

MECHANICAL ENGINEERING PORTFOLIO (Individual Projects)

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Aim: to design and fabricate cell phone stand, with help of software SolidWorks and GrabCAD Print.

Constraints: - One-piece design of cell phone stand, put on flat surface with inclined angle between 65 to 70 degrees.

- Design is limited to a total volume of 2.5 cubic inches of material, with no more than 0.25 cubic inches of support material.

Result: - Designed cell phone stand in one piece, with two inclined angles, 68 degrees and 35 degrees on the other side.

- Designed cell phone stand performing multitask, when one side is used as phone holder, the other side is used as mini-shelf for glasses or snacks.

- Rounded edges are applied everywhere in cell phone stand with safety factors taken into consideration.

- The total model material is estimated as 2.376 cubic inches plus 0.0062 support material, as shown in figure 3.

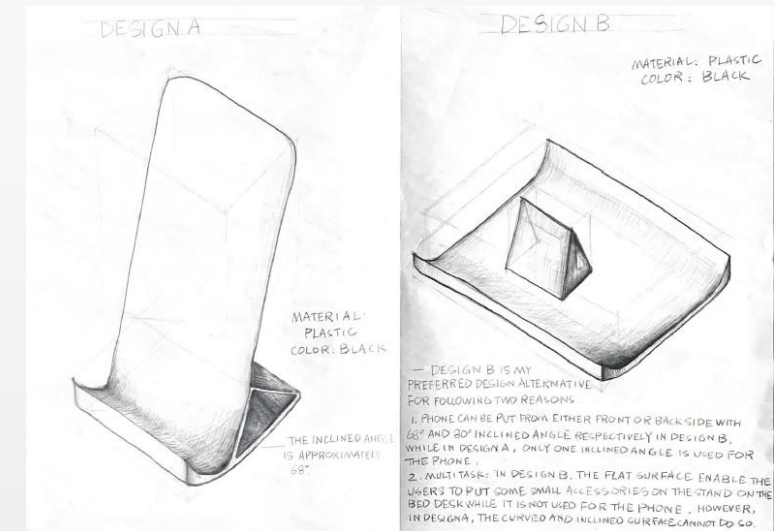


Figure 1: Design plan of phone stand

Tray Estimations		
phone stand	Print Time	1h 13m
	Model Material (in ³)	2.376
	Support Material (in ³)	0.062

Figure 3: material estimation on GrabCAD Print

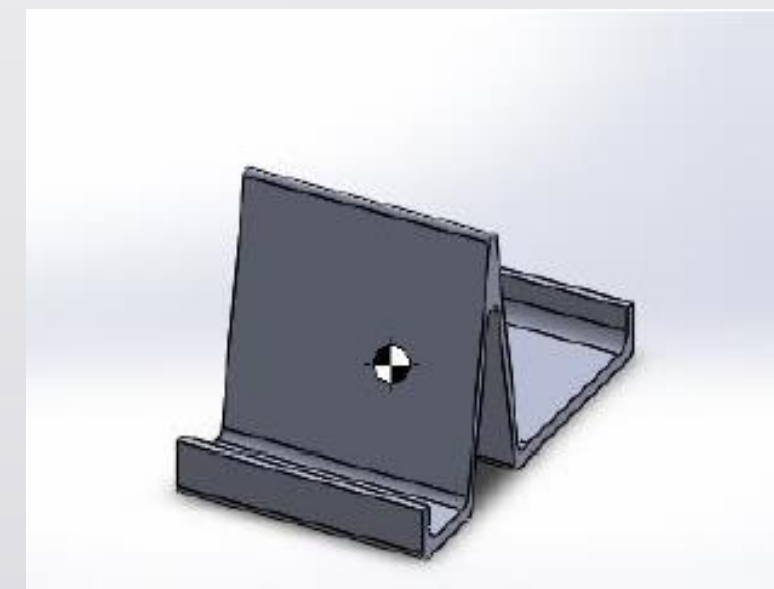


Figure 2: Design of cell phone stand with center mass shown

Design and Fabrication of Cell Phone Stand

Fabrication & Reflection: - Fabrication of cell phone stand reached all constraints from stakeholders and criteria, as well as expectation of appearance, as shown in figure 4.

- Two phones can be put on cell phone stand at same time, as shown in figure 5.



Figure 4: fabrication of cell phone stand



Figure 5: cell phone stand with two phones

Aim: to analyze and reproduce Strandbeest invented by Theo Jansen, a Dutch artist, in software Autodesk Inventor.

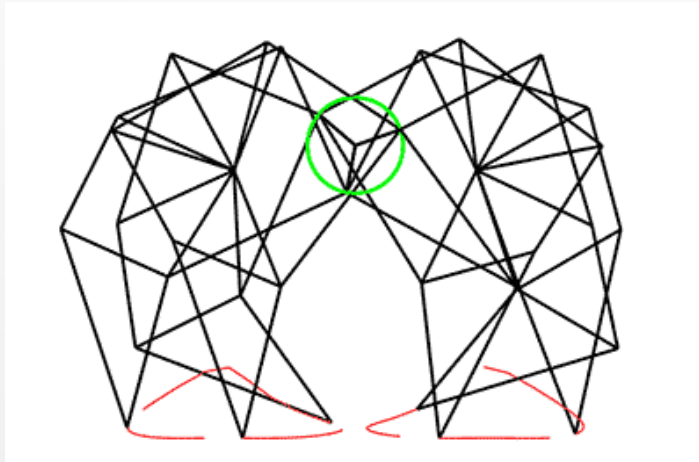


Figure 1: Analysis of Strandbeest Structure

Result: - Inspired by idea of producing New Form of Life that lives upon wind [1].
- Research how Strandbeest is Powered by conservation of Wind Energy to Kinetic Energy.
- Analyze Structure of Strandbeest starting from overall basic structure. Strandbeest is divided into two sides, and sum of turning angles of all legs of each side is calculated to be 360 degrees. When all legs complete one turn, Strandbeest finishes one cycle of movement.

- Figure 1 is example with one side composed of three legs. Thus, turning angle for each leg is calculated to be 120 degrees.

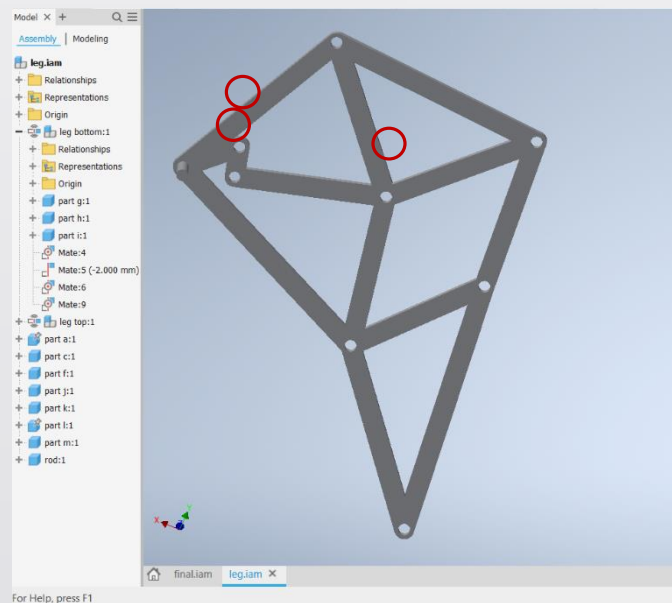


Figure 2: Structure of one Leg

- Figure 2 is reproduction of one leg, in which each component has certain length through calculations. Points in red circles are fixed locations that rest of leg components turn around.
- Overall structure was produced (see figure3), based on one leg structure.

