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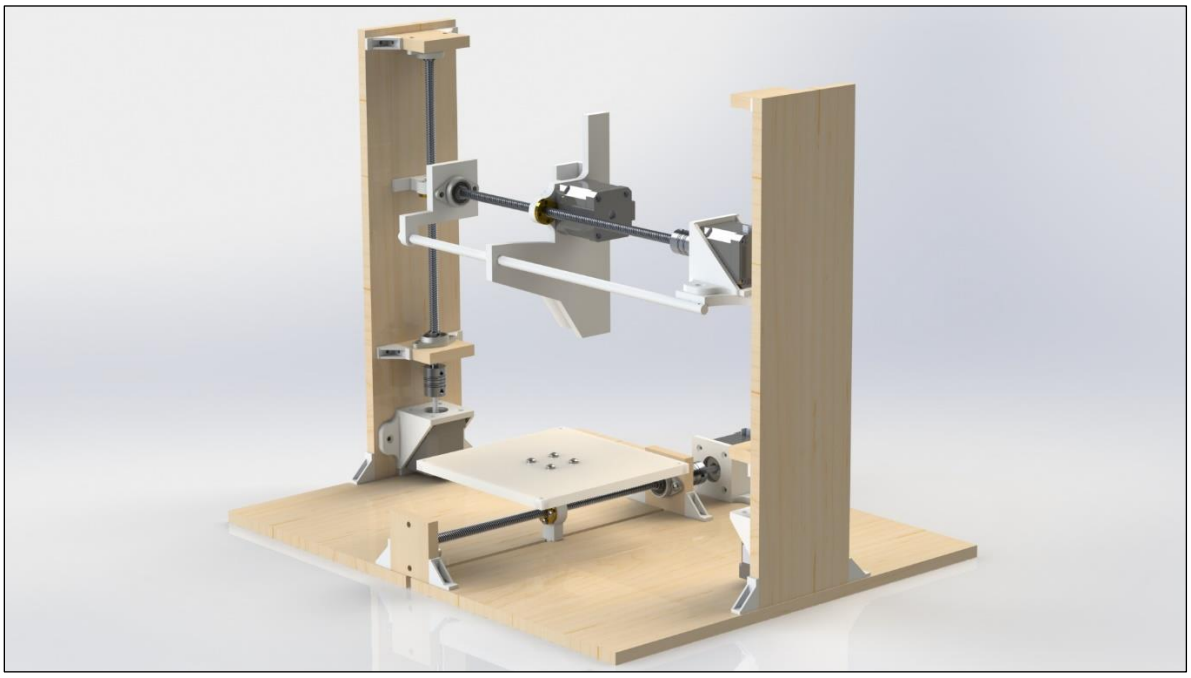
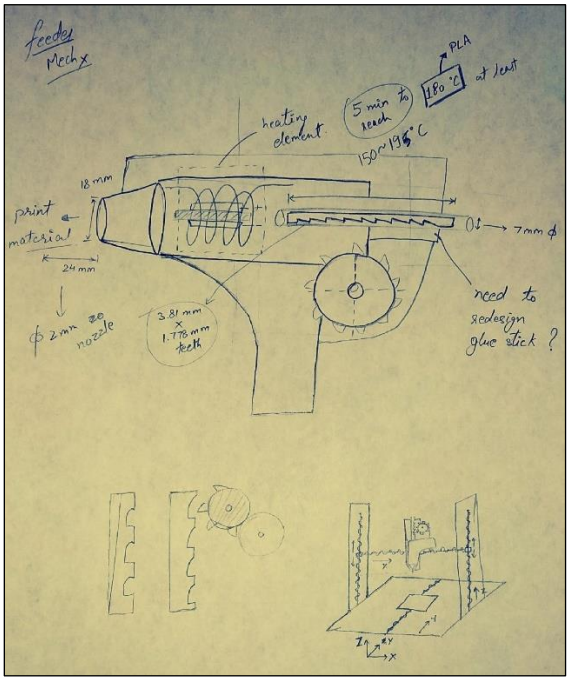
Dear Hiring Officer(s),
Please find some examples of my design works & product optimization projects in this document.

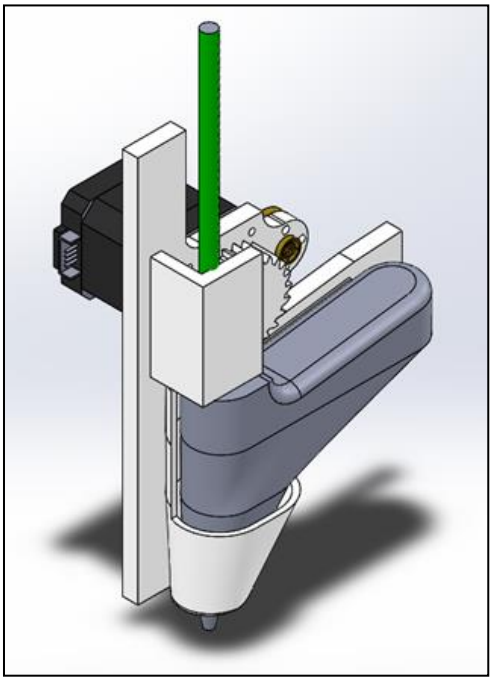
Project 1:



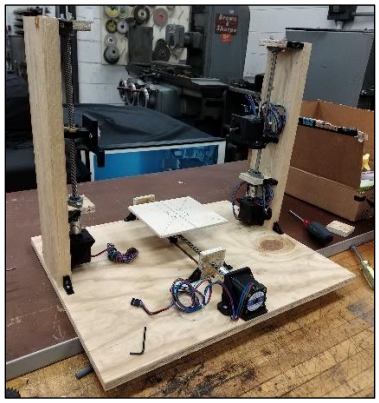
- **Name**: Designing of Swappable Modular 3D Printer.
- **Vision**: our concept was to use a modular handheld glue gun as a computer-controlled 3D printer.
- **My Role**: Project Team Leader
- **Team**: 3 people (Myself, Byron Mui and Bhanu Pratap Tomar)
- **Cost**: $125 (mostly spend on electronics)
- **Summary**:
  We took this project from conceptualization of a glue-gun based 3D printer to an actual fabricated working model. This project had many challenges which we were able to resolve promptly such as feeding mechanism, designing custom glue-gun mount, cost-constraints. The figure below shows the tested glue-stick with teeth, commercial glue-gun and its 3d scanned model, from the left, as:

Our initial vector sketch of the concept looked something like this and next to it is the SolidWorks model of the custom glue-gun mount shown below as:

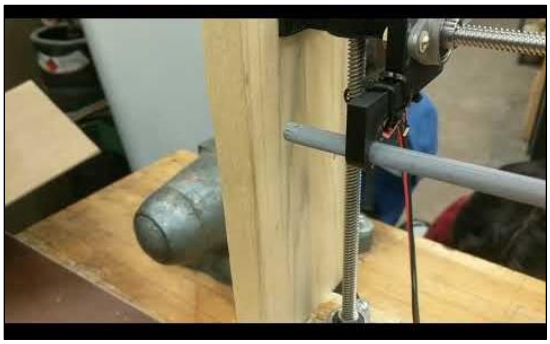




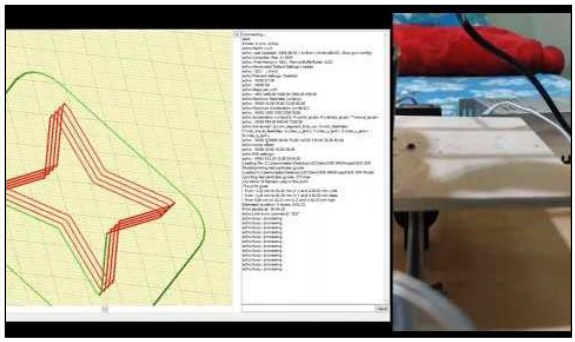
In below section from the left is, myself fabricating the frame for the numeric control of the 3D - glue-gun printer, our final fabricated frame and our 3D glue-gun printed 4-pointed star.



Also, we have some of the project outcomes covered as in form of a video report that can be viewed below or on YouTube as:

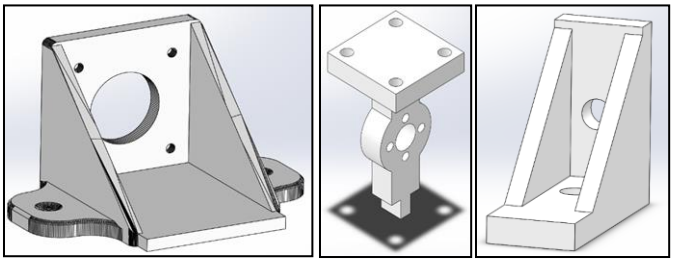


Video 1 Link



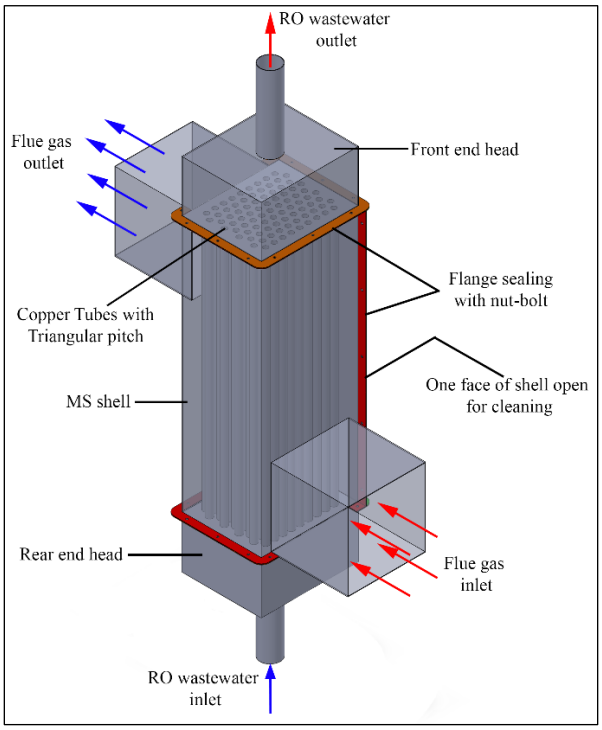
Video 2 Link

Some other 3D printed fixtures made during our project to assist in holding the nema stepper motor and guiding the printing bed are shown below:



Full report can be found here: Link

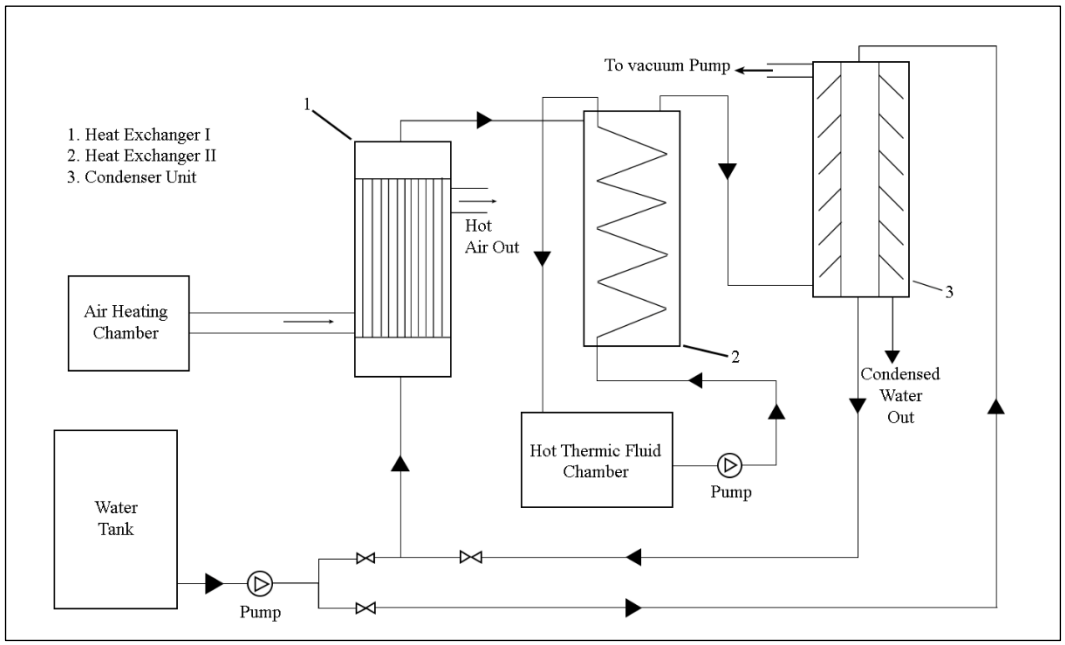
Project 2:



- **Name**: Multi-stage evaporator and condenser unit for water recovery.
- **My Role**: Research Scholar (Product Designing, Mathematical Heat Exchanger calculations, Generating Fabrication Drawing Sheets ISO)
- **Team**: 2 people (Myself, and guide professor, Dr. Basant Singh Sikarwar)
- **Summary**:
  Tex Corporation Limited is a textile company in Gurugram, India. They use the RO system for producing water for dying process. In this process, they produce 10,000-liter RO-wastage water. They cannot dispose this water because it pollutes ground water. In this context, the Amity Research Team has designed and fabricated a multi-effect evaporator and condenser system to recover clean water from RO wastage with following constraints:
  a) Using only the wastage of heat from hot flue gases and thermic fluid from heating system.

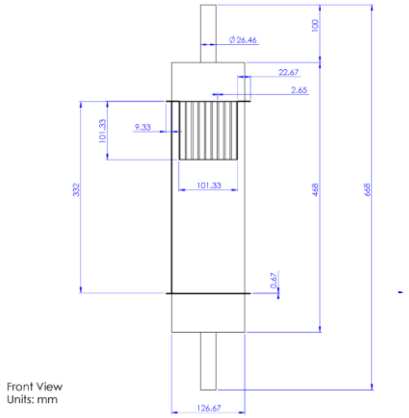
b) Recover 90% water from the available RO wastewater.
c) Design and fabricate a cost-effective system.
d) Systems should be durable and efficient.

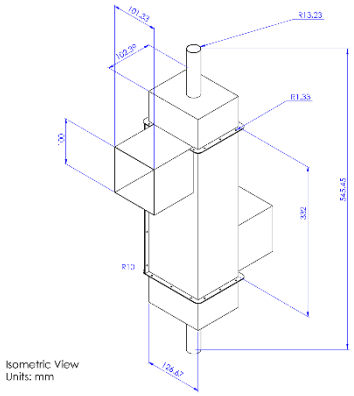
A schematic diagram of the initial concept was drafted as shown in below figure:

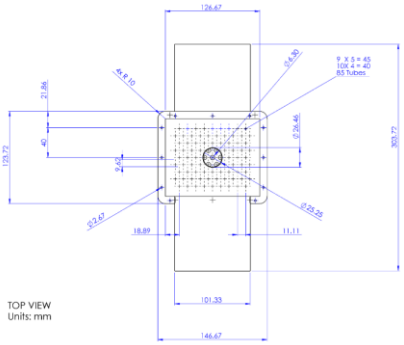


Creation of drawing sheets for preliminary prototype fabrication are made as:

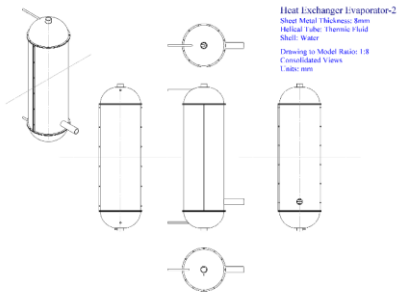
Heat Exchanger – 1: overall heat transfer coefficient of water (outside) and thermic fluid (inside): **110 W/m^{2}K using CFD Analysis (counter flow)**

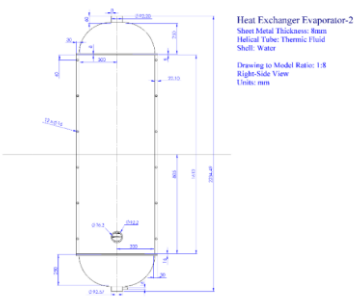


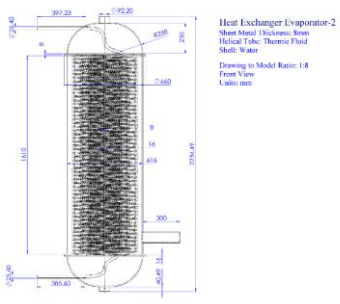




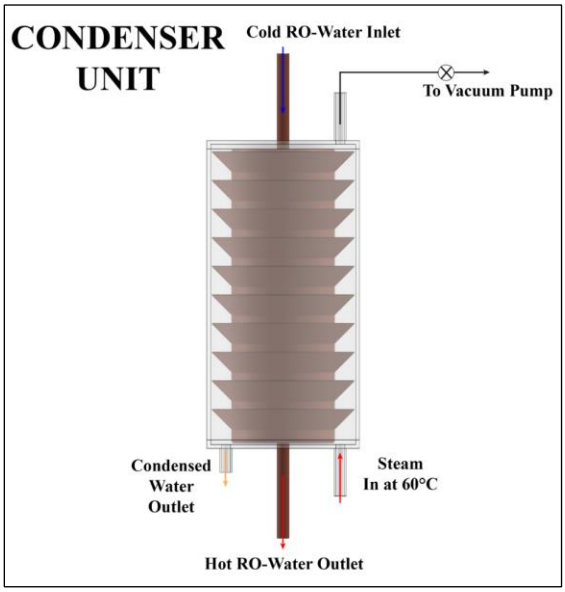
Heat Exchanger – 2:

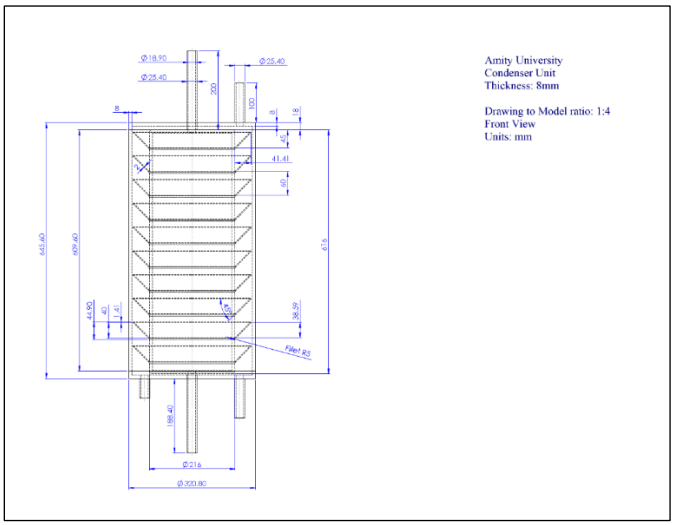




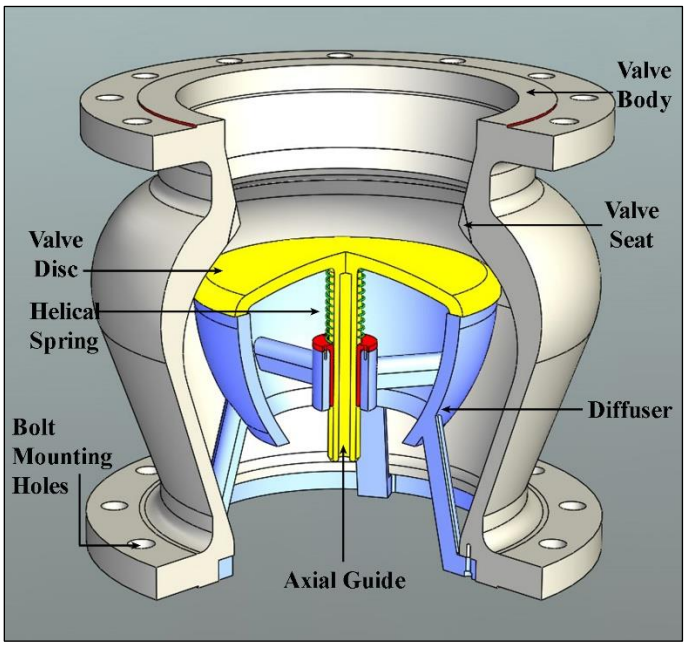


Condenser Unit:

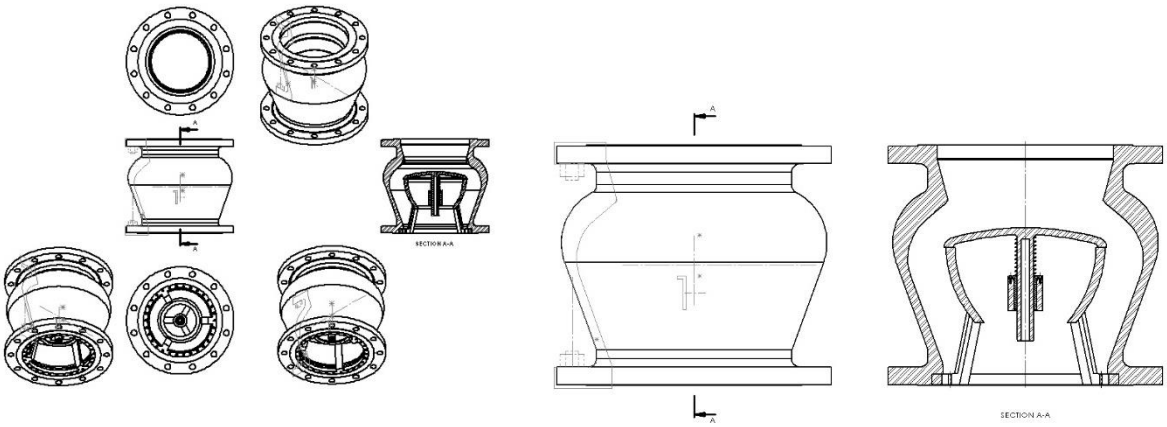




Project 3:



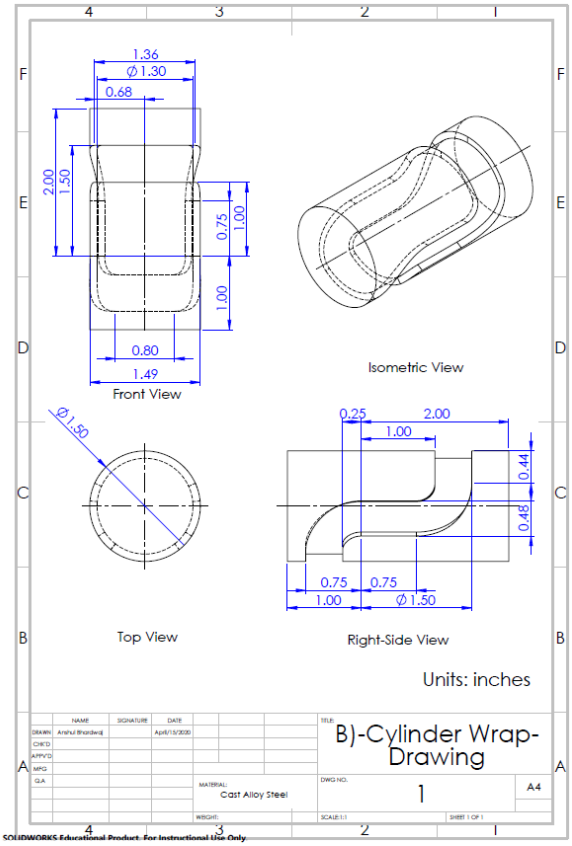
- **Name**: Optimization of Nozzle Check Valve Performance.
- **My Role**: Research Scholar (Product/Nozzle Designing, Numerical Simulation)
- **Team**: 2 people (Myself, and guide professor, Dr. Basant Singh Sikarwar)
- **Summary**:
  Conducted iterative FVM based numerical simulation study of the Nozzle Check Valve to observe the throughput and surface drag at the valve disc. Optimized the valve seat and valve disc profile based on the analysis and the finally design has the 6.2% valve performance increment.

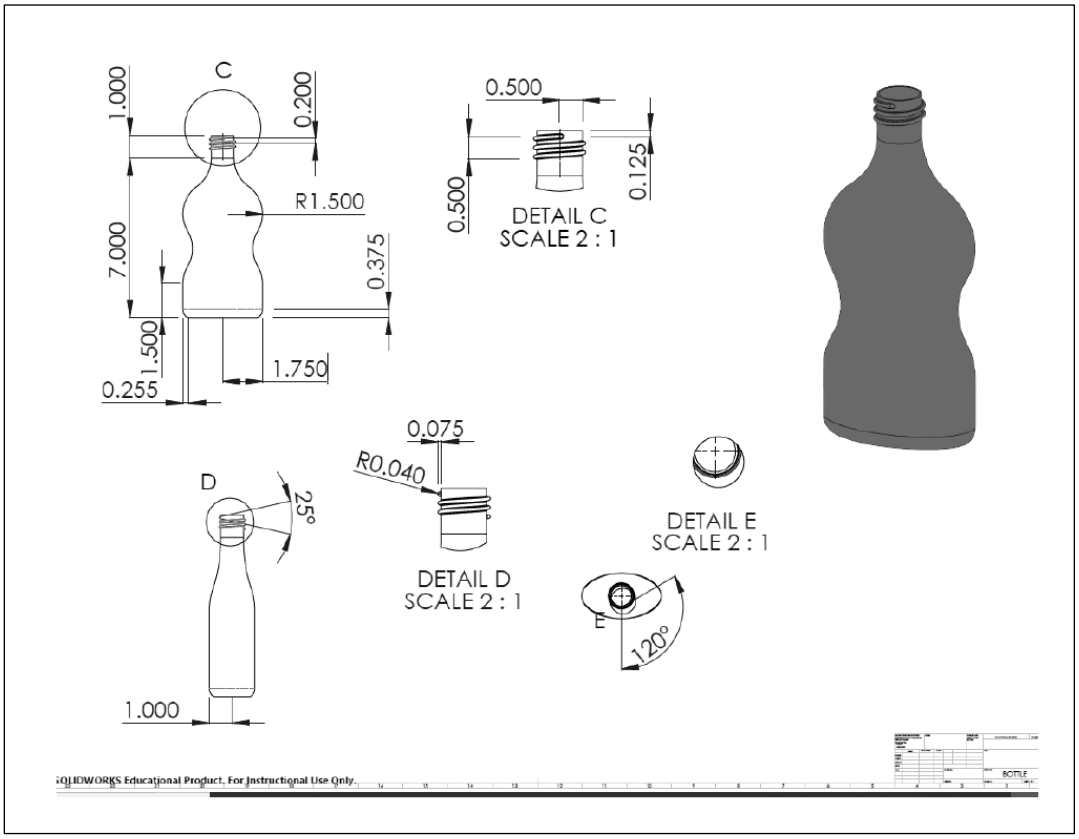


Problem 4:

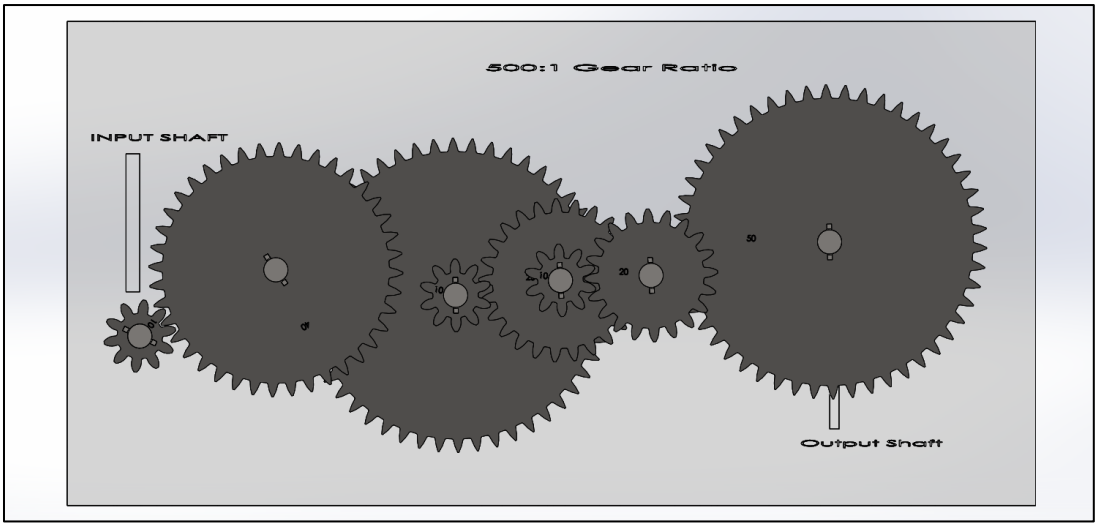
https://youtu.be/fn7ldlisl30

- **Name**: Precision Gearbox Assembly.
- **My Role**: Graduate Student
- **Summary**:
  This project was a part of my spring 2020 semester in which I have to make equation-based design for a gear box assembly. Also, below are some of the other drawing sheets that I have generated during the same coursework as:


1.36
Ø1.30
0.68
2.00
1.50
0.75
1.00
1.00
0.80
1.49
Front View
Isometric View
Ø1.50
Top View
0.25
2.00
1.00
0.44
0.48
0.75
0.75
1.00
Ø1.50
Right-Side View
Units: inches
B)-Cylinder Wrap-Drawing
Cast Alloy Steel
A4
SOLIDWORKS Educational Product. For Instructional Use Only

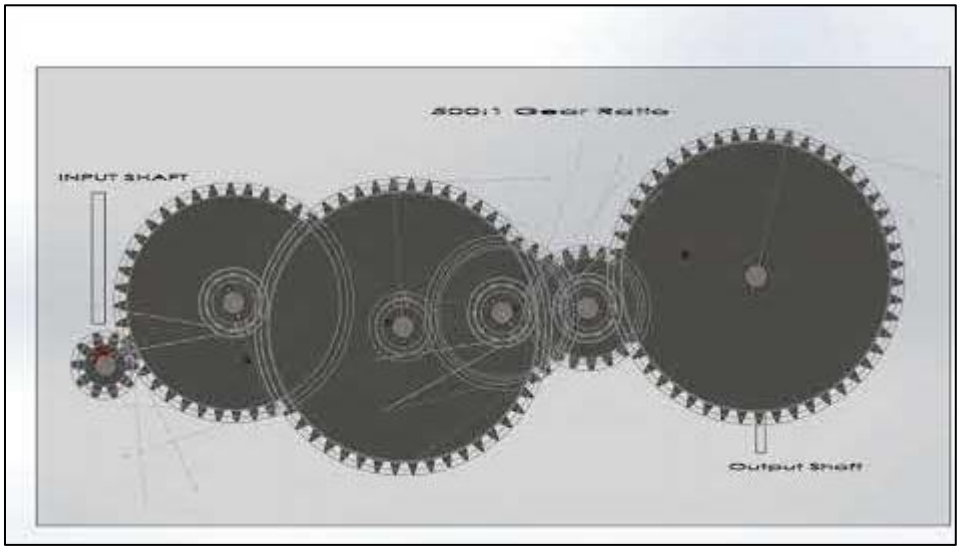

C
1.000
0.200
R1.500
7.000
0.375
1.500
0.255
1.750
0.500
0.500
0.125
DETAIL C
SCALE 2 : 1
0.075
R0.040
DETAIL D
SCALE 2 : 1
DETAIL E
SCALE 2 : 1
D
25°
E
120°
1.000
SOLIDWORKS Educational Product. For Instructional Use Only
BOTTLE

Project 5:



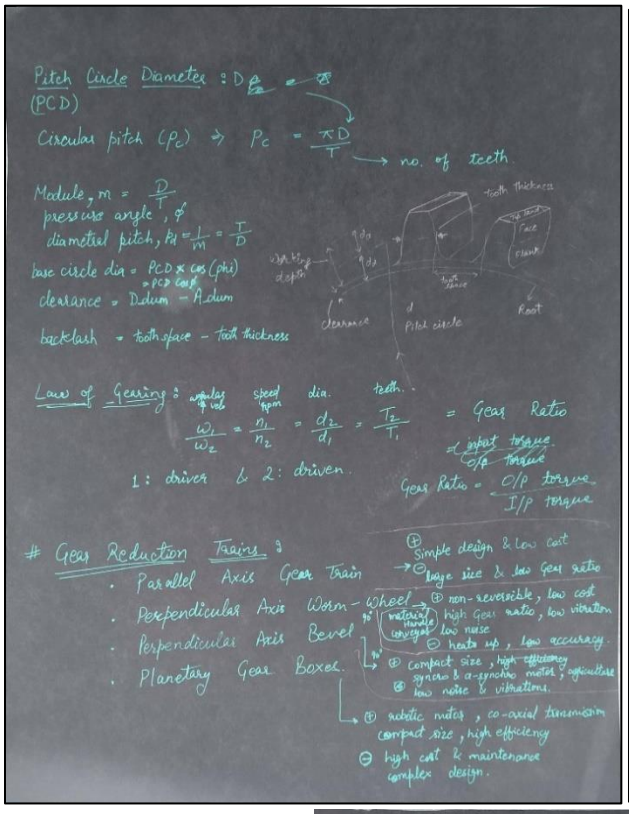
- **Name**: Torque Generator; Spur Gear-Train Step Down 500:1 Gear Ratio
- **My Role**: Personal Project
- **Summary**:

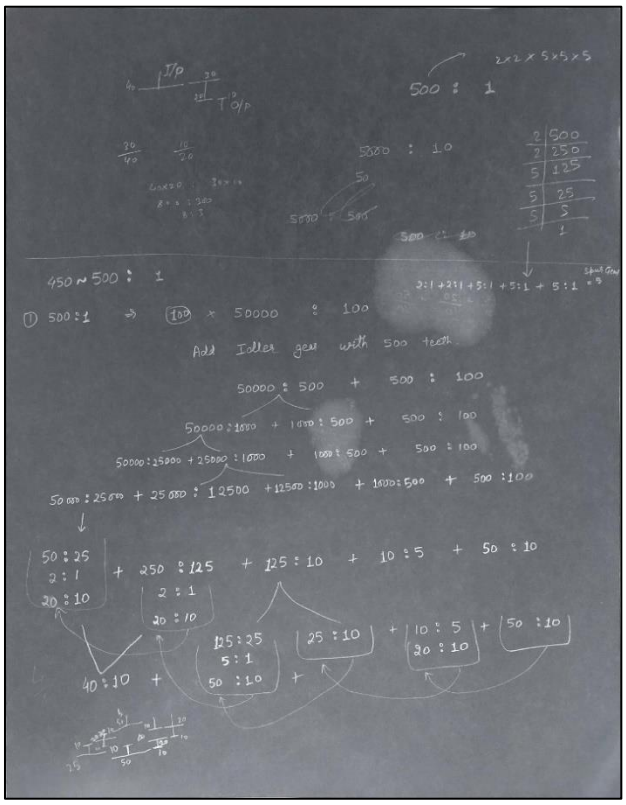
Aim: Gear ratio 500:1 step down using spur gear.
Efficiency: Low
Manufacturability: Easy
Parametric Designing:
Gear ratio needed 500:1.
This gives prime factorization of 500 as 2*2*5*5*5 which means we need 2:1+2:1+5:1+5:1+5:1.
Let's assume minimum and maximum teeth on spur gear to be 10 and 50.
5 spur gear train as: 40:10 * 50:10 * 25:10 * 20:10 * 50:10
Motion Analysis:

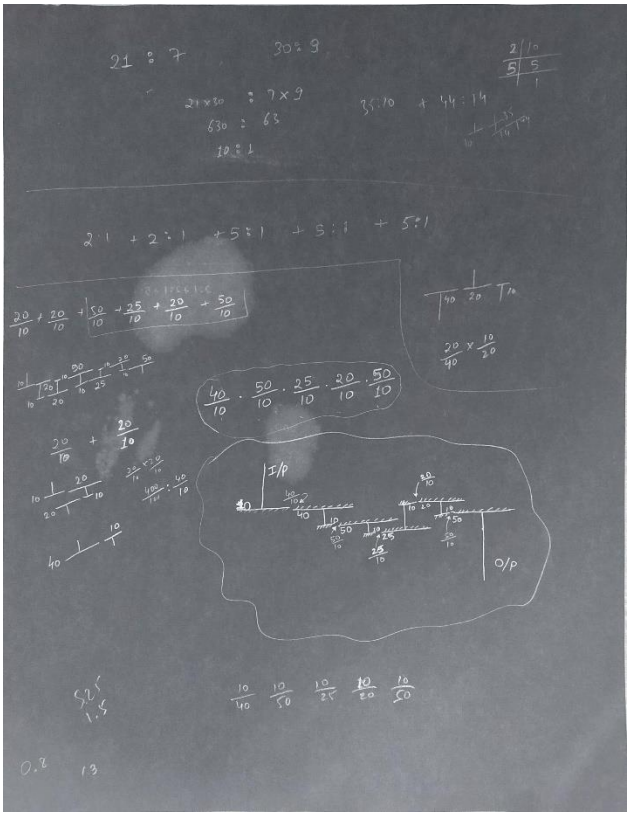


https://youtu.be/ymJuCoP9wsc

Calculation shown here:







Project 6:

- **Name**: Linear Axial Tensile Testing Instrument
- **My role**: Research Specialist, Made for CBRL and MBRB labs.
- **Summary**: Made a design for tensile testing equipment after getting order notice from department. The aim was to create a system that can be used for tensile testing of soft material such as tissues and polymers. Prepared a detailed BOM and prototype. Conducted inspection and validation for the accuracy and reliability of the instrument. After few adjustments, fabricated the final model that is currently being used in lab for tensile testing.

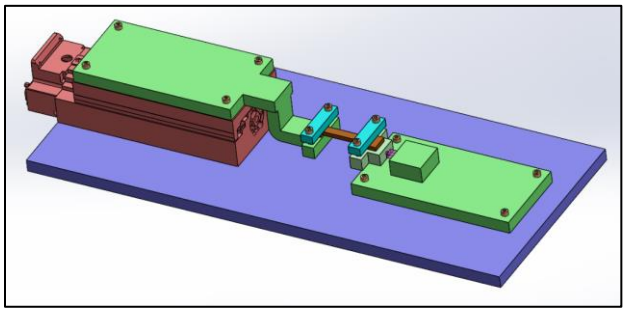
Aim: Design and fabricate tensile testing machine
Efficiency: Medium-High
Manufacturability: Easy
Design Function:

Requirement
Sample Dimensions (general) min./max.
Force response resolution (load cell selection)
Displacement resolution (change in gap) min./max.
Speed precision (feed rate) mm/s or µm/s
Max. sample elongation (mm)

Selection of vendors for linear stage motors:
Build equipment in workshop, Linear Stage Motors ↓
Industries that sells linear stage motor that can be used for tensile testing:

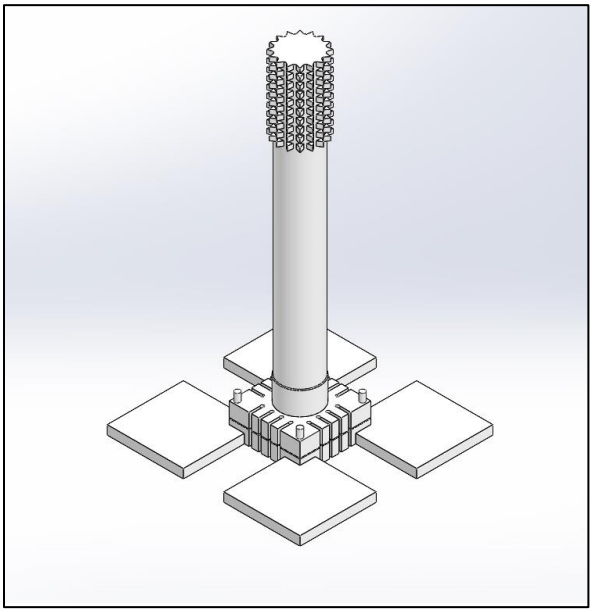
Name	Company	Link
Servo Linear Actuator MAG	Dover Motion	https://dovermotion.com
Ball Screw Linear Actuator – LMB	Dover Motion	https://dovermotion.com
Motorized Linear Stages	Newport	https://www.newport.com
Linear Motion Slide – LM	Dover Motion	https://dovermotion.com
Linear Motion Stage	PI USA	https://www.pi-usa.us

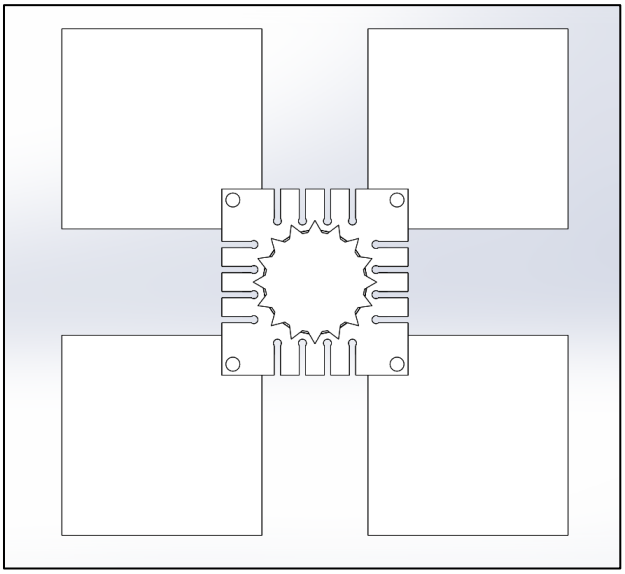
Parametric Designing:

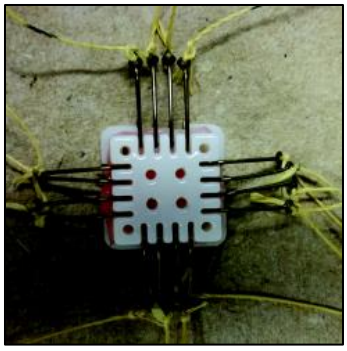


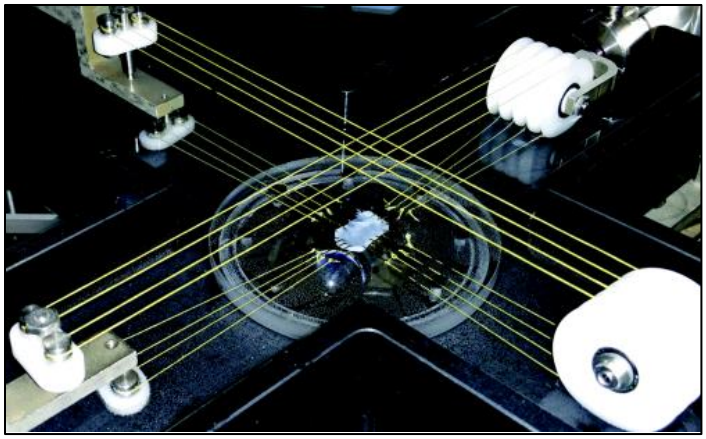
Project 7:

- **Name**: Tissue Suture Sectioning Holder
- **My role**: Research Specialist, Made for CBRL lab.
- **Summary**: A custom fixture that helps in holding soft tissues in place and allow sutures to be mounted easily. This is made in accordance to research project sponsor and objective shown by professor and his research team.



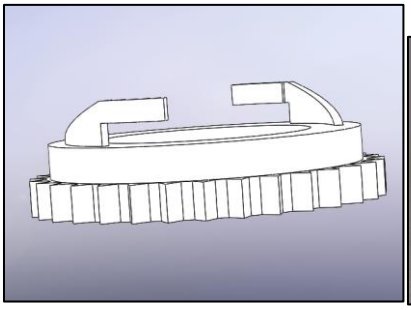


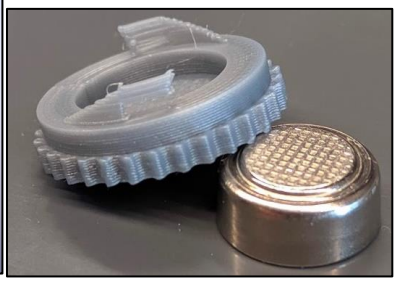




Project 8:

- **Name**: Restoration of Discarded Mitutoyo Digital Indicator
- **My role**: Research Specialist
- **Summary**: Designed a part that can act as the battery enclosure for Mitutoyo digital indicator. The part is fabricated through Dremel 3D printer. This was one of the fastest resolutions to a failed instrument/problem. Fixed the equipment downtime and was up and running within 4 hours of stating working for it.





Project 9:

- **Name**: Restoration of Incubator & UV-Index Solarmeter
- **My role**: Research Specialist
- **Summary**: Conducted maintenance and repair of the laboratory equipment Incubator and UV-Index Solarmeter. The Incubator had a broken tactile switch in the PCB, removed the old and installed the new one with a solder.
  In UV-index Solarmeter the variable resistor failed and needed to be replaced. Both tools are now working as intended.

Incubator:



UV-Index Solarmeter: