we conclude that our stepper motor is NEMA 17 STEPPER MOTOR.

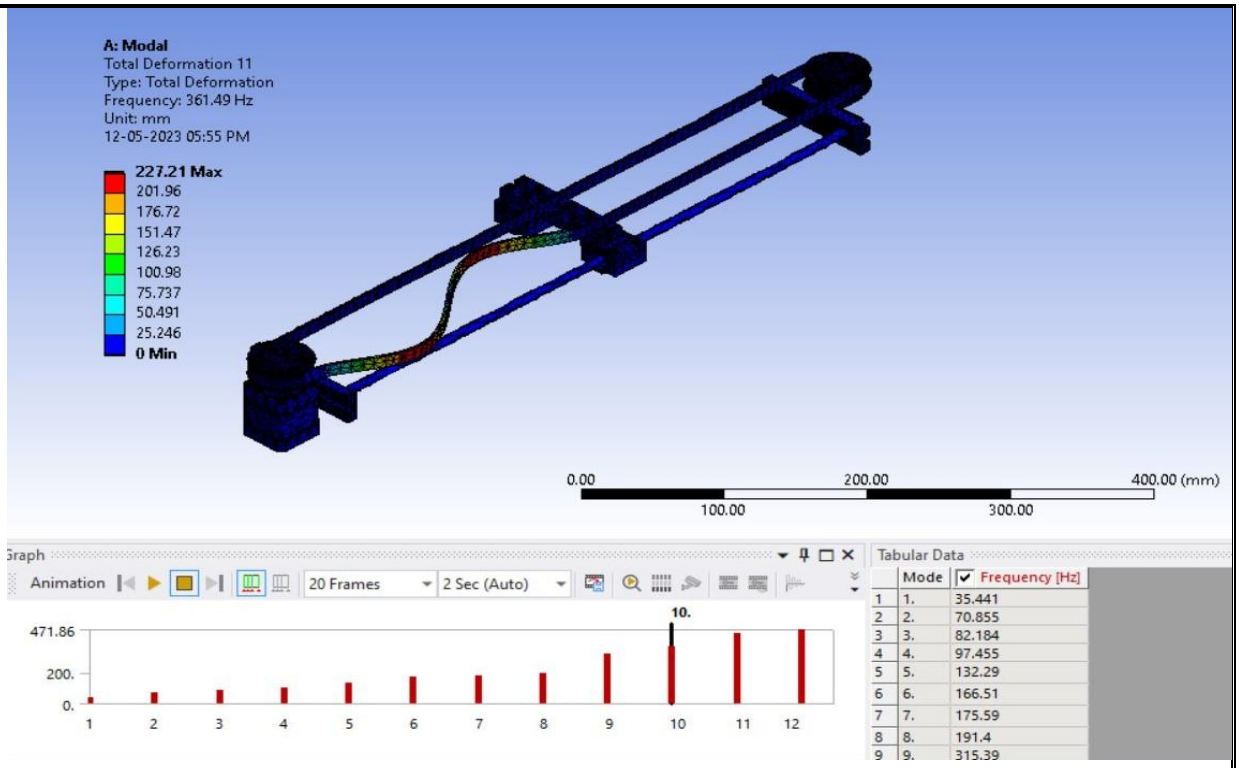
6 Analysis of critical parts and Prototype Planning.

6.1 FEM Analysis of Critical Parts:

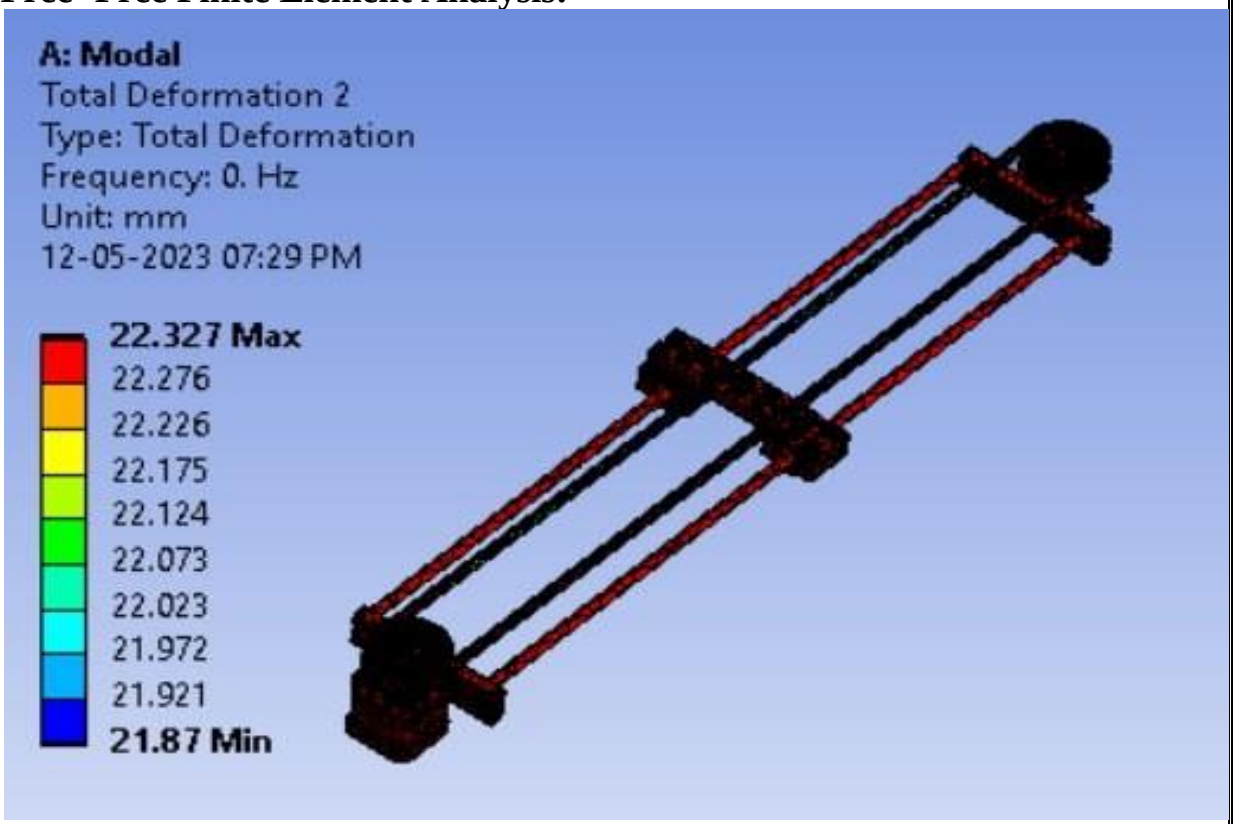
We have observed in this project Belt and pulley as the critical parts, All other parts are undergoing the simple static deflection, because Belt and pulley systems play a crucial role in transmitting power and motion between rotating shafts. When analyzing such systems, two important concepts are often considered: free-free and forced-free analysis.

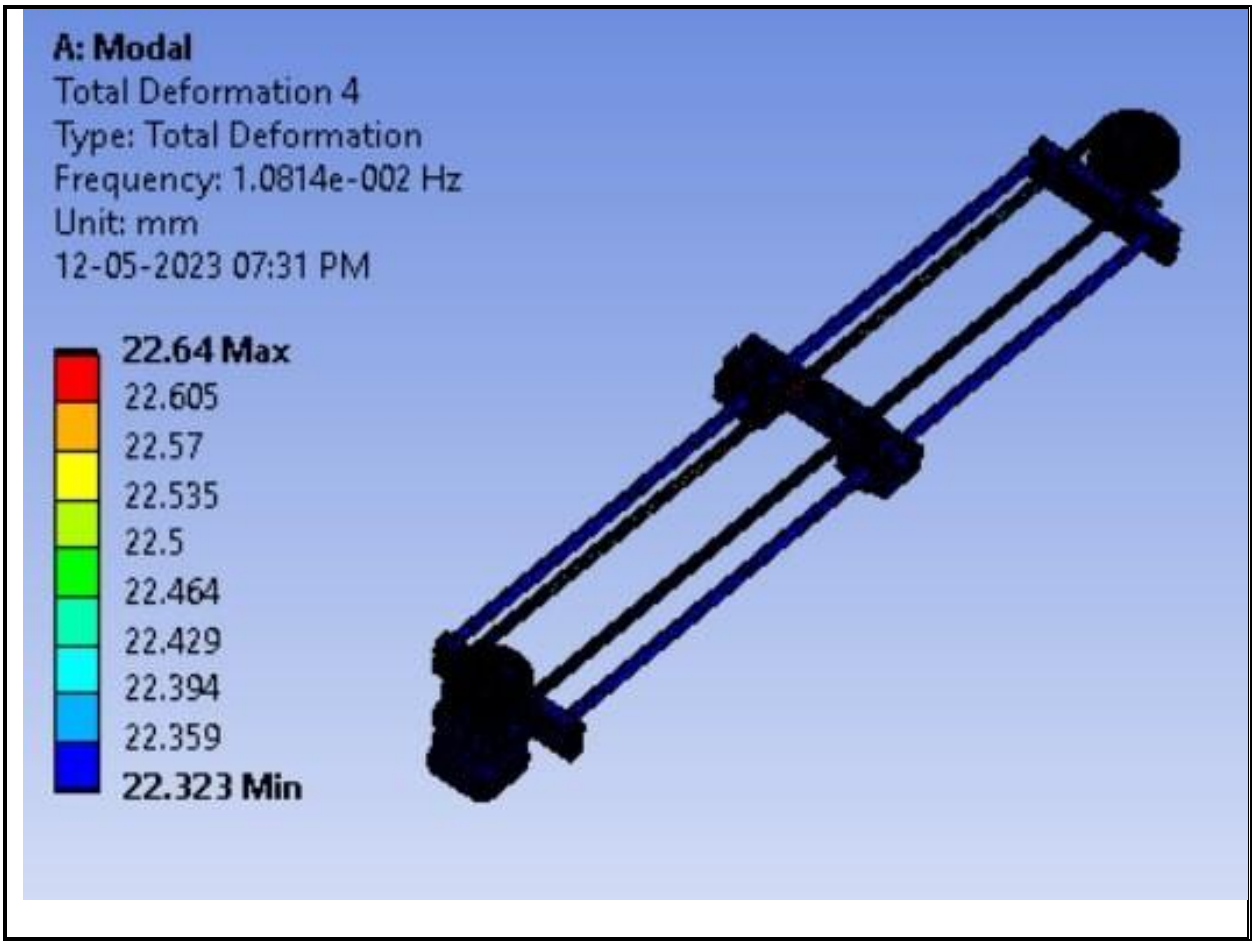
Forced-Free Finite Element Analysis:





Free- Free Finite Element Analysis:





Conclusions/ Results and redesign criteria:

Result obtained Frequency of the Free-Free and Forced-Free Finite Element Analysis.

Modal analysis of belt and pulley sub-assembly:

Modal analysis is a commonly used technique in structural engineering to evaluate the natural frequencies and mode shapes of a system subjected to external forces or impulses. The present study aimed to perform a constrained modal analysis on a belt and pulley sub-assembly of a Braille printer machine frame. A detailed 3D model of the machine frame was created using Solid Works software with precise dimensions and specifications. The model was then converted to a STEP file and imported into ANSYS software to assign appropriate material properties and mesh the model for accurate and reliable results. Modal analysis was carried out on the machine frame by constraining the stepper motor, and natural frequencies were calculated using ANSYS software. The results obtained provided essential information about the natural frequencies and mode shapes of the structure under consideration, which can be used

to optimize the design and improve the safety and reliability of the machine frame in actual operating conditions.

Free-Free analysis:

Mode No	Frequency	Mode shapes
7	175.5944014868	Misalignment of the belt at Y-axis.
8	191.3983720598	Misalignment of the belt at Y-axis.
9	315.3868831529	Complete wobbling of the belt.
10	361.4896121954	Half of the belt wobbling.
11	447.8177437347	Misalignment of the belt at Y-axis.
12	471.8621053250	Misalignment of the belt at Y-axis.

Forced-Free analysis:

Modes	Frequency	Mode shape
7	56.496	Misalignment of the belt at Y-axis.
8	98.221	Complete wobbling of the belt.
9	115.72	Complete wobbling of the belt.
10	115.84	Half of the belt wobbling.
11	187.87	Misalignment of the belt at Y-axis.
12	207.25	Misalignment of the belt at Y-axis.

