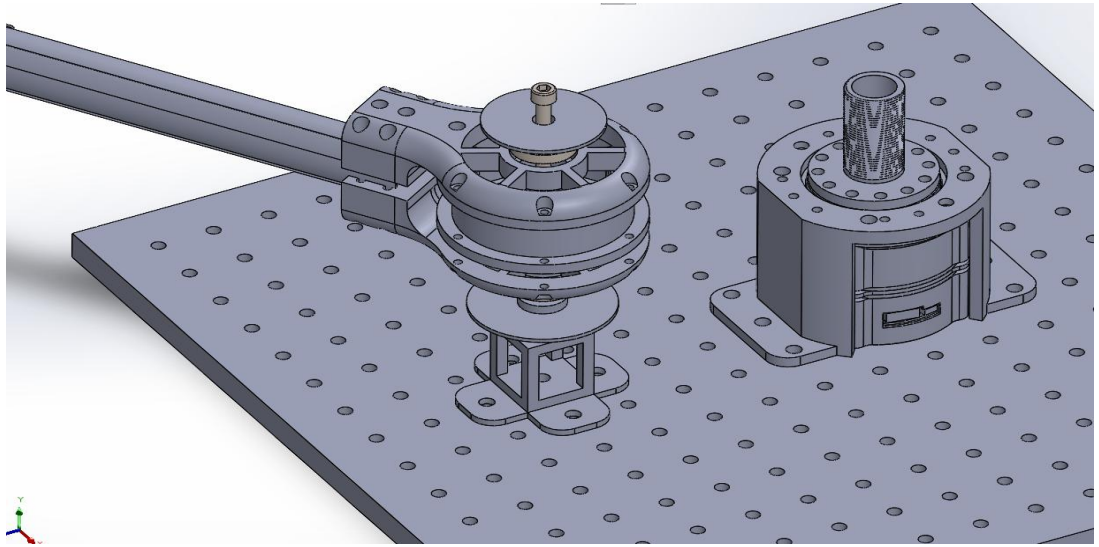
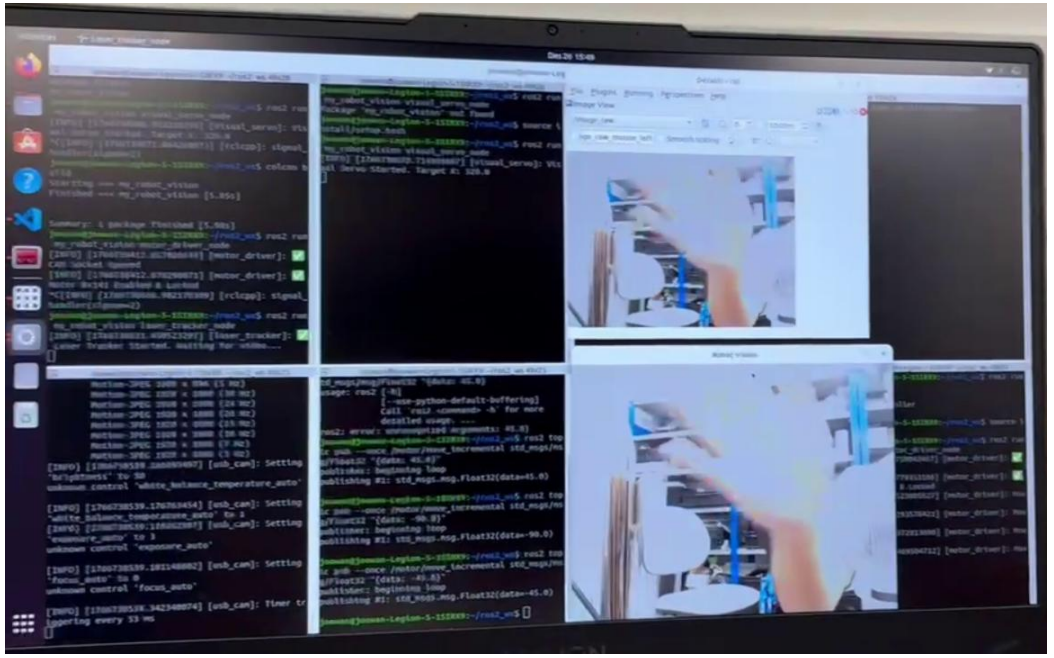
Hyundai Motor Group Innovation Center (HMGICS)

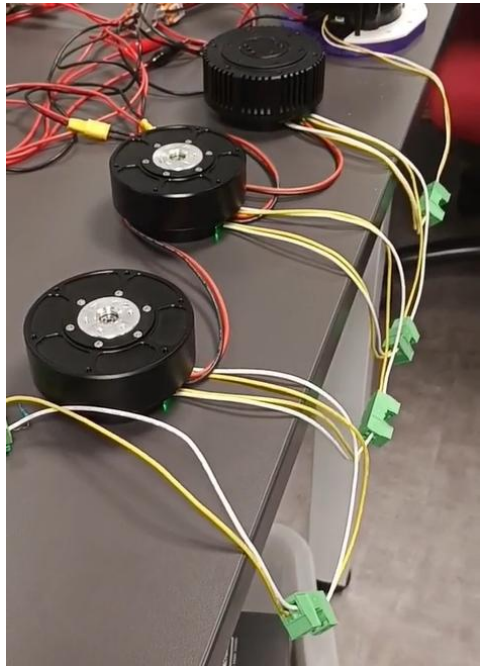
Professional Internship as Robotics R&D Engineer

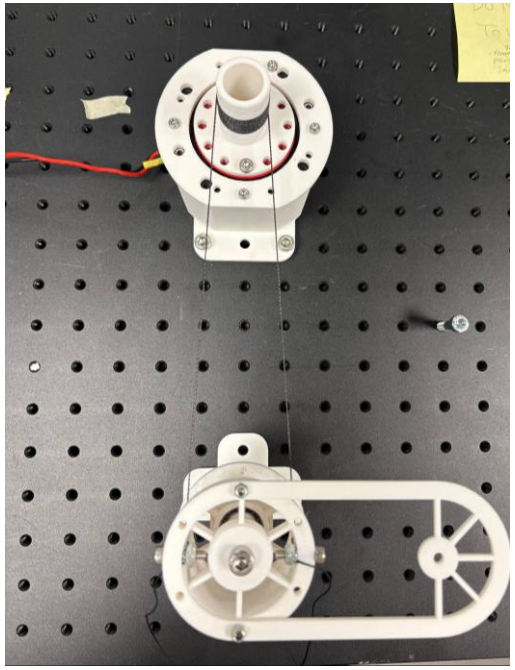
sincere gratitude to my mentors and colleagues!

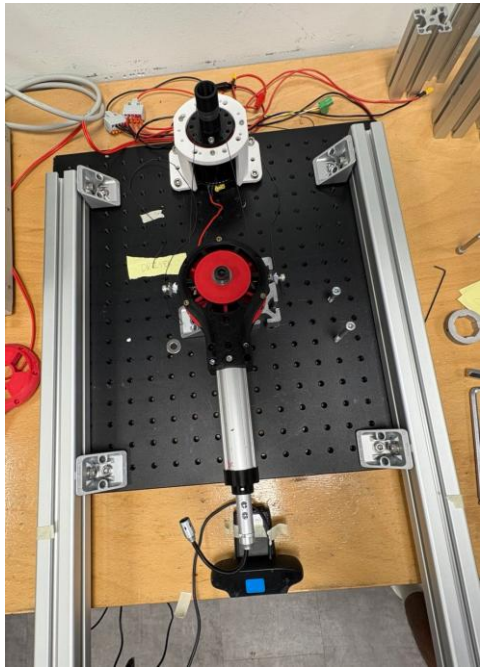
FYP (In Progress…)

