Technical Details for Proposed Robot

1. Type of Robot:

   Submarine / Underwater robot

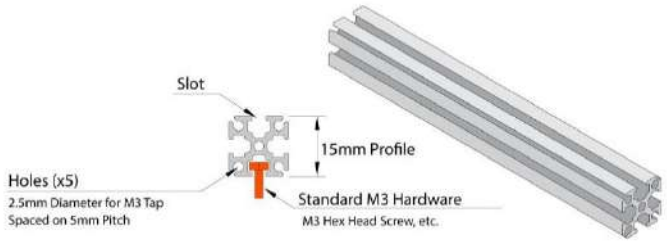
2. Robot Assembly Design (Proposed Diagram):

   All 3D CAD drawings are attached to bottom of this documents.

3. Components to be used:

   I. List of Structure components:

      a. Aluminum Extrusion Beams 15mm Square Profile

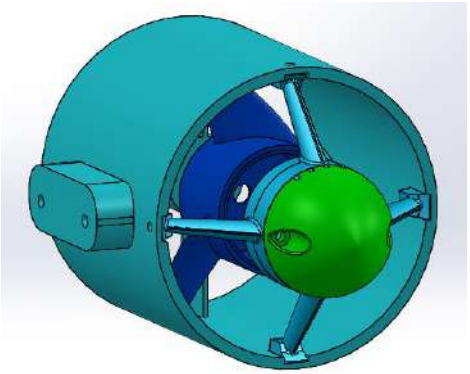


      b. 12.8V 6200mAh LiPo Battery

      c. Brushless DC Motors and Electronic Speed Controller (ESC)

II. List of Motion Components:

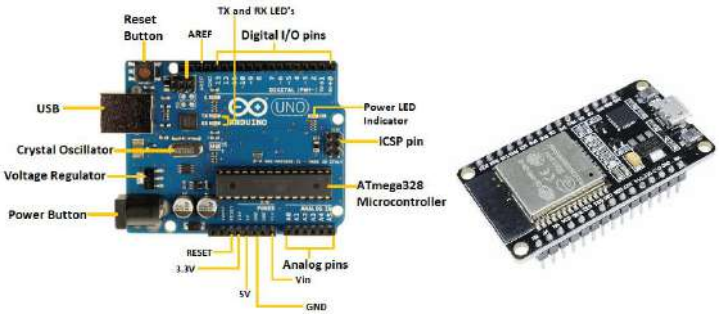
a. Thruster + Impeller (Custom made from ABS plastic)



III. List of Electronics Components:

a. Flysky CT-6B 6-channel Remote Control with FS-R6B receiver (2.4GHz 6-channel Remote Control transmitter and receiver)

b. Arduino UNO and ESP32 module



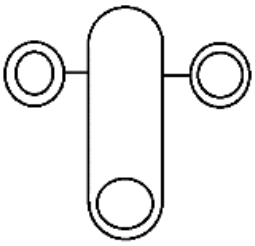
c. TS5828L 5.8G 600MW 40CH Transmitter with antenna
d. 5.8G UVC OTG Android Audio-Video Phone Receiver

e. 600TVL 170deg mini-FPV AV Camera
f. Infrared LEDs

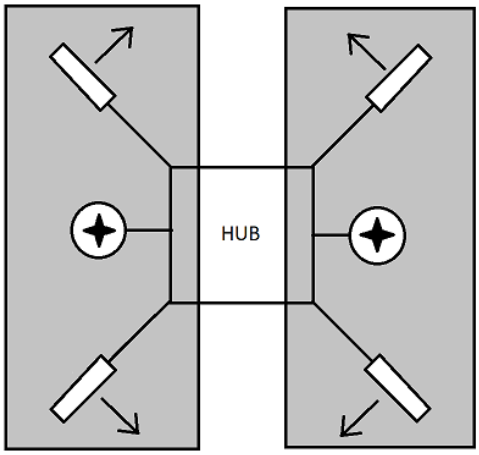
IV. List of other Accessories: Waterproof body with ABS plastic material

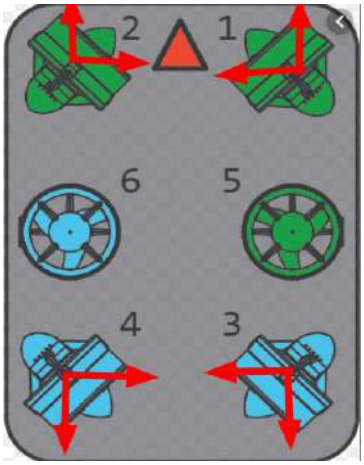
4. The methodology of Making Robot:

The first idea of the submarine robot was to have a 3-motor robot, with one motor at the back and 2 in front. The front motors were also meant to rotate around the horizontal axis. This design was inspired by the rotating engines of the aerial vehicle “V22 Osprey”. The first picture is the rough design on top view of this idea. The second picture is the V22 Osprey reference.



The second idea was a 6-motor robot, with 2 vertical motors and 4 horizontal motors. The horizontal motors would be attached diagonally, with opposite motors being parallelly opposite. The given picture is the rough design of the top view of this idea. The arrows point in the direction the motor will face, and a motor facing vertically is shown by a black star shape. Due to this vector position arrangement of propellers, we can easily get 3 Degree of freedom (Forward/Backward, Left/Right, Up/Down). The picture below shows the robot with foam blocks and down-facing motors. The frame has not been included.





A few key features of this design are:

- It has foam blocks which help it float up. This allows the robot to float to the surface in case of a power loss
- It has down-facing motors (shown by filled star). They will push the robot down.
- It has an integrated frame, making it more stable than the previous design
- The directions of horizontal motors counteract linear drifting during rotation

The robot also includes components such as depth and pressure sensors, temperature sensors, and water quality sensors.

5. Application of proposed Robot in a societal context:

The attached robot design provides sufficient maneuverability and it is capable of doing different underwater activities because it is loaded with many sensor and hardware accessories. For example:

- Pressure and Depth Sensor
- HD Underwater Camera
- Temperature Sensor
- Oxygen Level Monitoring Sensor
- Underwater LED Lights
- Manipulator/Gripper

List of Applications:

- Inspect Large underwater structures
- Inspect Submerged waterways or bridges
- Check Oil rigs, Pipelines and Underwater caves
- Help Marine researchers and biologists to study marine ecosystems like coral reefs
- Monitor levels of Oxygen, CO_2, NO_x, etc. in closed waterbodies
- Inspect large industrial water tanks

This submarine drone cum robot also can be easily modified by adding different types of sensors and hardware accessories for using in cases like **DAMS, BRIDGES, OIL&GAS, SHIPPING, PORTS, RESEARCH, RESCUE, DEFENCE, NAVIGATION and AQUACULTURE.**

6. Size of Robot proposed for Proof of Concept (Small Version):

a) Length: 36 cm max
b) Width: 36 cm max
c) Height: 25 cm max

7. Size of Robot proposed as prototype (Actual Version):

a) Length: 45 cm
b) Width: 45 cm
c) Height: 45 cm

8. Timeline for Robot Making with milestones

- *[Upon clearing Ideation stage, 15 January]*

    - Assembling parts and testing stability of Proof of Concept – 21 days (3 weeks)
    - Writing program to control robot – 14 days (2 weeks)
    - Testing in real water, making required modifications – 14 days (2 weeks)
    - 1 week as buffer

- *[Submission of Proof-of-Concept Robot, 15 March]*

- *[15 days buffer]*

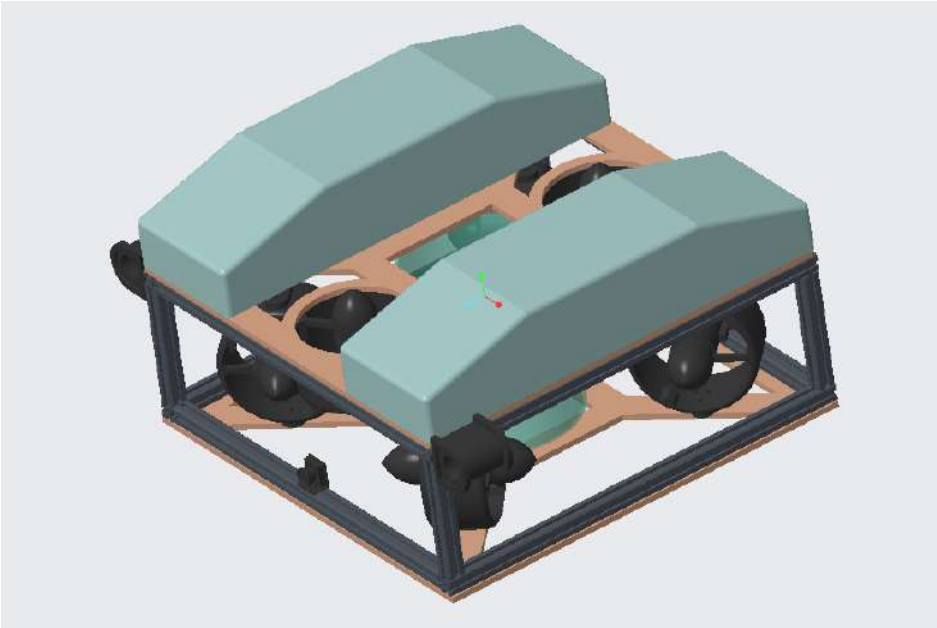
- *[Upon clearing Proof of Concept stage, 31 March]*

    - Acquiring parts for Full Scale model – 7 days (1 week)
    - Assembling Full Scale model using parts – 21 days (3 weeks)
    - Importing movement code from previous robot – 14 days (2 weeks)
    - Testing robot movement and making modifications – 14 days (2 weeks)
    - Writing program for Grand Objective – 14 days (2 weeks)
    - Testing Grand Objective – 7 days (1 week)
    - 1 week as buffer

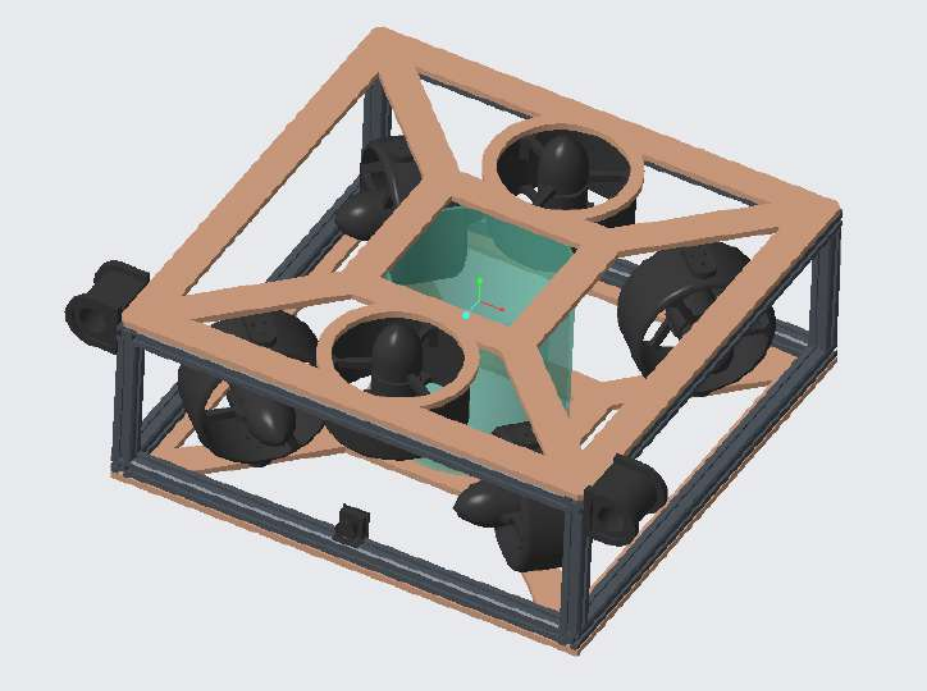
- *[Submission of Full-Scale Prototype Robot, 30 June]*

9. Proposed outline (photography)

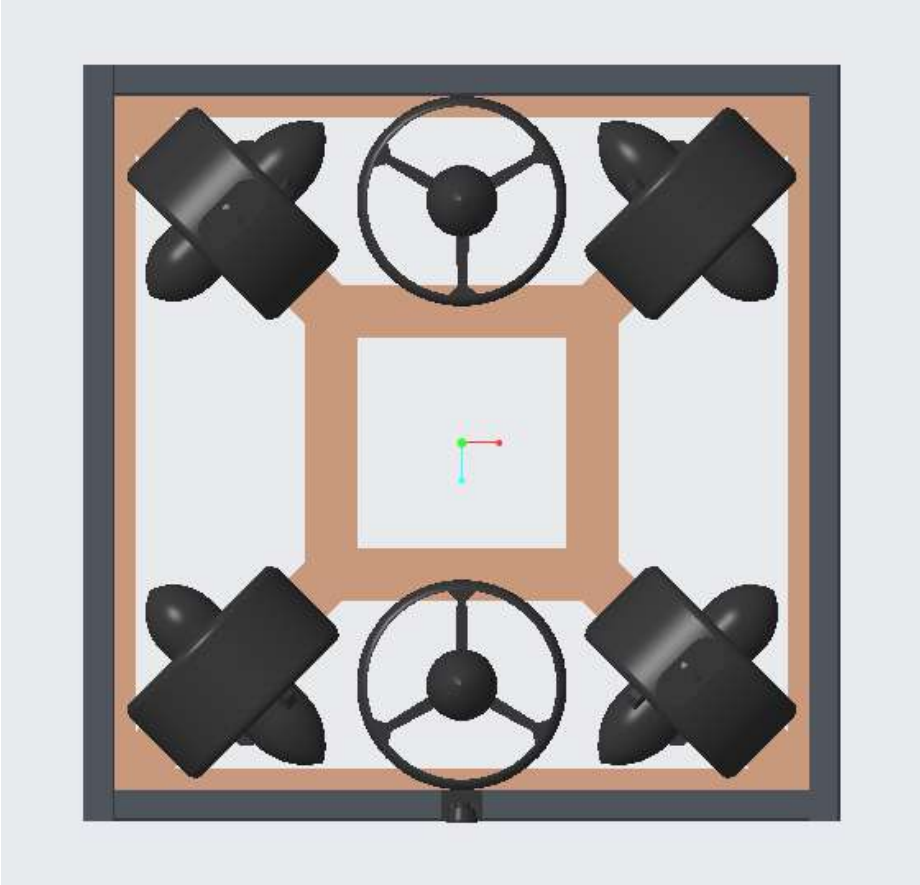
3D CAD Drawings



3D Model of Proposed Submarine Drone



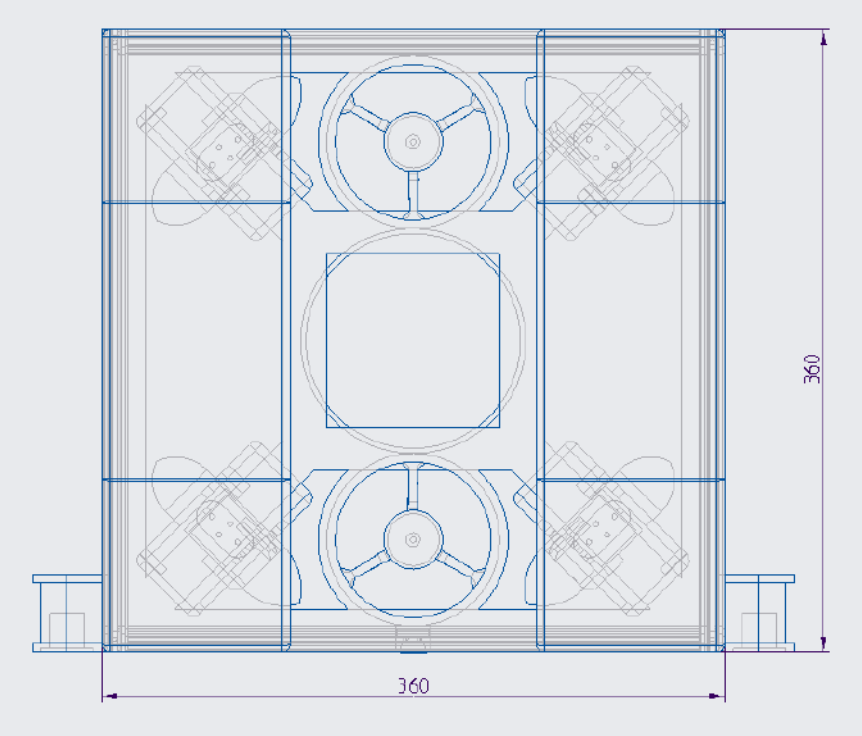
Inside Section View



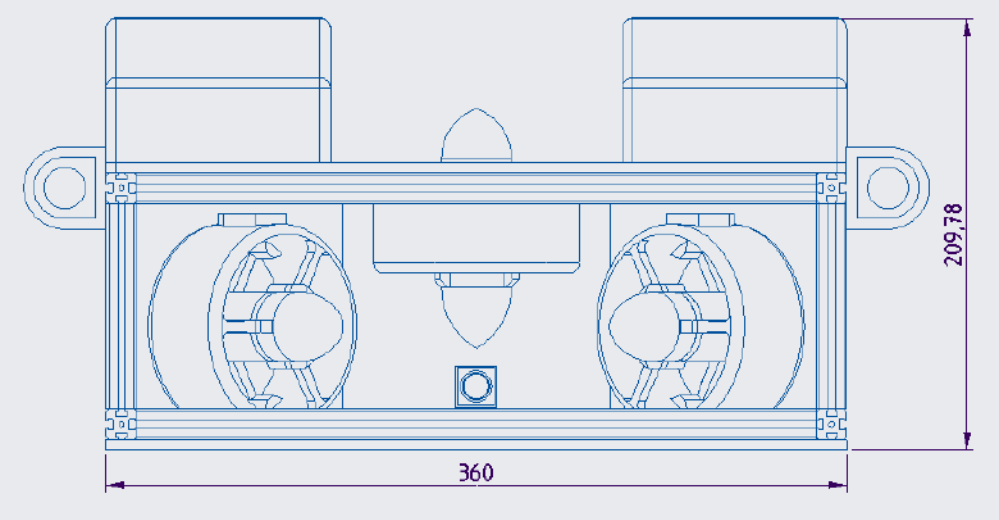
Propeller Vector arrangement

Gripper Cum Manipulator

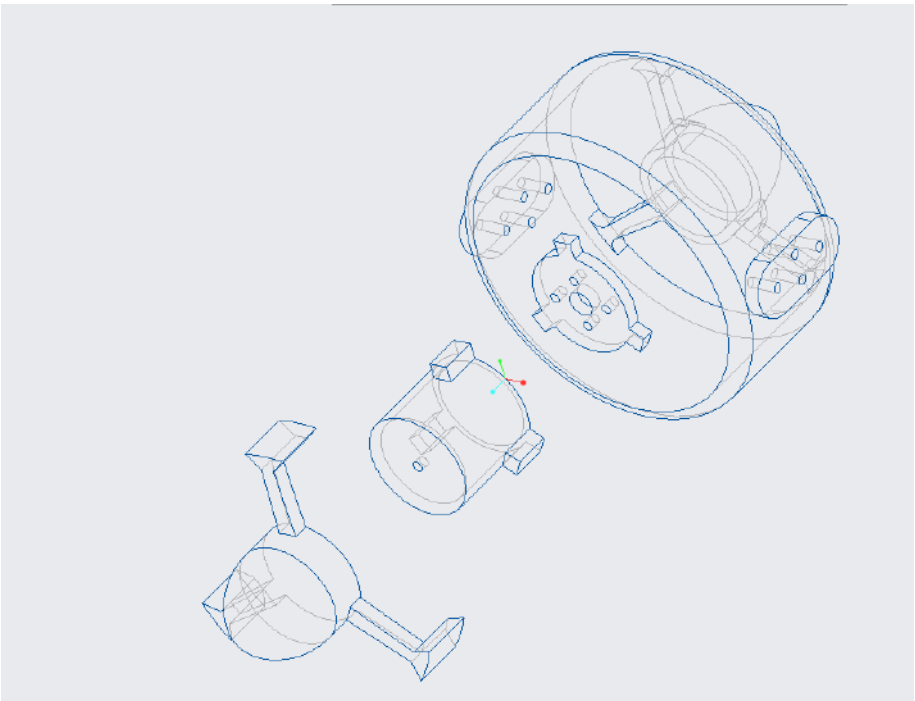
2D CAD Drawings (Sub-topic 4)



Top view



Front view



Thruster burst view