



AUTONOMOUS UNDERWATER VEHICLE

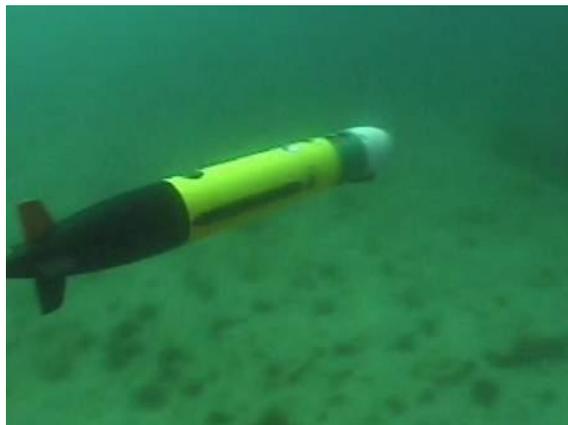
Introductory Session

January 07, 2017

Purpose of an AUV



Pluto Plus AUV



Remus AUV



Battlespace Preparation AUV



Cornell AUV: Gemini

COMMERCIAL

- Maps of Seafloor
- Building subsea infrastructure
- Detecting underwater mines

RESEARCH

- Studying marine life
- Measuring properties like concentration of elements in ocean floor

DEFENSE

- Upcoming interest in navy forces
- Finding wreckages of crashed airplanes

HOBBY

- For robotics enthusiasts
- Participating in competitions held annually

OUR OBJECTIVE

- To promote robotics, especially underwater robotics as an educational interest.
- To provide facility to interested students and faculties for conducting amateur research and educational experiments in underwater robotics.
- To represent the institute at national and international level competitions held annually, and exhibit the caliber and prestige that the institute carries.



COMPETITIVE EVENTS



Student Autonomous underwater Vehicle (SAVe)