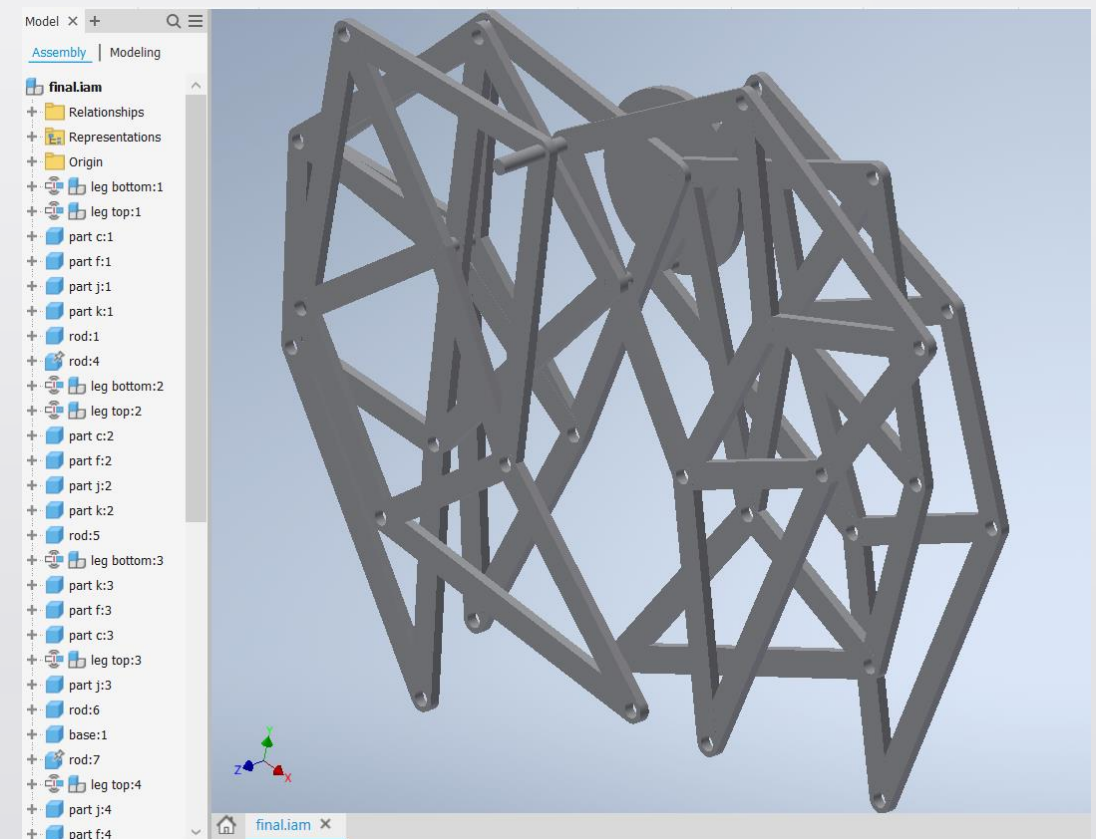


Figure 3: Strandbeest overall structure

Analysis and Reproduction of Strandbeest

Aim: to design and build sprint robot and four-way robot, with help of software Autodesk Inventor and VEX Robotics.

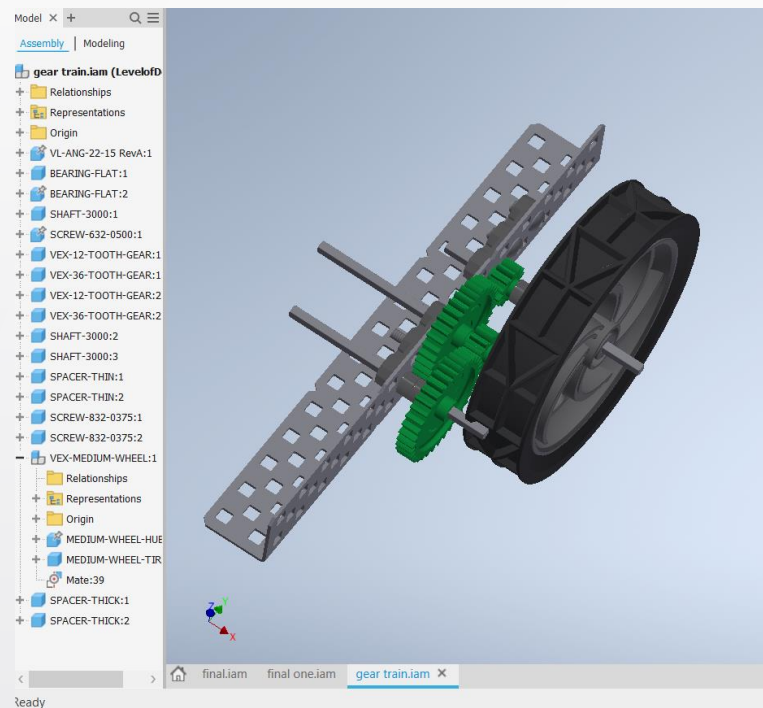


Figure 1: Gear Ratio for Sprint Robot

Result: - Designed gear ratio for Sprint Robot to reach maximum speed within range of acceptable of motor power and allowance of small and medium gears only, as shown in figure 1.

- Achieved champion among 10 competitors in class.

Result: - Designed Four-Way robot with wheels on four sides, to compete in collecting as many plastic cubes as possible, as shown in figure 2.

Analysis: - Each two parallel wheels control one direction, saving time for turning 90 degrees compared to others two-wheel robot.

- The robot is relatively light and moveable so that it has a low resistance of pushing force from other robots.

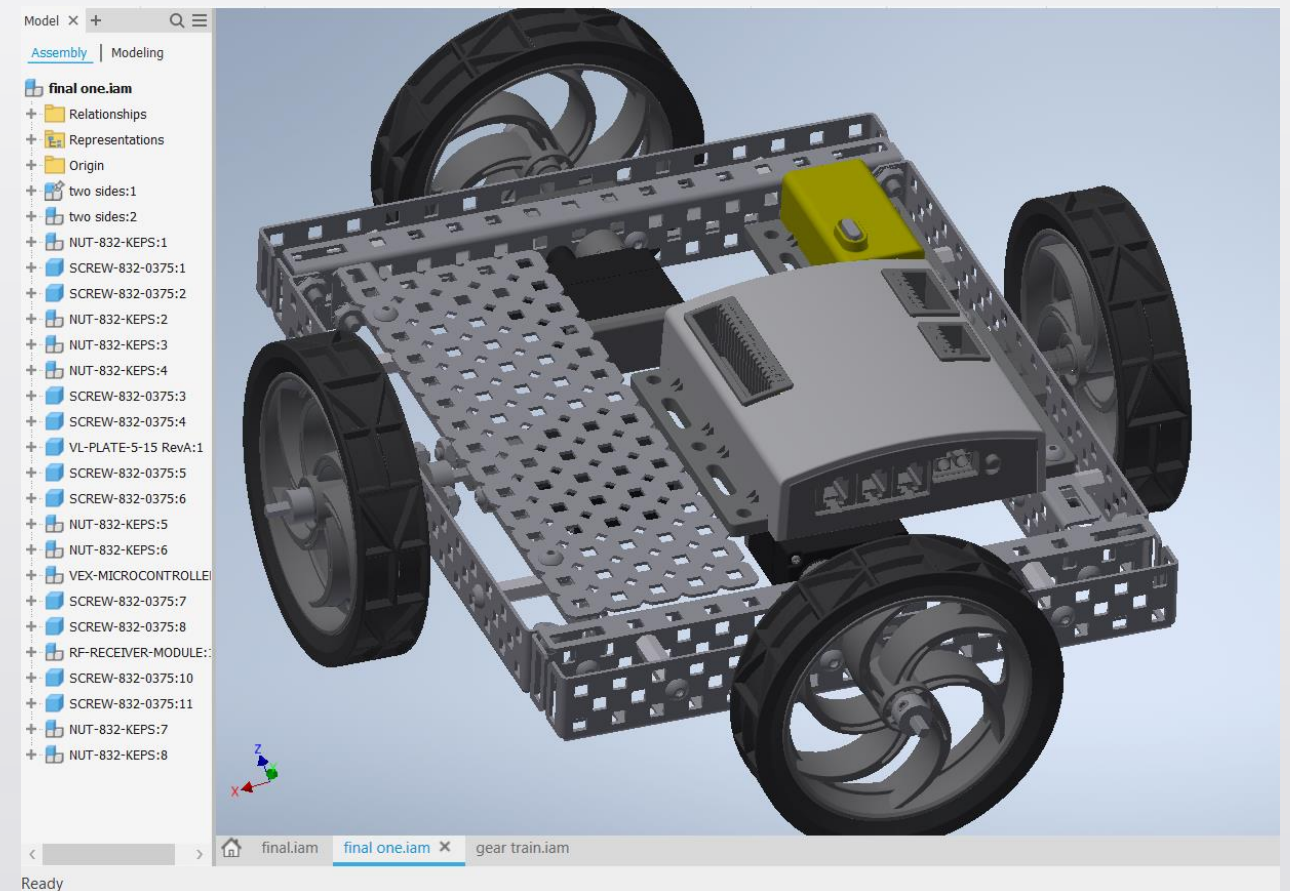


Figure 2: four-way robot

Aim: to analyze and reproduce a block puzzle, with help of software Autodesk Inventor.

Result: - research idea of Mortise and Tenon Frame Joints, creating simple but strong wood joining.

- Analyze and produce structure of each component of puzzle, as shown in figure 1.
- Assemble all components in certain order, as shown in figure 2.
- [Animation of assembling and disassembling of block puzzle.](#)

