A Minor Project Report on

"LISALA VENDOR"

Bachelor of Engineering in

Mechanical Engineering

Submitted by

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Under the Guidance of

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School of Mechanical Engineering

CERTIFICATE

This is to certify that Capstone Project entitled **"LISALA VENDOR"** submitted by **Team C11 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. Nagaraj Ekbote , Dr. B. B. Kottursheta

Prof. Balachandra Halemani

Guide **Head of department**

Name of the Examiners **Signature with date**

1. **Prof Nagaraj Ekbote**
2. **Prof Madhusudan**
3. **Prof Balchandra Halemani**

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.

At the outset, we would like to express our deep sense of gratitude for our guide **Prof. NAGARAJ EKBOTE AND BALCHANDRA HALEMANI** for making this project report successful through their invaluable guidance at every stage of the project report.

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 co-ordinators **Prof Nagaraj Ekbote , Prof Sridhar M**, **and Prof. Balchandra Halemani** School of Mechanical Engineering, KLE Tech,, Hubli

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

Student signature

(Team C11)

MINOR PROJECT TEMPLATES

Phase wise expectations and tasks:

Design Phase:

1. Refined problem statement		
1.1	Identifying end users (Customers)	✓
1.2	Identify customer needs	✓
1.3	Analyzing the needs	✓
1.4	Requirements List	✓
2. Product benchmarking		✓
2.1	Studying and exploring competitive products	✓
2.2	Patent search	✓
2.3	Literature survey	✓
3. Design Specifications		✓
3.1	Objectives	✓
3.2	Constraints	✓
3.3	Objective tree (affinity diagram)	✓
3.4	Design Specifications	✓
4. Concept generation		✓
4.1	Defining Functions	✓
4.2	Morphological chart	✓
4.3	Generating design alternatives	✓
4.4	Selecting best alternatives (Pugh chart)	✓
5. Design		✓
5.1	3D Model	✓
5.2	Assembly models	✓
5.3	2D drawing	✓
5.4	Design Calculations	✓
6 Prototype Planning		✓
6.1	Raw materials	✓
6.2	Bill of Materials	✓
6.3	Joining techniques/ methods	✓
6.4	Flow Chart	✓
6.5	Sub-Assembly Planning	

Phase 1

1 **Refined problem statement: Ultraviolet Plate Dispenser for Hostels, buffets, Restaurants Canteens and Catering services.**

Customer: Giridhar Bhatakal Interviewer(s): Raghunandan and Prasanna Date:30-03-2021

Question/Prompt	Customer Statement	Interpreted Need/ Expectations
Typical uses	UV rays are harmful if exposed	UV rays should not be exposed to the atmosphere
	UV lamps or bulb are expensive	UV lamps or bulbs must be economical
	Difficult in operating using UV radiations	User friendly and easy to use
Likes-current methods followed(traditional techniques)	Normal disinfectant spray is used	Less effort is required
	They don't require electricity	Electricity consumption is saved
Dislikes-current methods followed(traditional techniques)	Cannot be used immediately if disinfectant sprays are used	It should be ready for use
Suggested Improvements	Proper sanitization of plates must be done	Reliable sanitization method should be used

Customer: Ramesh Jay	Interviewer(s): Sanganagouda & Yashovardhan	Date:30-03-2021

Question/Prompt	Customer Statement	Interpreted Need/ Expectations
Typical uses	It is Anti-bacterial	It is able to kill all kinds of microorganism
	UV lamps is convenient to use and no chemicals are needed	No chemical residue is left on the plates
	UV only works in its light path and can be blocked by objects	Reflectivity of UV light should be ensured
Likes-current methods followed(traditional techniques)	Sterilizing using steam under pressure	High energy is required for steam
	I would be using hot air to blow out the bacteria	High temperature is used
Dislikes-current methods followed(traditional techniques)	Sometimes Plates may break under high pressure or temperature	Machine should work under optimum condition
Suggested Improvements	Plates should be sterilized in proper order without damage	Self-alignment of plates is important

Customer: Malteshgouda Patil	Interviewer(s): Samrudh & Raju	Date:1-04-2021

Question/Prompt	Customer Statement	Interpreted Need/ Expectations
Typical uses	Dispensing of plates should be continuous	Time consumed for dispensing a plate should be minimum
	I should be aware when to insert the plates	Insertions of plates should be indicated
	Plates should not fall while dispensing	Process of dispensing of plates should be smooth
Likes-current methods followed(traditional techniques)	I would prefer to keep plates in hot water	Sanitization of plates is not ensured
	-NA-	-NA-
Dislikes-current methods followed(traditional techniques)	Machine consumes more space	Machine should be compact in size
Suggested Improvements	Make sure that machine don't make noise	Proper damping is necessary to minimize the NVH levels

1.4 Requirements List

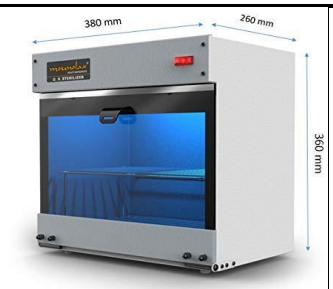
Customer	Requirements
1-3	Proper sanitization of plates
	Dispense plates simultaneously
	Aesthetic Appearance
	Shock proof
	Water proof
	Compact Design
	Controlled NVH levels of the machine
	Self-alignment of plates

Phase 2

2. Product Benchmarking

2.1 Studying and exploring competitive products

Products (Images or name)	Specifications	Cost INR	Advantage	Limitations	Functions
1.Borosil-Suruksha 	22L 44W time 0-10mins 4UV lamps	11990	Portable, 99.99% disinfectation.	Rusts easily Leakage of UV radiation through joints and cover	Safe food disinfection Can disinfect variable size products Disinfects in short time
2.Virushield Large 	70 L 11W 2UV lamps	2890	Asymmetric placement and tray ensures optimal bottom surface coverage. Reflective interiors for 360 degree reach	Huge size Lid with Velcro so chances of leakage is there Safety is compromised	Sterilizes all groceries gadgets keys and masks
3.Mounolax UV-C sterilizer	38x26x36 2 UV bulbs	3549	Removable under mount drip tray Elegantly decorated	Small size Therefore multiple items cannot	Sterilizes small items or

			Durable	be sterilized simultaneously and can sterilize only small items	electrical gadgets
4.IFFOVERSEA S-Ultra 	37x37x37 45L Weight 1.8kg 2UV 11W each	2549	Comes in form of foldable bag highly portable Most effective reflectors	No indication of UV bulb is on	Sterilizes all surfaces from food to metals

2.2 Patent search

Patent Name/ Number/ Date	Information
Antimicrobial Blue light US20060085052A1	Blue light within range of 400-470nm Excites the endogenous photosensitizing chromophores leading to generation of reactive oxygen species that are toxic to microbial cells
US9039966	Light between 400nm to 500nm inactivation at 405nm potential pathogens are killed using aBL
CN 102563453	UV radiation emitted are in the range of 240nm-400nm.

2.3 Literature survey

Literature details	Gathered Information
Eurotek Environmental Private Limited managing director Raj Kumar Kurra launches UVC (Ultraviolet-C) Scanz Plus sanitization machine invented by Safelifz in Hyderabad. News article: The Hindu Newspaper Published on: 03-07-2020	The machine can be used in airports, malls, super markets, and apartments for 99.9% protection from viruses as disinfection had gained importance during **COVID** times. It also has an internal infrared temperature sensor apart from an alarm system mounted on top for making an alarm if any abnormality is observed in the human temperature. It is totally password protected and it cannot be tampered by any unauthorized person.

Phase 3

3. Design Specifications

3.1 Objectives

Objectives	
Proper sanitization of plates	Proper holding of plates
Uniform spread of UV light	Self-alignment of plates
Dispense of sanitized plates	Avoid multiple hand contact with plates
Portable in design	User friendly
Automatic dispensing	Economical design
Less power consumption	Minimize noise and vibration
Less space consumption	Environment friendly
Low/No maintenance	Smooth operation of dispensing mechanism
Shock proof	Water proof

3.2 Constraints

Constraints	
Alignment of limited number of plates	Sanitization of minimum 5 plates
Sanitization time of plates is between 10-15min	Simultaneous dispense of plates
Dispense of one plate at a time	Machine should be compact

3.3 Objective tree (affinity diagram)

O#	Objectives	First level objectives	Second level objectives	Third level objectives
1	Safety	✔		
2	User safety		✔	
3	Device safety		✔	
4	Water proof			✔
5	Shock proof			✔
6	Proper sanitization of plates	✔		
7	Uniform spread of UV rays		✔	
8	Proper holding of plates	✔		
9	Self-alignment of plates		✔	
10	Dispense of sanitized plates	✔		
11	Automatic dispensing		✔	
12	Low/No maintenance	✔		
13	Less power consumption		✔	
14	Less space consumption		✔	
15	Minimize noise and vibration	✔		
16	Minimize mechanism sound		✔	
17	Minimize dispensing sound		✔	
18	Portable in design	✔		
19	Compact size		✔	
20	Sturdy and Durable		✔	

Objective tree:

3.4 Design Specifications:

Sl No.	Engineering Specifications	Units
1	Overall dimensions	Millimeters
2	Ultraviolet radiations	Nanometers
3	Time consumption for sanitization	Minutes
4	Time consumption for dispensing	seconds
5	Sanitization per plate	Numbers
6	Electricity consumption	Amperes
7	Operation	Semi-automatic

Competitive Benchmarking:

Metric #	Metric	Units	Competitive Products		
			Product 1 Borosil-Suruksha	Product 2 Virushield Large	Product 3 Mounolax UV-C sterilizer
1.	Volume	L	22L	70L	38x26x36
2.	No of UV lamps		4	2	2
3.	Cost	INR	11990	2890	3549
4.	Power consumption	W	44	11	11
5.	Safety	%	70	95	90
6.	Weight	kg	5	2	7

Phase 4

4.1 Concept Generation

4.1 Defining Functions

Sl No	Functions	Sub Functions (optional)
1	Separation of plates	
2	Sanitization of plates	Killing of bacteria and virus
3	Dispensing of plates	
4	Indication of sanitization and apprise the no the of plates	Alert sound

4.2 Morphological Chart

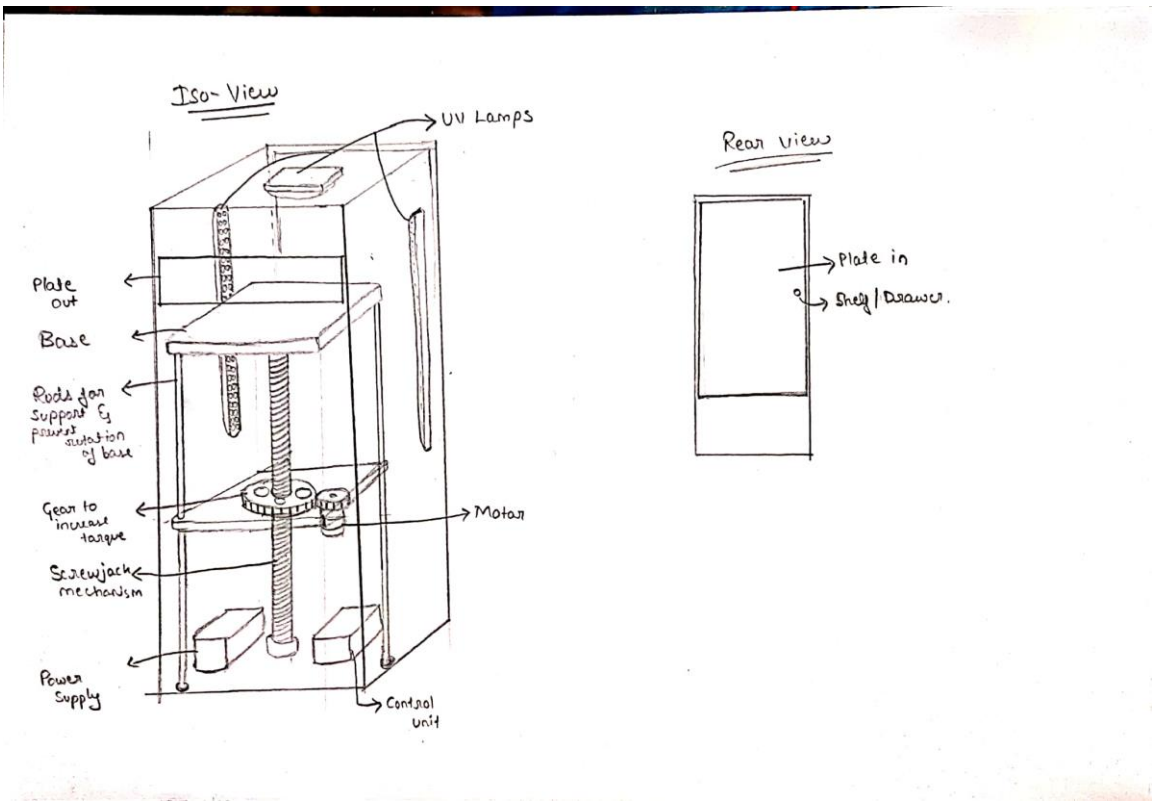
Functions M ▼	**Means 1**	**Means 2**	**Means 3**	**Means 4**	**Means 5**
Separation of plates	Servo motors	Solenoid push-pull	threaded rods		
Sanitization of plates	UV light	alcohol disinfectant	steam	Dettol	disinfectant spray
Dispensing of plates	screw jack mechanism	springs	hydraulic mechanism	threaded stud	timer belt
Indication of systems status quo	buzzer	speaker	electric bell	led light	digital display

4.3 Generating design alternatives

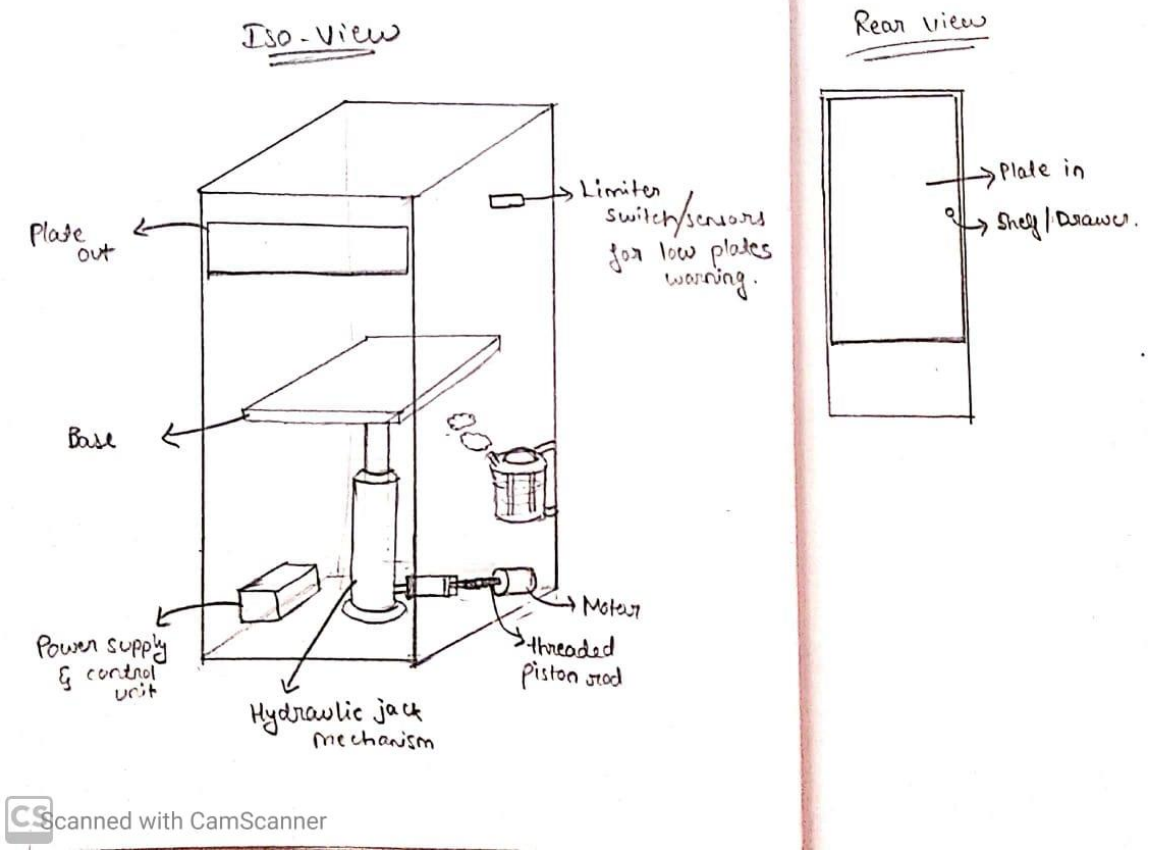
Identified Design Alternatives:

Si.	Design Alternatives
1	**means(2,3,4,4)**
2	**means(2,1,1,1)**
3	**means(1,5,2,3)**
4	**means(3,2,5,5)**

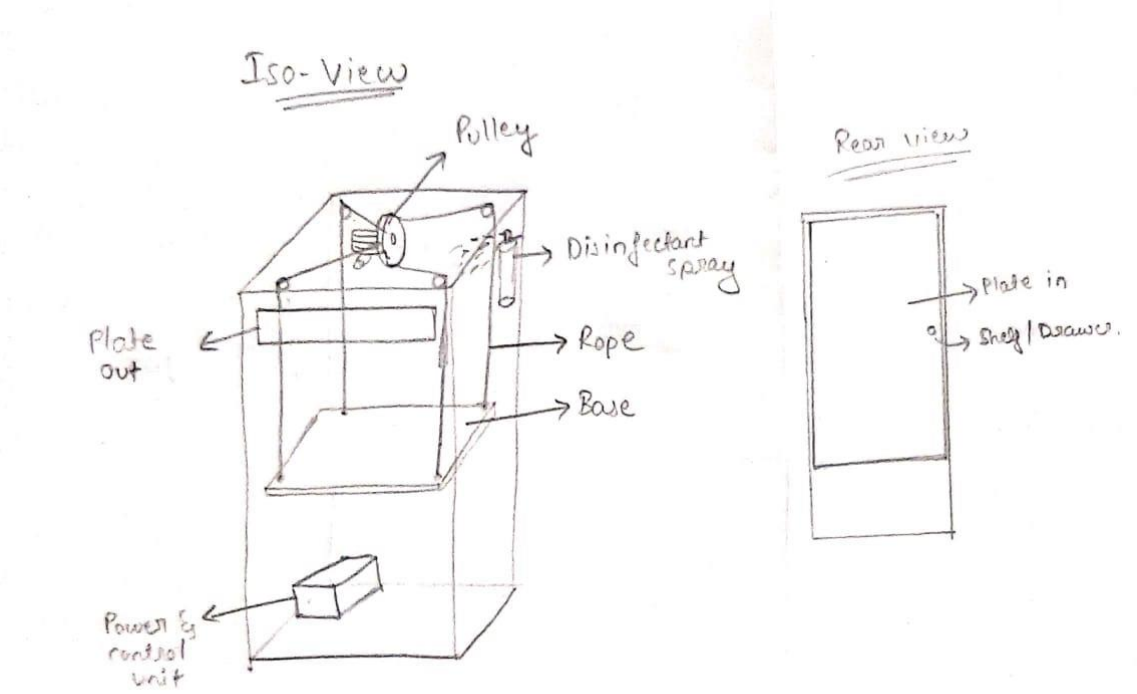
Sketch of generated design concepts/ alternatives:

Design Alternative 1


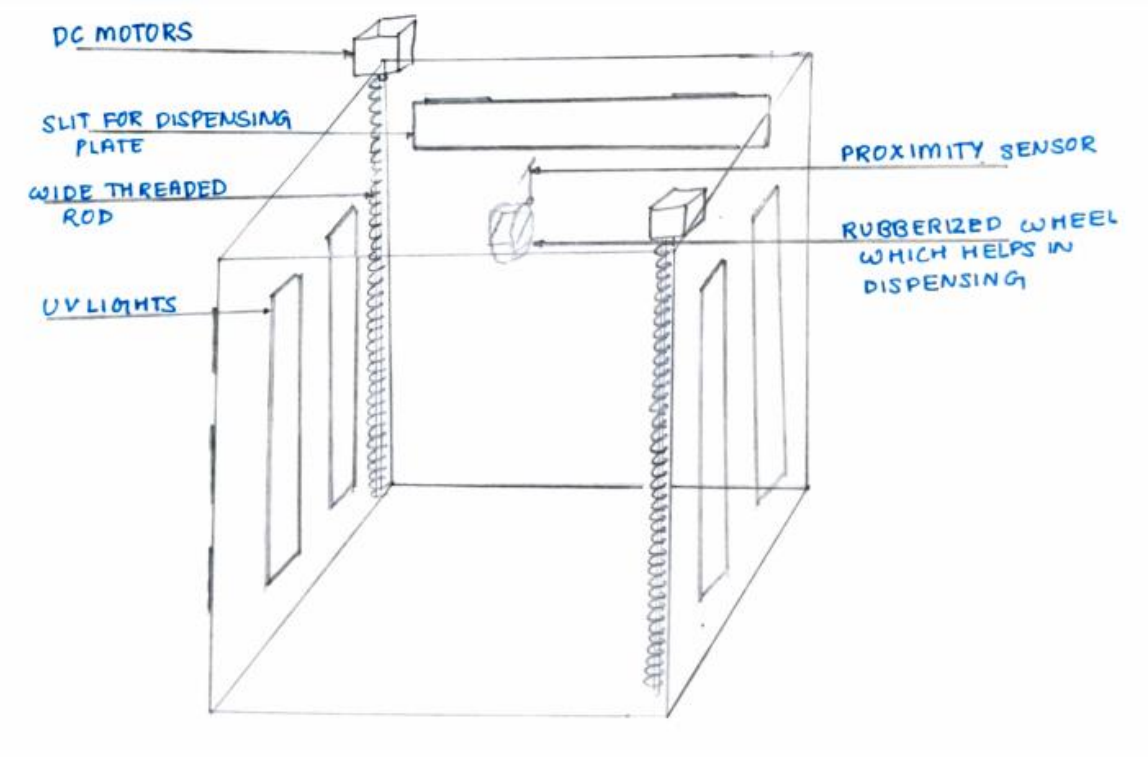
Design Alternative 2



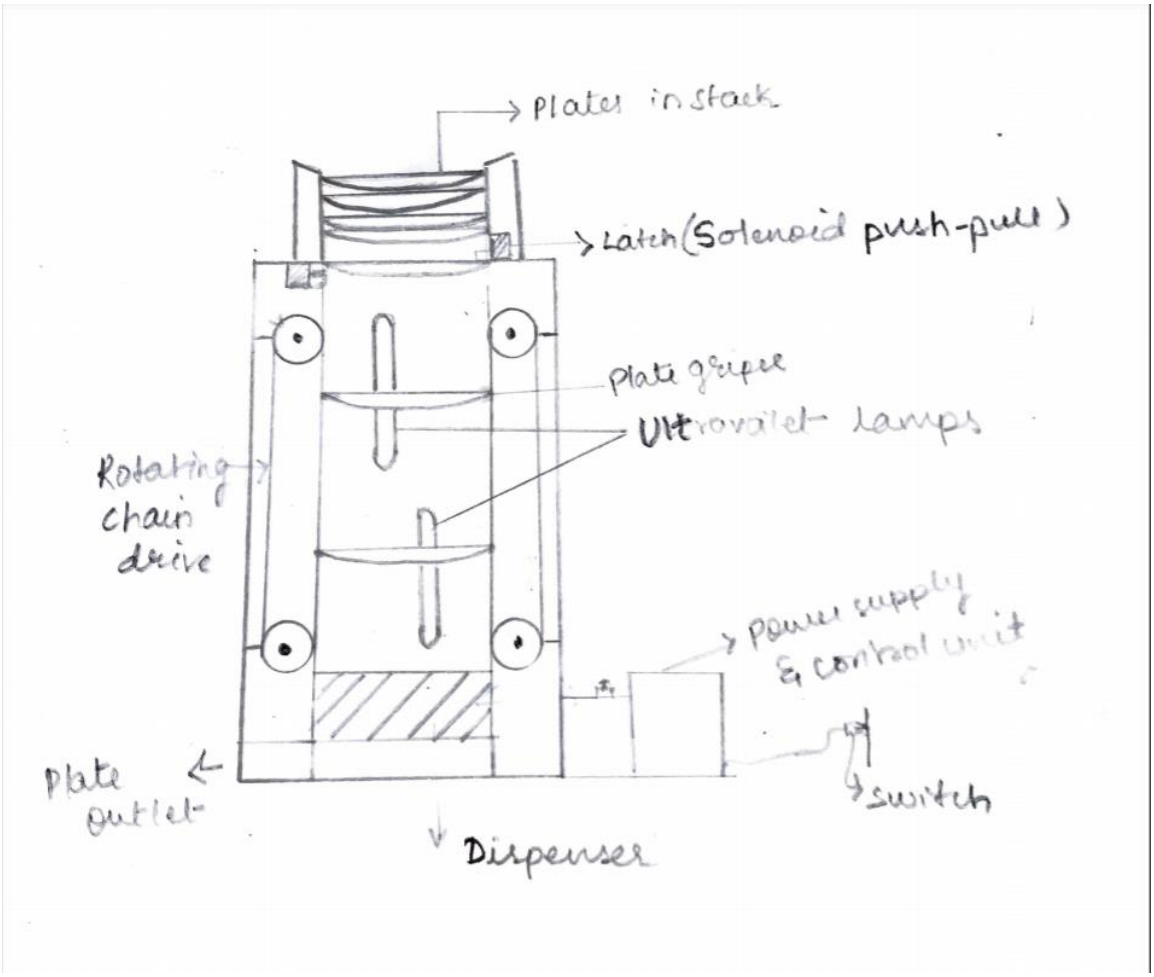
Design Alternative 3



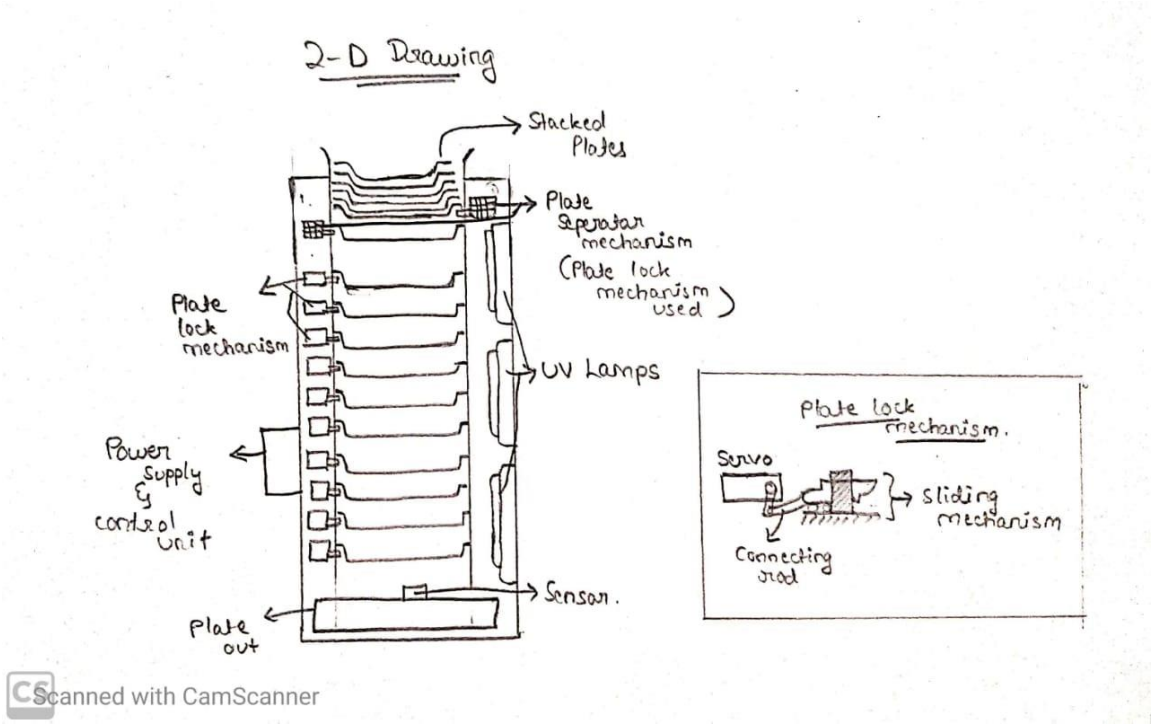
Design Alternative 4



Design Alternative 5



Design Alternative 6



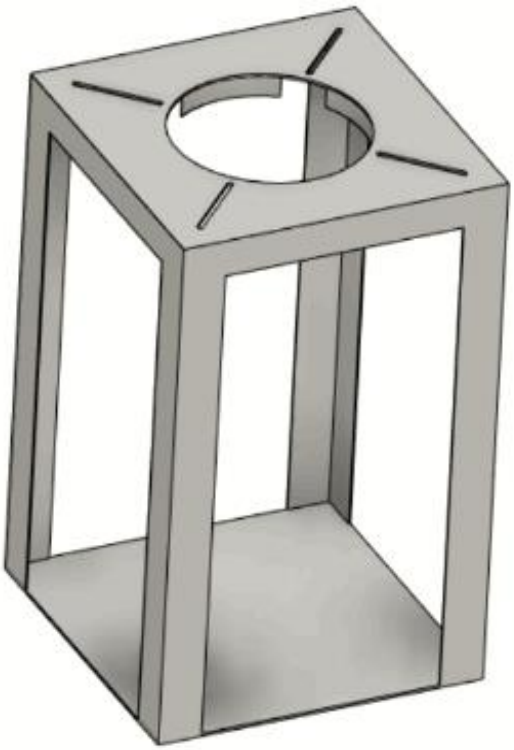
4.4 Selecting Design Alternative (Using Pugh Chart)

Requirements	Weight	Design1	Design2	Design3	Design 4	Design 5	Design 6	Reference
Safety	10	+	+	+	+	+	+	0
Portable	4	+	+	+	+	+	+	0
Power	5	0	0	0	0	0	-	0
Efficiency	8	0	+	-	-	+	-	0
Automatic	8	-	-	-	-	+	+	0
Cost Efficient	8	0	-	+	0	+	-	0
Dispenser	9	+	+	+	+	+	+	0
NVH level	7	-	+	0	-	0	+	0
Marketable	8	+	0	0	0	+	-	0
Pluses		4	5	4	3	7	5	0
Sames		3	2	3	3	2	0	0
Minuses		2	2	2	3	0	4	0
Overall Total		2	3	2	0	7	1	0
Weighted Total		16	22	15	0	55	9	0
Yes / No		NO	NO	NO	NO	YES	NO	0

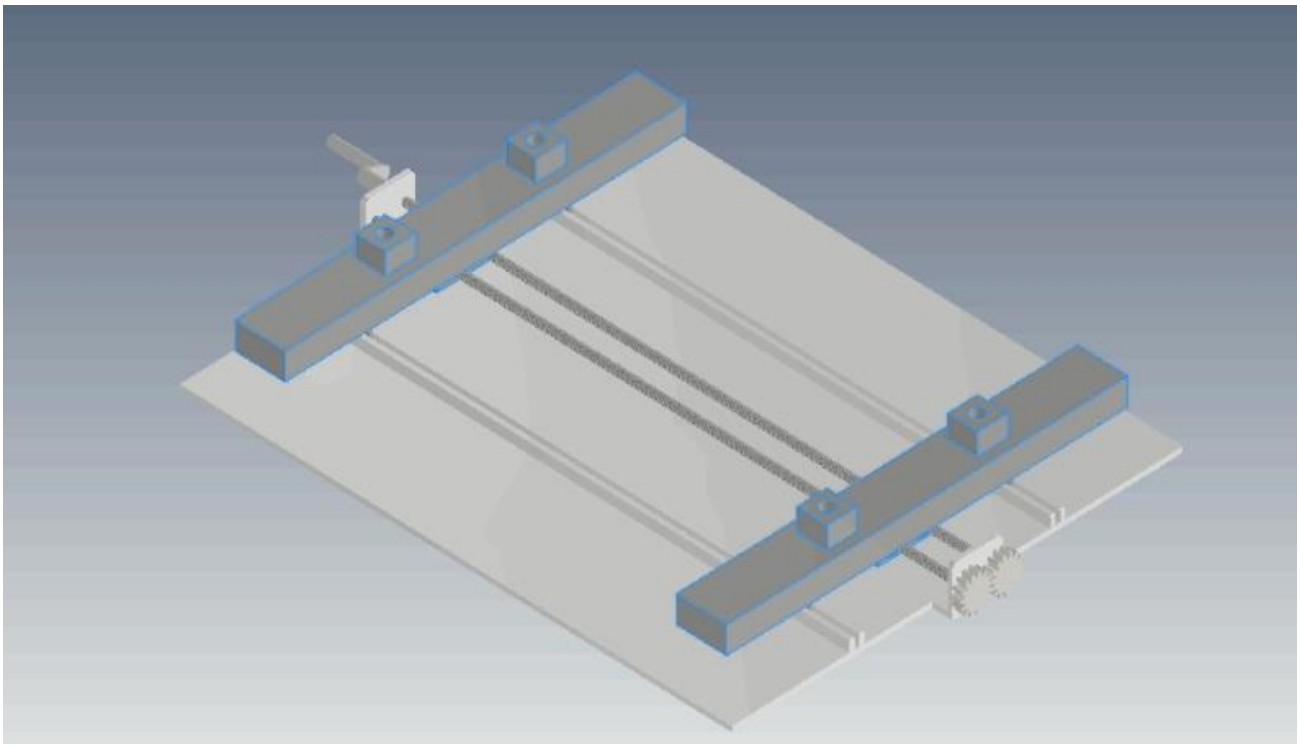
Selected Design Alternative: DESIGN 5

5.1 3D Models

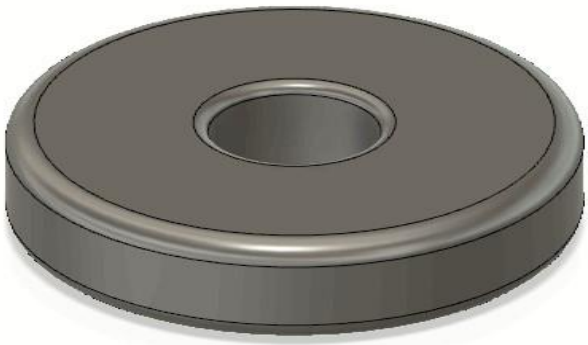
1. SUPPORT FRAME:



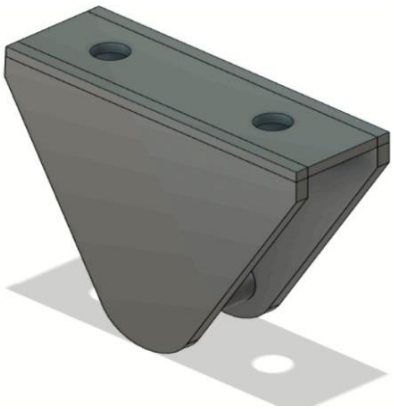
2. MOVABLE BASE:



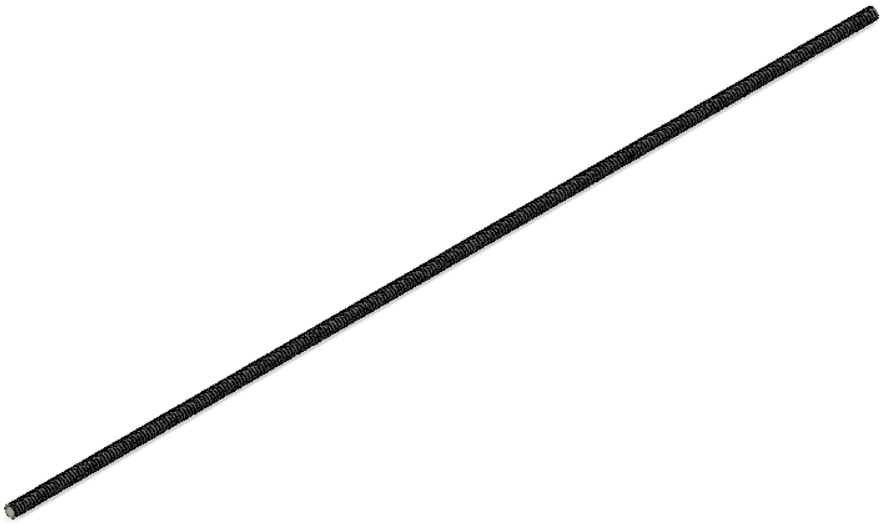
3.WHEELS:



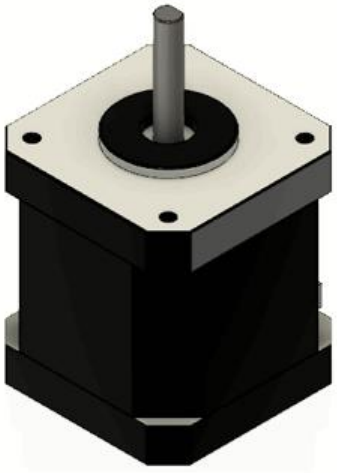
4.WHEELBASE:



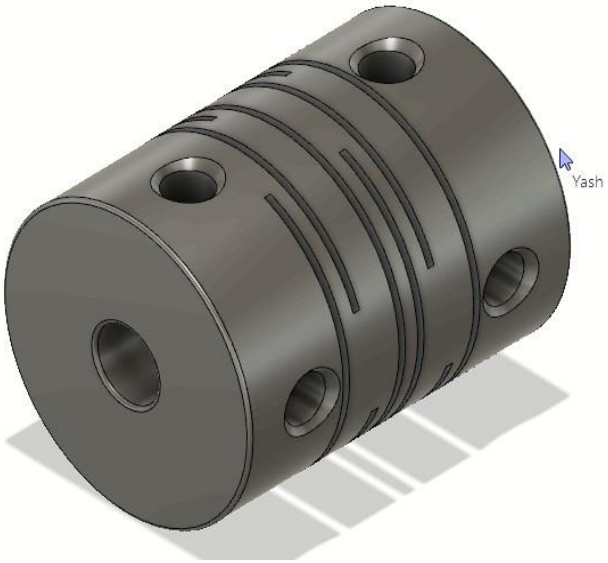
5.LEAD SCREW:



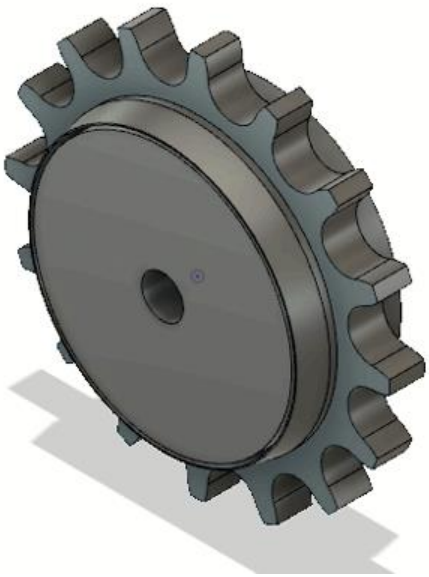
6.STEPPER MOTOR:



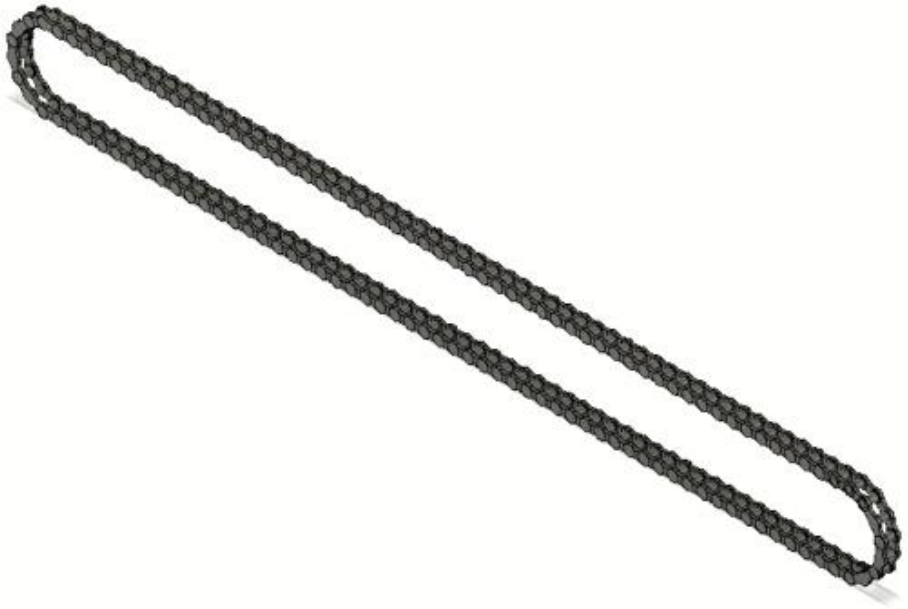
7. COUPLER:



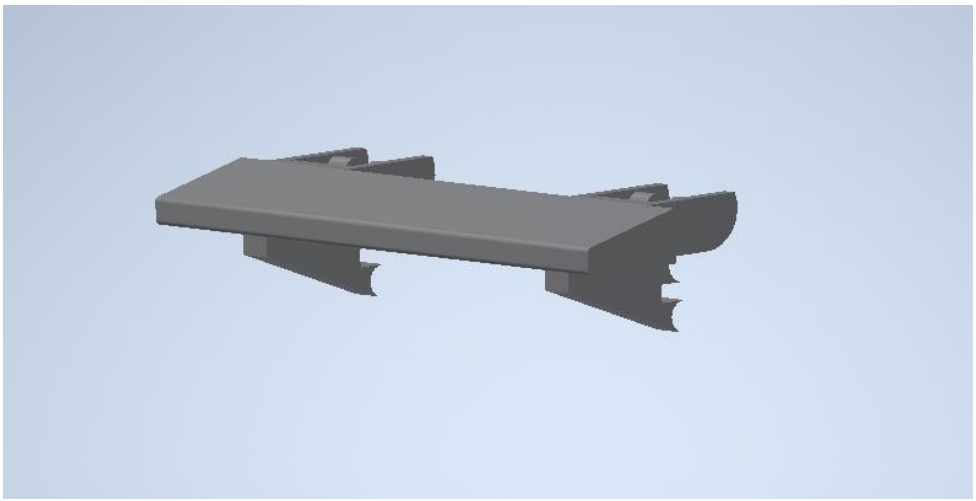
8. SPROCKET:



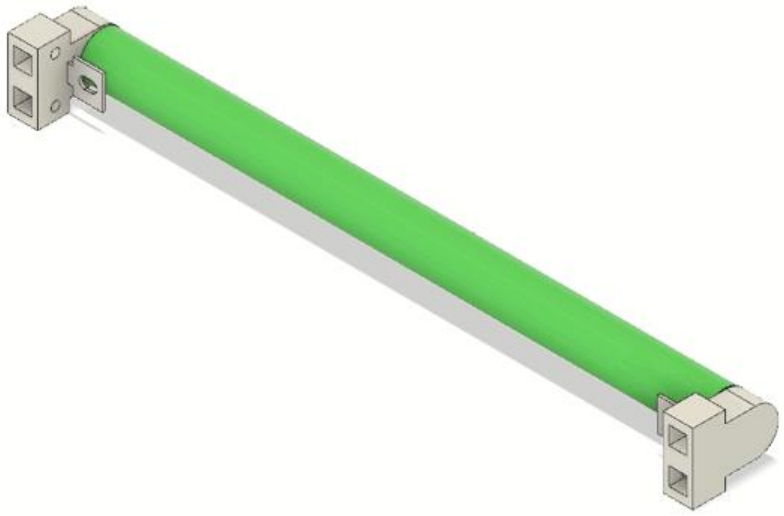
9.CHAIN:



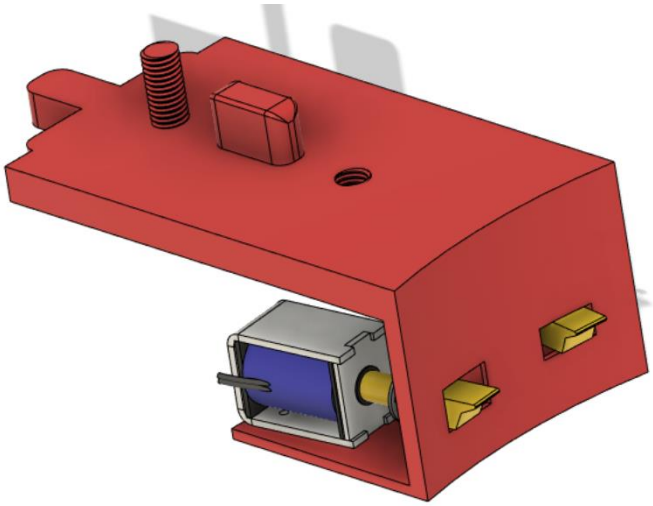
10.CHAIN WEDGE:



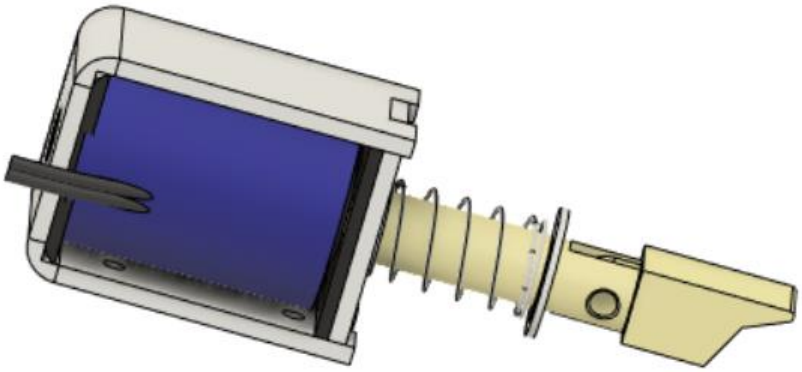
11.UV LIGHT:



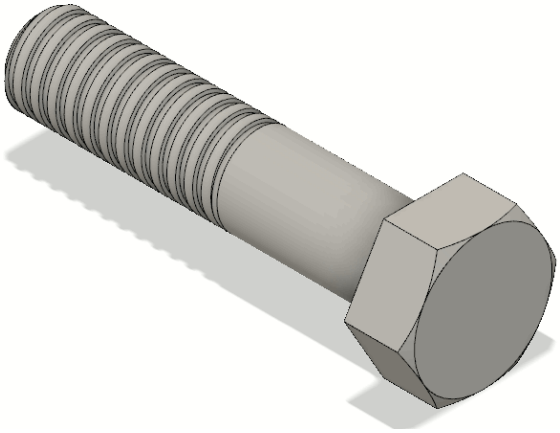
12. SOLENOID HOLDER:



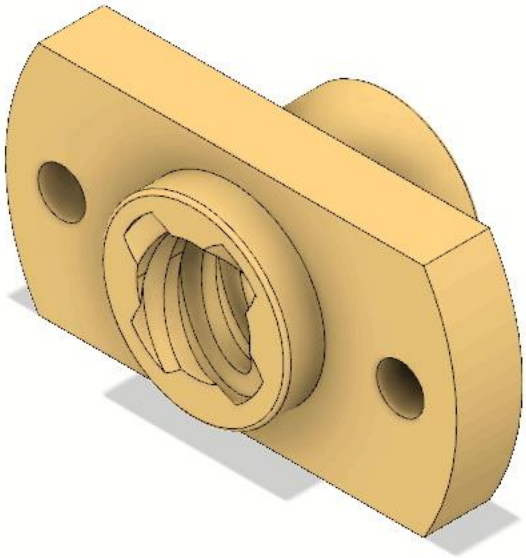
13.SOLENOID WITH WEDGE:



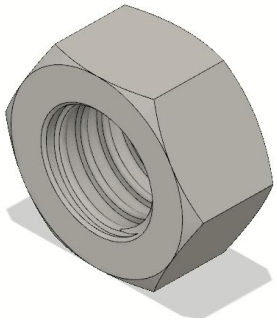
14.BOLT:



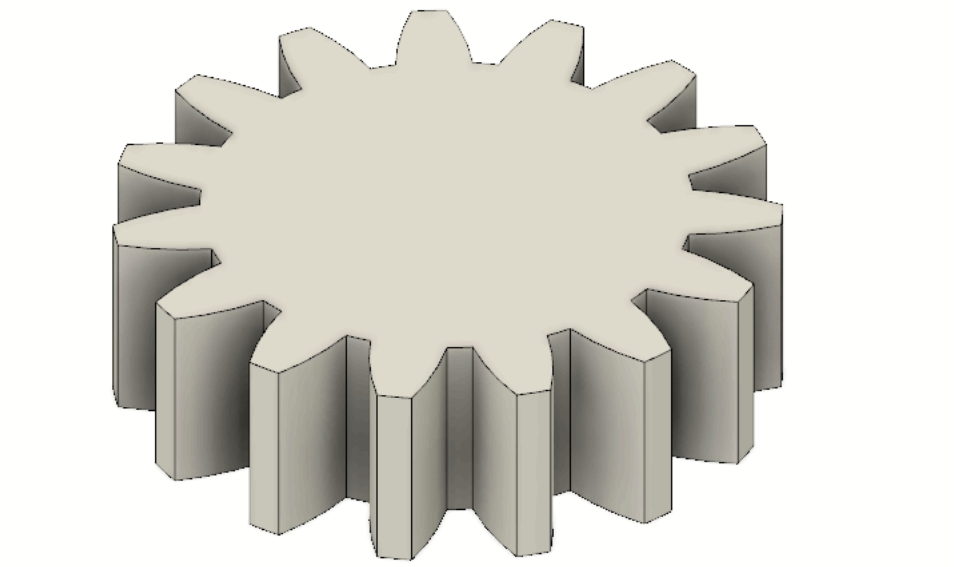
15. LEAD SCREW NUT:



16.NUT

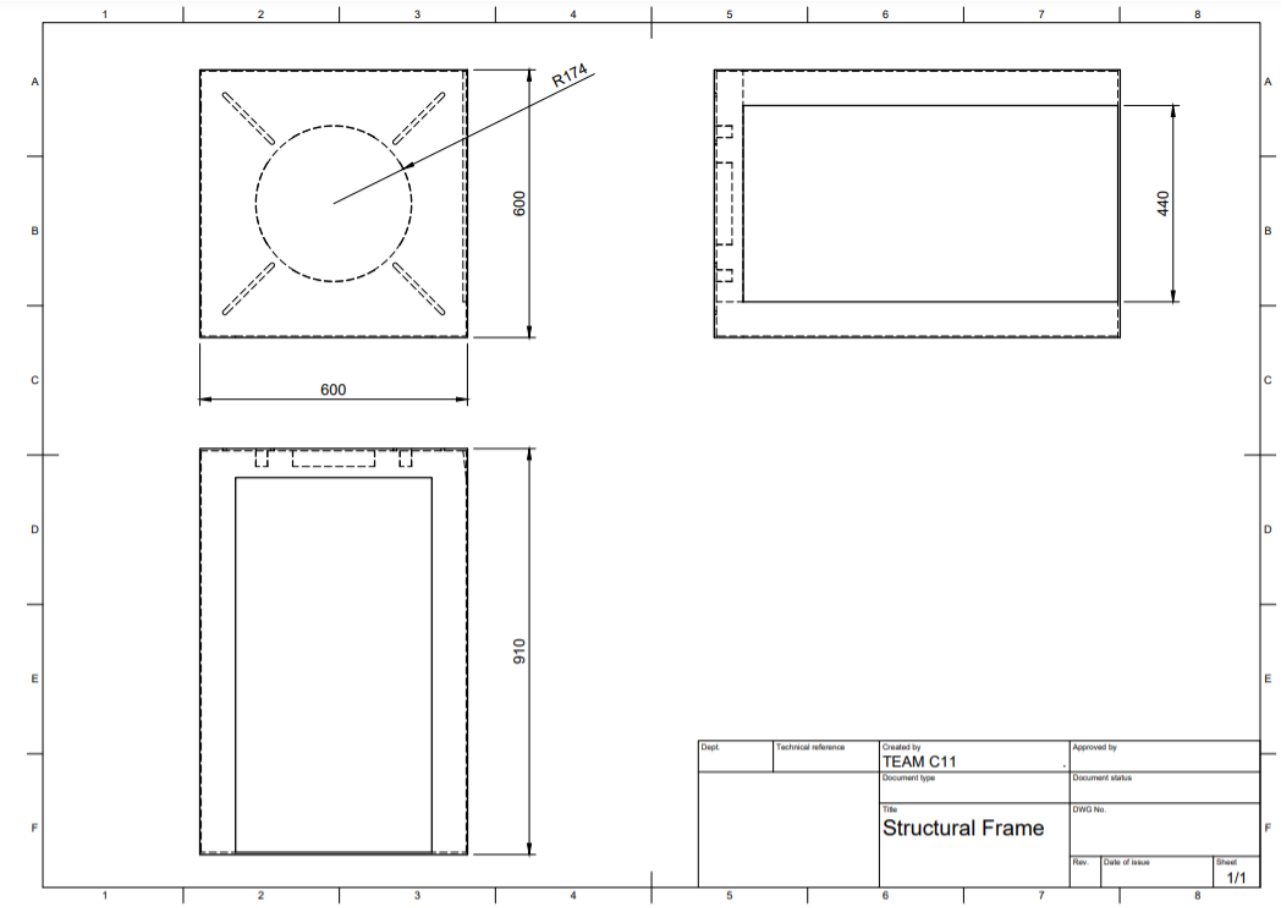


17.SPUR GEAR

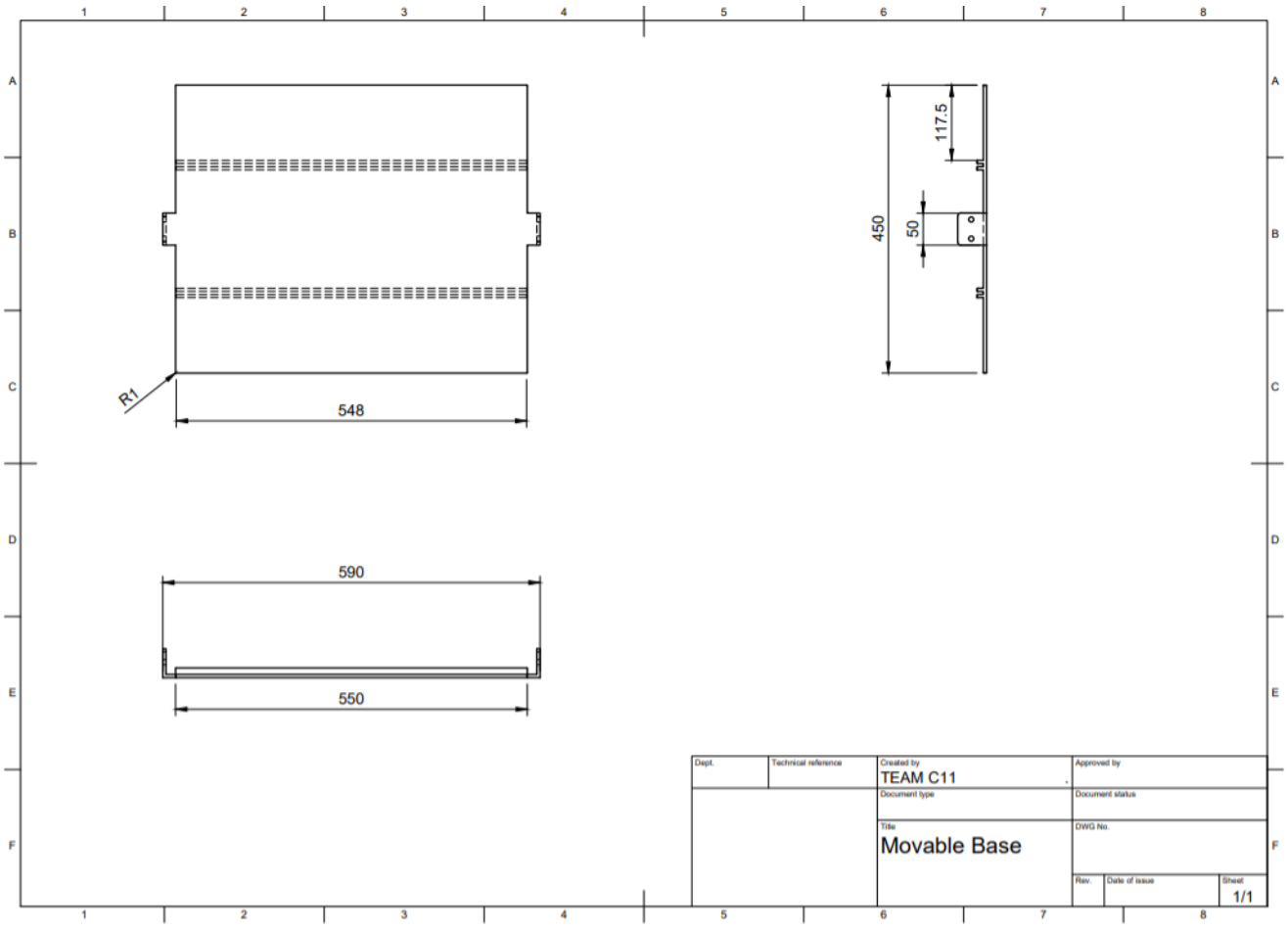


2D DRAFTING :

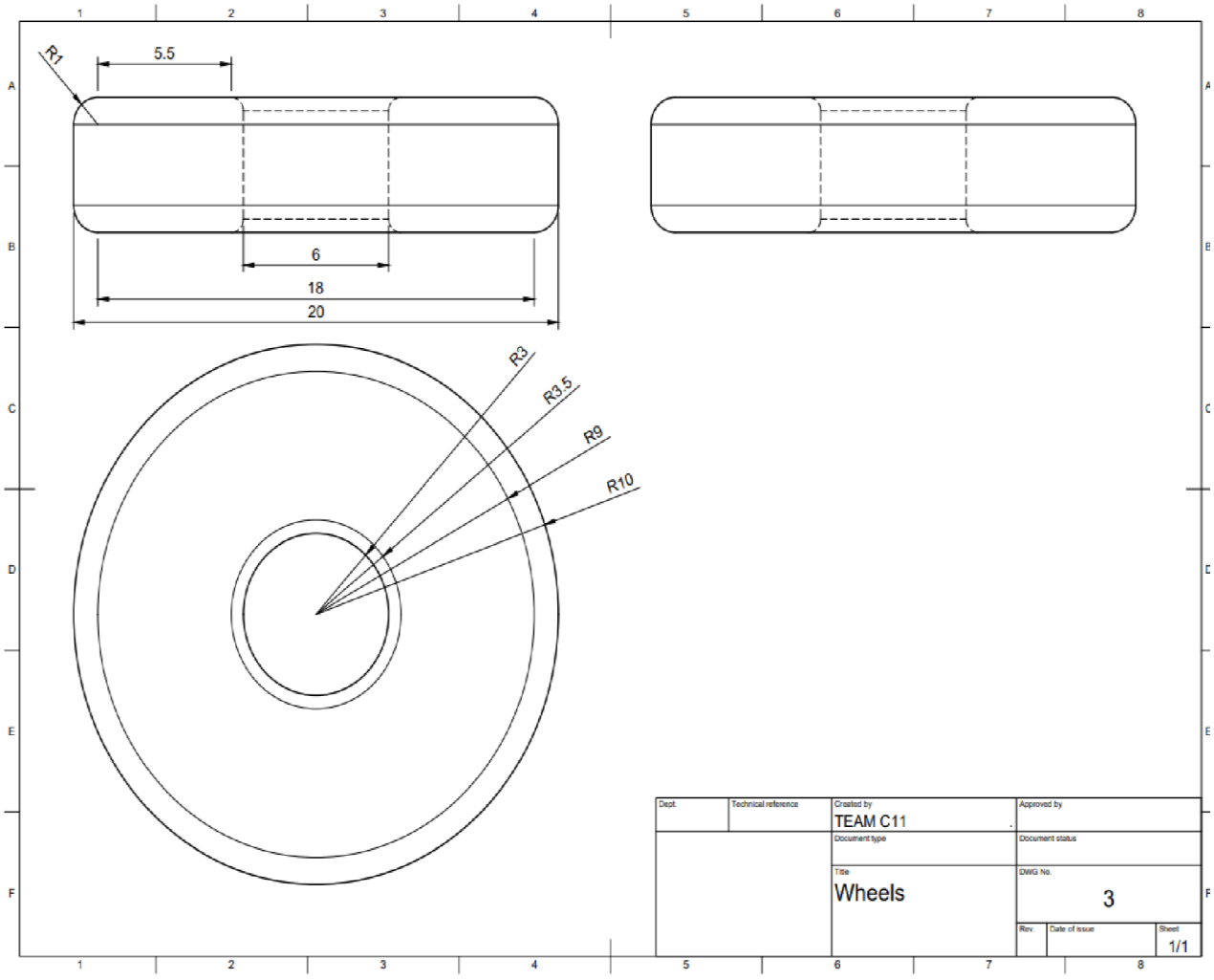
1.STANDARD SUPPORT FRAME



2.MOVABLE BASE:



3.WHEELS: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Technical reference
Created by
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Rev.
Date of issue
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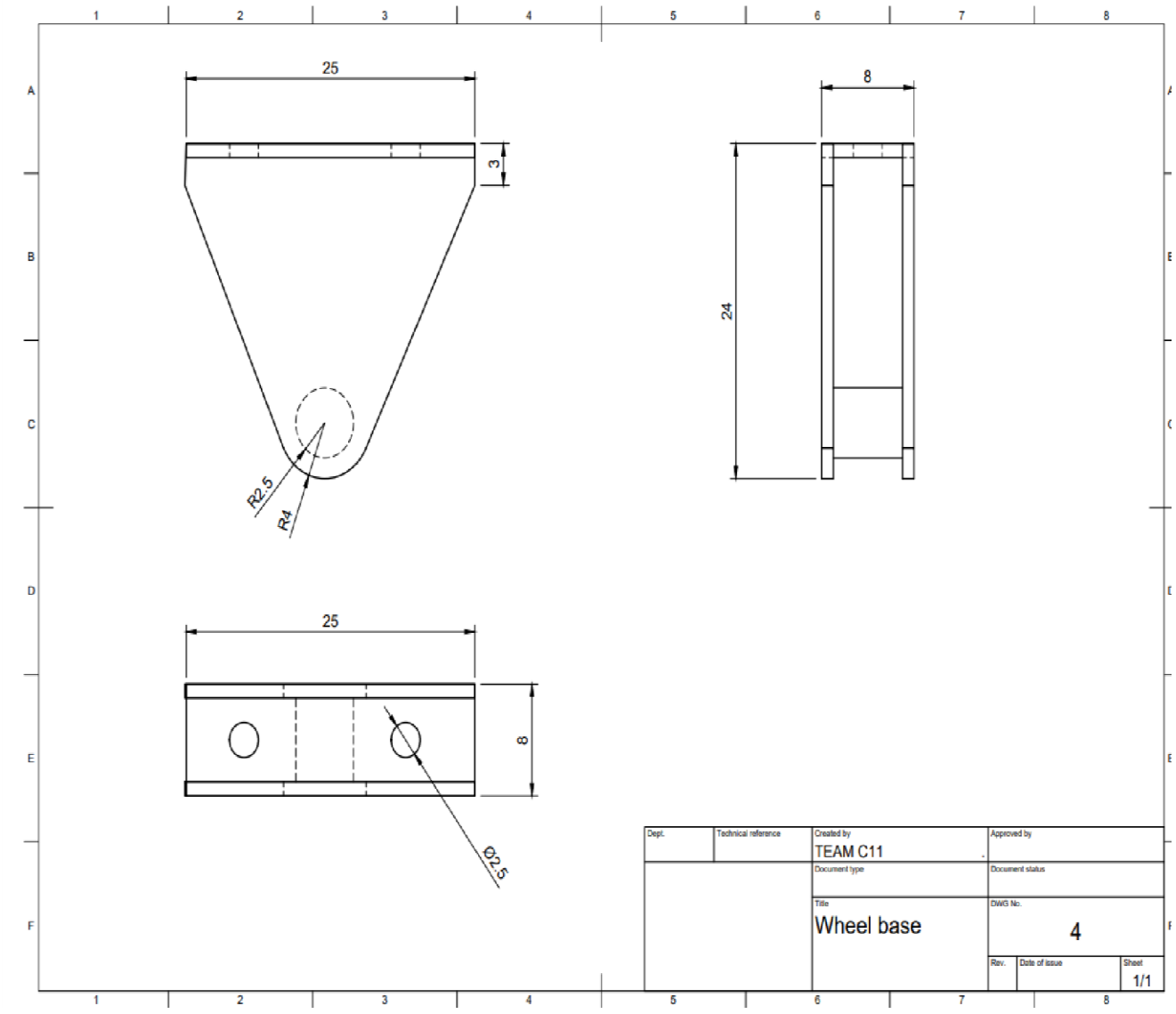
4.WHEEL BASE: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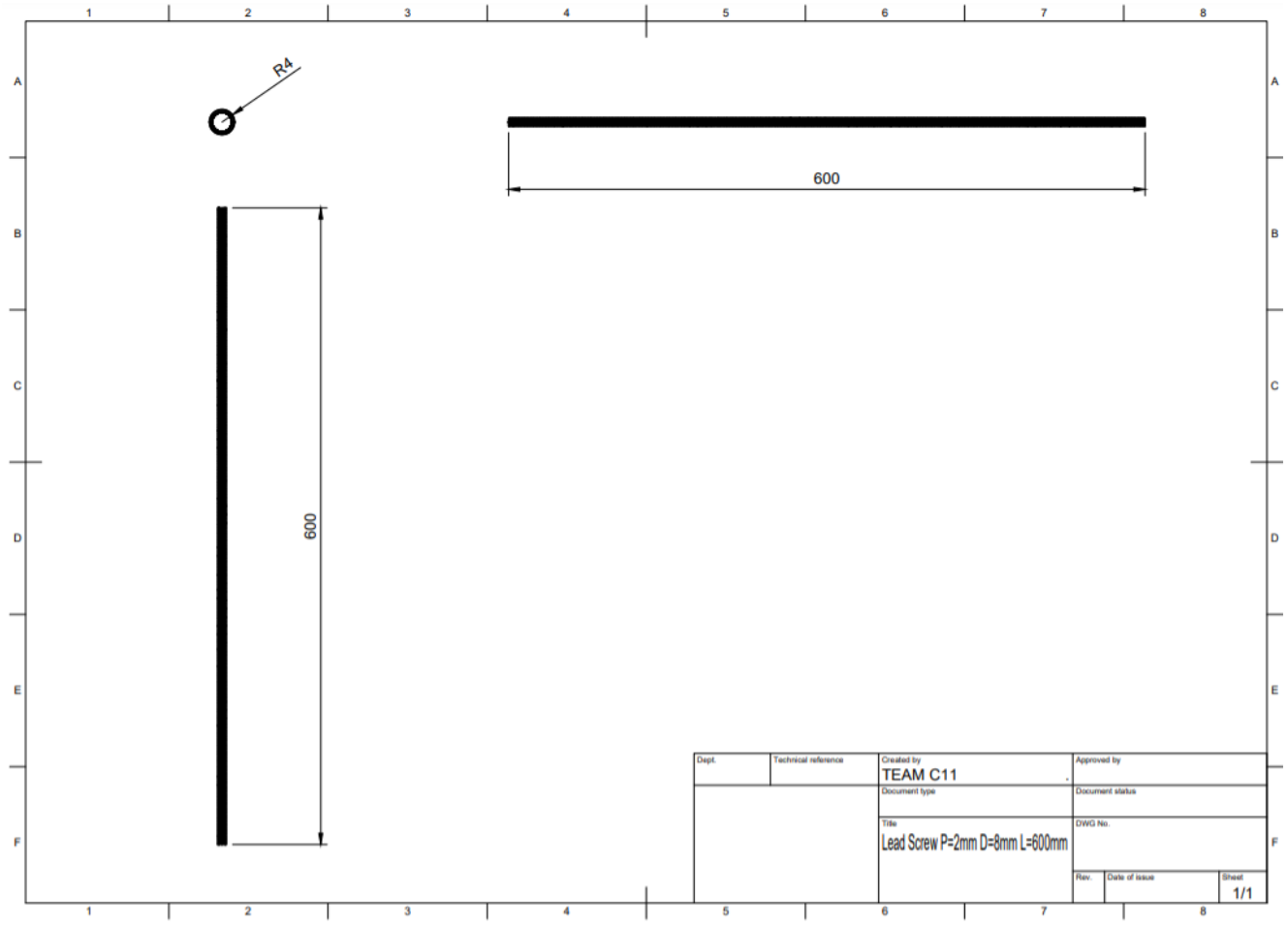
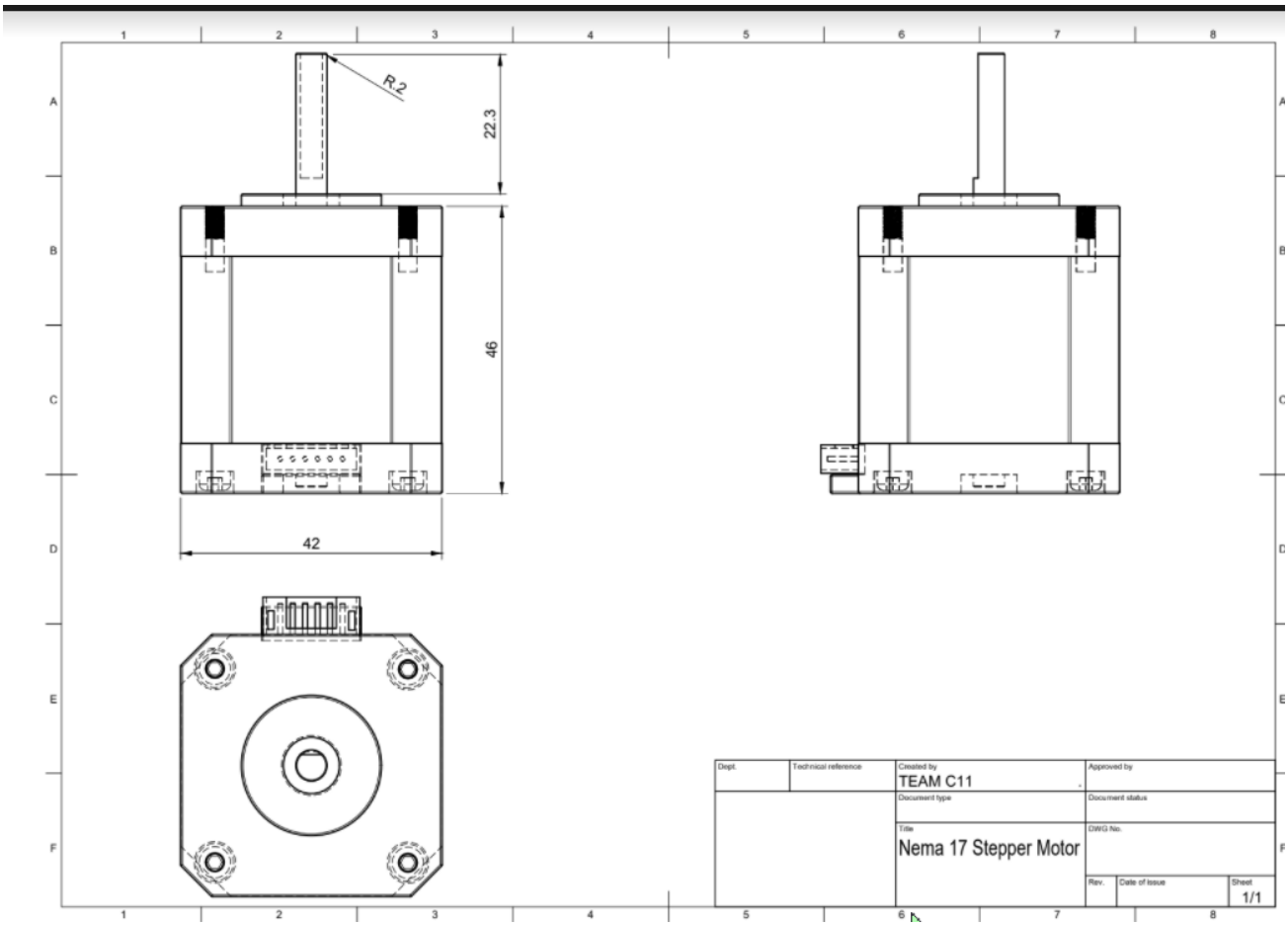
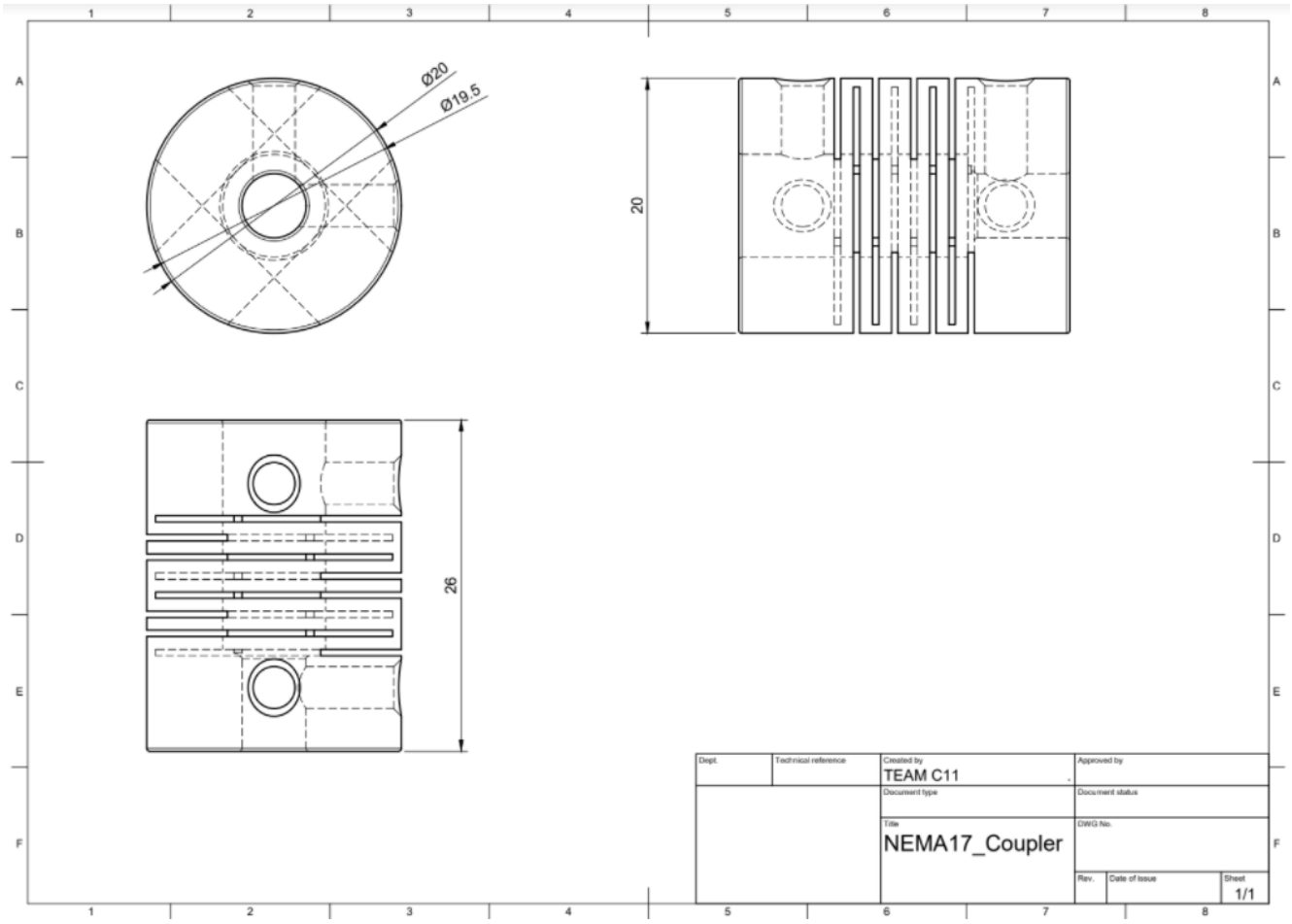
5.THREADED ROD:



6.STEPPERMOTOR:



7.COUPLER: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Dept.
Technical reference
Created by
TEAM C11
Approved by
Document type
Document status
Title
NEMA17_Coupler
DWG No.
Rev.
Date of issue
Sheet
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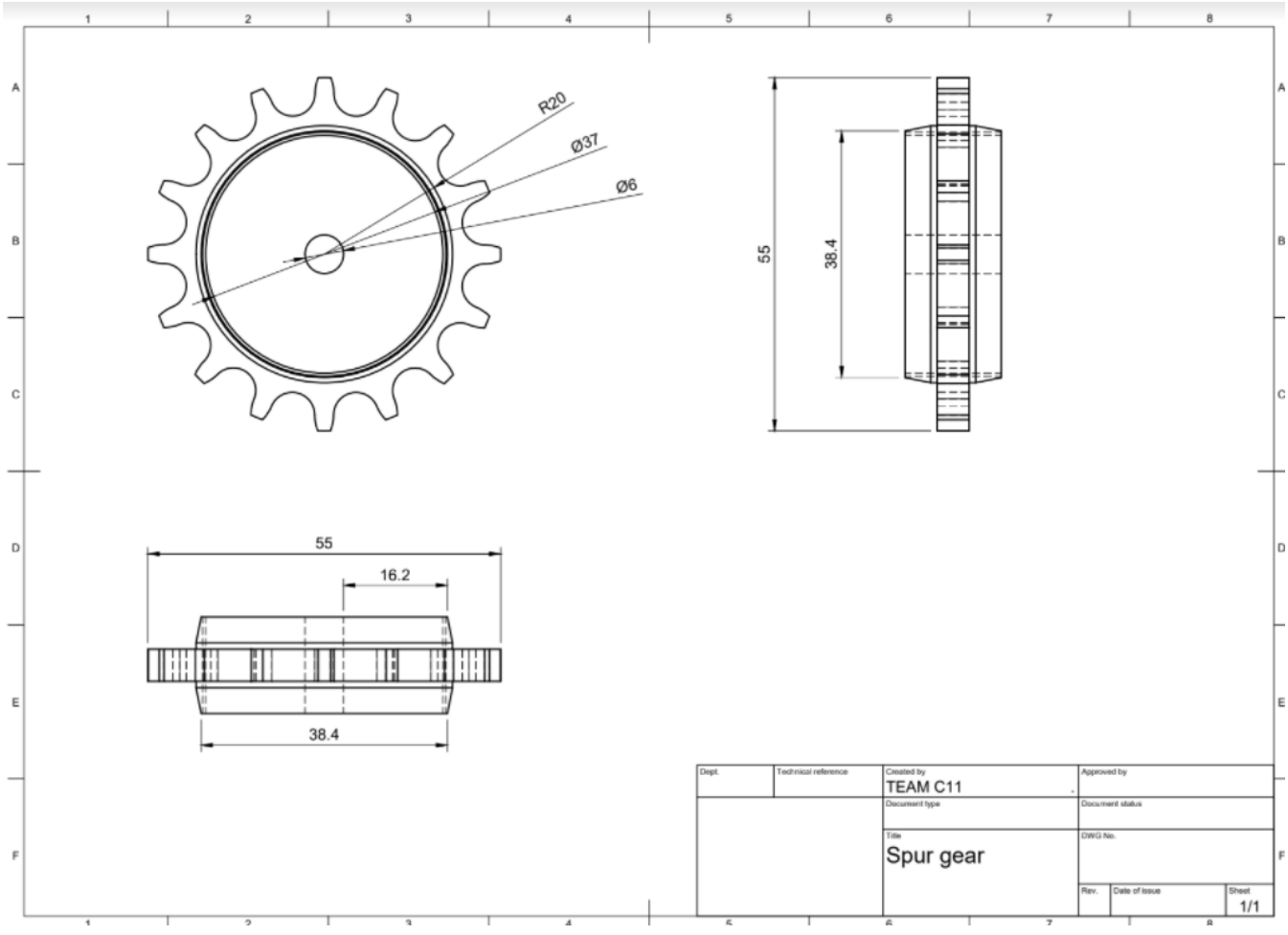
7.SPROCKET: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Spur gear
DWG No.
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Date of issue
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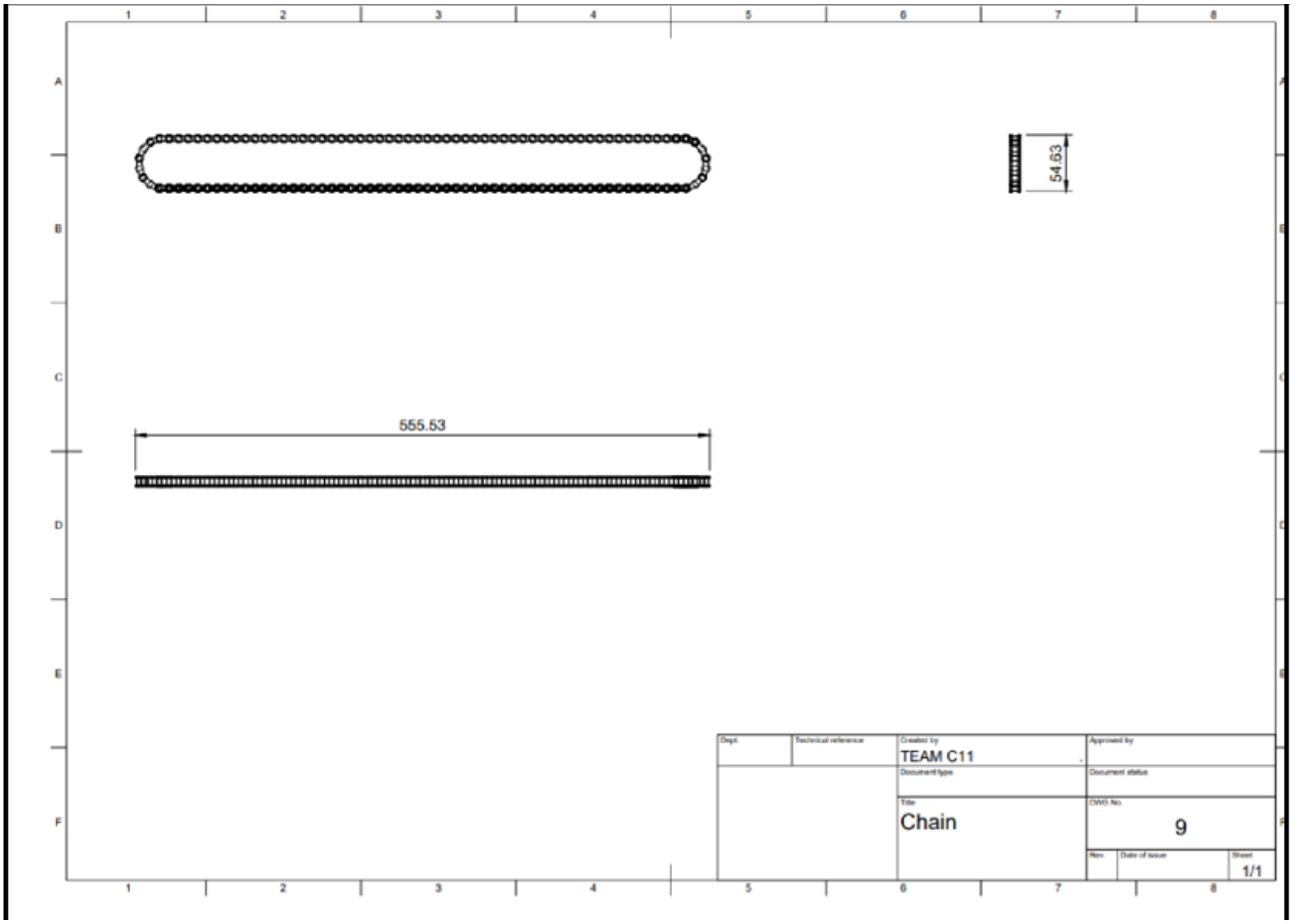
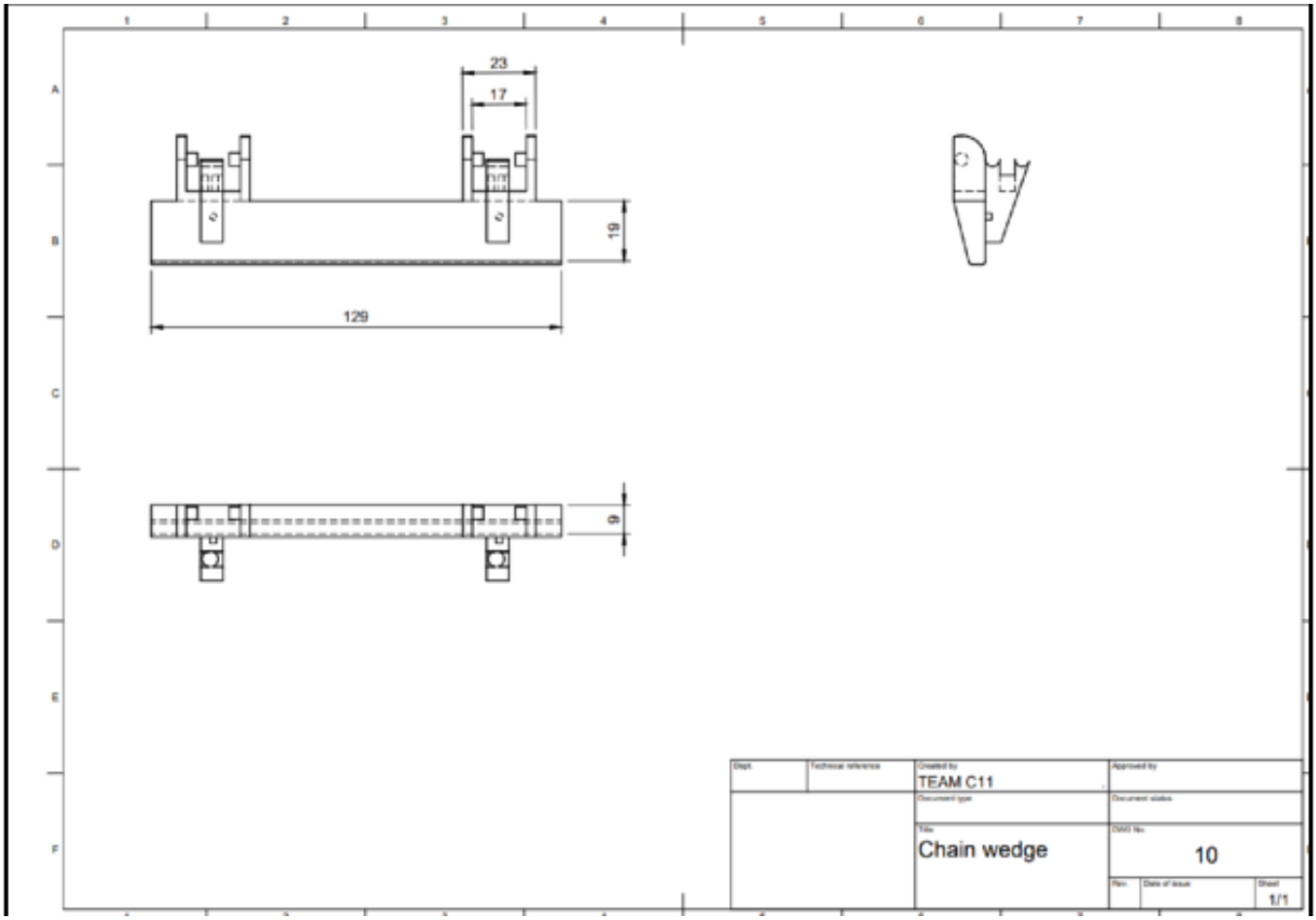
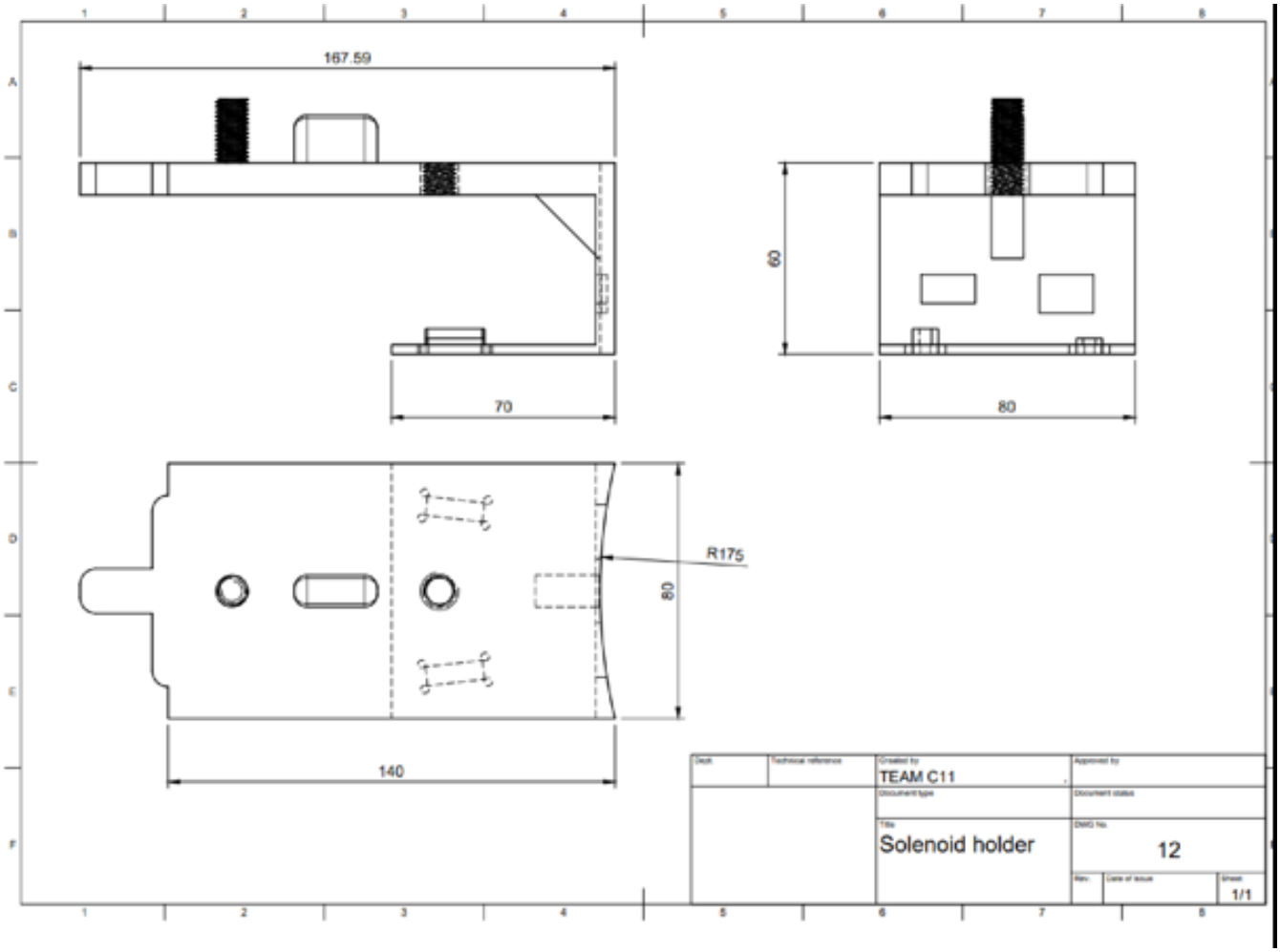
9.CHAIN:



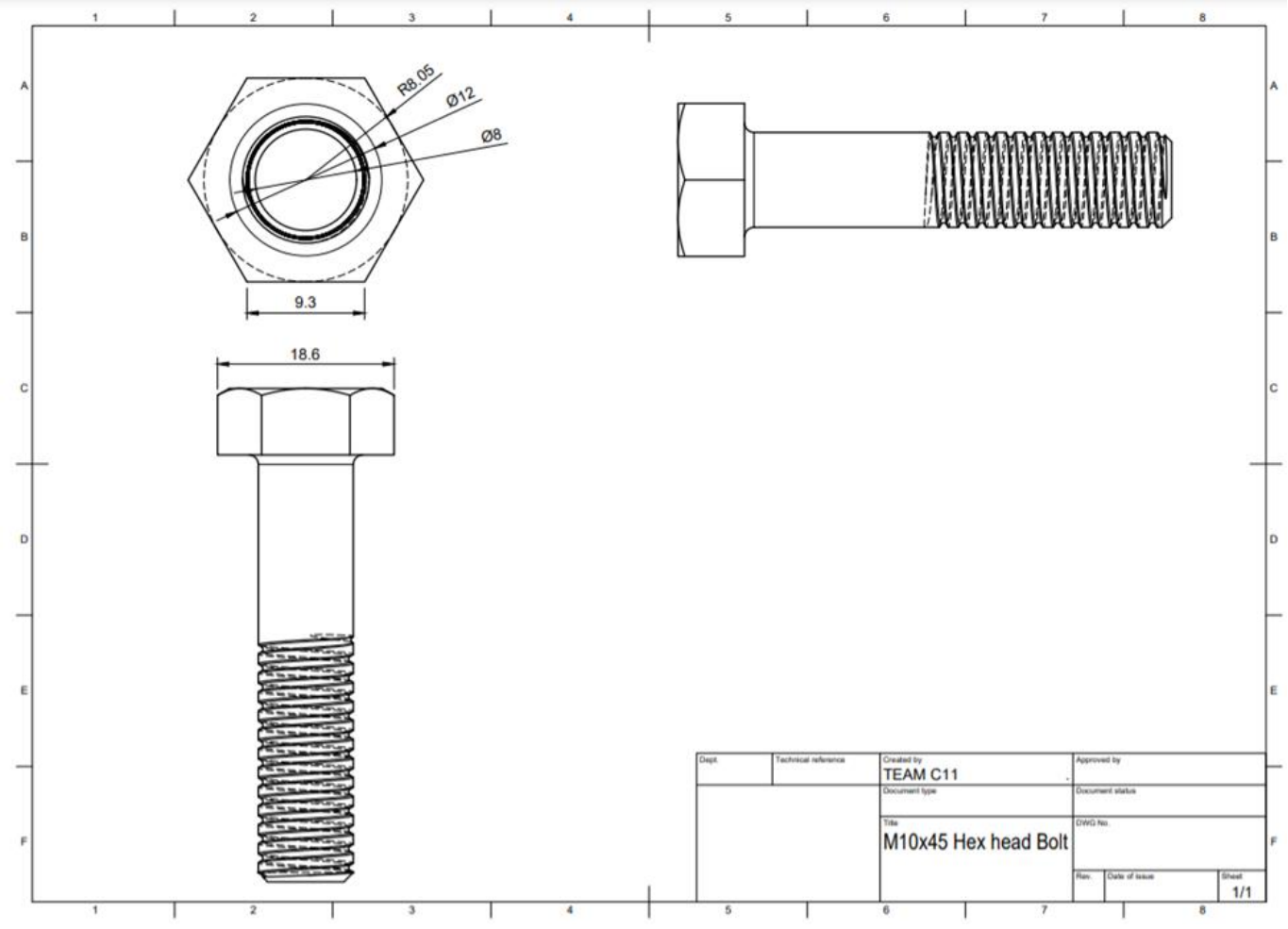
10. CHAIN WEDGE



11.SOLENOID HOLDER



12. HEAD BOLT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TEAM C11
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M10x45 Hex head Bolt
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Date of issue
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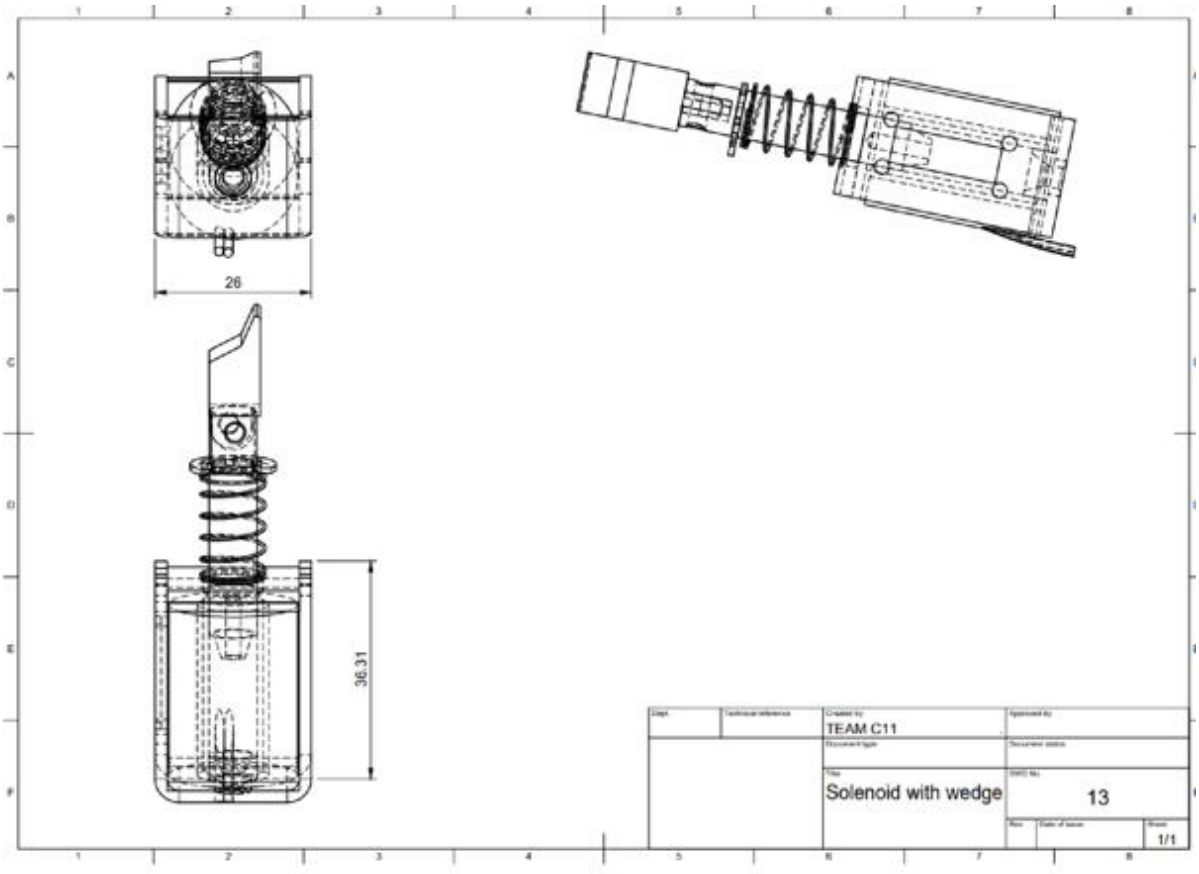
13.SOLENOID WITH WEDGE



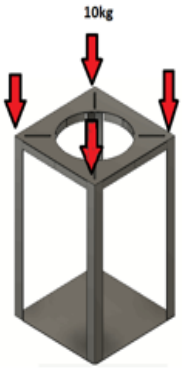
5.4 Boughtout and Manufactured Parts

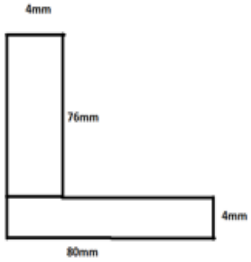
Boughtoutparts	Manufactured Parts
Electronic components Arduino Uno, IR sensor, Solenoid, Nema 17 stepper motor and its Driver. Mechanical component are lead screw ,nuts and bolt Spur Gear, Coupler.	Structural frame, Complete base, Chain and chain support frame, wedges , Solenoid holder, Sprockets, Handle , UV lamps, Frame covers, Plates, wheels and base for it.

5.5 Design Calculations:

1. STANDARD SUPPORT FRAME

STANDARD SUPPORT FRAME





E=210 GPa L=900mm

I= MOI of 'L' section

$x = \frac{A1X1+A2X2}{A1+A2}$

1. A1=46X4=184mm^2

   X1=2mm

   Y1=23+4=27mm

2. A2=50X4=200mm^2

   X2=25mm

   Y2=2mm

$X' = \frac{A1X1+A2X2}{A1+A2}$ $Y' = \frac{A1Y1+A2Y2}{A1+A2}$

=13.97 =13.97

$I_{xx}=I_{xx1}+I_{xx2}$

$I_{xx1}=I_g+I_{ah}^2= (bd^3/12) + a_1(y-y_1)^2$ $I_{xx2}=I_g+I_{ah}^2= (bd^3/12) + a_2(y-y_2)^2$

$=63685.01mm^4$ $=28927.84mm^4$

$I_{xx} = I_{yy} = 92607.85mm^4$

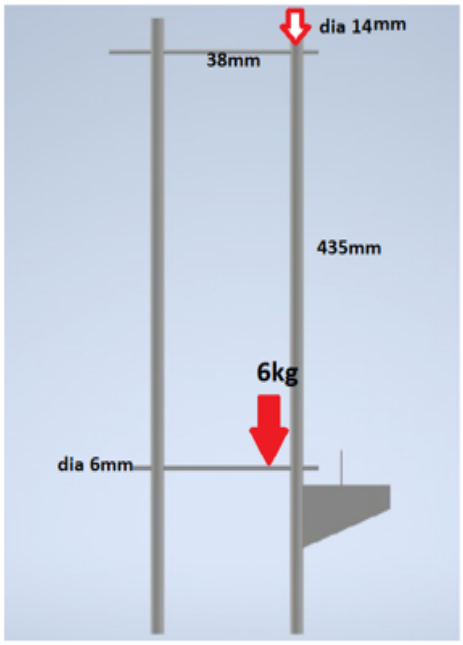
EULERS CRIPPLING/BUCKLING LOAD

$P_{CR} = (\pi^2EI)/4l^2$

=59.24KN

2. UPPER SUPPORT CHAIN DRIVE

UPPER SUPPORT FOR CHAIN DRIVE



EULER CRIPPLING LOAD

$P_{CR}=\frac{\pi 2EI}{4l2}$

$L=\frac{l}{2}$

E=200GPa

$I=\frac{\pi}{64}$ X d^4 d=Φ14

$I=1885.74mm^4$

$L=\frac{l}{2}=\frac{335}{2}=217.5mm$

Taking max load applied on the rod as 6kg and assuming the end conditions as fixed

$P_{CR}=\frac{\pi 2EI}{4l2}$

=8292N

Maximum load applied on rod is 6kg=6x9.81=58.86N

For 6mm diameter rod we will get shear load of 6X9.81=58.86N

$Shear=\frac{FQ}{Ib}$

$=4F[R^2-y^2]/3\Pi R^4$

For maximum shear y=0

Therefore

$Shear = 4FR^2/3\Pi R^4$

=2.775 MPa

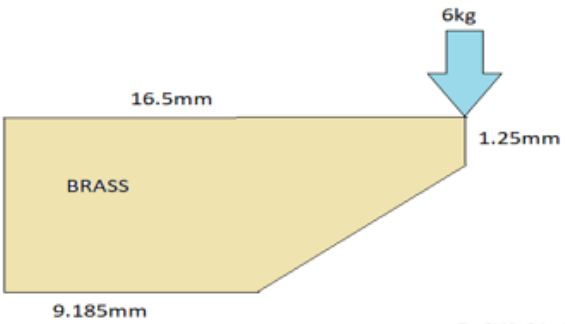
Tensile strength of steel rod 345-525 MPa

Shear stress = tensile strength/1.73

Shear strength= 200-300 MPa

3. WEDGE

WEDGE



E=6X9.81=58.86kg

A=16.6X1.25=20.625mm^2

y=1.25/2=0.625mm

I=(bd^3/12)=2.685mm^4

b=16.5mm

stress=$\frac{FAy}{Ib}$

stress=17.12 MPa

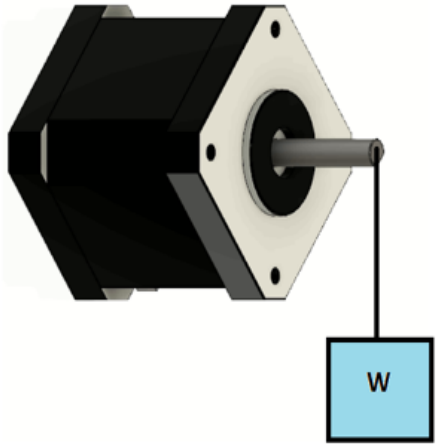
Tensile strength of Brass is between 124-310 MPa

Shear strength = $\frac{124}{1.73}$ =71.67MPa

As permissible stress is more than design stress hence design is safe.

3. STEPPER MOTOR

STEPPER MOTOR CALCULATIONS



W=6kg

F=6X9.81=58.86N

Radius of pulley = 25mm

=0.025m

Torque = FXR =58.86X0.025

=1.4715N-m

We are using NEMA 17 as our motor torque provided by it is 3.2kg-cm

Which after conversion is equal to 3.13 N-m

This torque is greater than our design torque and closer to it.

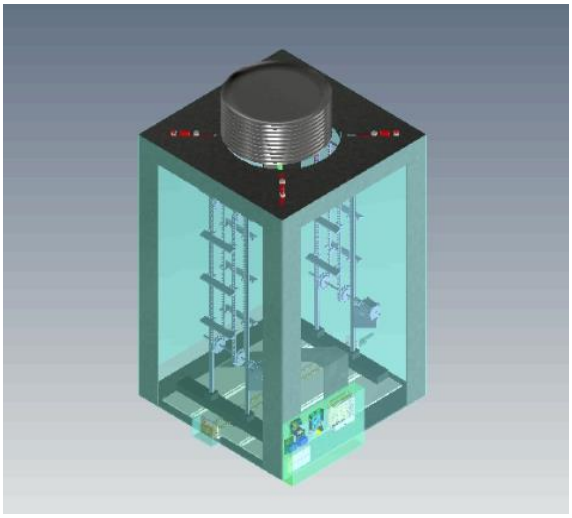
FINAL SPECIFICATIONS OF STEPPER MOTOR (NEMA 17)

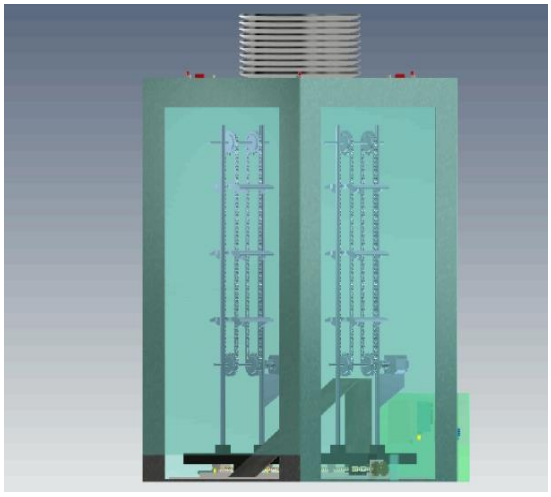
1. Torque=3.13 N-m
2. Draws 1.2A at 4V
3. Power supply between 18V to 30V DC

5.6 BILL OF MATERIAL

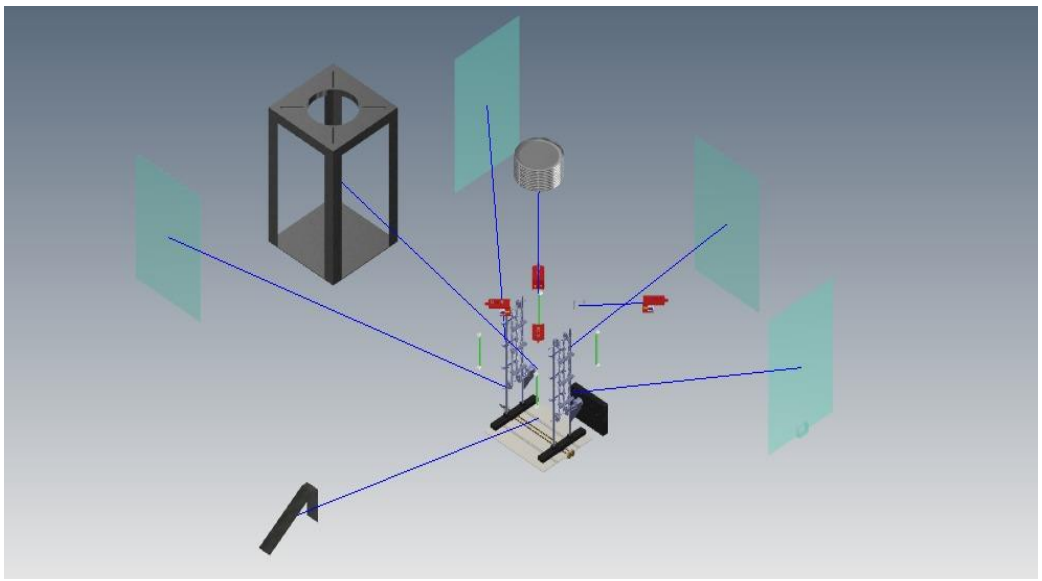
Sl.No	Part No.	Part Name	Quantity	Material specification
1	1	Support frame	1	MS steel
2	2	Movable base	1	590X450mm
3	3	Wheels	4	R10
4	4	Wheel base	4	24x8mm
5	5	Lead Screw & Nut	2	P=2mm L=600mm D=8mm
6	6	Stepper motor	2	Torque= 3.13 Nm 1.2A at 4V
7	7	Coupler	2	25x20x20mm
8	8	Sprocket	4	Dia= 40mm
9	9	Chain	4	Centre distance=500mm
10	10	Chain Wedge	12	Nylon
11	11	UV Lamp	4	40W
12	12	Solenoid holder	4	ABS plastic
13	13	Solenoid with wedge	8	12V 1A Wedge material=Brass
14	14	M10 Nut & Bolt	4	-