6.2 Raw materials required for Prototyping:

List the possible materials and their properties that can be chosen for suitable parts of your prototype:

SI NO	Material	Properties /Reason for selecting the material	Part Name and Number
1.	Mild Steel	✓ Ductility ✓ Strength ✓ Weld ability ✓ Toughness ✓ Machinability ✓ Cost effective ✓ Versatility	Total Structure/Frame
2.	Stainless steel	✓ Corrosion Resistance ✓ High strength ✓ High Resistance ✓ Aesthetic Appeal ✓ Ductility and Formability ✓ Low Maintenance ✓ Environmental Sustainability ✓ Wide Range of Applications	Movement for bearing
3.	Neoprene	✓ High Tensile Strength ✓ Flexibility ✓ Oil and Chemical Resistance ✓ Heat Resistance ✓ Low Noise and Vibration	Power transmitting

4.	Aluminum	✓ Lightweight ✓ High Strength-to-Weight Ratio ✓ Corrosion Resistance ✓ Non-Magnetic ✓ Electrical Conductivity ✓ Electrical Conductivity	Movement of stylus, Bearings, pulley

6.3 Bill of Materials

Si No	Part Number	Part Name	Quantity	Material Specification
1	1	Stepper holder	2	ABS Plastic
2	2	Slider support	1	Acrylic sheet
3	3	Electronics box	1	Acrylic sheet
4	4	Rod clamp	2	Sheet metal(MS)
5	5	Nut & Bolts	30	M6 MS
6	6	Stand	4	MS Hollow square rod

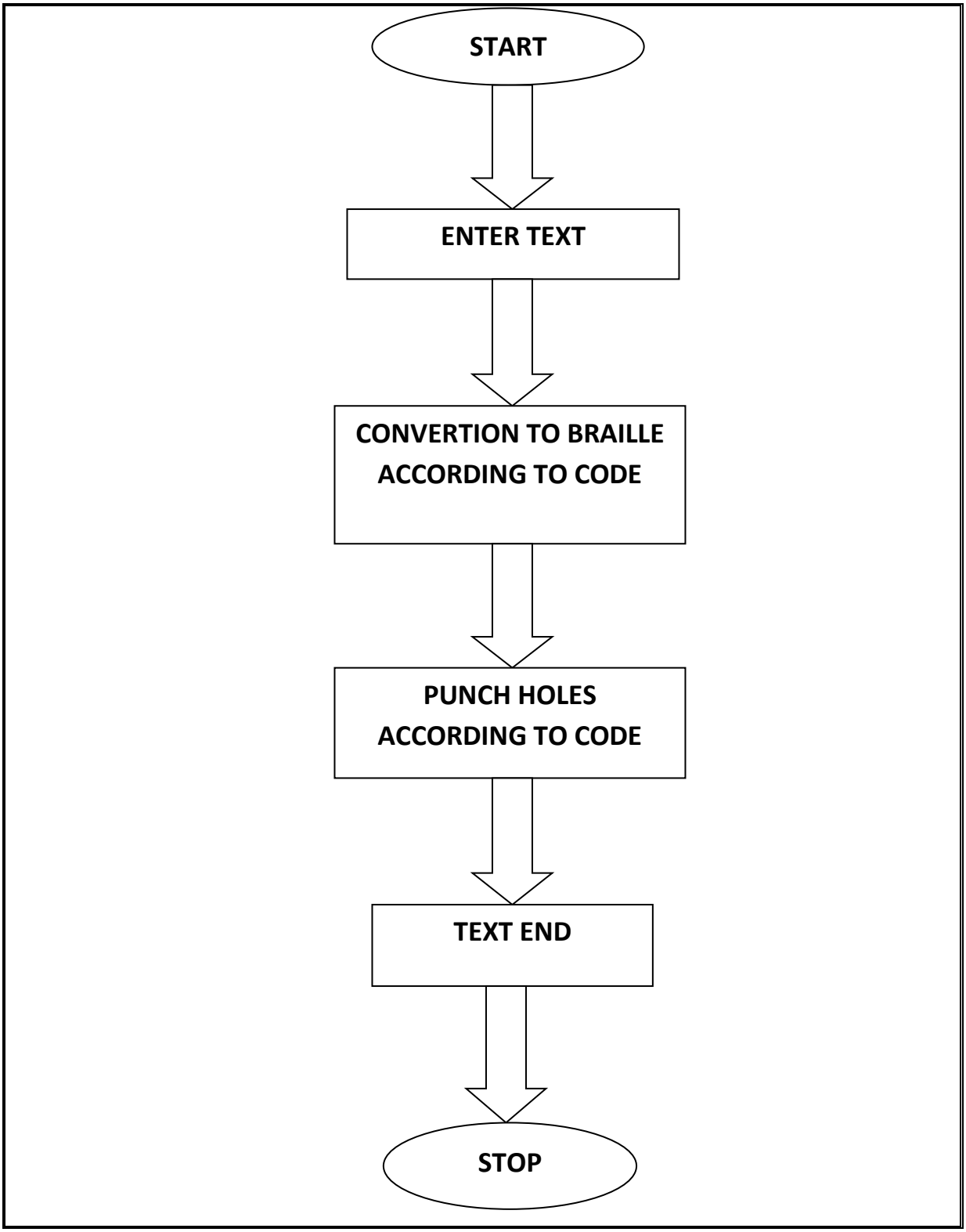
6.4Joining techniques/ methods:

:

SI NO	Joining Method	Material to be joined	Resources required and specification
1	Welding	✓ Frame of mild steel ✓ SS bar to Frame	✓ Welding Equipment ✓ Welding Consumables ✓ Welding Safety Gear ✓ Welding Tools ✓ Welding Procedures ✓ Material Specifications ✓ Welder Qualifications
2	Nut and Bolts	✓ Stepper motor holder ✓ ABS (Acrylonitrile Butadiene Styrene) to Frame ✓ Linear bearing to Bar. ✓ Pully holder to Frame	

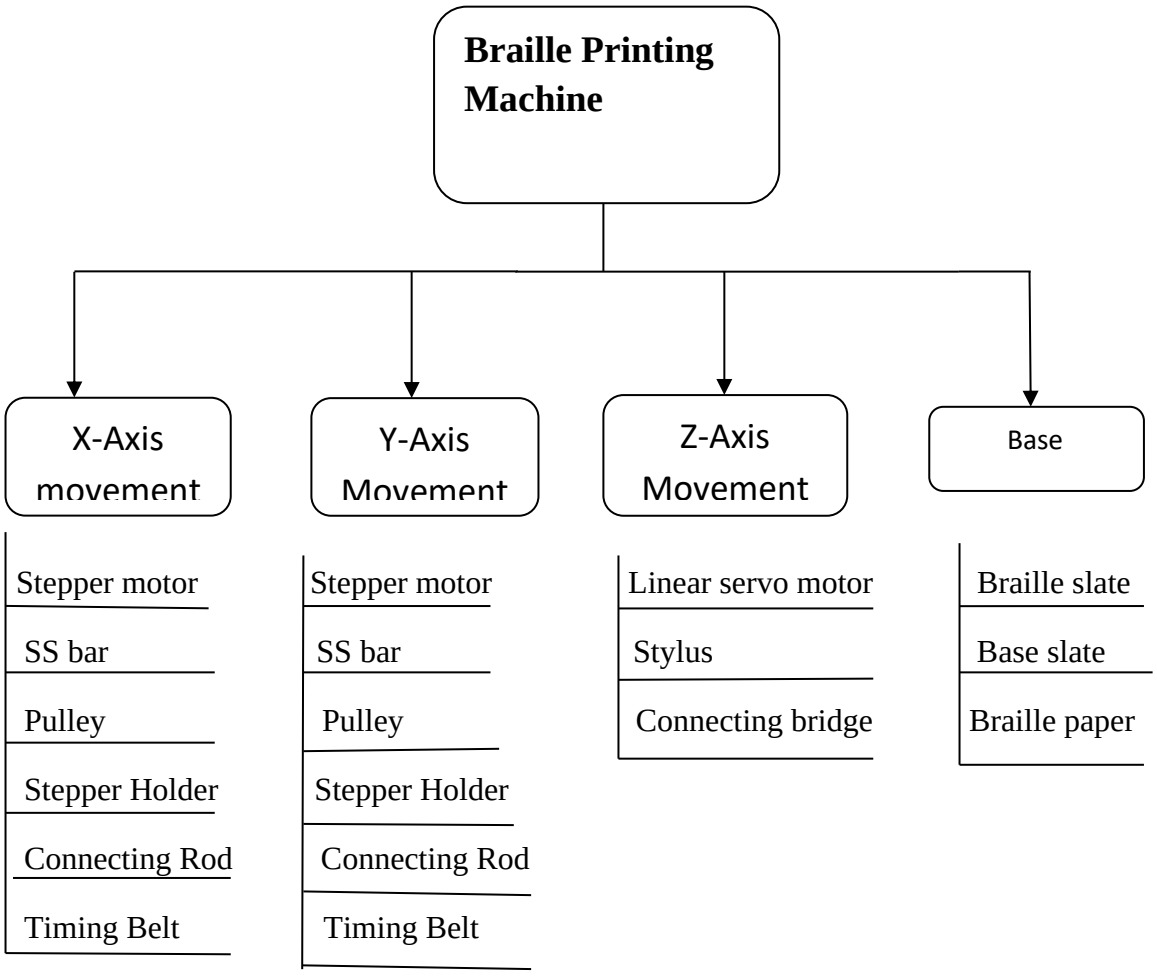
3	Adhesive (Fevikwik)	✓ Arduino Set up box ✓ Acrylic Sheet joining ✓ Belt joining	