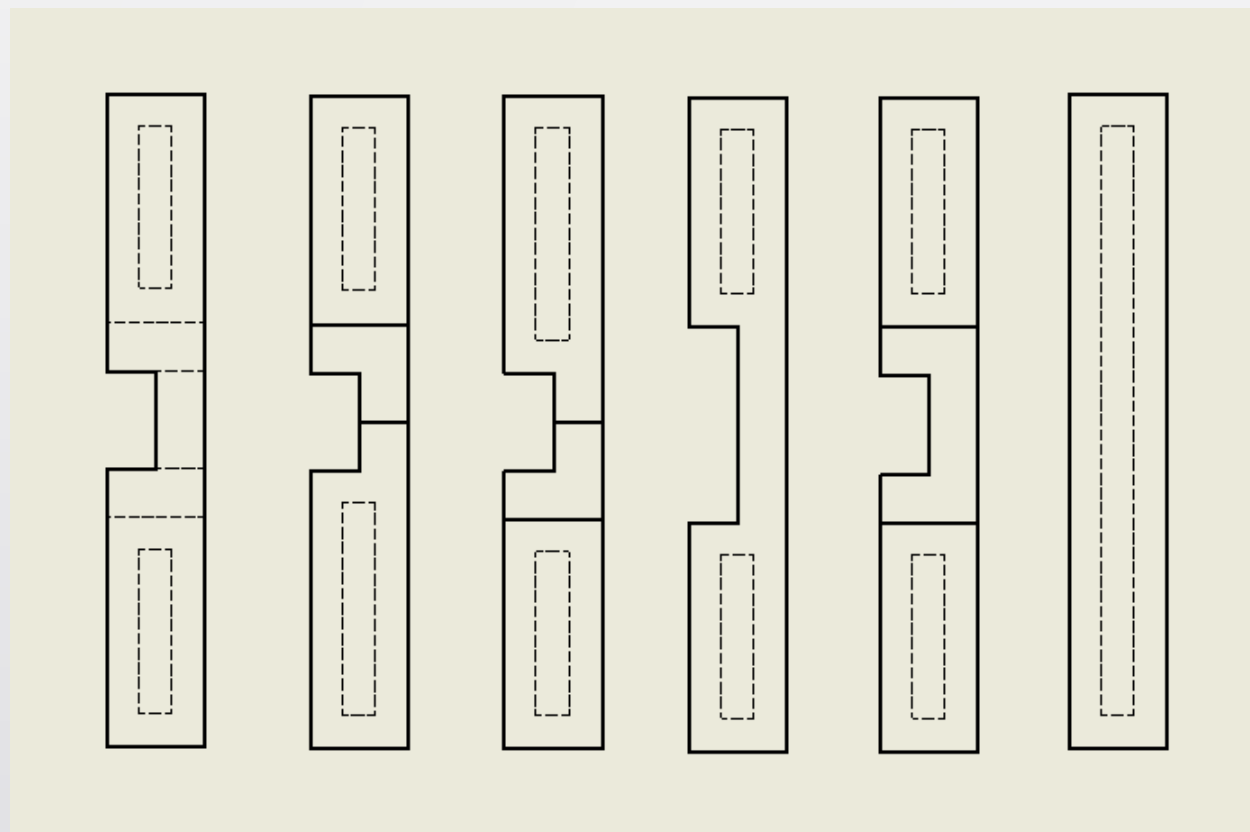


Figure 1: components of block puzzle assembly

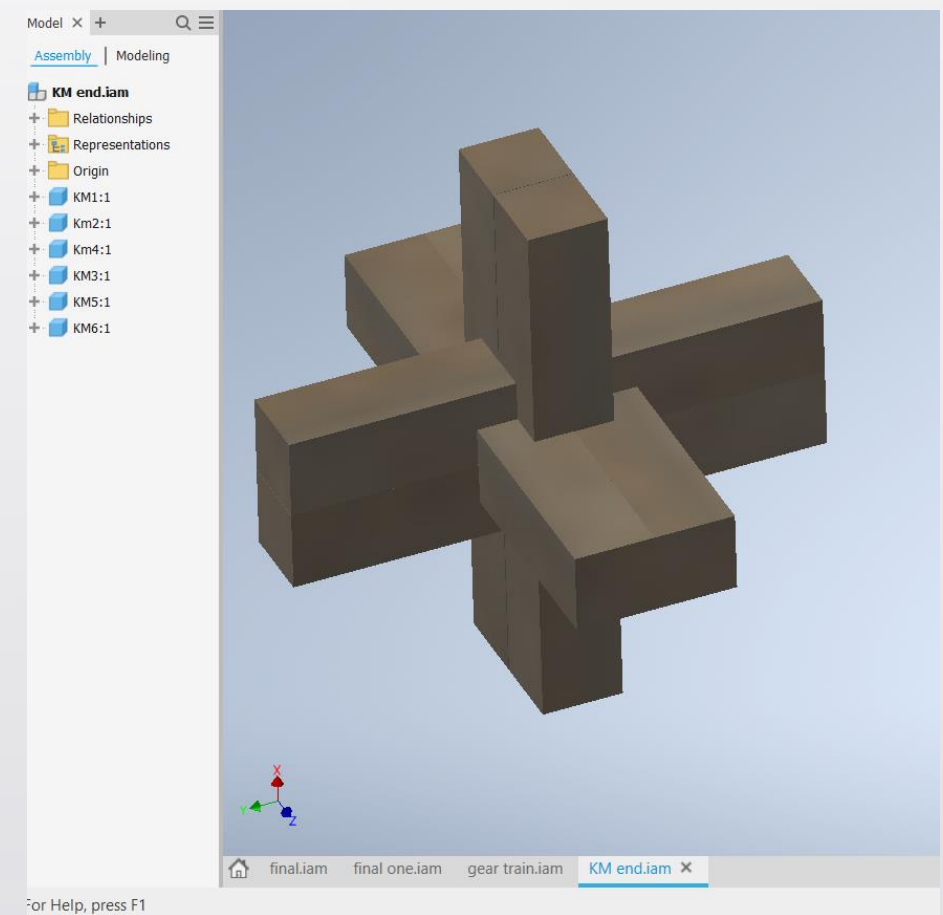


Figure 2: block puzzle assembly

Analysis and Reproduction of Block Puzzle

Aim: to reproduce light saber assembly and high power light saber assembly in software Autodesk Inventor.

Result: - successfully reproduce light saber and high power light saber in Inventor, as shown in figure 1 and 2.

