IITK

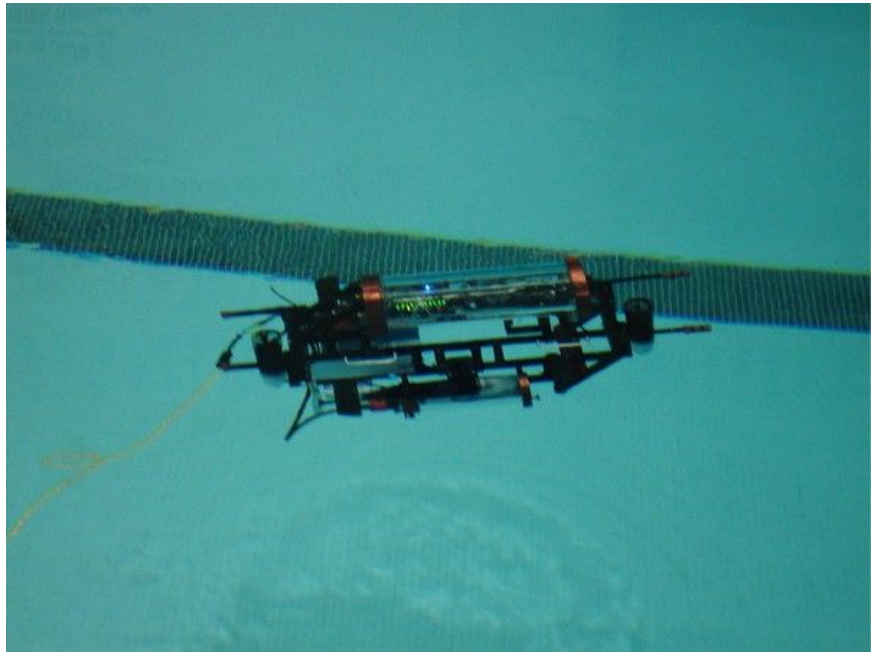
AUTONOMOUS UNDERWATER VEHICLE

Introductory Session

October 08, 2017

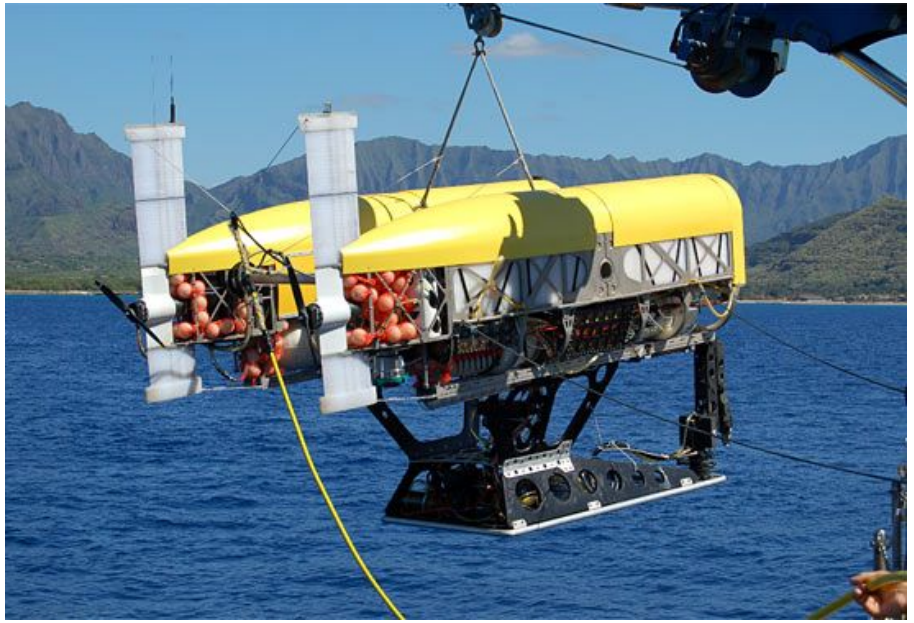
Why AUV?

- Unmanned, self propelled vehicles
- Operate independently for a period of few hours to several days
- Used in oceanographic and data collection in marine environments.



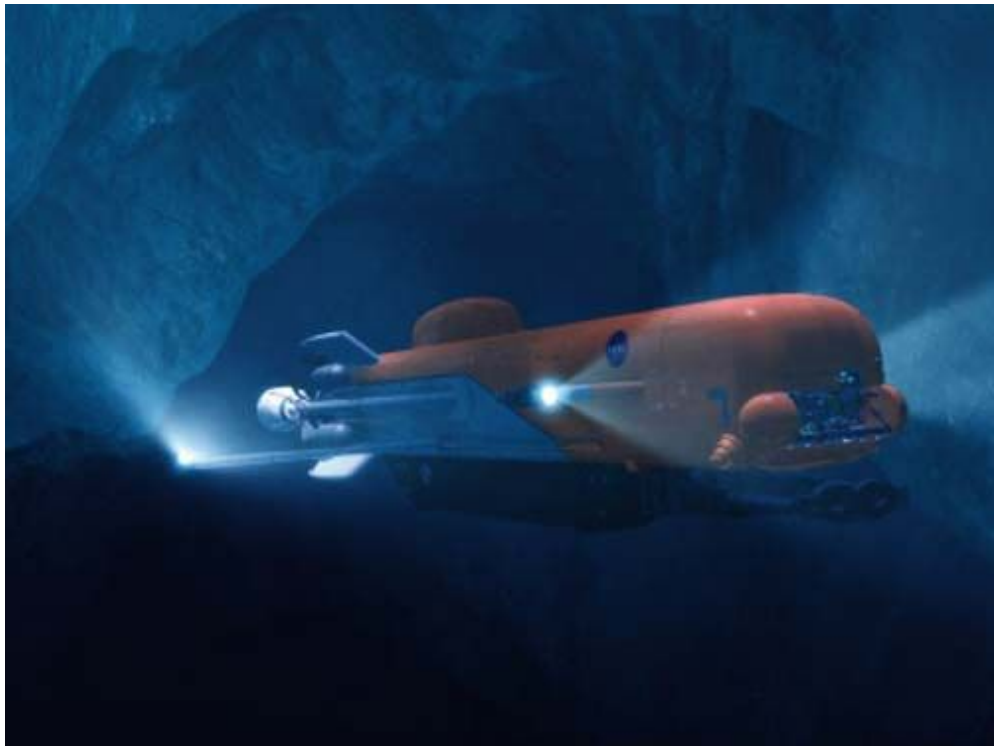
AMAZING FACTS TO BLOW YOUR MIND

- Deepest AUV: Neerus
- Hybrid design with both autonomous and remote controlled capabilities
- Reached the Mariana Trench in 1998 with a total of 40 km optic fibre cable.
- Max depth of current day submarine is around 750m



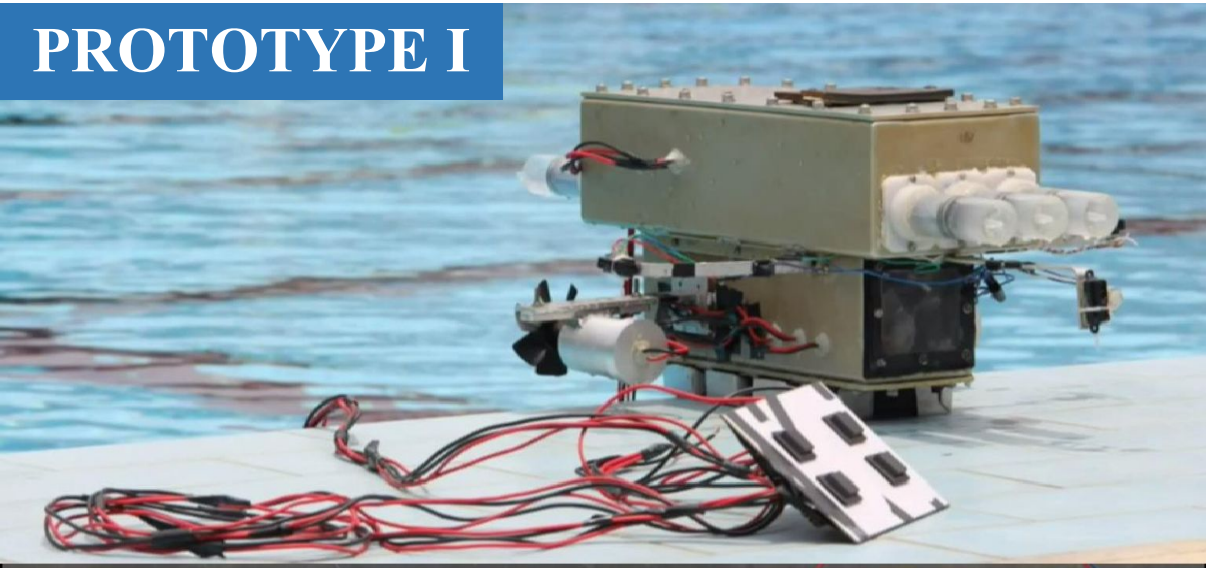
Future of AUV

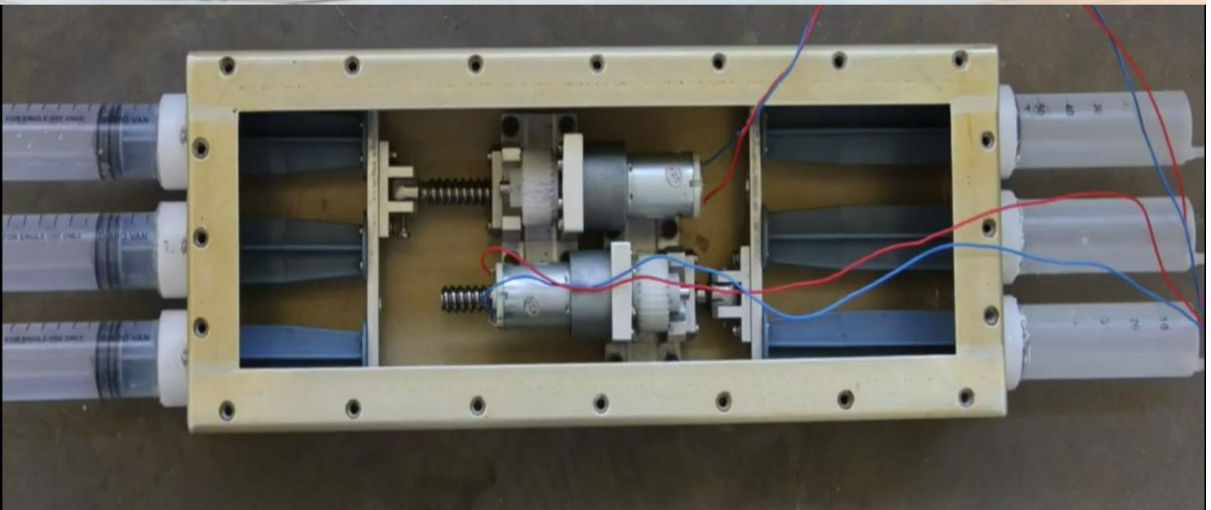
- Japan creating an AUV with cutting edge technology for mineral exploration and monitoring nuclear reactors
- NASA planning to send an AUV to Jupiter's moon Europa to explore the world beneath its icy surface.



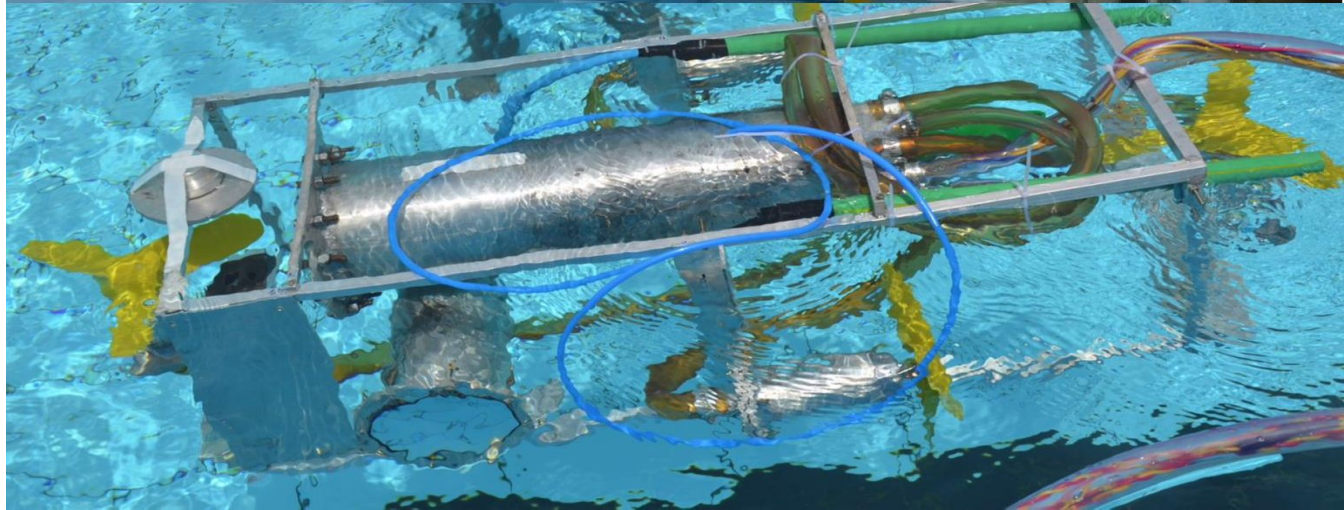
OUR HISTORY

PROTOTYPE I





PROTOTYPE II



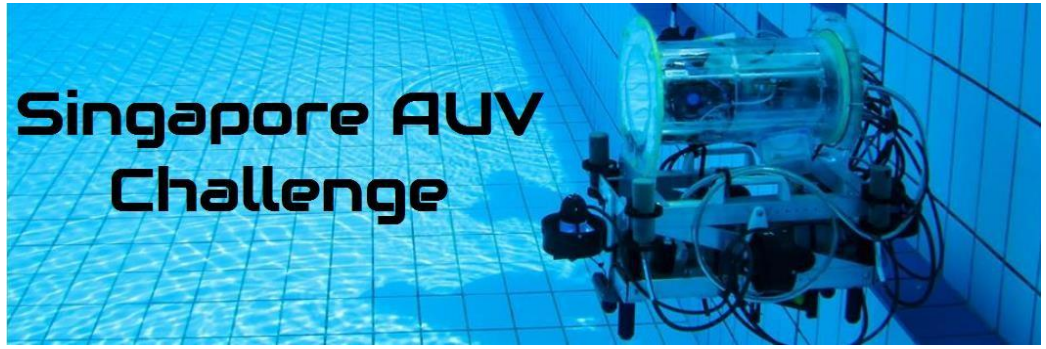
OUR OBJECTIVE

- To promote underwater robotics as an educational interest and future research sector.
- To build a robot which can autonomously carry out underwater surveillance, detect, locate and grab objects.
- To bring in new ideas and publications on marine technology by providing this platform to people who wish to innovate.
- To participate in various National and International competitions.

COMPETITIVE EVENTS

Student Autonomous underwater Vehicle (SAVe)

Organizer: NIOT, Chennai under Ministry of Earth Science Date: October, 2018
Venue: NIOT, Chennai

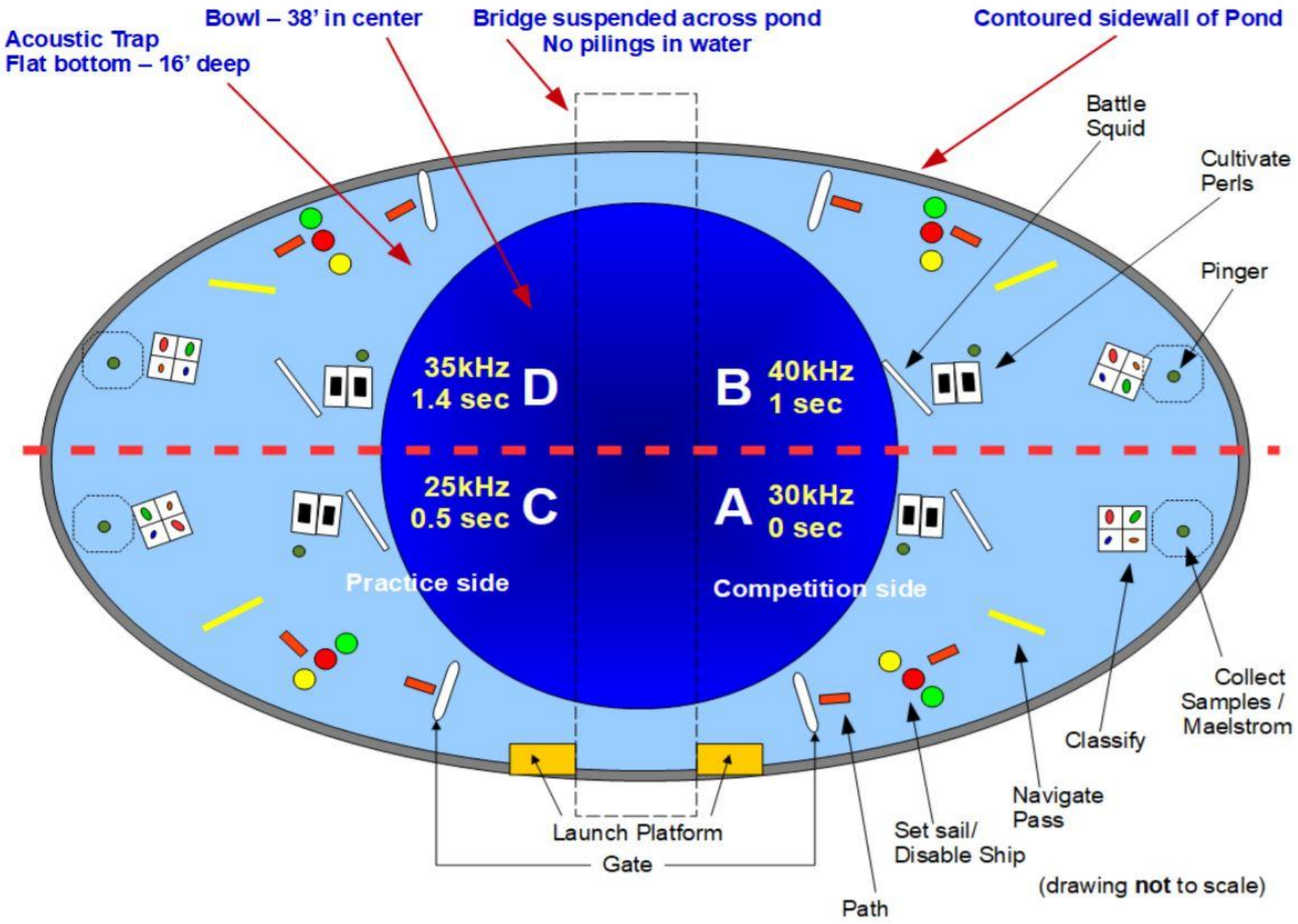


Singapore AUV Challenge

Organizer: IEEE & OES
Date: March, 2018
Venue: Singapore Polytechnic, Singapore

International RoboSub Competition

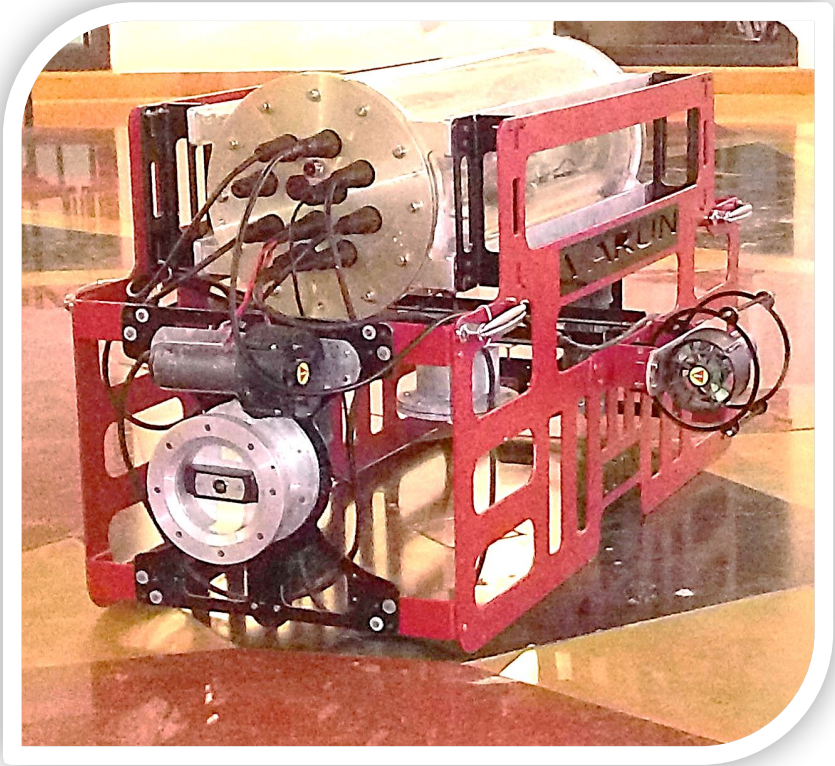
Organizer: AUVSI Foundation
(Co-sponsored by U.S. Office of Naval Research)
Date: Last week of July, 2018
Venue: SSC Pacific TRANSDEC, San Diego, CA



TASKS IN THE GAME ARENA

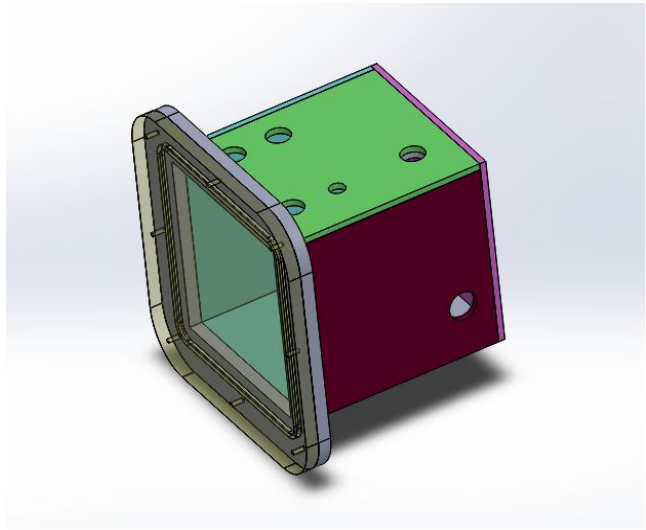
robosub

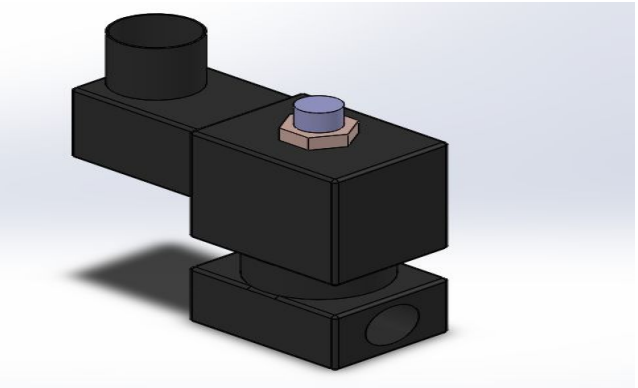
MECHANICAL



Mechanical Subsystem

- Robot Designing
- Design Analysis
- Waterproof Casing
- Waterproof Connectors
- Pneumatic System





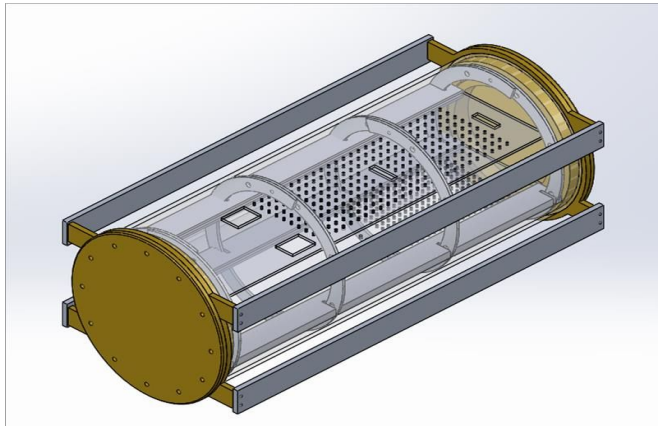
Robot Designing

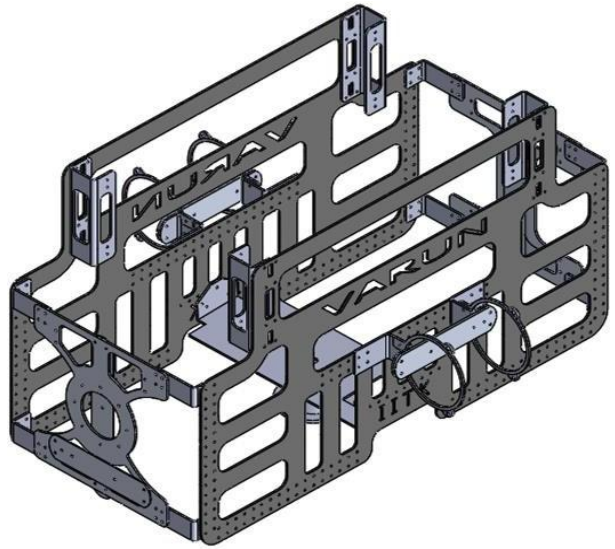
AUTODESK® INVENTOR®

SOLIDWORKS

Used for designing the robot before fabrication to ensure that everything is picture perfect

- 3-D view of the robot
- Orthographic and isometric views of parts
- Selecting the material required

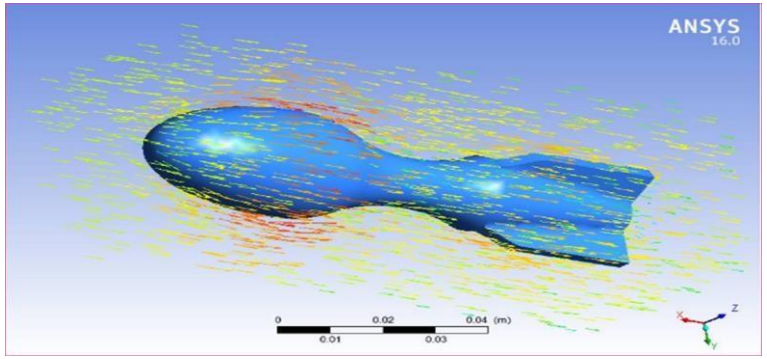


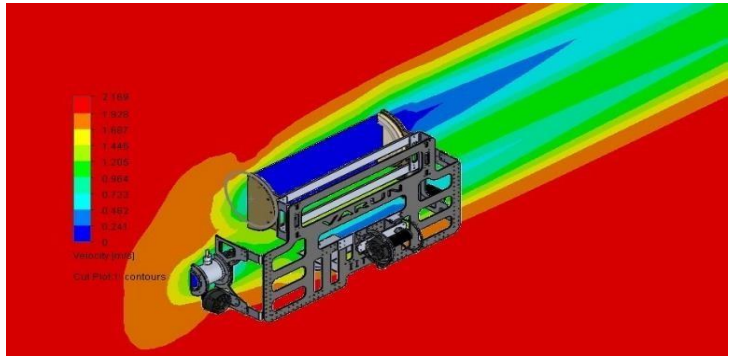


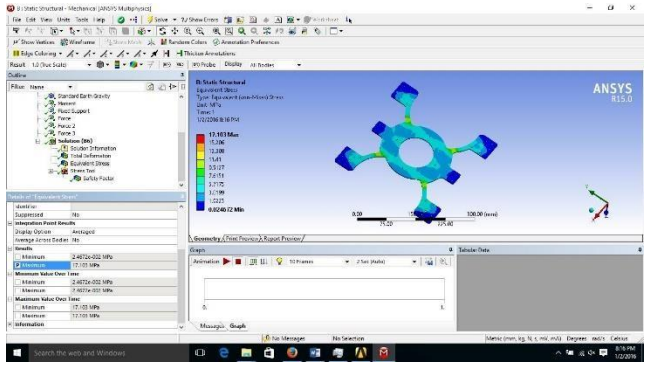
Design Analysis

Used for analyzing the design for optimizing it's performance in terms of:

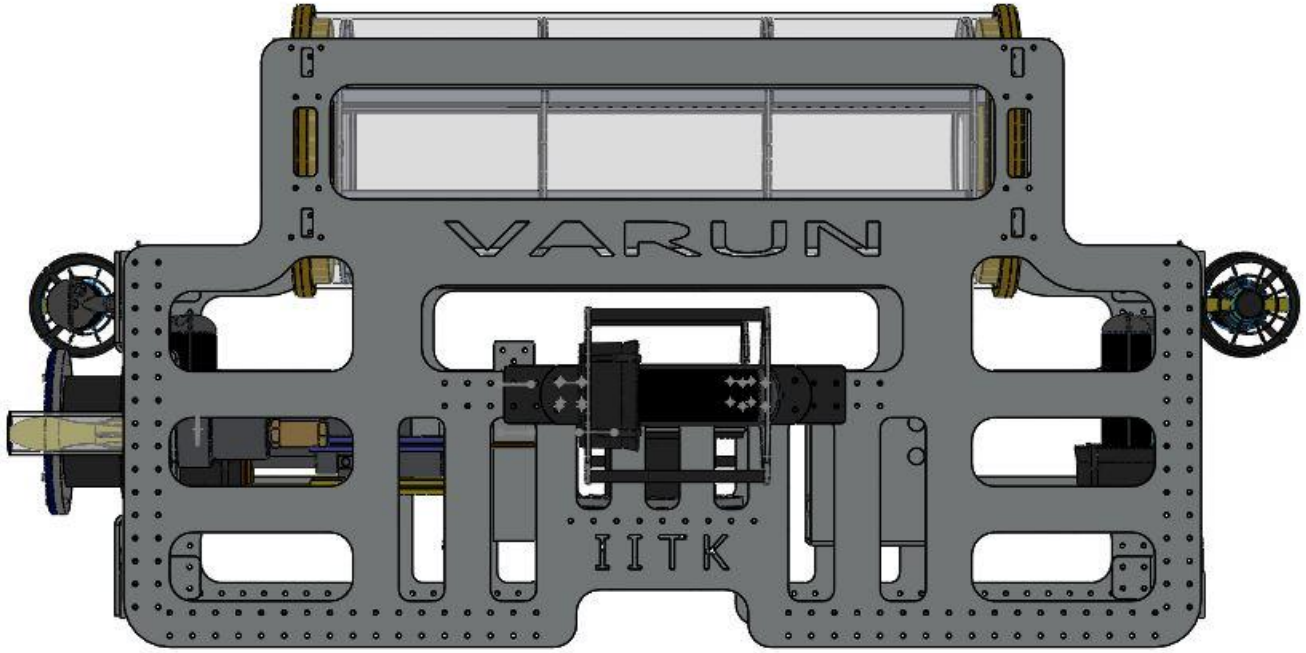
- Coefficient of Drag
- Centre of Mass
- Center of Buoyancy
- Vehicle Speed
- Weight







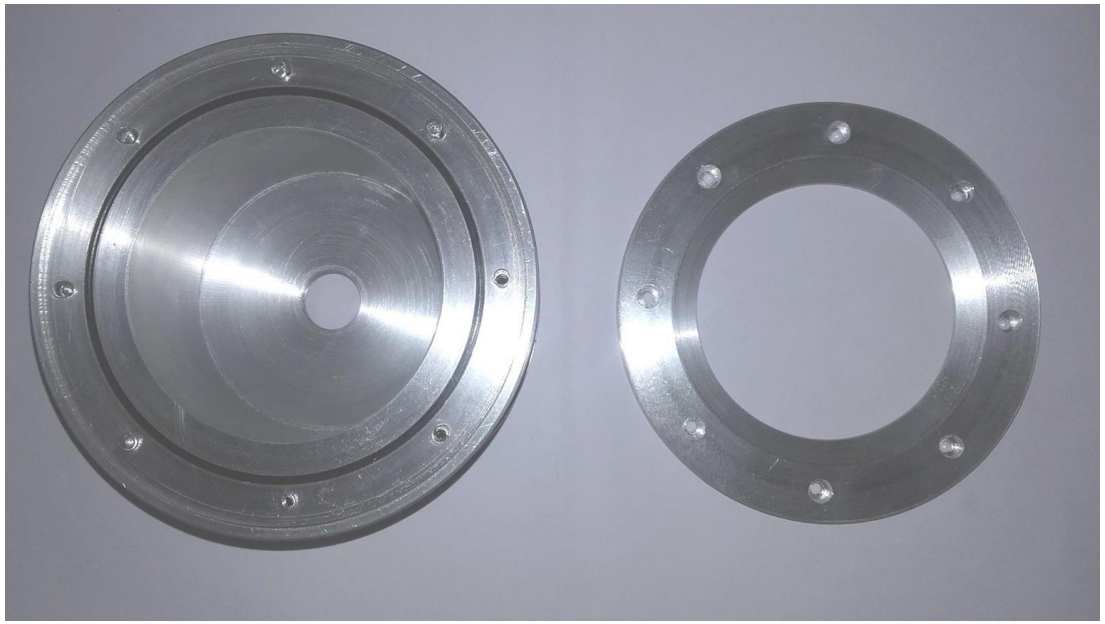
Varun's Design Specification



Name:	Varun
Degree of Freedom:	5
Number of thrusters:	6
Weight:	41.550 kg
Buoyancy:	+1%
Dimensions (in mm):	1430*434*560

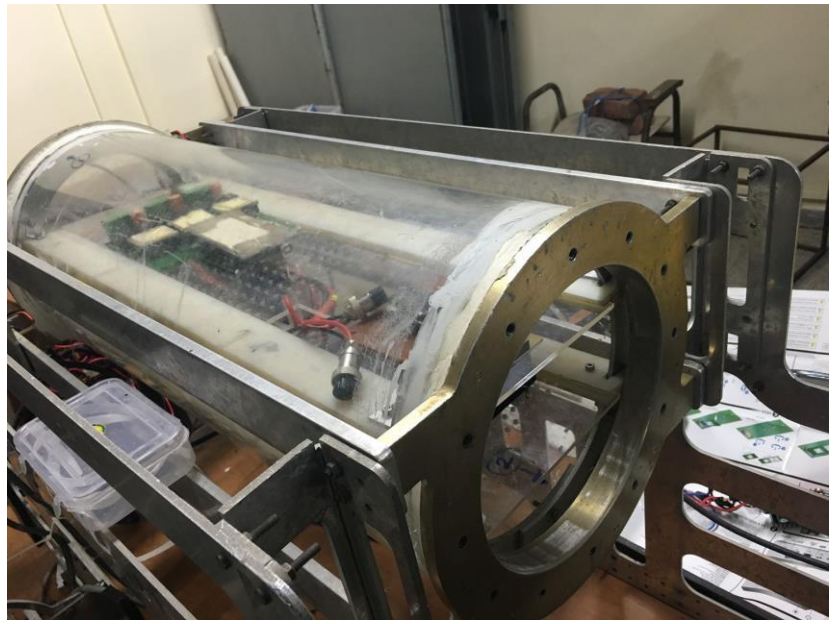
Custom- Made Waterproof Casings

Manufactured using in-house facilities available at Tinkering Lab and 4-i Laboratory under Mechatronics Lab



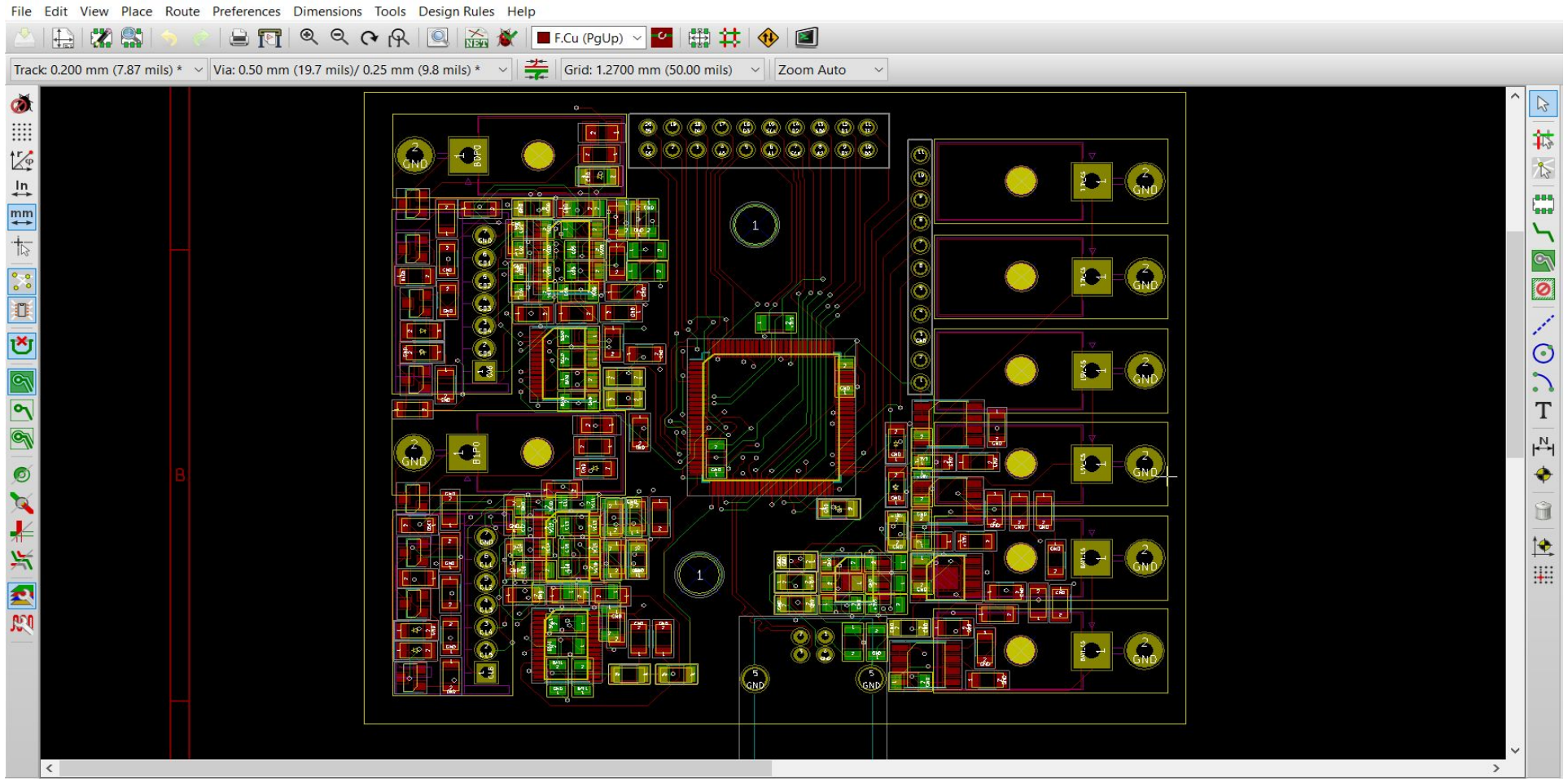
Front Camera Casing

Hull Cap with Connectors



Main Pressure Hull

ELECTRICAL


File Edit View Place Route Preferences Dimensions Tools Design Rules Help
F.Cu (PgUp)
Track: 0.200 mm (7.87 mils) *
Via: 0.50 mm (19.7 mils)/ 0.25 mm (9.8 mils) *
Grid: 1.2700 mm (50.00 mils)
Zoom Auto
GND

What do we do?

- Battery and power management
- Sensors
- Actuators
- PCB Designing

Battery Management

LiPo Battery

Pros:

- High capacity to weight ratio
- Multiple cell configurations available
- Rechargeable
- High discharge rate

Cons:

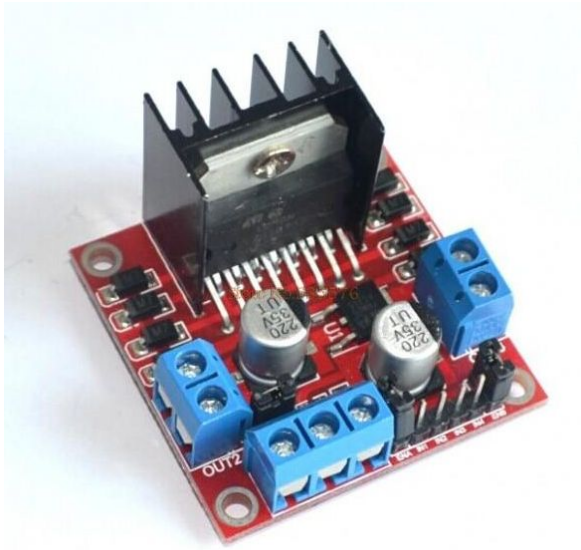
- Highly sensitive to:
  - Over charge
  - Over discharge
  - Temperature
- Relatively expensive

Power Management

- **Thrusters** 0-12V, Up To 8A
- **NUC** 12-19V, Up To 5A
- **Arduino, Camera, IMU** 5V, Up To 2A
- **Pressure Sensor** 3.3V, Less than 1A

Actuators

Thrusters



Motor driver

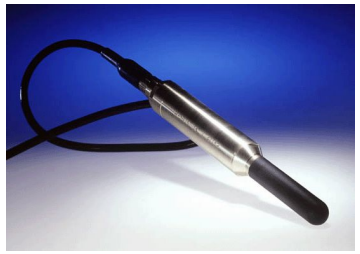
Pneumatics

Sensors

Pressure Sensor
Gives depth of vehicle under the water

Camera
Gives view of arena

IMU
Gives orientation, acceleration and angular velocities of the bot

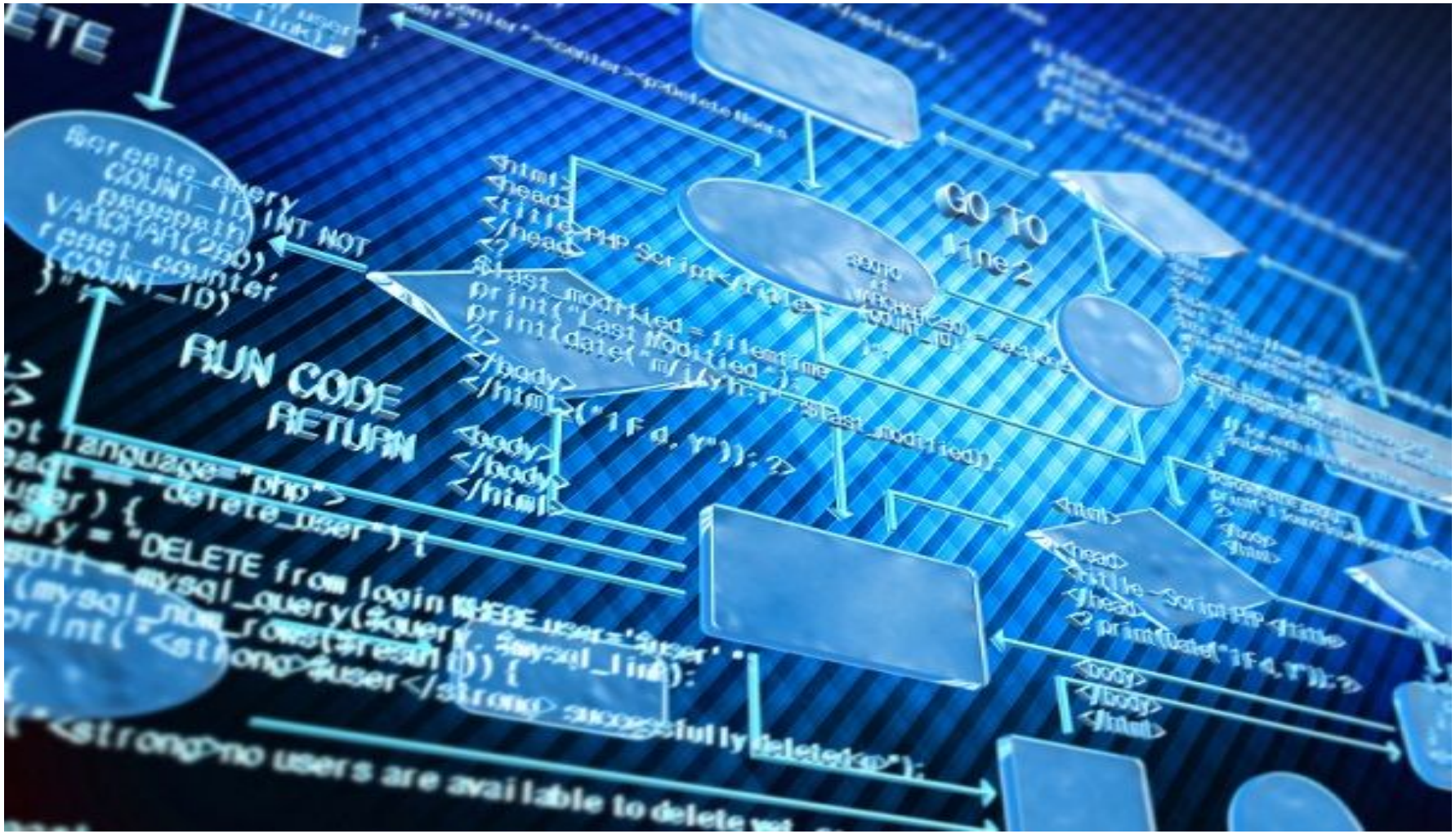


Hydrophone
Used for acoustic localization

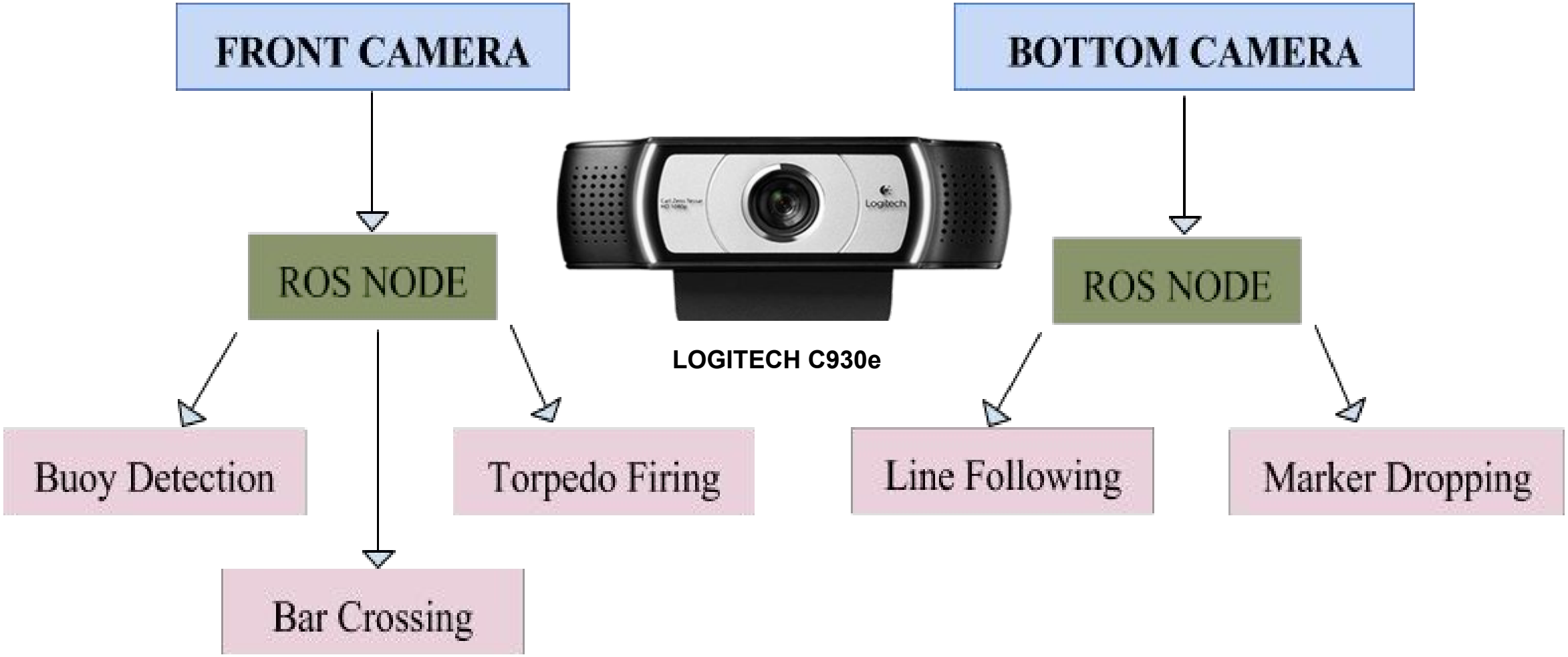
PCB Designing

- Custom specifications
- Compact size
- Easy debugging
- Easy integration into other systems in the vehicle

SOFTWARE



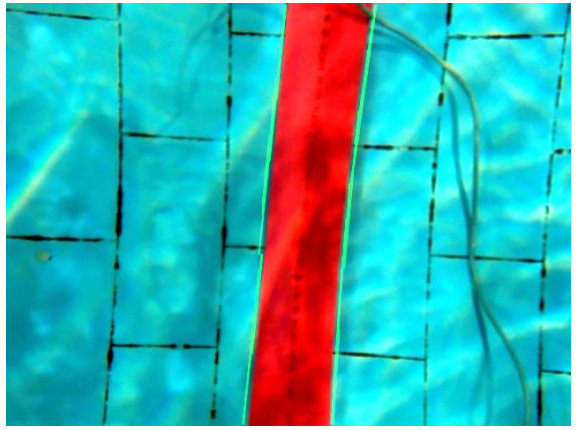
Vision



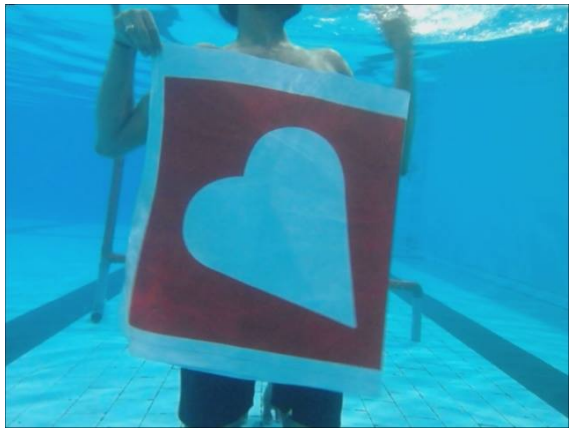
LOGITECH C930e

Samples

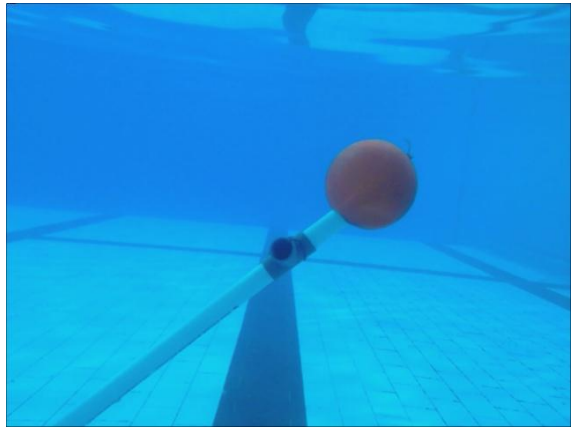
Line Detection



Shape Detection



Buoy Detection

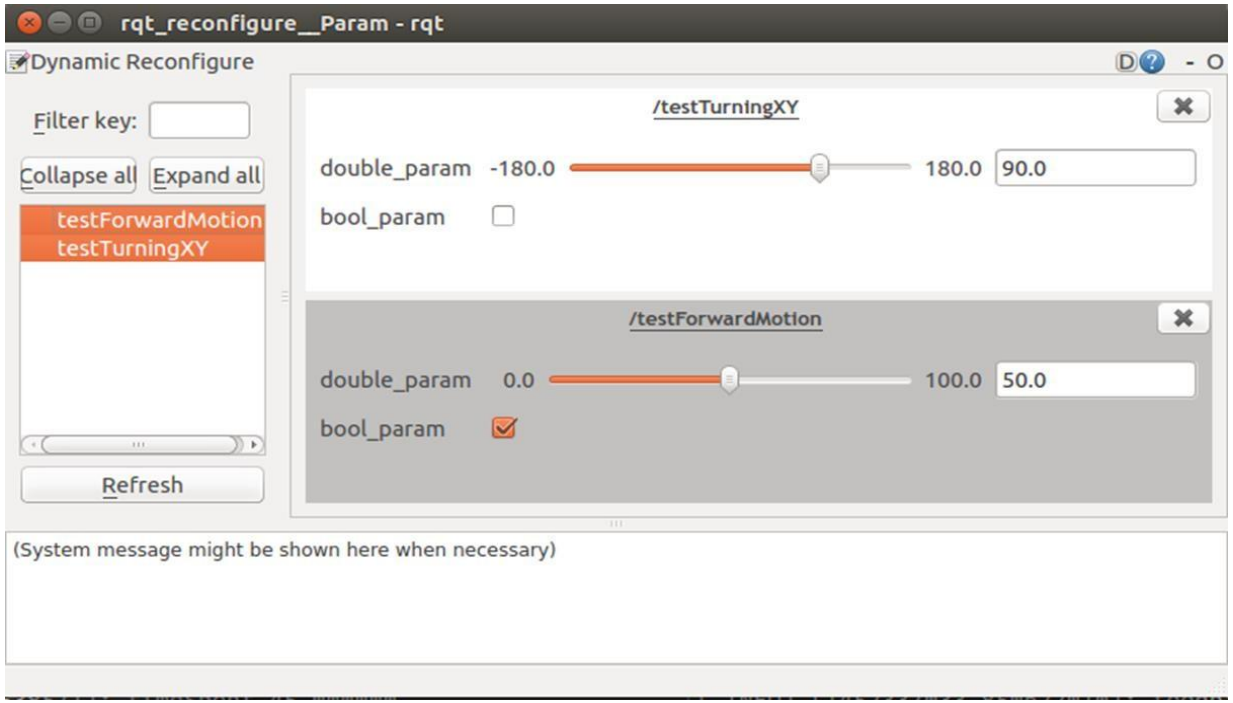


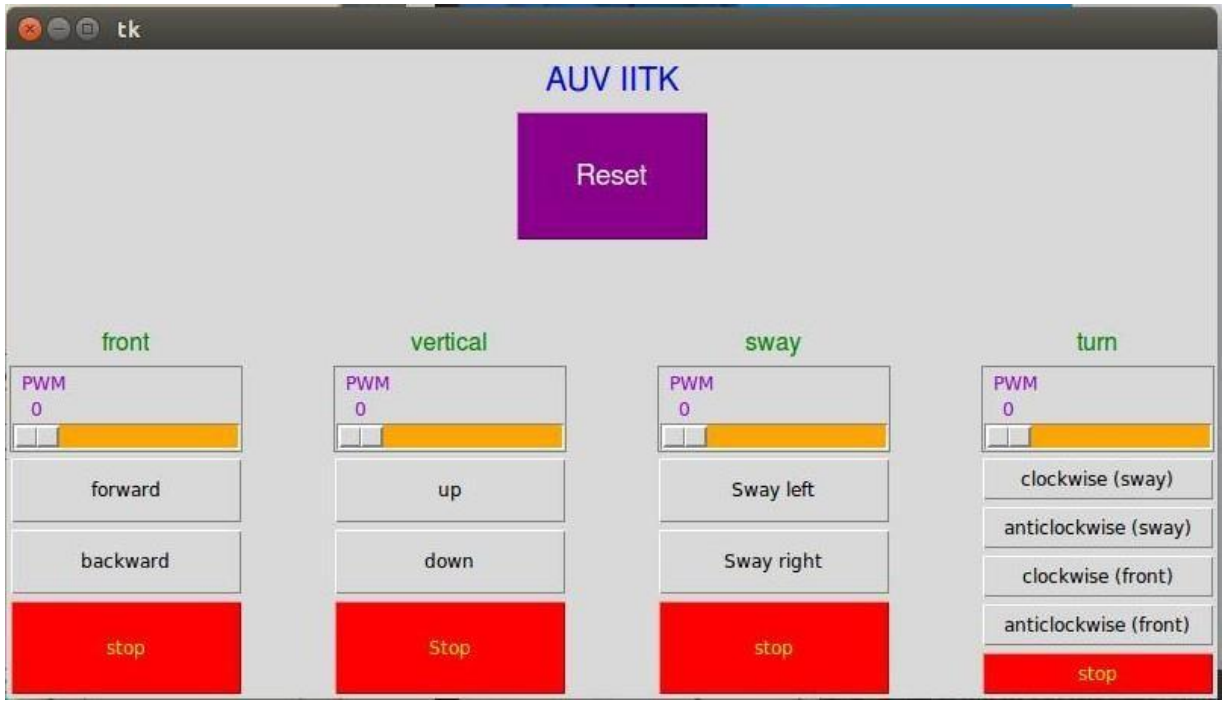
ROBOT OPERATING SYSTEM

- Flexible framework for writing robot software
- Collection of tools, libraries, and conventions that aim to simplify the task of creating complex and robust robot behavior.
- Has built-in messaging system that manages details of communication between distributed nodes via anonymous publish/subscribe mechanism.
- Easier to capture data published by some task (node) to a file, and then republish that data from the file at a later time.

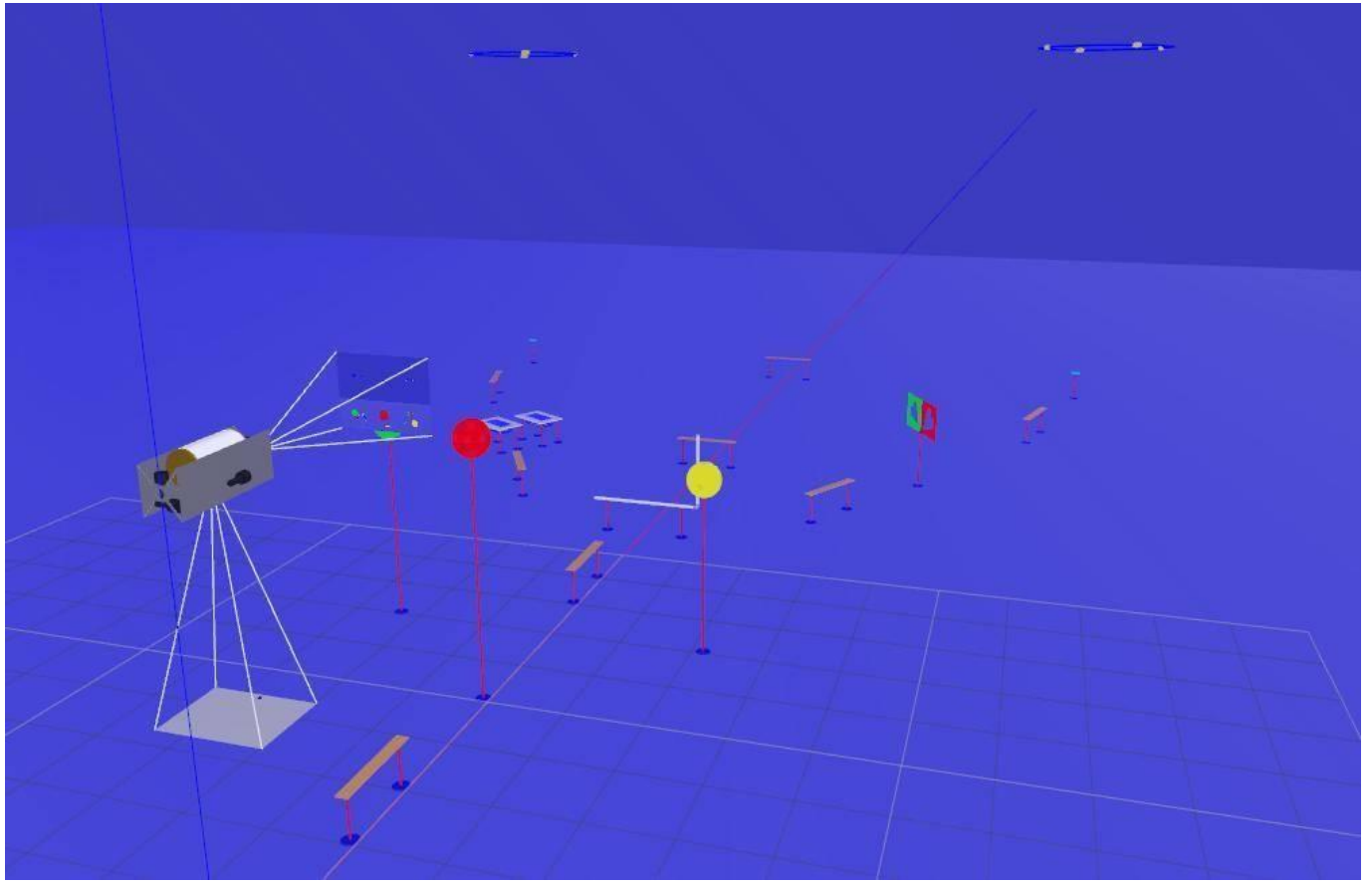
Graphical User Interface(GUI)

We use this GUI for testing our Bot's Motion.



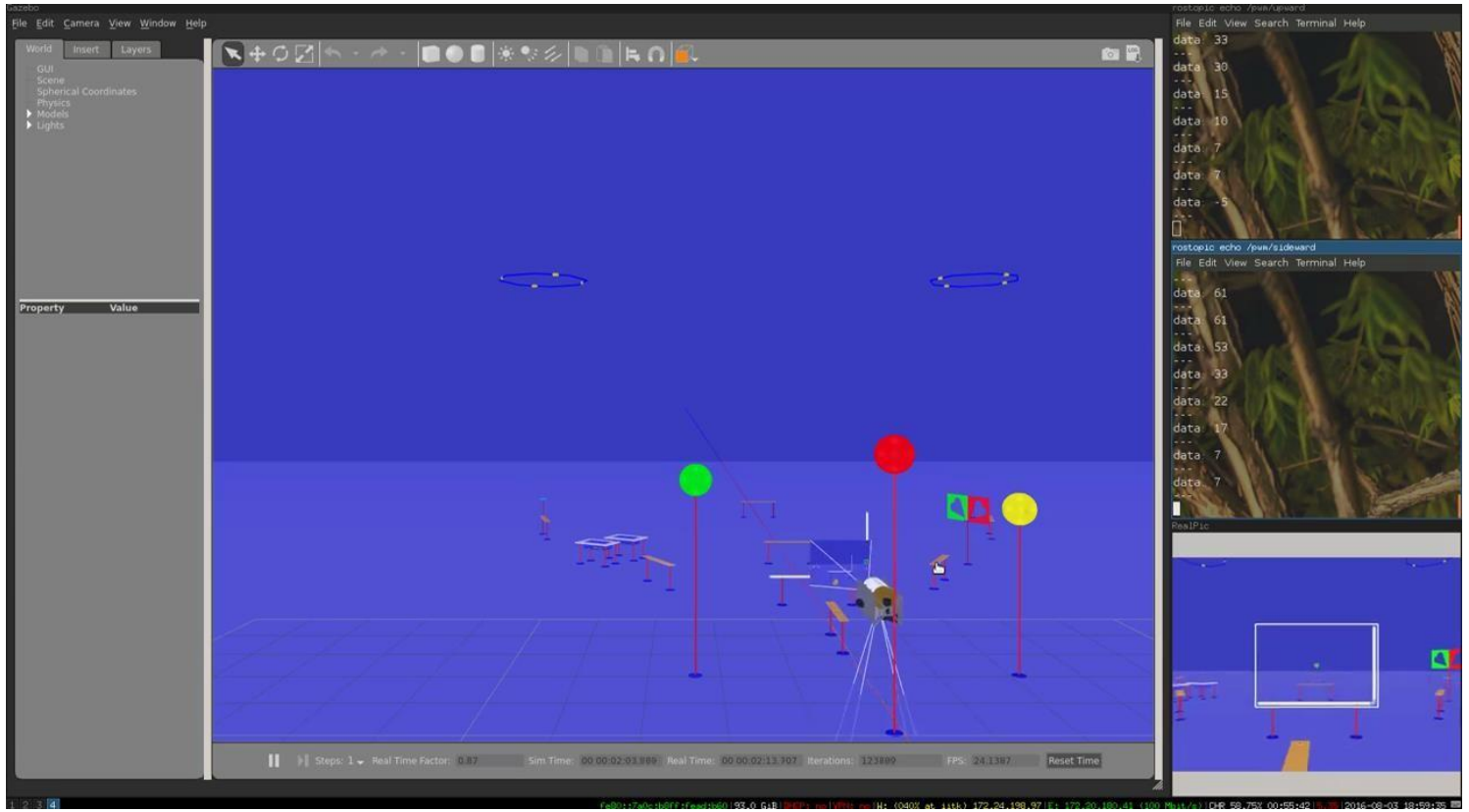


Actually testing our code rather than praying that it'll work!



Tasks

- Task_gate
- Task_line
  - line_detection
  - line_centralize
  - Line_align
- Task_buoy
- Task_torpedo
- Task_octagon



Business

Face of the Team

- Represent team in various exhibitions and conferences held across the country
- Ensures interests of campus community and professors
- Opportunity to connect with industrial professionals and experts
- Publishes papers and newsletters for the team

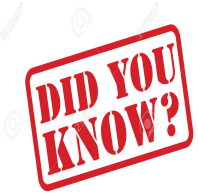
marine technology SOCIETY

IEEE

Marketing and Sponsorships

- **Establish tie-ups of the team with various companies.**
- **Learn methods of influencing companies and alumni to fund the project.**
- **Learn how to advertise and brand the team.**

Doppler Velocity Log



Sponsorships required to purchase better sensors and have availability of better services to build the robot.

A new sensor we want to purchase called Doppler Velocity Log is worth INR 13 lakhs!

Expectations from the Team

- **Sub-projects in the groups of 2-3.**
- **Strict deadlines for the work be met.**
- **15-20 hours of work per week.**
- **Have to stay in the winter break during the Winter Camp.**
- **Leaving in-between from the team would lead to no recognition of your work**
- **Above all enthusiasm and dedication for your work and the team**

The Team 2016

Any Questions?

For more information, visit: auviitk.com, *or* contact:

Akash Jain	09450533385
Rithvik Patibandla	09133140747
Manish Kumar	09628580293