Organizer: NIOT, Chennai under Ministry of Earth Science

Date: October, 2017

Venue: NIOT, Chennai



Singapore AUV Challenge

Organizer: IEEE & OES

Date: March, 2018

Venue: Singapore Polytechnic, Singapore



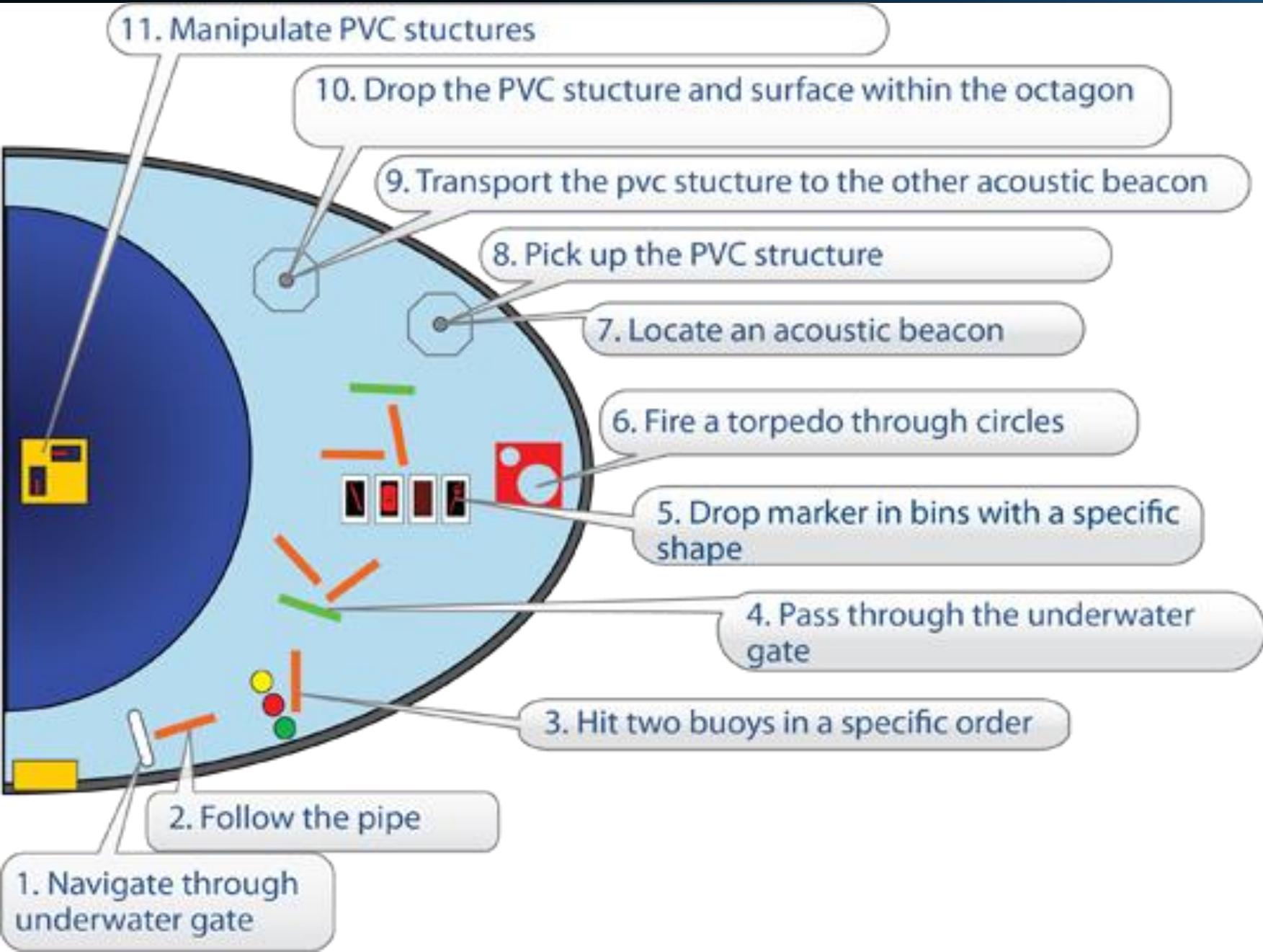
International RoboSub Competition

Organizer: AUVSI Foundation

(Co-sponsored by U.S. Office of Naval Research)

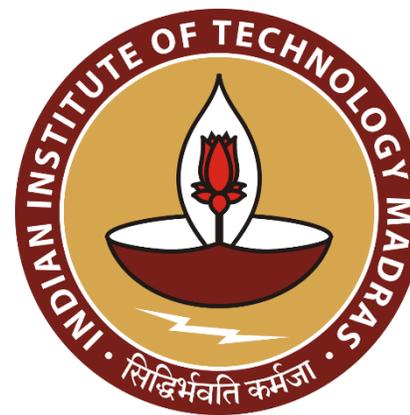
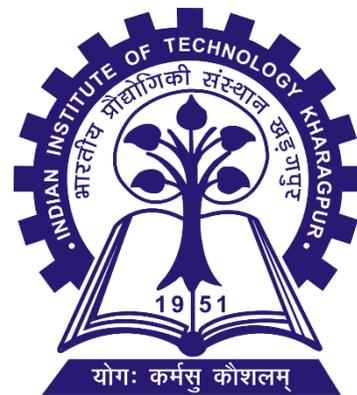
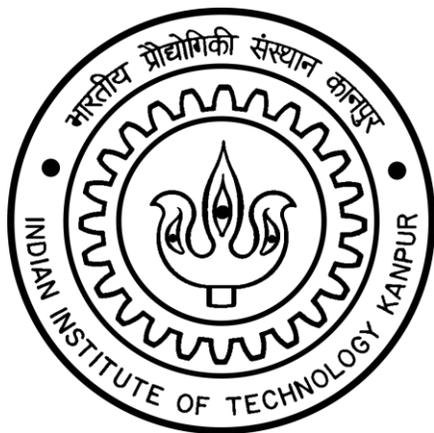
Date: Last week of July, 2018

Venue: SSC Pacific TRANSDEC, San Diego, CA

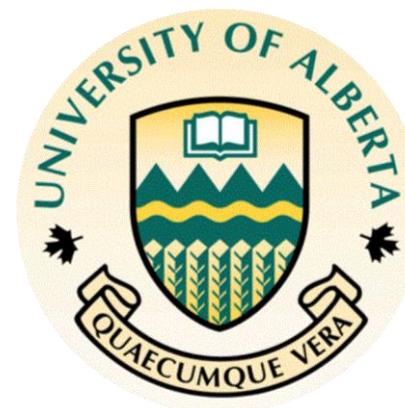
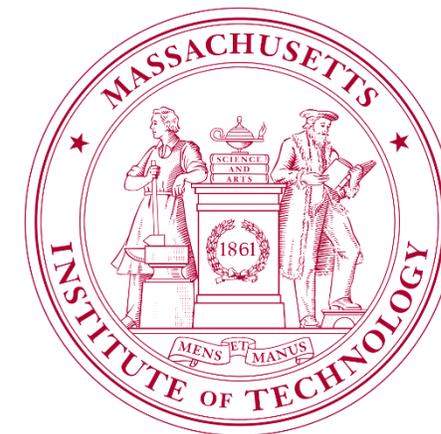
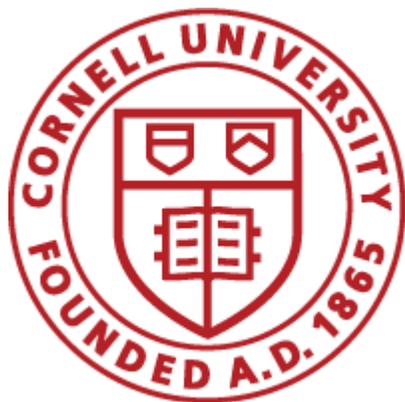