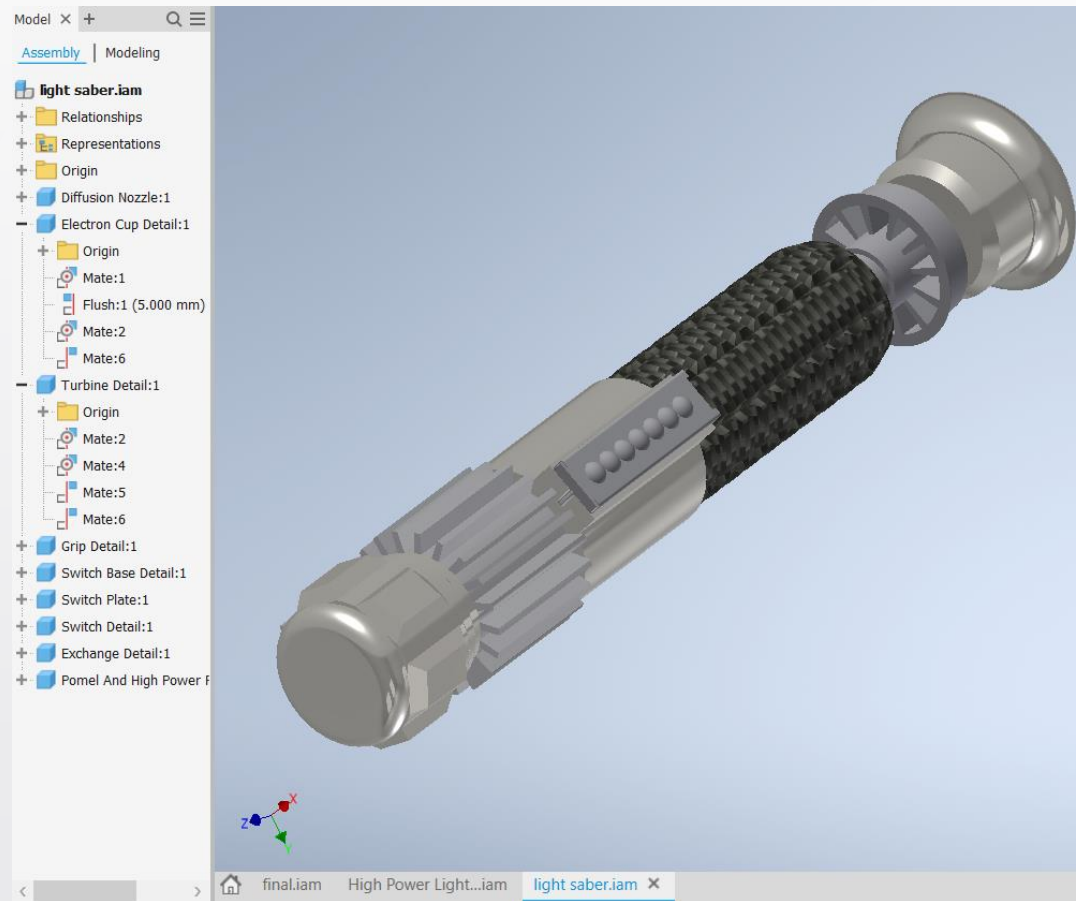


Figure 1: Light Saber

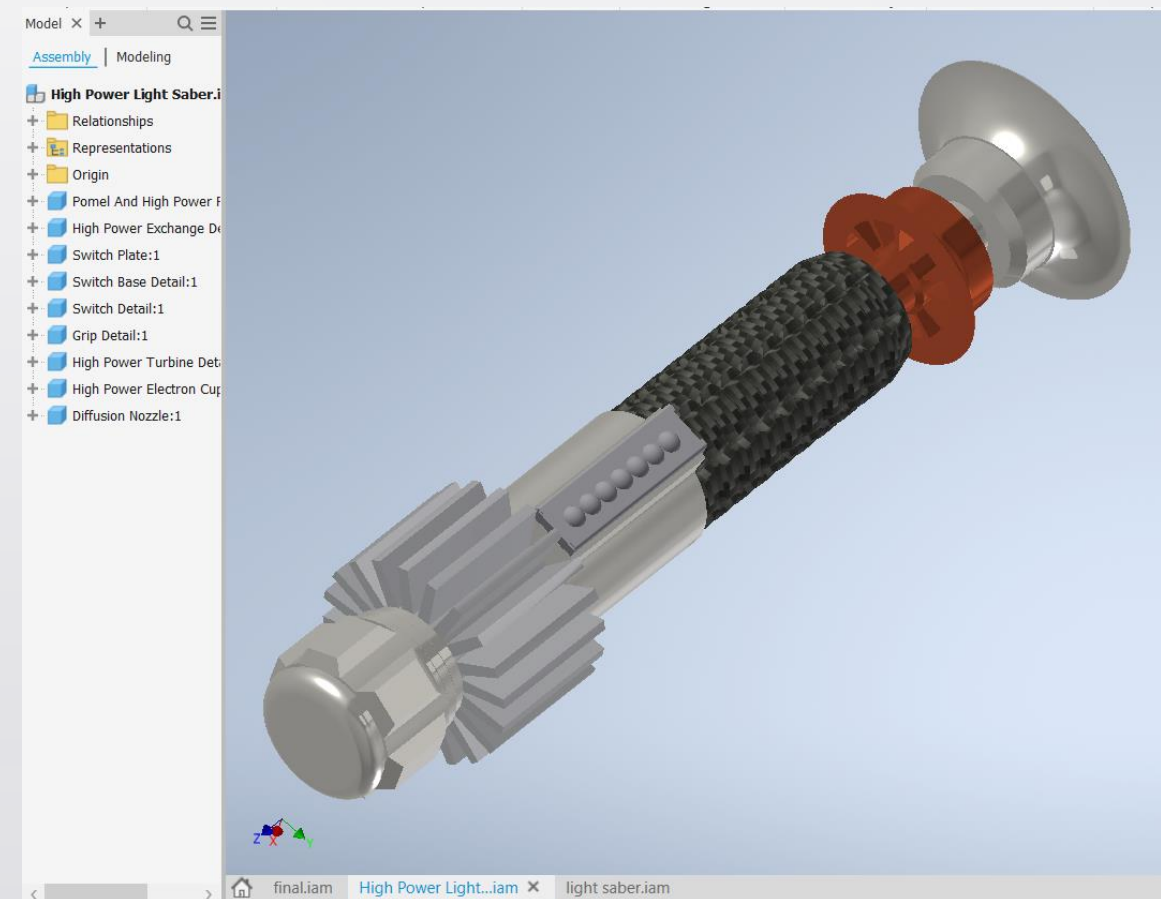


Figure 2: High Power Light Saber

LIGHT SABER ASSEMBLY - Invention

Aim: to reproduce gripper and lifter mechanism in software Autodesk Inventor.

Result: - successfully reproduce gripper and lifter mechanism in Inventor, performing exactly the same as actual objects (see figure 1 and figure 2).