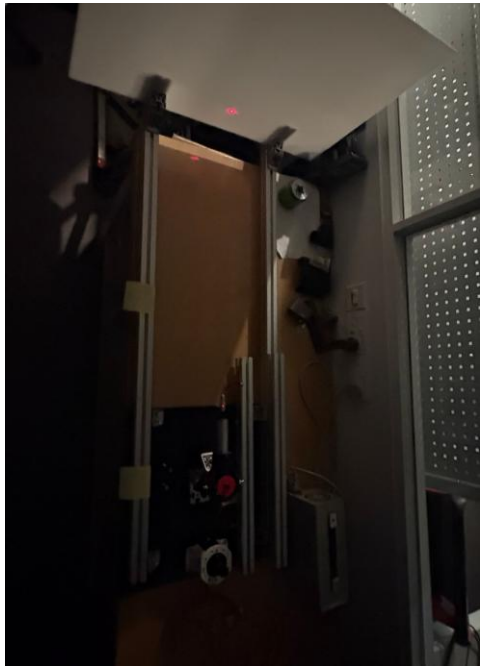


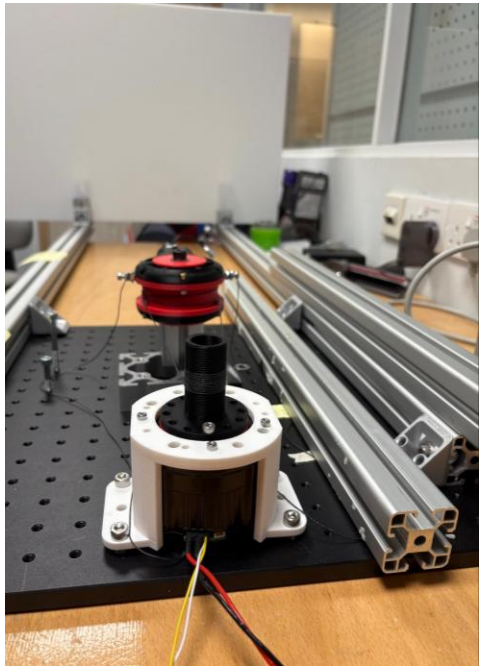


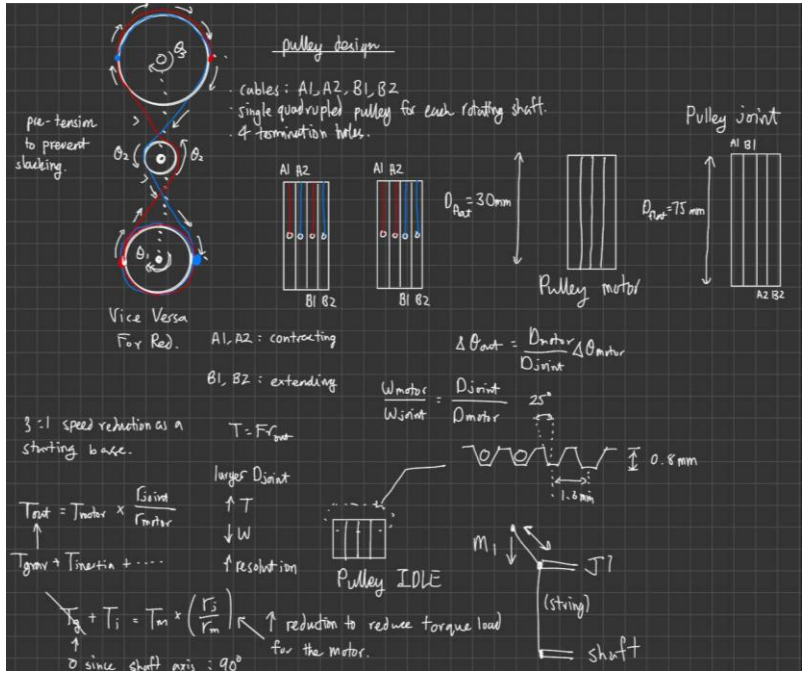


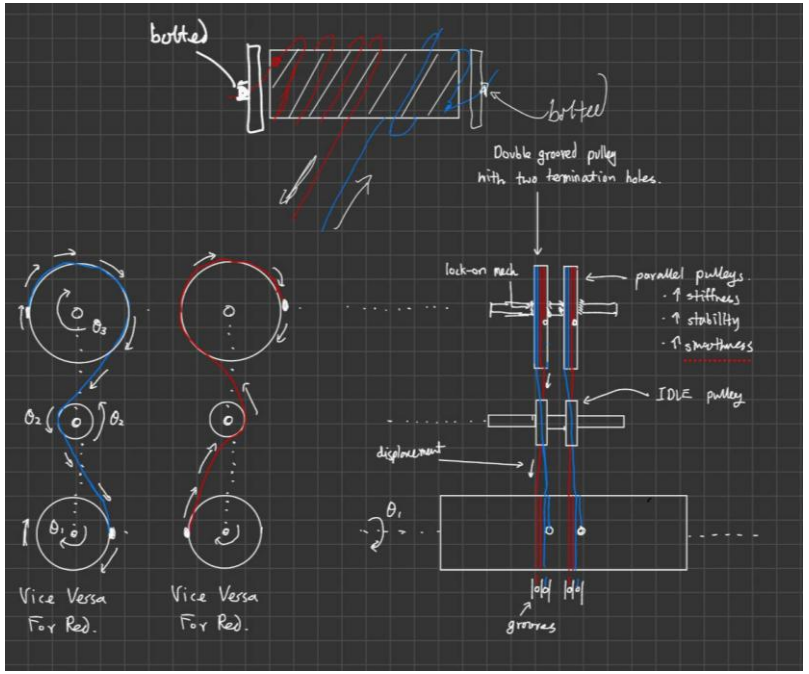


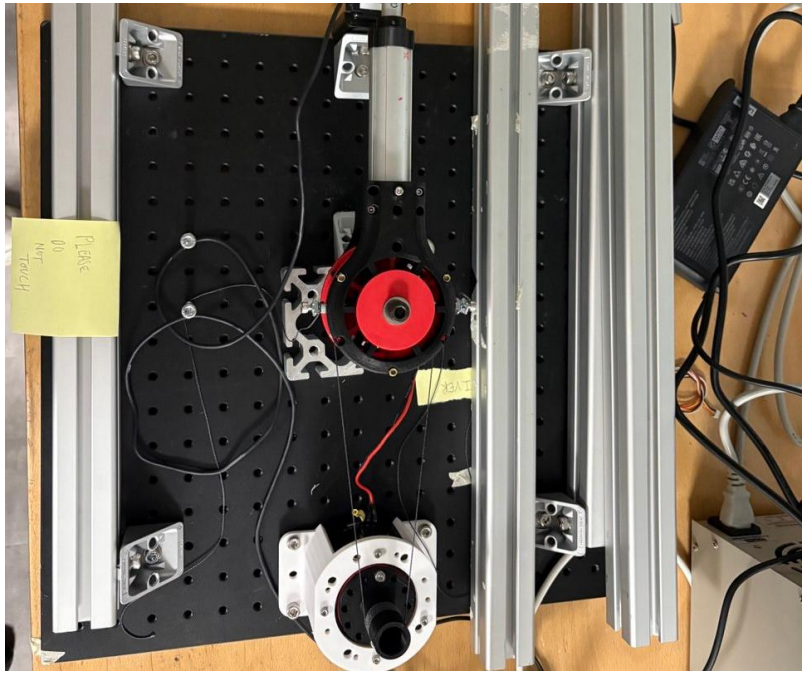


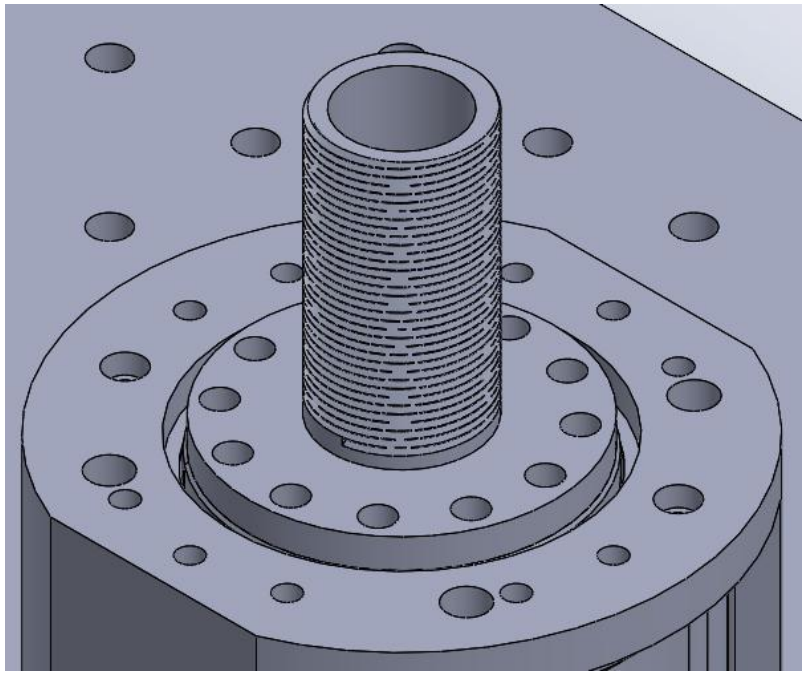


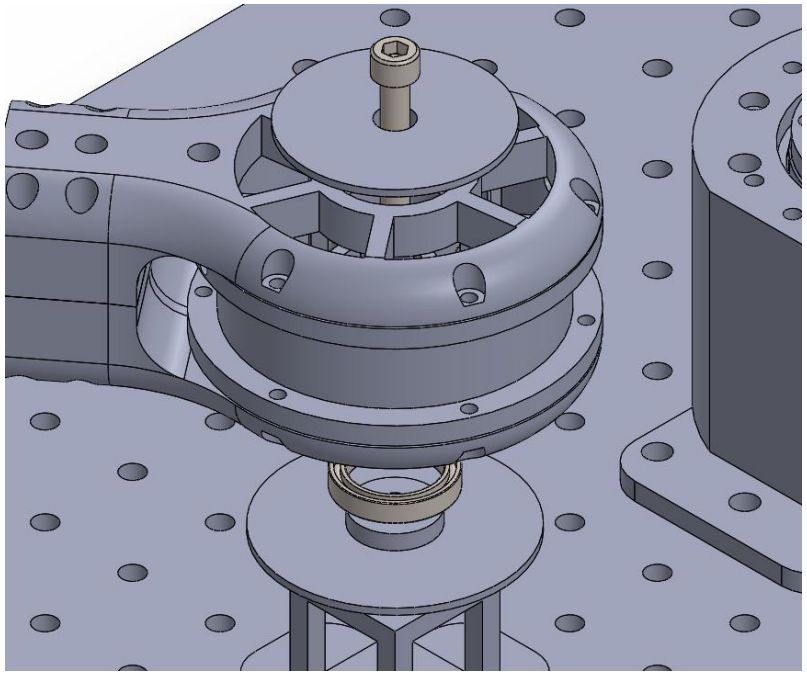


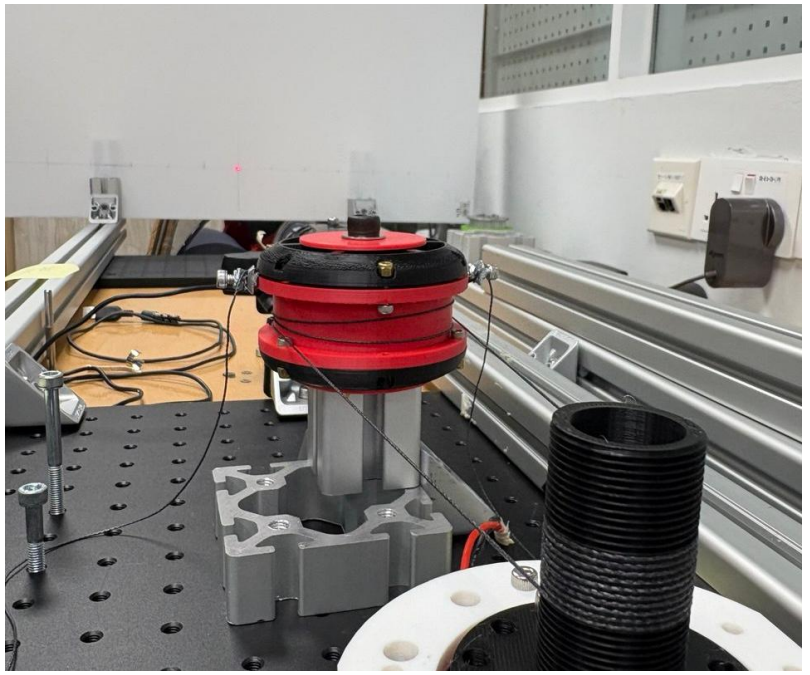

Pulley design
cables : A1, A2, B1, B2
single quadrupled pulley for each rotating shaft.
4 termination holes.
pre-tension to prevent slacking.
Pulley joint
Pulley motor
Vice Versa
For Red.
A1, A2 : contracting
B1, B2 : extending
3 : 1 speed reduction as a starting base.
larger Djoint
↑ T
↓ W
↑ resolution
Pulley IDLE
0.8 mm
1.6 mm
25°
(string)
J1
shaft
reduction to reduce torque load for the motor.
since shaft axis : 90°

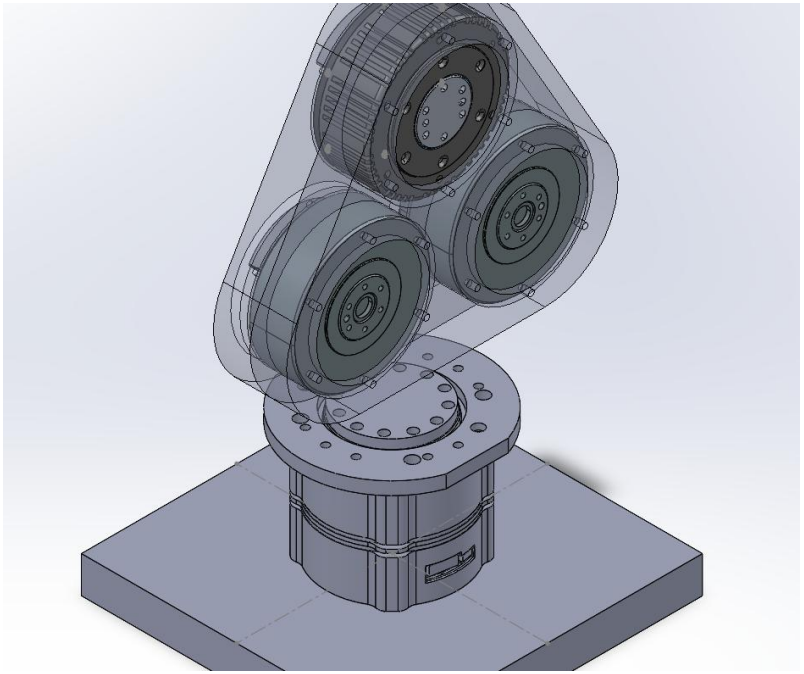

bottom
bottom
Double grooved pulley with two termination holes.
lock-on neck
parallel pulleys.
· ↑ stiffness
· ↑ stability
· ↑ smoothness
IDLE pulley
displacement
grooves
Vice Versa
For Red.
Vice Versa
For Red.

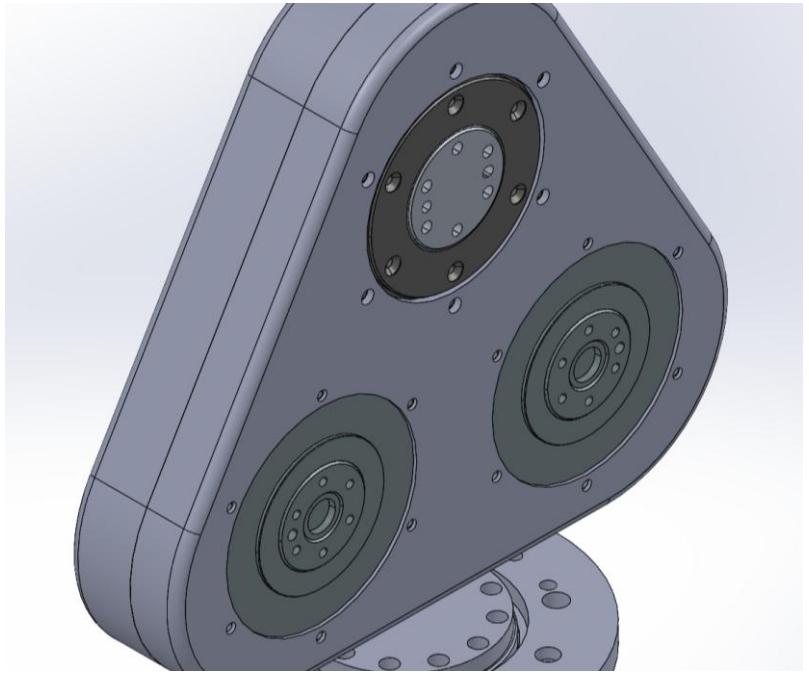

PLEASE DO NOT TOUCH

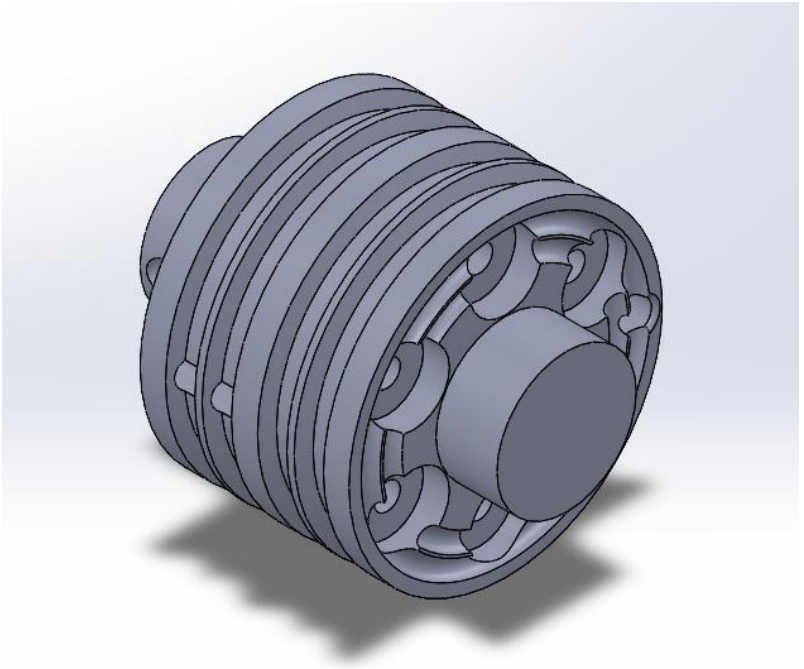


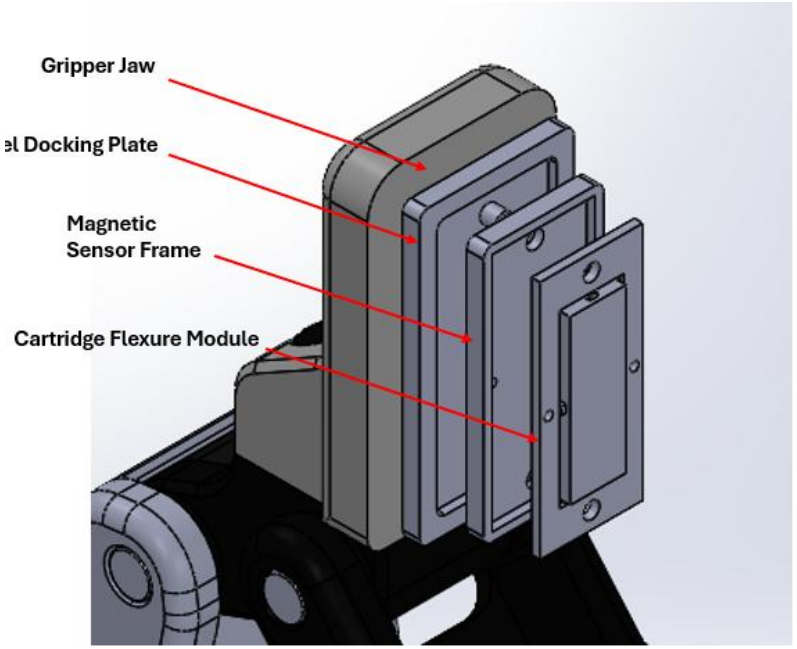


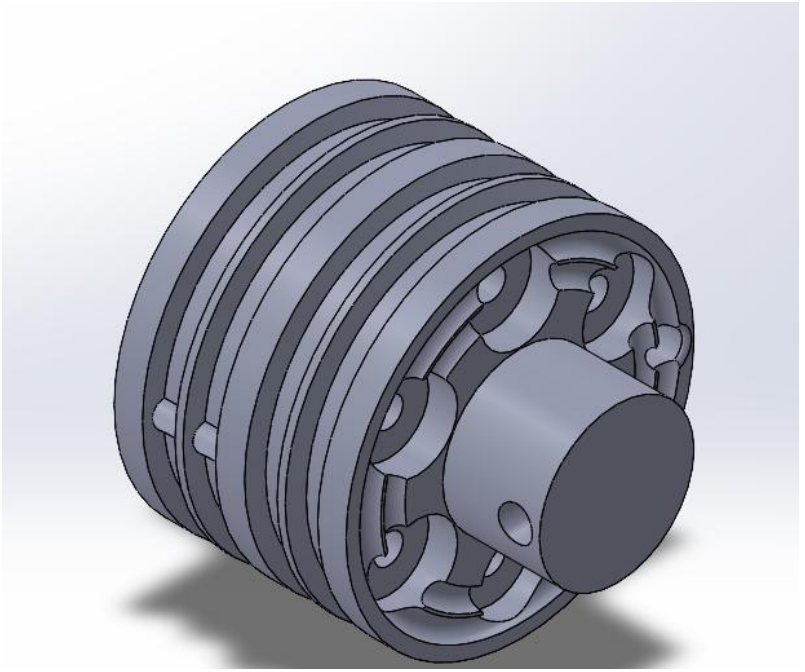









Gripper Jaw
el Docking Plate
Magnetic
Sensor Frame
Cartridge Flexure Module



MAE Robotics Club

CERTIFICATE

THIS CERTIFICATE IS PRESENTED TO

Joowan Ryu

for participating in the Lunar Exploration Innovation Challenge 2022 organised by ASPIRE Incubation labs and Nanyang Technological University, Singapore.

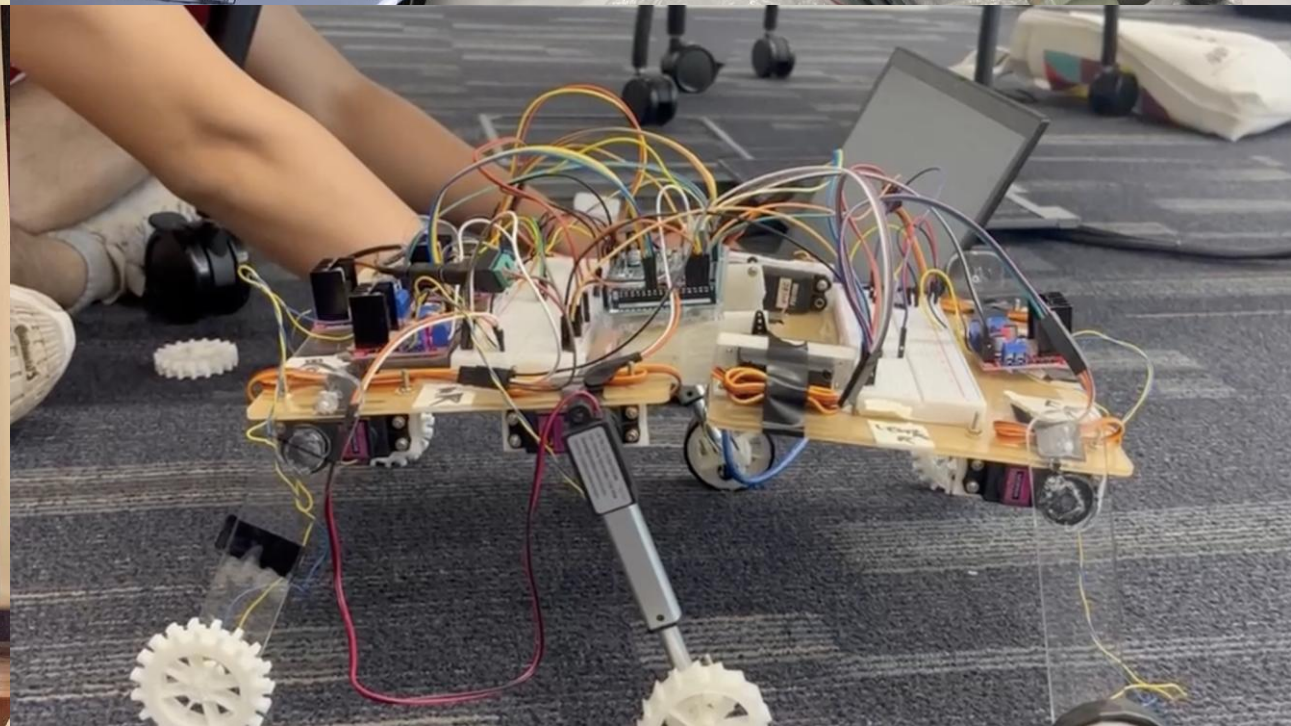
This certificate is awarded by

Jeff Williams
NASA Astronaut

Brought to you by:

Science Centre Singapore

SIT Singapore Institute of Technology



NANYANG TECHNOLOGICAL UNIVERSITY
SINGAPORE

This certificate is presented to NTU President Research Scholar

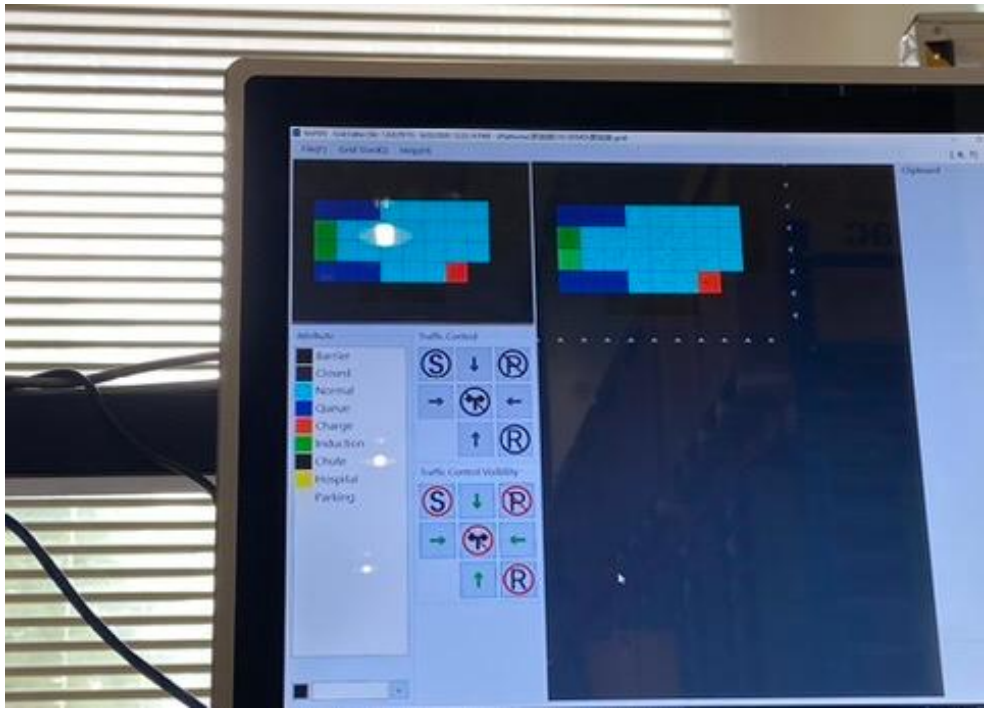
RYU JOOWAN

In recognition of research accomplishments
in URECA Undergraduate Research Programme
2021 – 2022

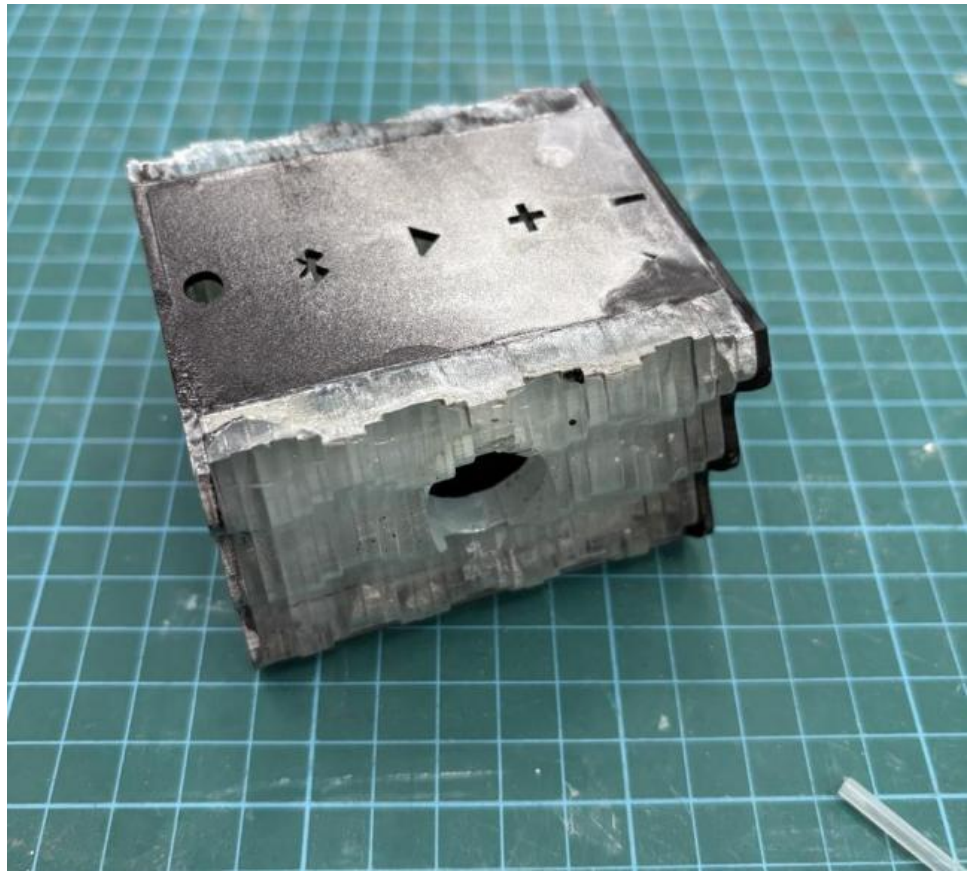
30 June 2022
Date

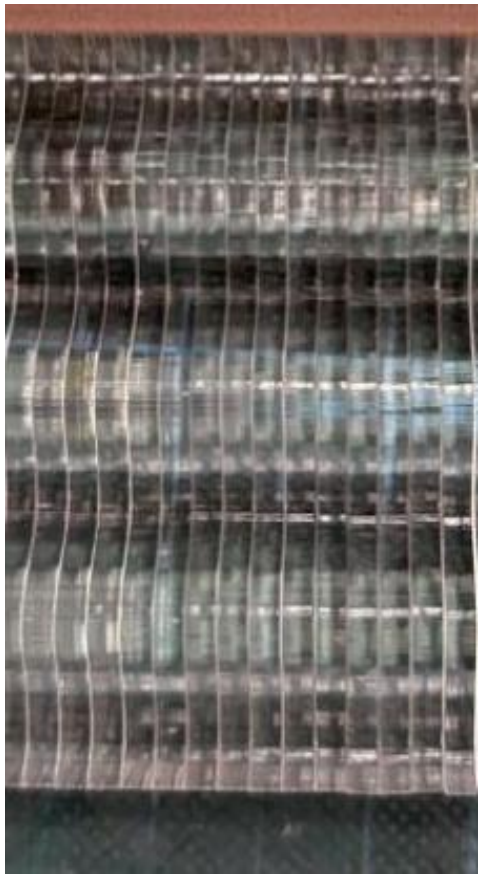
Prof Tan Ooi Kiang
Deputy Provost (Education)
Nanyang Technological University

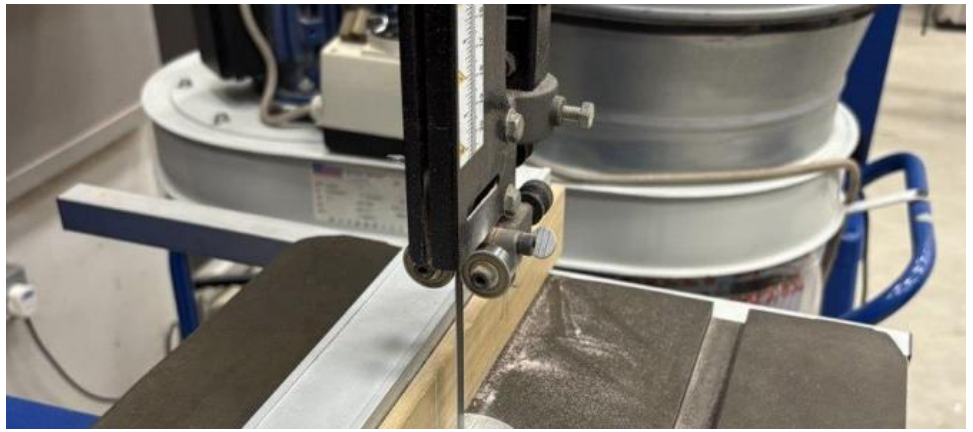
Visit At SIT & Hai Robotics

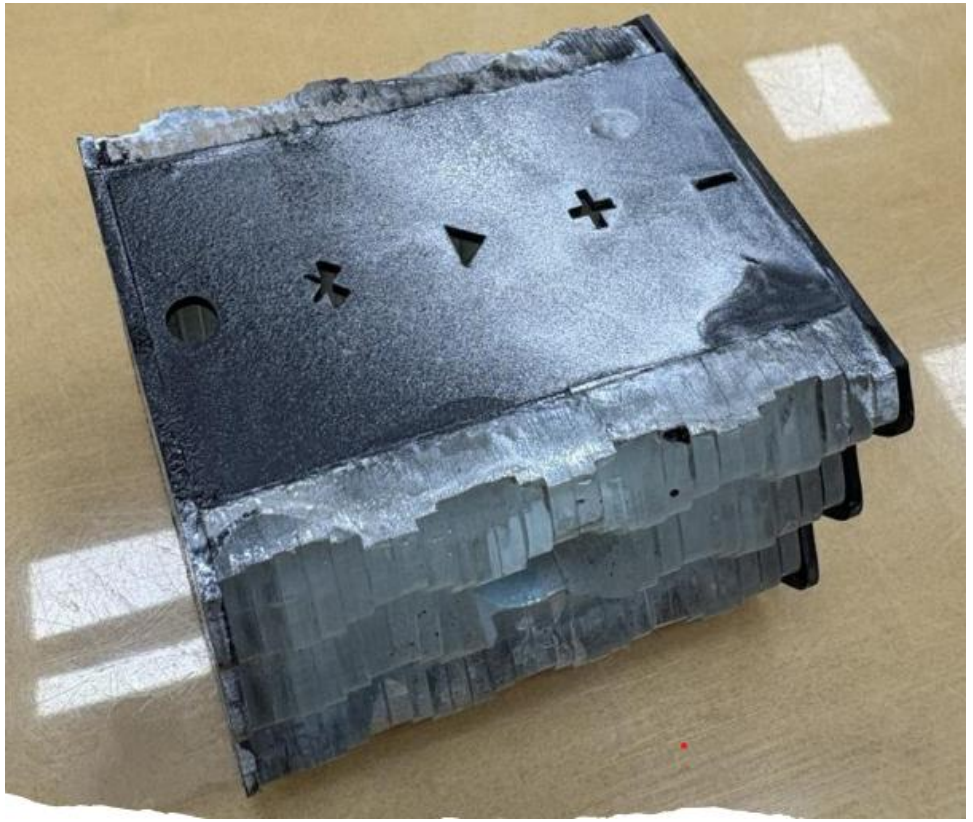


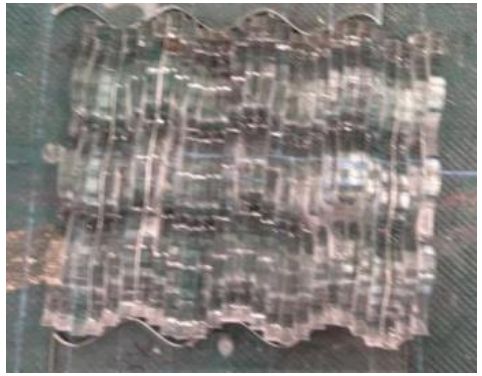
Product Conceptual Design (electives)