TASKS IN THE GAME ARENA

PARTICIPATING TEAMS FROM INDIA

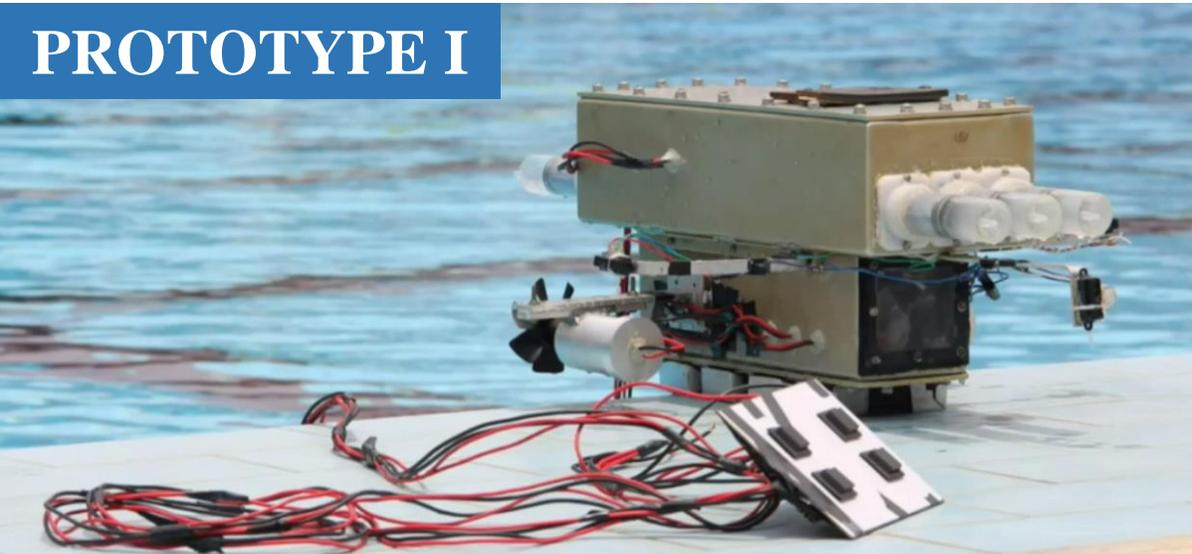


MAJOR INTERNATIONAL PARTICIPANTS

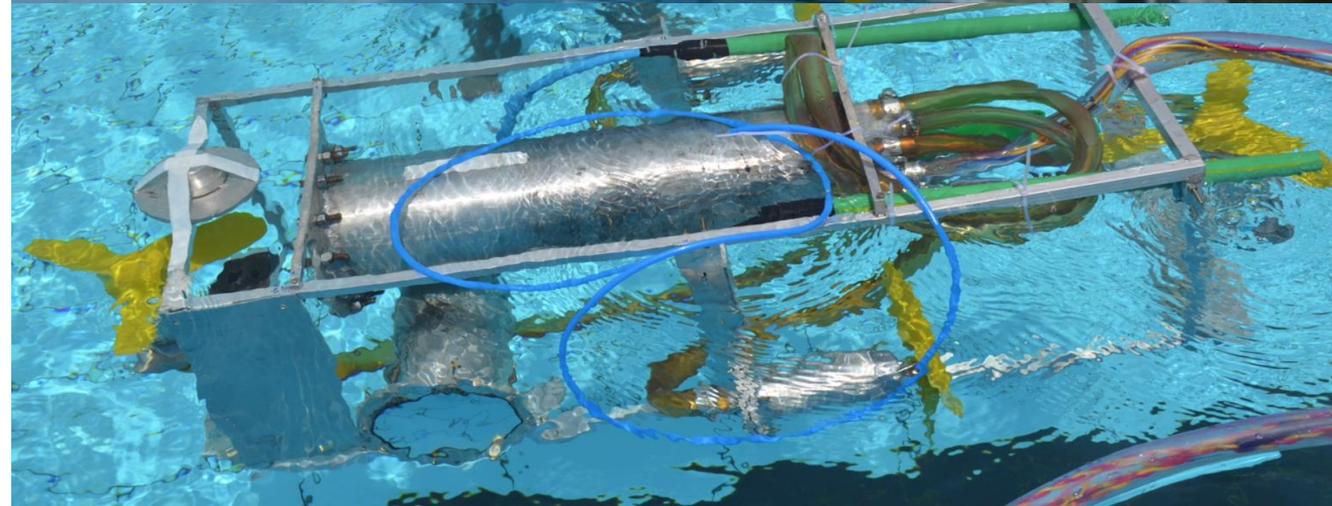
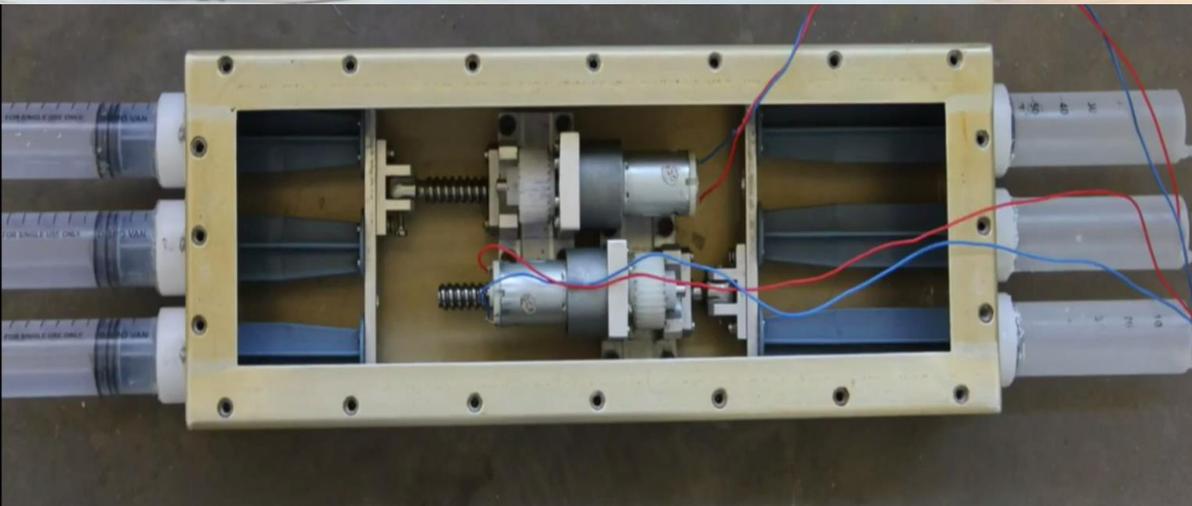