5.7 ASSEMBLY OF MODEL





5.8 EXPLODED VIEW OF MODEL

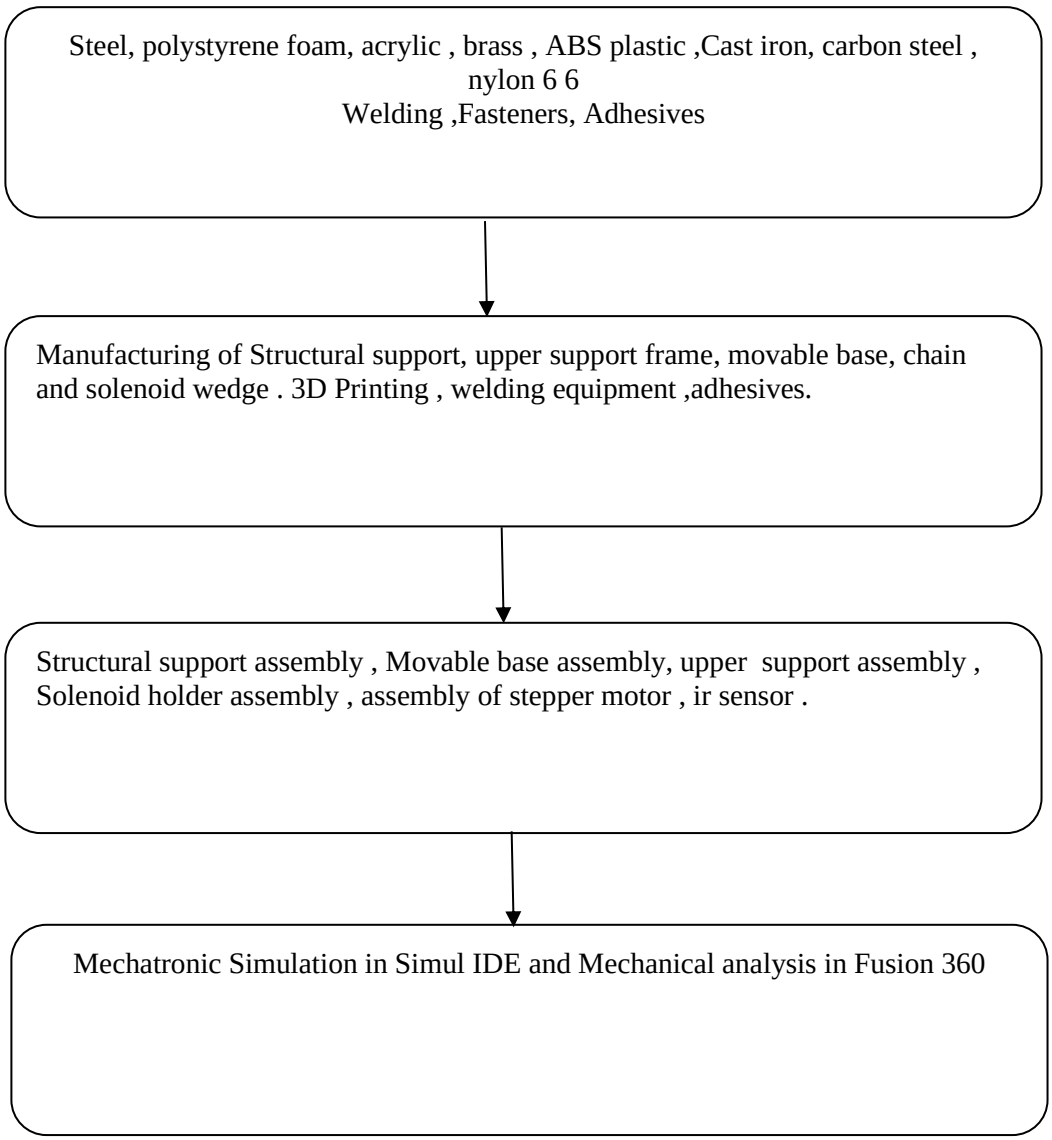


6.3 Joining techniques/ methods:

SL NO	Joining Method	Material to be joined	Resources required and specification
1	Fasteners	Structural Support with solenoid holder	M10 nut and bolt
2	TIG Welding	Structural support assembly made of steel	Welding machine ,tungsten electrode
3	Adhesives	Upper support and movable base	Araldite
4	Fasteners	Chain wedge with chain , Solenoid with solenoid holder	M3 nut and bolt

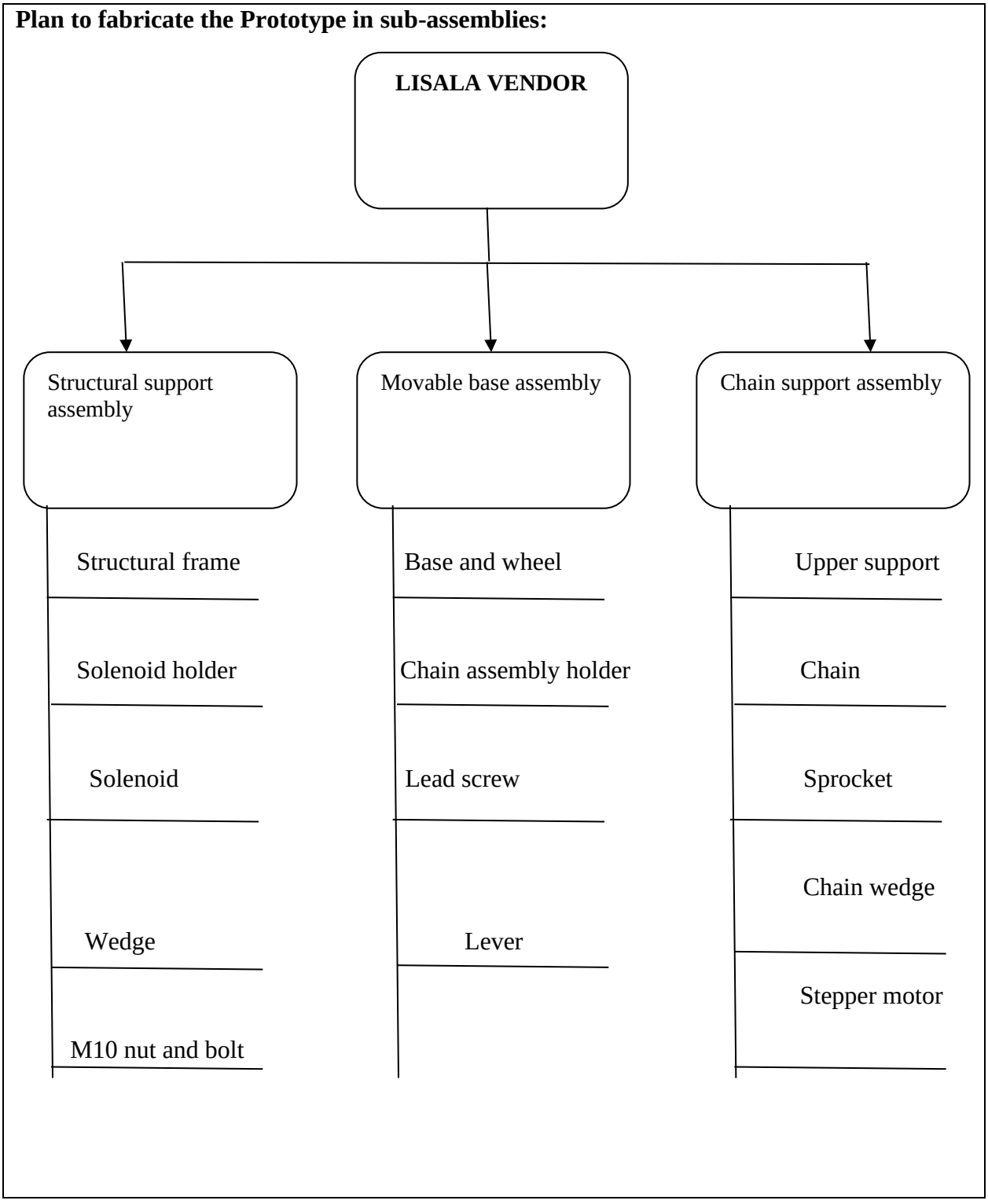
6.4 Flow Chart:

Prepare tentative flow chart of series of operation to be followed for prototyping:



6.5 Sub-Assembly Planning:

Plan to fabricate the Prototype in sub-assemblies:



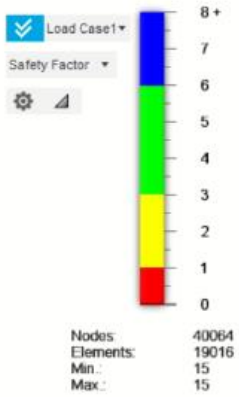
Sub Assembly	**Brought out Parts**	**Manufactured Parts**
Structural support assembly	Steel rods	Solenoid wedge
	Solenoid	Solenoid holder
	Nut and bolts (M10)	-
Movable base assembly	Lead screw and nut	Base
	Lever	Chain assembly holder
	Wheel and wheel base	-
Chain support assembly	Stepper motor	Chain
	Steel rod	Sprocket
	-	Chain wedge

6.6 Material Specification:

MATERIAL SELECTION

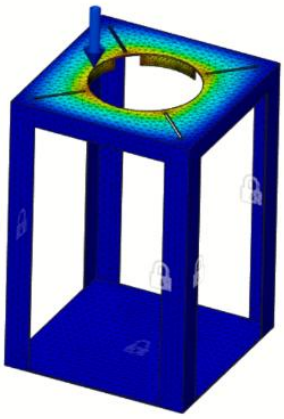
STRUCTURAL SUPPORT – STEEL
CHAIN ASSEMBLY SUPPORT – STEEL
MOVABLE BASE- POLYSTYRENE FOAM
CHAIN ASSEMBLY HOLDERS – ACRYLIC
SOLENOID WEDGE – BRASS
CHAIN WEDGE – ABS Plastic
SOLENOID HOLDER – ACRYLONITRILE–BUTADIENE-STYRENE (ABS Thermoplastic)
SPROCKET – CAST IRON
CHAIN – CARBON STEEL
LEAD SCREW – CARBON STEEL
WHEELS-NYLON 6 6
WHEEL BASE –STEEL
GEARS – CAST IRON

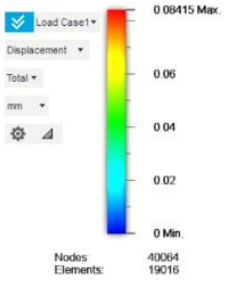
6.7 Finite Element Analysis:

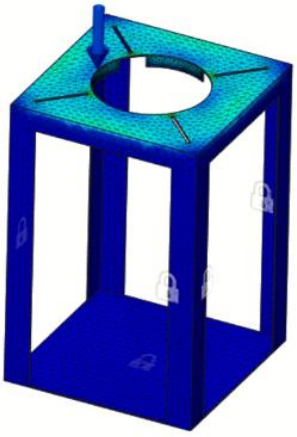


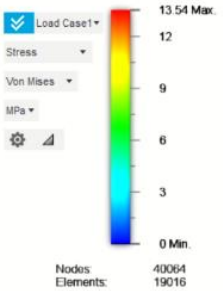
1} STRUCTURAL SUPPORT

- Analysis type : Static structural
- Material type : Steel
- Mesh type : Fine mesh
- Nodes – 40064
- Elements - 19016
- Boundary conditions:
- Force – 300N (downwards)
- Fixed supports – Base and side support.
- Result: Since factor of safety is 15MPa, the design is safe.



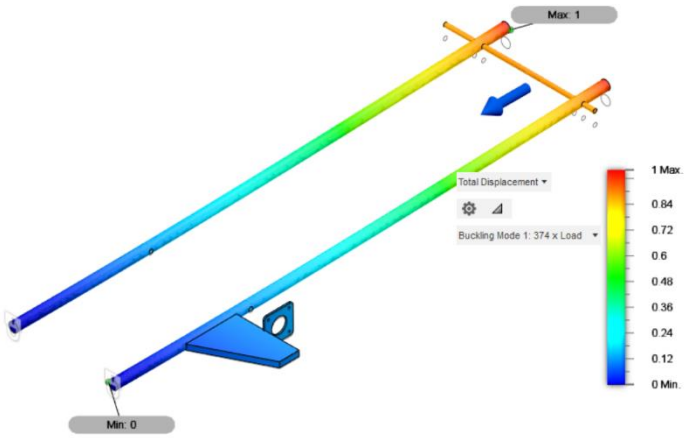






2. Chain Assembly Support:

- Analysis type: Structural buckling
- Material type: Steel
- Mesh type: Fine mesh
- Nodes: 28920
- Elements: 16233
- Boundary conditions:
- Force :10 N (downwards)
- Fixed supports – Base and side support.
- Result: Since it buckles only 1mm,
- the design is safe.



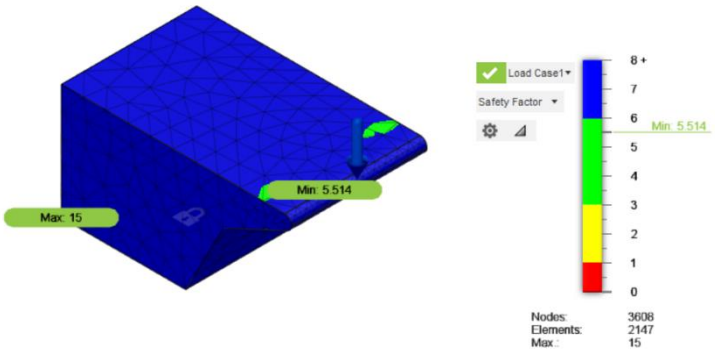
- **SOLENOID WEDGE**
  - **Analysis type: Static Structural**
  - **Material Type: Brass**
  - **Mesh type: Fine mesh**
  - **Nodes: 3608**
  - **Elements: 2147**
  - **Boundary conditions:**

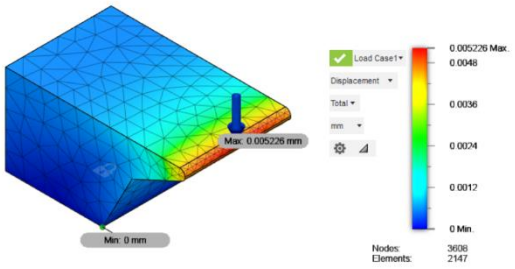
1. Force: 60N (downwards)

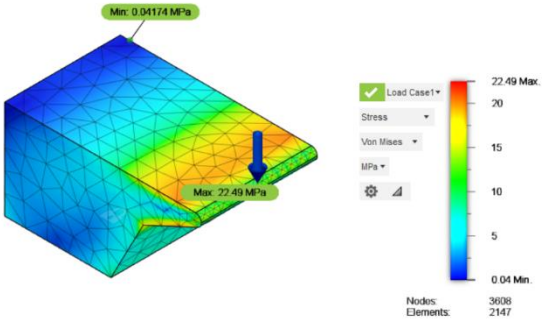
2. Fixed: Bottom side

- **Result: Since the minimum**

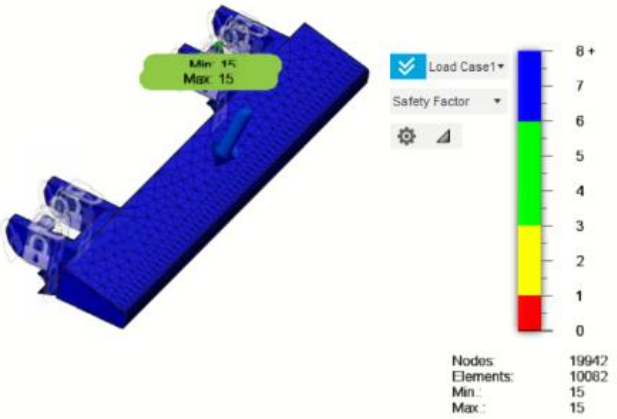
Factor of safety is 5.514MPa, the design is safe.