6.5 Flow Chart:



6.6 Sub-Assembly Planning:

Plan to fabricate the Prototype in sub-assemblies:



Individual SA Part Names

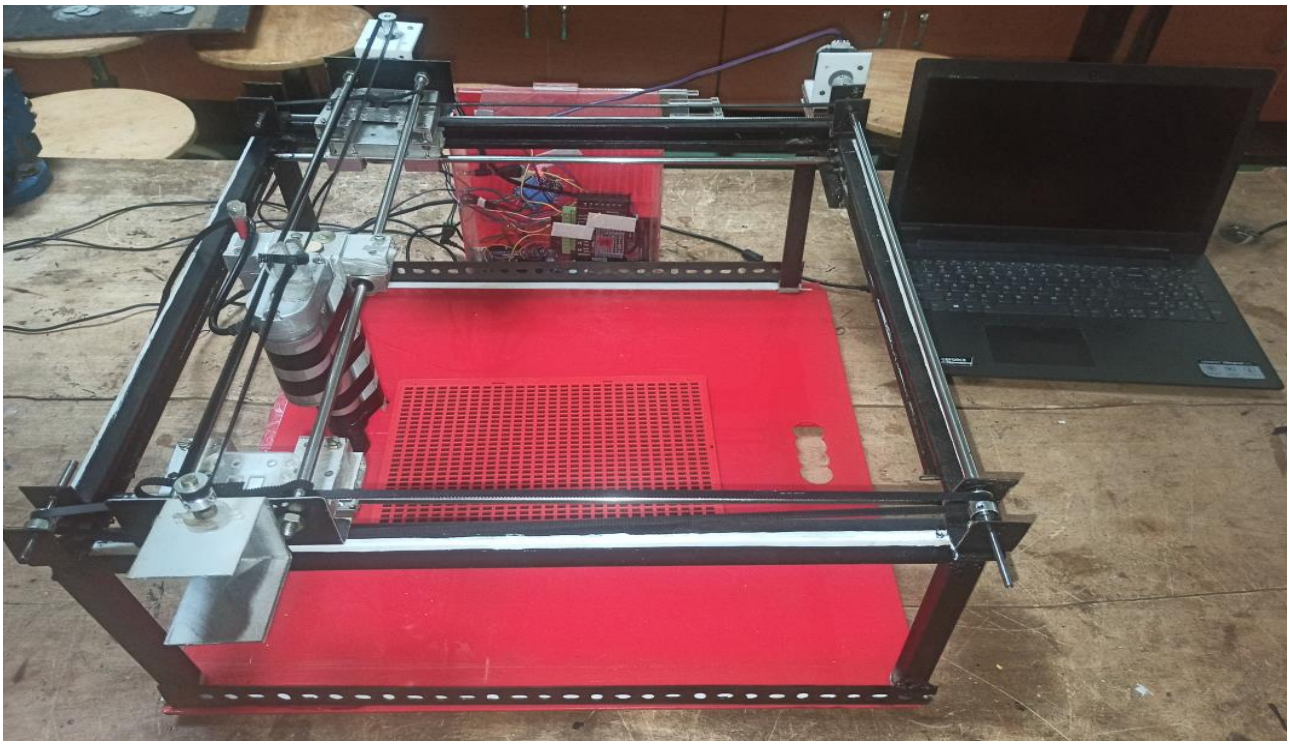
Sub Assembly	Brought out Parts	Manufactured Parts
X-Axis Movement	Pulley	Connecting Rod
	Timing Belt	Stepper motor Holder
	Stepper motor	Bush
	SS bar	Turning of SS bar
	Linear bearing	Pulley Holder
	Nut and Bolt	
Y Axis Movement	Pulley	Pulley Holder
	Timing Belt	Timing belt gripper
	Stepper motor	Stepper motor holder
	SS bar	Linear servo holder
	Linear Bearing	
Z-Axis Holder	Linear servo motor	Linear servo motor Holder
	Braille stylus	Stylus holder
	Nut and Bolt	
Base	Braille slate	Stands
	Braille base	Arduino box

7. Final Impressions

7.1 Final Cost Estimation

Product Expenses			
SI	**Part Name**	**Qty.**	**Total Cost**
1	Stepper Motor	2	1090 Rs
2	Stainless steel bar	1	350 Rs
3	Linear Bearings	6	1050 Rs
4	Stepper Motor Driver	2	1100 Rs
5	Timing Pulley	6	480 Rs
6	Timing belt	3	225 Rs
7	Arduino mega 2560	1	1080 Rs
8	Linear servo motor	1	3550 Rs
9	Nut and bolt		
10	Braille slate and Stylus	1	400 Rs
11	Paint		
12			
13			
14			
		Total Parts Expenses Rs.	9325

7.2 Final Prototype Pictures



7.3 Conclusions:

A Braille printing machine utilizing an XY plotter is an efficient and accurate solution for producing Braille text. The plotter's precise control over movement allows for the faithful translation of text into Braille patterns. This method offers advantages such as consistent output, automation for time savings, flexibility in printing different sizes and styles of Braille, and seamless integration with digital content. Overall, it enhances accessibility and improves the production process for Braille materials.

7.4 Product Catalogue

Introduction:

A Braille printer is a specialized device designed to convert digital or electronic text into tactile Braille characters, allowing individuals with visual impairments to read and access printed materials. It plays a crucial role in promoting accessibility and inclusivity for people who are blind or have low vision. These printers can produce Braille materials with high precision, ensuring that the tactile dots are accurately placed, making them easily readable by touch. Some advanced Braille printers also support multiple languages, fonts, and formatting options to accommodate different needs.

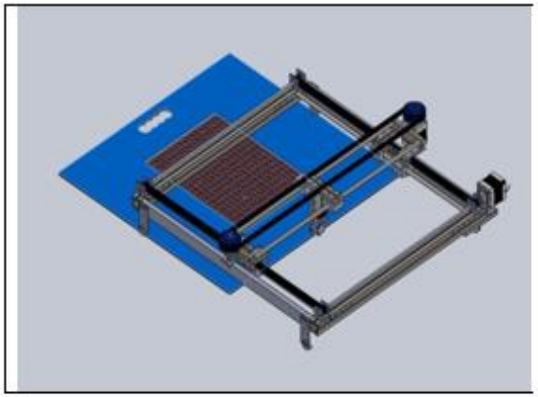
Background/Introduction

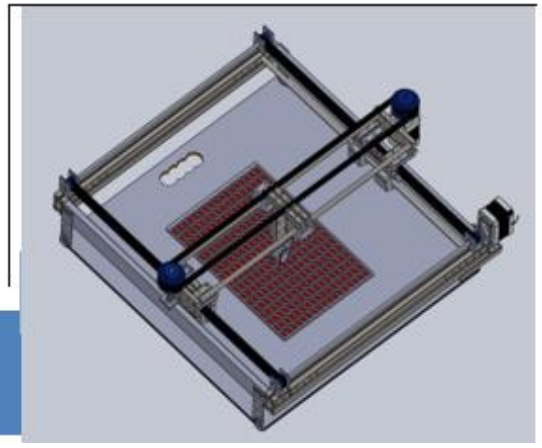
Braille itself is a writing system composed of raised dots that represent letters, numbers, punctuation marks, and even musical notations. It enables individuals with visual impairments to read through touch. However, producing Braille materials manually can be a time-consuming and labor-intensive process.

Features:

- Braille Printing:
- Compatibility
- Print Quality:
- Paper Handling:
- Compact and Portable Design:
- Accessibility Features:
- Maintenance and Connectivity:

3D Model:





PRODUCT SPECIFICATIONS:

1.Embossing Method: dots on paper
2.Printing speed: 12v, 2ampere dc supply
3.paper size and handling: A4 size paper
4.Connectivity: USB, computer.
5.Supported languages: English
6.Power requirements: 24W
7.physical dimensions and weight :(550*550*25) mm
8.Software compatibility: Arduino ide