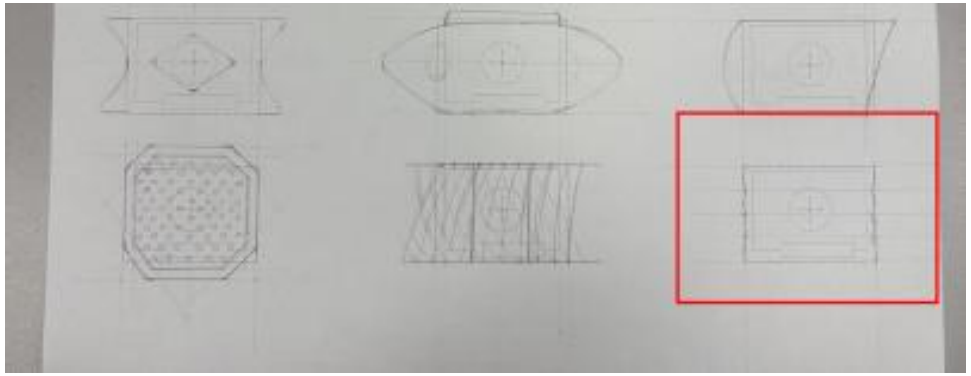
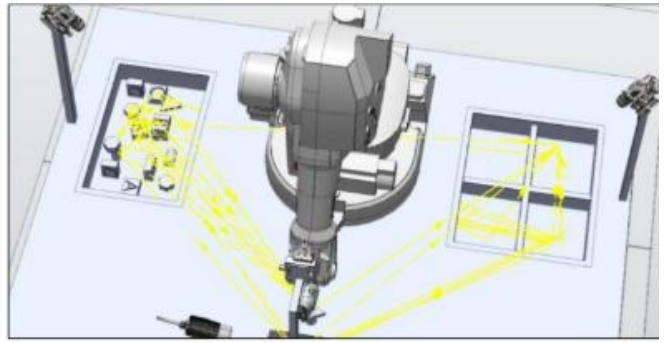
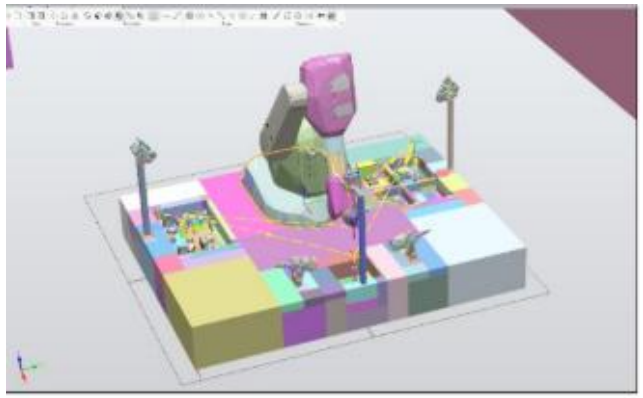


ABB RobotStudio Path Planning Demonstration

unstructured item sorting, generating optimized RAPID routines to reduce cycle time.
Designed pickable objects and environment tooling in CAD.





Home Position
Move J

Pick Pose Estimation
Identify graspable object and it's 6d pose in input tray

Pick Motion Sequence
1. Approach to target object
2. Grasp target object
3. Retreat from target objectPos

Inspection Motion Sequence
1. Approach Inspection Module
2. Take 2 set of side images of the object
3. Place object on vacuum holder
4. Take top image of the object
5. Pick up the object from vacuum holder

Process Inspection
Process classification and defect analysis of the object using taken images

Place Pose Estimation
Identify safe 6D place pose to inside corresponding output tray index

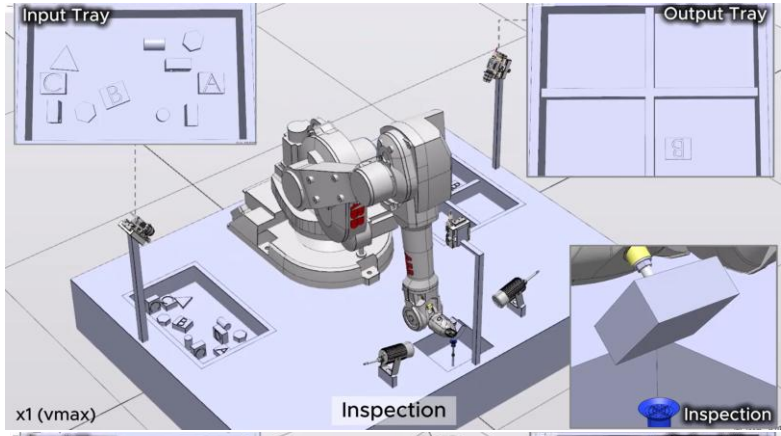
IF last object from input tray:
Execute same placement logic and move to "HOME"

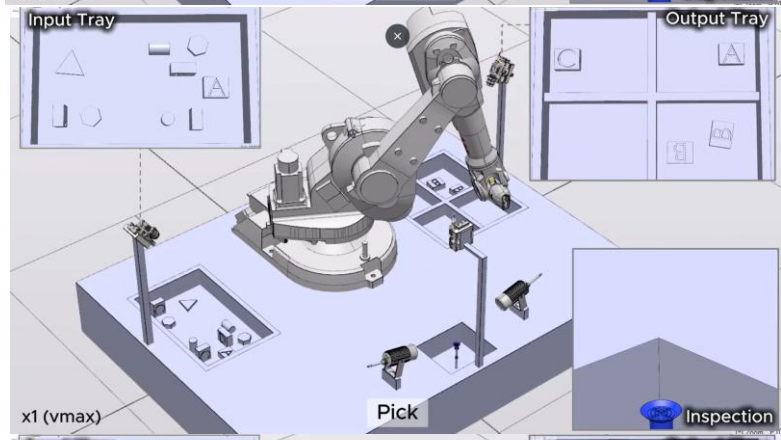
IF classification result is SQUARE A:
1. Approach output tray index 1
2. Place picked object in estimated place pose
3. Retreat from ouput tray index 1

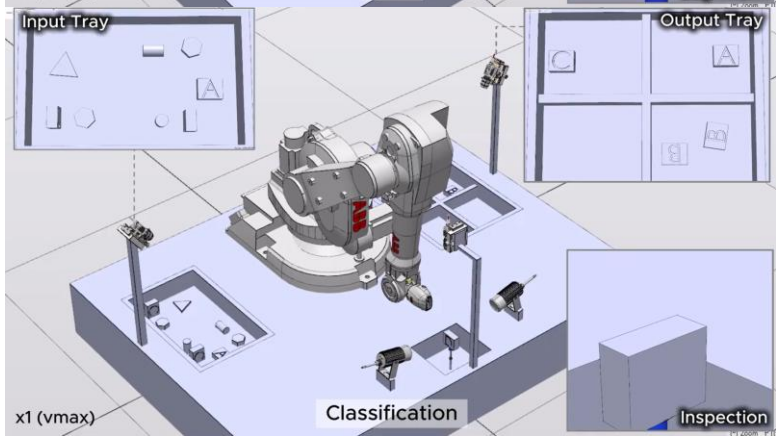
IF classification result is SQUARE B:
1. Approach output tray index 2
2. Place picked object in estimated place pose
3. Retreat from ouput tray index 2

IF classification result is SQUARE C:
1. Approach output tray index 3
2. Place picked object in estimated place pose
3. Retreat from ouput tray index 3

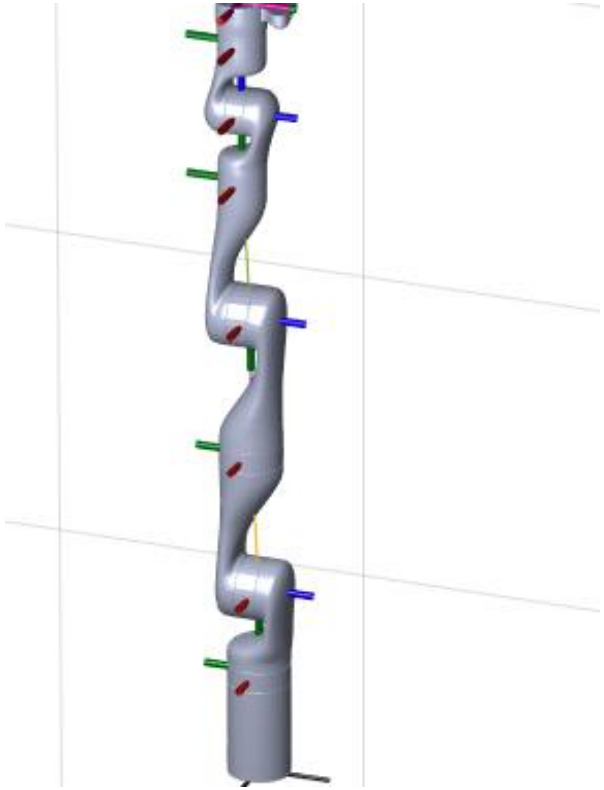
IF classification result is SQUARE D or HEXAGON or TRIANGLE or CYLINDER:
1. Approach output tray index 4
2. Place picked object in estimated place pose
3. Retreat from ouput tray index 4