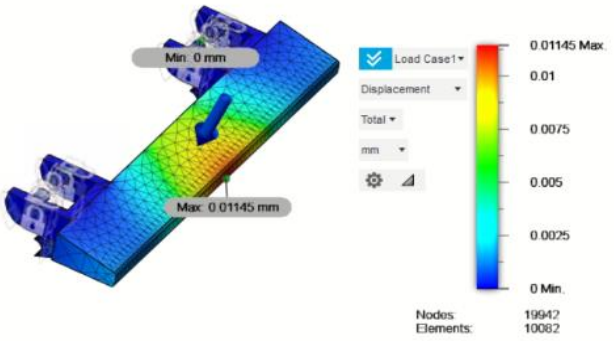
- **CHAIN WEDGE**

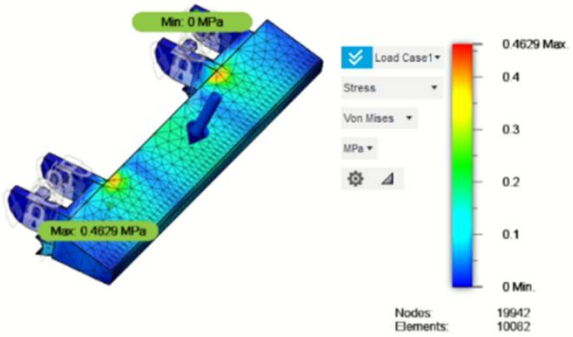


- **Analysis type : Static Structural**
- **Material type : ABS plastic**
- **Mesh type : Fine mesh**
- **Nodes :19942**
- **Elements:10082**
- **Boundary Conditions:**

1. **Force: 20N(downwards)**
2. **Fixed supports : chain holder attachment**

- **Result : Since deformation is minimal, the design is safe**

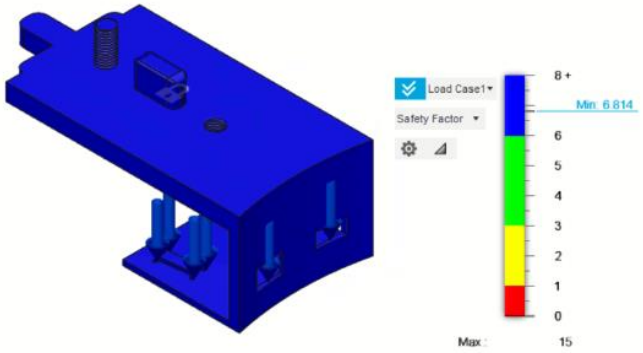


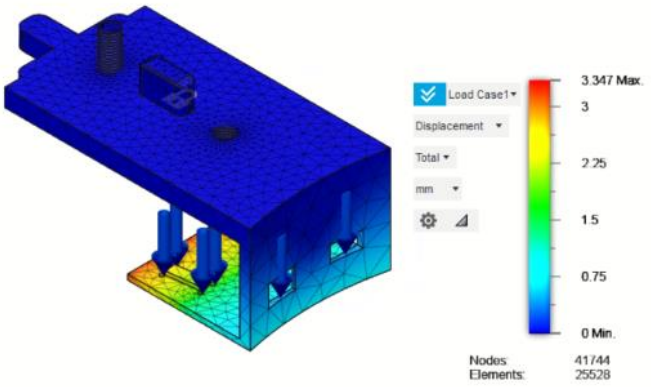


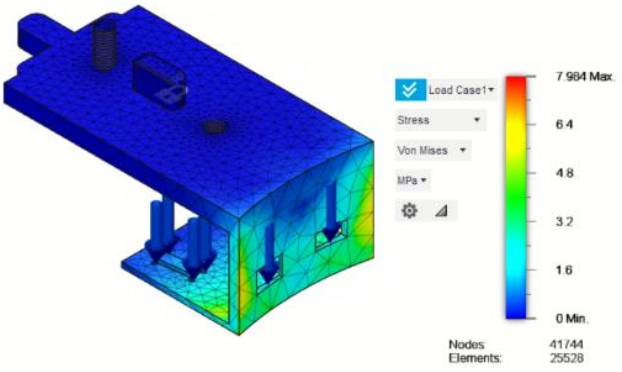
- **SOLENOID HOLDER**
  - **Analysis type: Static structural**
  - **Material type: ABS Plastic**
  - **Mesh type: Fine mesh**
  - **Nodes: 41744**
  - **Elements:25528**
  - **Boundary Conditions:**

1. **Force: 25(downwards)**
2. **Fixed supports: Upper face of the holder**

- **Result: Since minimum FOS is 6.814 MPa and deformation is under limits, the design is safe**



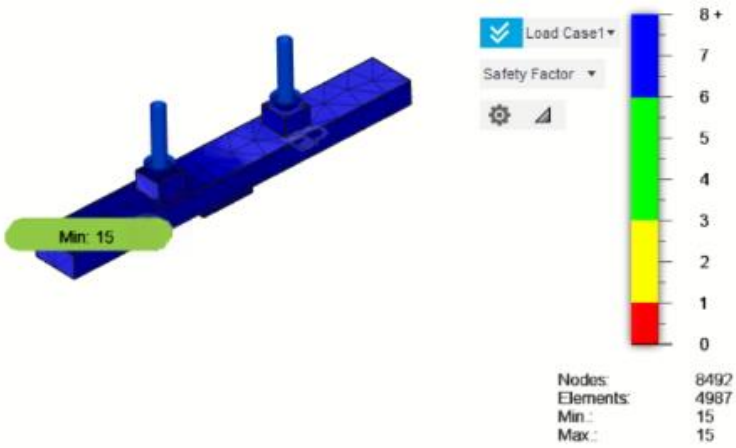


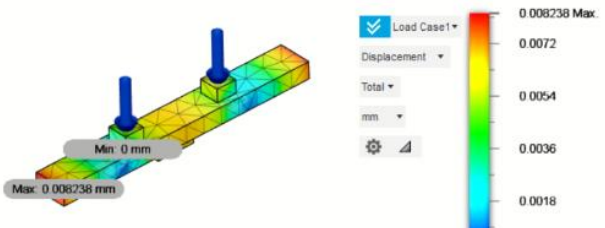


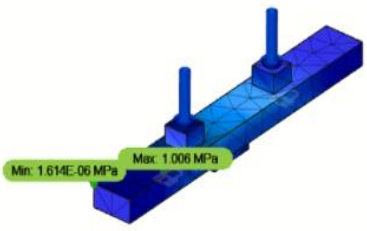
- **CHAIN ASSEMBLY HOLDER**
  - **Analysis type: Static structural**
  - **Material type: ACRYLIC**
  - **Mesh type: Fine mesh**
  - **Nodes: 8492**
  - **Elements:4987**
  - **Boundary Conditions:**

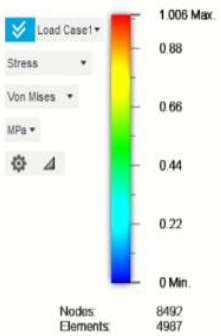
1. **Force: 60N (downwards)**
2. **Fixed supports: Wheel attachment slot**

- **Result: Deformation is under safe limits, the design is safe**





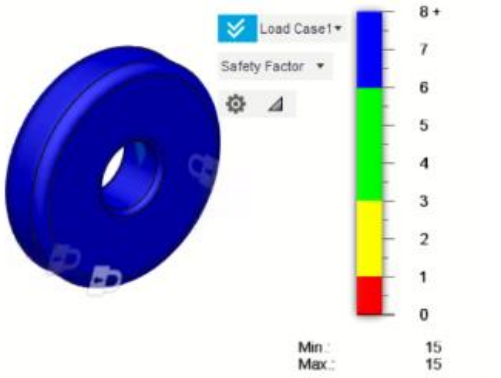


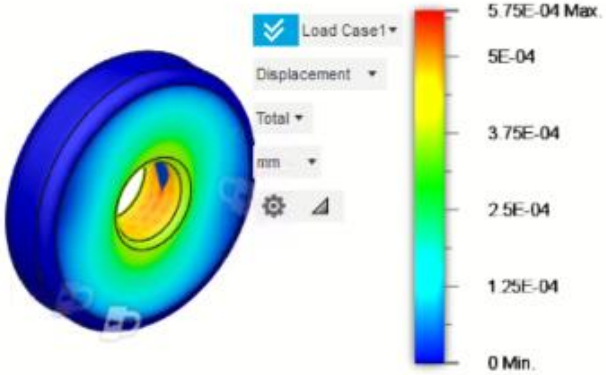


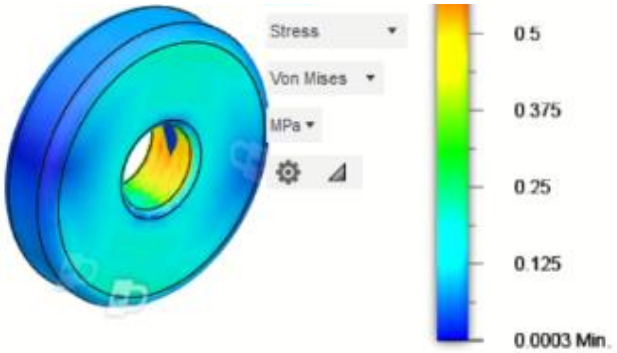
- **WHEEL**
  - **Analysis type : Static structural**
  - **Material type : NYLON 6 6**
  - **Mesh type : Fine mesh**
  - **Nodes:6948**
  - **Elements:4178**
  - **Boundary Conditions:**

1. **Force: 25 (downwards)**
2. **Fixed supports : circumference of the wheel**

- **Result : Deformation is under safe limits, the design is safe.**



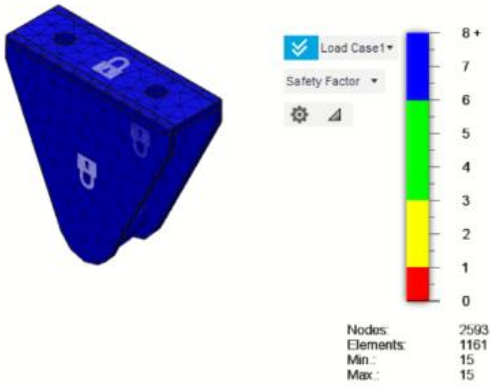


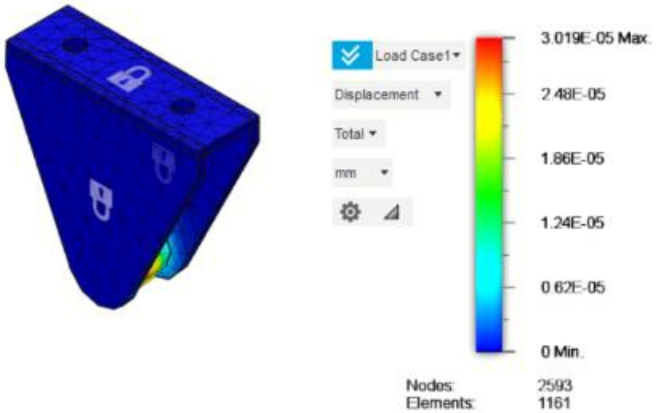


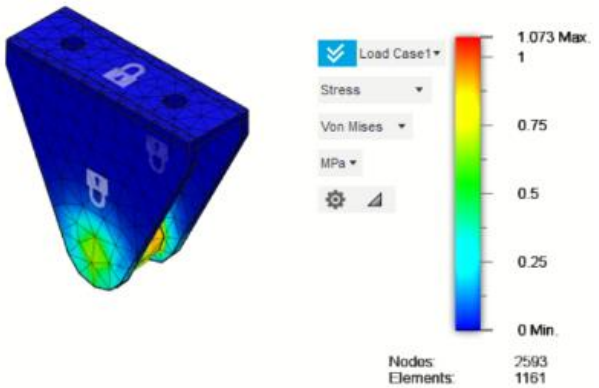
- **WHEEL BASE**
  - **Analysis type : Static structural**
  - **Material type : STEEL**
  - **Mesh type : Fine mesh**
  - **Nodes : 2593**
  - **Elements:1161**
  - **Boundary Conditions:**

1. **Force: 25 N(downwards)**
2. **Fixed supports : Body of the face**

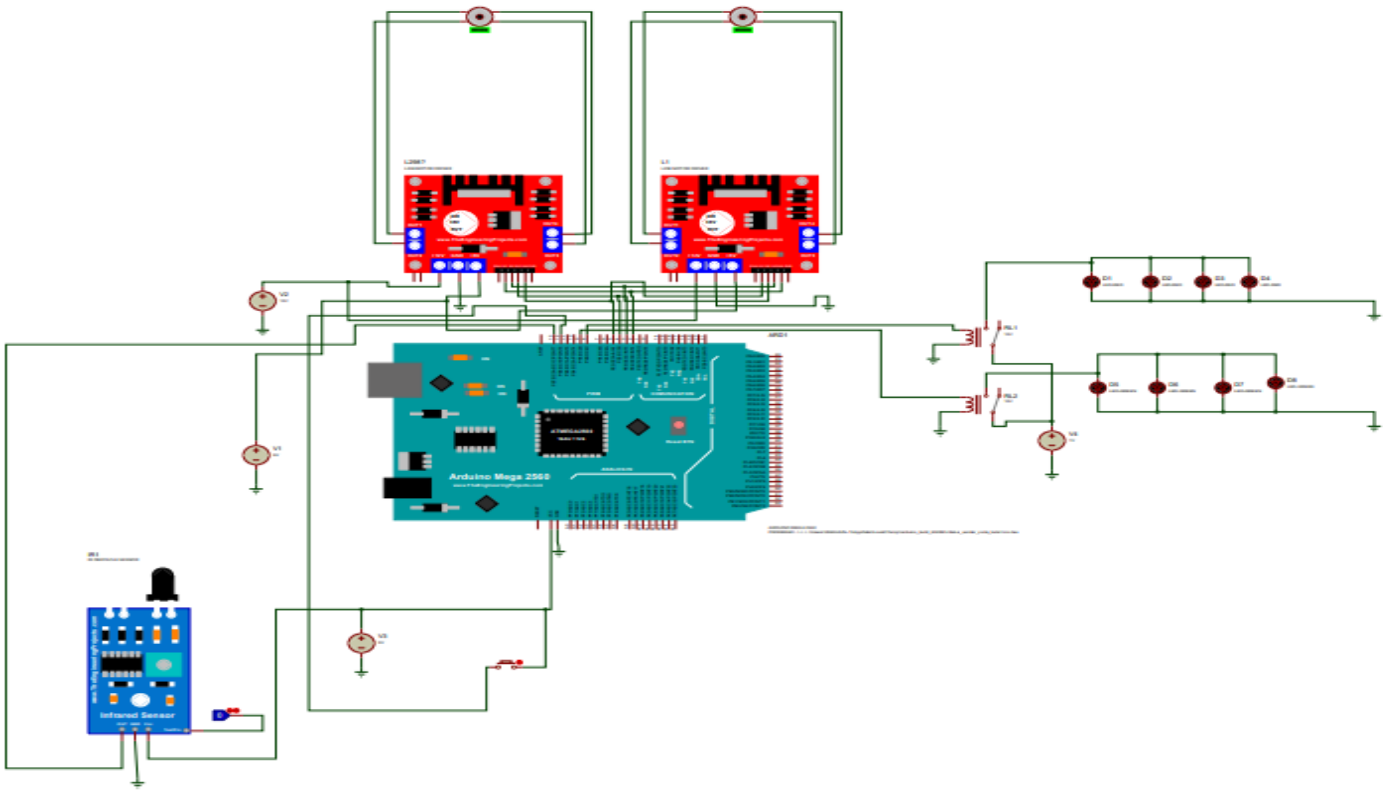
- **Result : Deformation is under safe limits, the design is safe.**







7.1 Electrical Circuit:



7.2 Electrical Circuit Simulation:

https://drive.google.com/file/d/1vwhBN_R6cKR8vMDqzDt_bKE1oSC1OCJI/view?usp=sharing

- Arduino Mega 2560 is used as microcontroller for our project, where it connected to stepper motors (Nema – 17) via L298n driver and made connections are made as per above diagram.
- Solenoids system is connected via two relays for each set (of 4) to the microcontroller. These two are the outputs from the microcontroller in our project
- We have two inputs for our microcontroller that is mainly
  - Push button for initialisation of the device (Operator)
  - IR sensor for dispensing (one plate at a time) for customer

- We have used SimulIDE for our electrical circuit simulation

- **Working Simulation:**

  https://drive.google.com/file/d/1wpFRQuYGNs0UyY9M0Uk8ST_Y6mfp0g_K/view?usp=sharing

8.1 Results and Conclusions:

- From finite elemental analysis our design is safe.
- The part models were designed and assembled with appropriate dimensions.
- The program for mechatronic subsystem of the project worked effectively in the software.
- Working of the model was animated using Fusion 360.
- We conclude that we have improved CAE/CAD design skills exponentially and could able to design model within constraints. Also learnt to work under collaboration in a team remotely. We were able to complete the project within given time by efficiently managing the project. We have improved software skills in Autodesk Fusion 360, Inventor Professional, Proteus, Simul IDE.

8.2 Future Scope:

Our product has the potential to be develop as one of the leading innovations as health and hygiene unit especially where the buffets system of the food service is used.

9. Product Catalogue:

WORKING VIEW

Operating Instructions:

1. Set the machine according to the size of the plates (refer tutorial).
2. Power ON the machine.
3. Place the stack of plates.
4. Press the initializer, ONLY ONCE (Red button behind the machine).
5. Wait for few seconds while the plates are separated and sanitized inside the machine
6. Wave your hand below the sensor in front to get a sanitized plate. (For customers).
7. USES UV LIGHT. TAKE SAFETY PRECAUTION WHEN THE MACHINE IS ON.

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LiSaLa VENDOR

UV PLATE SANITIZER AND DISPENSER

School of Mechanical EngineeringKLETECH
KLE Technological University
School of Mechanical Engineering
Minor Project Team C11

Introduction:

The pandemic has made us aware the importance of staying protected and the precautions to be taken to keep ourselves safe major concern at such times in places of large gathering, sanitization plays a pivotal role which can drastically reduce the risk of getting unknowingly infected.
So, we have come up with our product LiSaLa Vendor, your very own plate sanitizer and dispenser.
This device helps you in your day today life in this pandemic especially in hostels, buffets and many more situations where you face risk of getting infected by microbes from the plate you eat.

Background:

This innovation was inspired by the ongoing pandemic situations of Covid – 19 where people had the risk of getting infected by the plates which are kept exposed. Our product stores, sanitizes and dispenses single plate at a time.

Features:

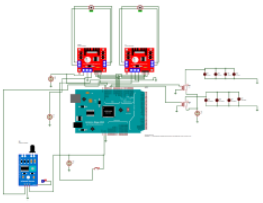
- Operates for range of plates sizing from (10–14-inch diameter plates)
- Self-separates the stack of plates reducing the work of user
- Can handle up to 30kgs of plates
- Stores, sanitizes and dispenses plates

Product Specifications:

- Four 40W UV Lamps used
- Dimension 600X600X900mm
- Steel Body frame
- Handles 30kg load
- Nema-17 stepper motor- 1.2A at 4V, 3.13Nm torque
- Push-pull solenoid - 12V 1A
- Arduino Mega2560
- IR sensor

3D Models:

CIRCUIT DIAGRAM:



Mechanism:

- Lead Screw: The lead screws are rotated by a combination of gears upon which a nut holding upper support holder provides adjustments for plate size.
- Chain drive: Used in upper support as conveyer to carry the separated plates.
- Push – pull solenoids: Uses combination of motions to separate the plates