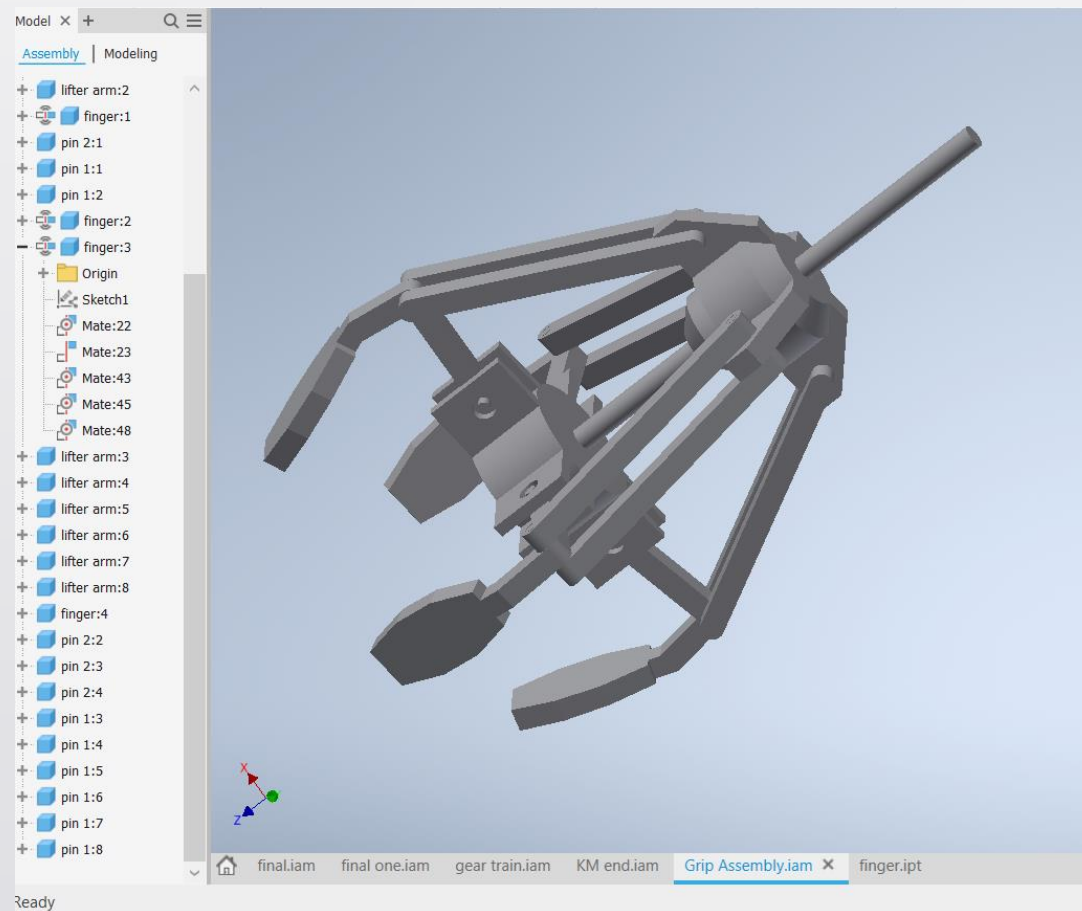


Figure 1: Gripper

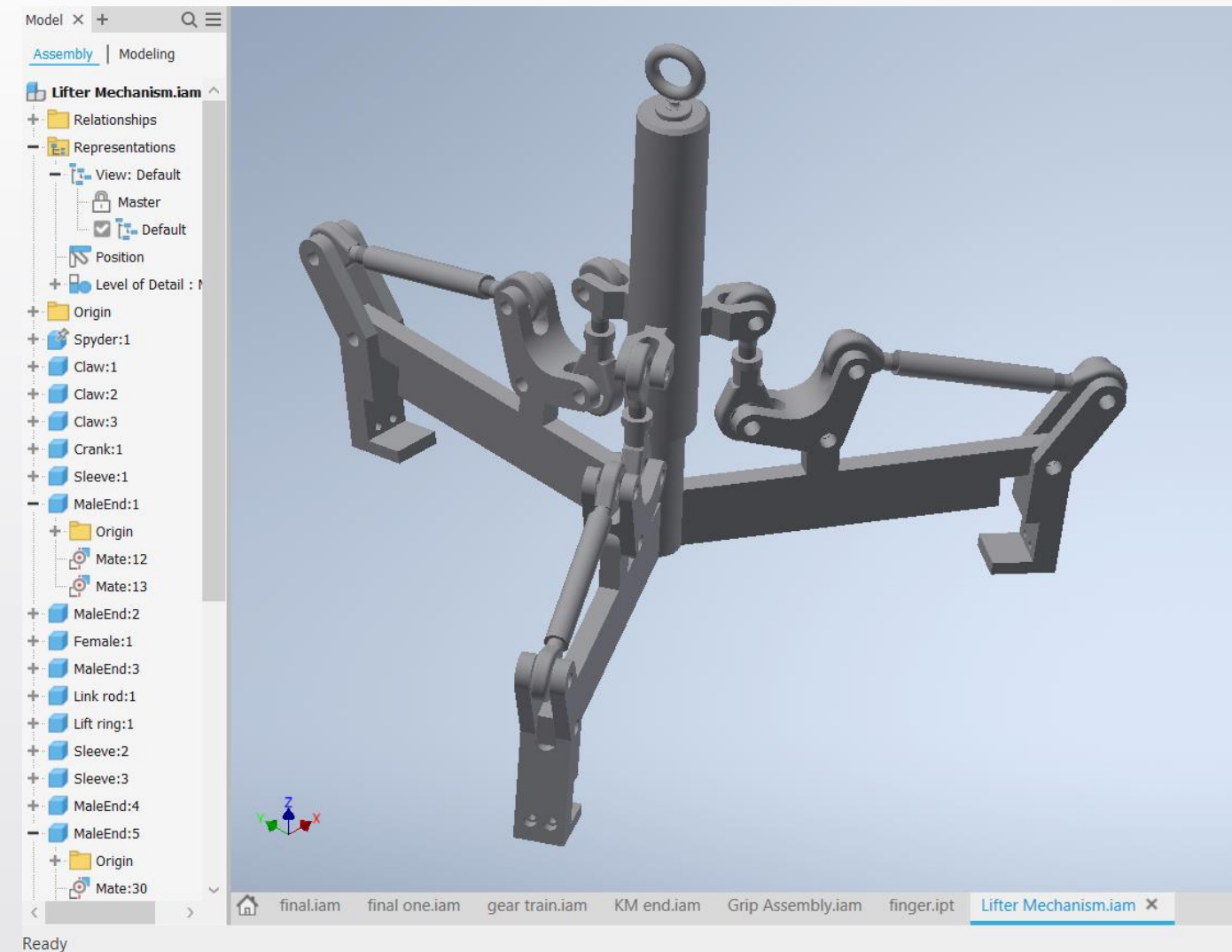


Figure 2: Lifter Mechanism

[1] M. Fairs, "'I try to make new forms of life,' says Strandbeests creator Theo Jansen | Dezeen", *Dezeen*, 2020.
[Online]. Available: <https://www.dezeen.com/2014/12/12/strandbeests-theo-jansen-interview-wind-powered-machines-new-species/>. [Accessed: 18- Jan- 2020].