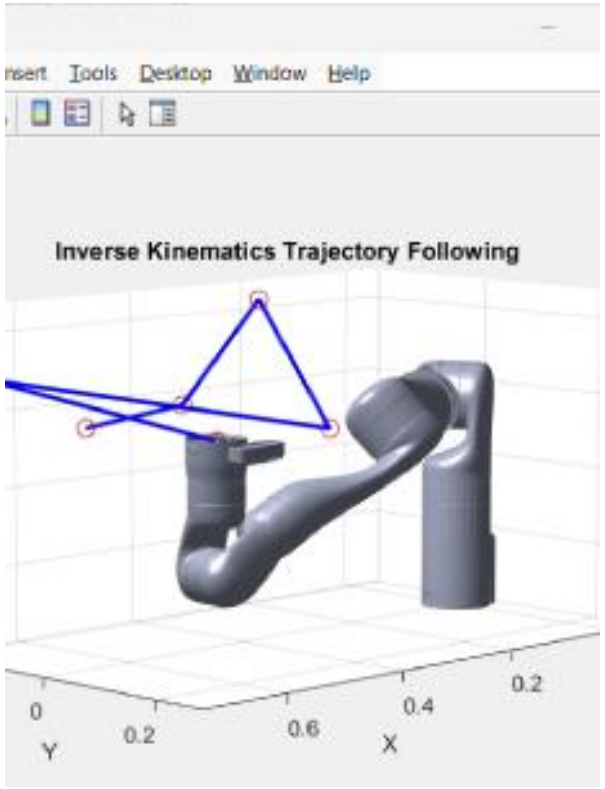






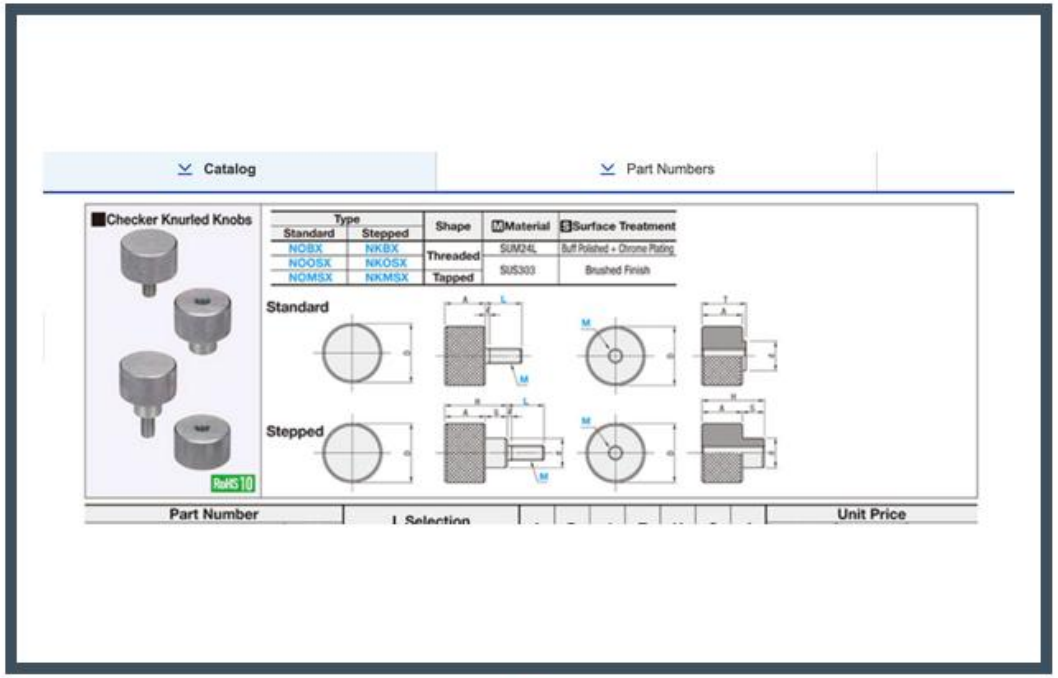
Inverse& Forward Kinematics Using MATLAB

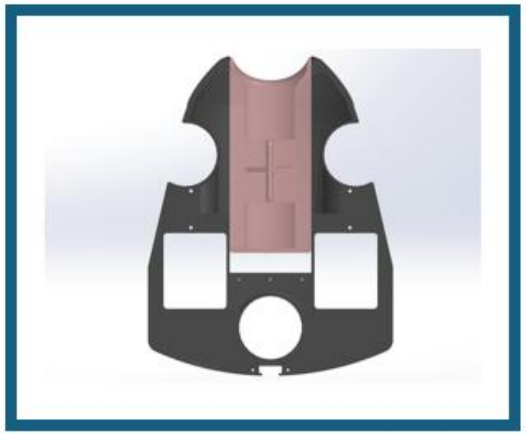


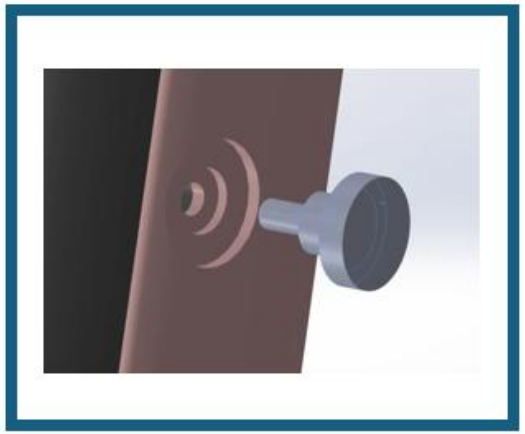


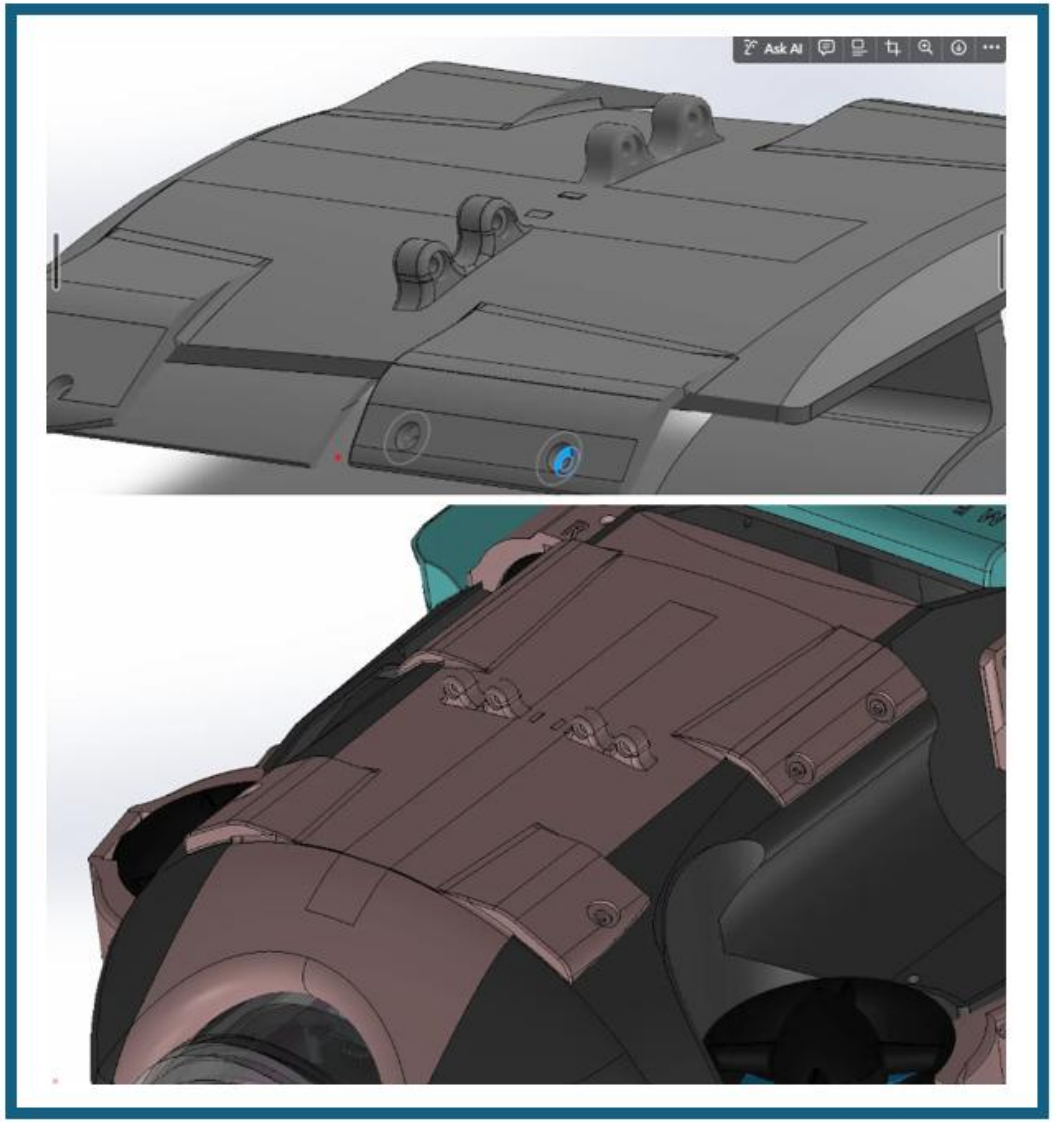

```
rot = [1,0,0 ; 0 cos(theta) -sin(theta); 0
rot = [cos(theta) 0 sin(theta); 0 1 0 ; -s
rot = [cos(theta) -sin(theta) 0; sin(theta
yms theta1 theta2 theta3 l4 theta5 theta6
1 = 1; x2 = 2; x3 = 0.5; z1 = 2; z2 =1.5;
1 = [subs(Zrot,theta,theta1) [0;0;0]; 0 0
2 = [subs(Yrot,theta,theta2) [x1;0;z1]; 0
3 = [subs(Yrot,theta,theta3) [-x2;0;z2]; 0
4 = [subs(Yrot,theta,theta5)*subs(Xrot,the
5 = [eye(3) [x3;0;0];0 0 0 1 ]

k = H1*H2*H3*H4*H5
3x3 showing its degree of rotation
1x3 on the last col showing its position
1 = 20/180*pi;
2 = 10/180*pi;
3 = 5/180*pi;
en4 = 3;
5 = 30/180*pi;
6 = -20/180*pi;

olve_fk = vpa(subs(fk,{theta1,theta2,theta
```

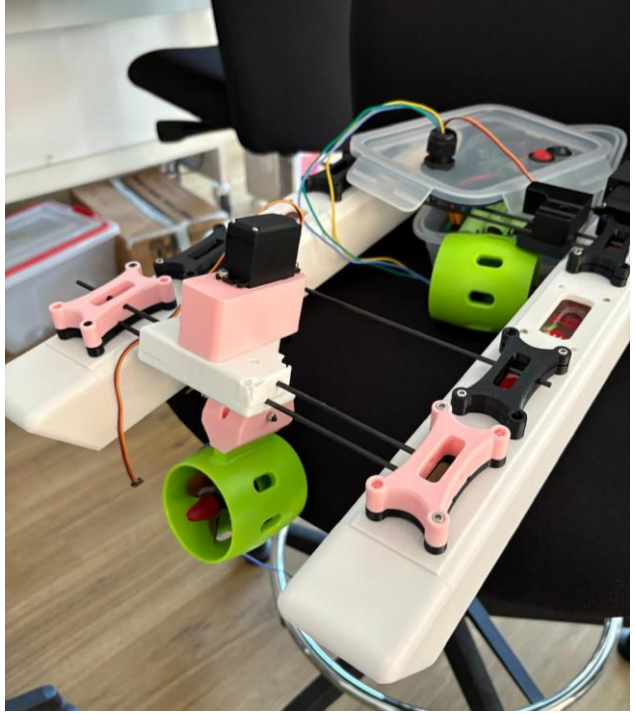
NTU MECATRON Team Underwater Robot Hardware Design Modification

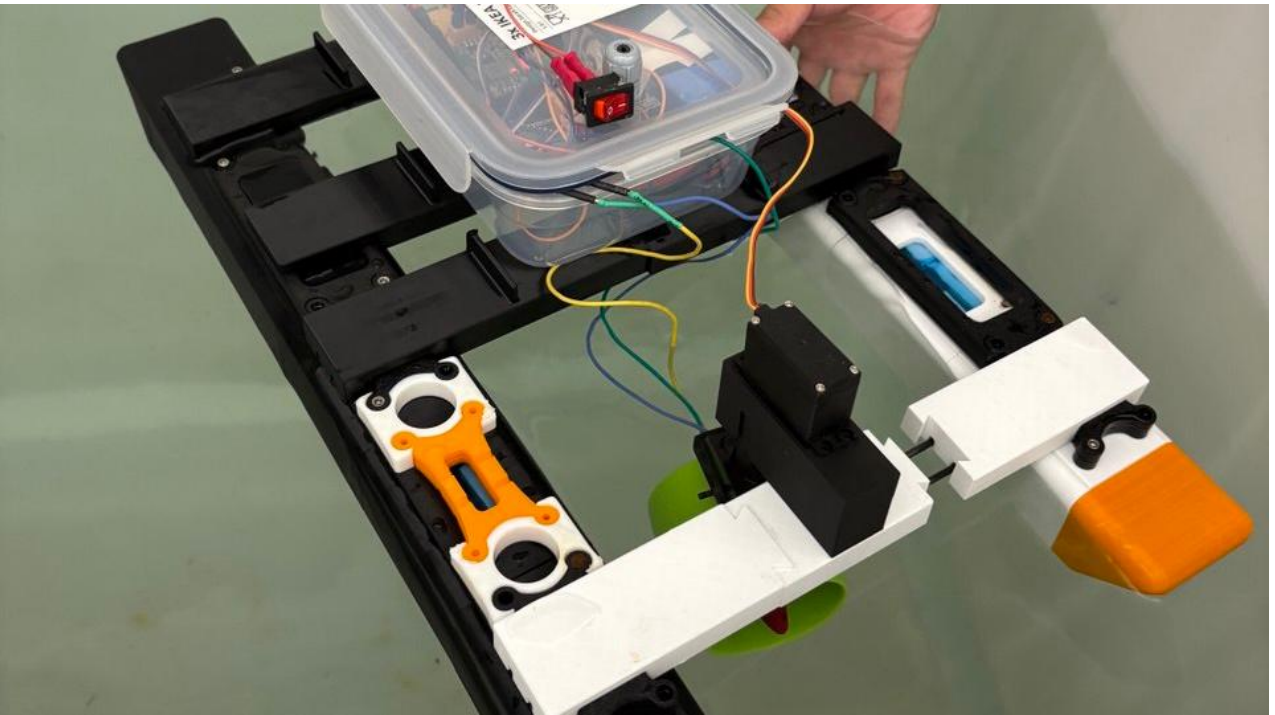








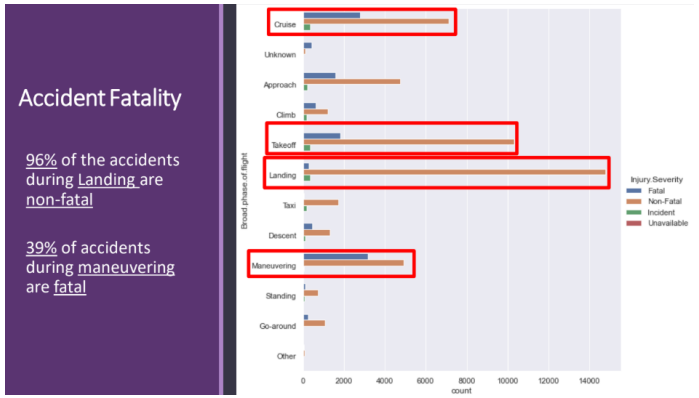


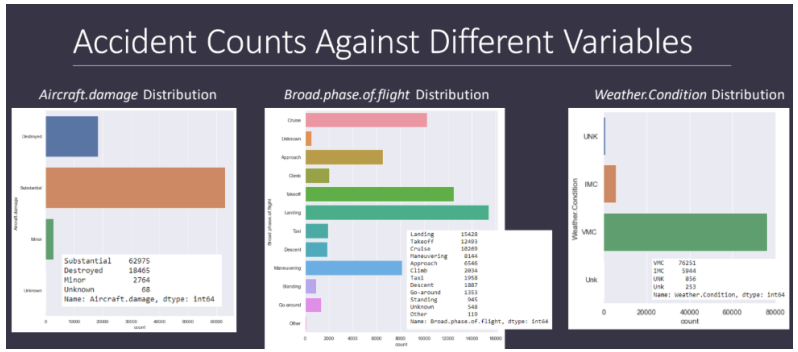


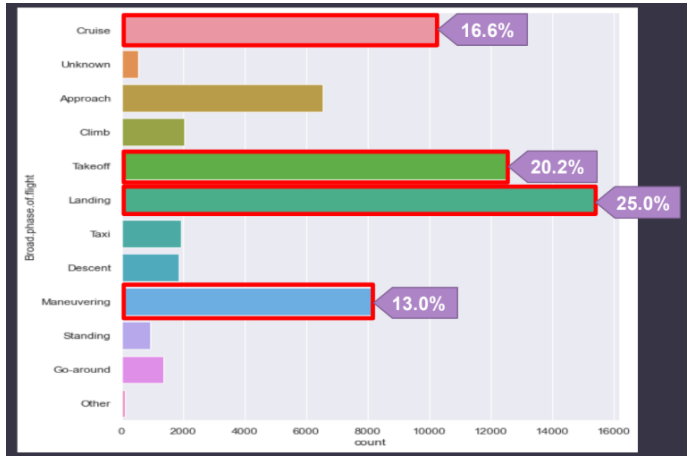
Workshop Demonstration

Designed and fabricated a **modular underwater robot platform** optimized for educational workshops. Helped engineer the mechanical structure for **rapid assembly and disassembly**, allowing students to gain hands-on experience with actuation, waterproofing, and mechatronic integration.

Data Science and AI Project







built predictive models to forecast future incidents with high accuracy