OUR HISTORY

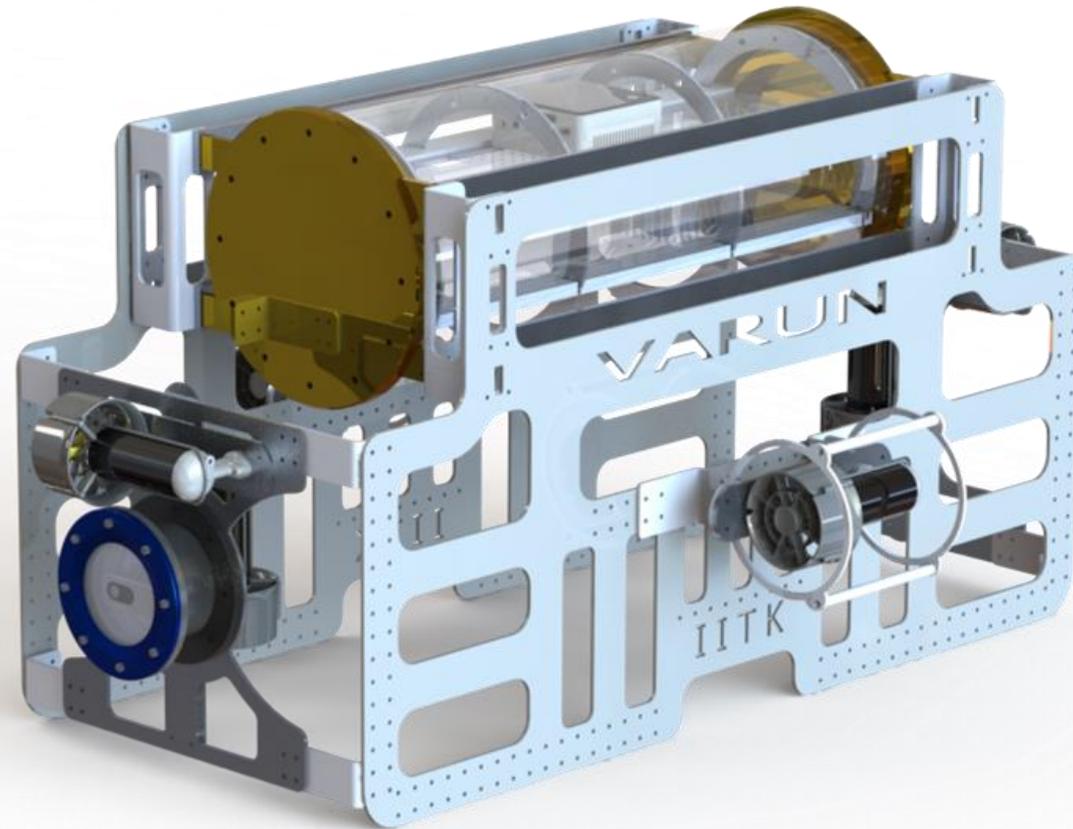
PROTOTYPE I



PROTOTYPE II



MECHANICAL

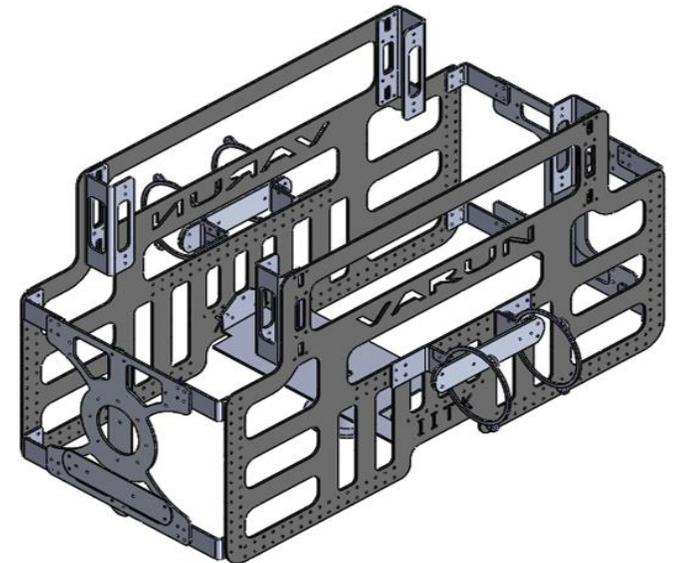
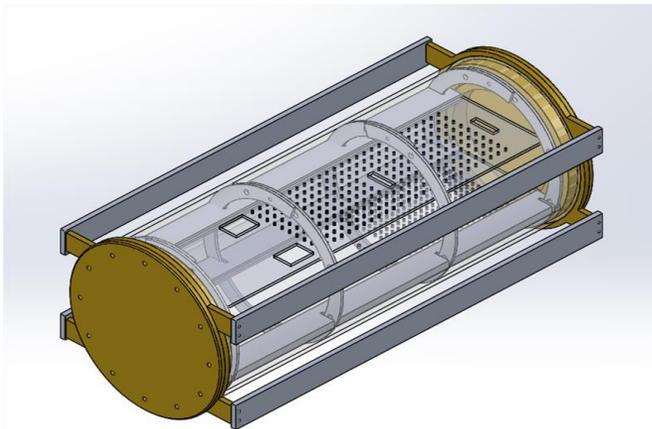


Robot Designing



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

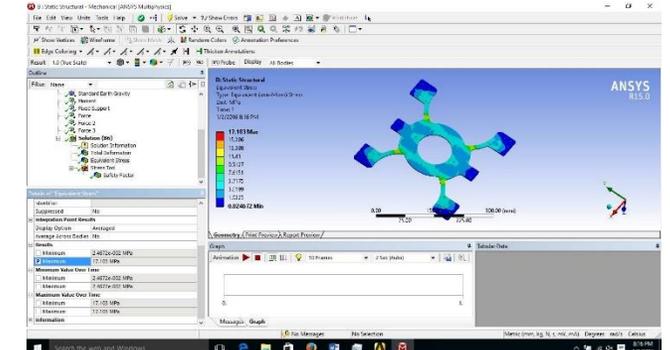
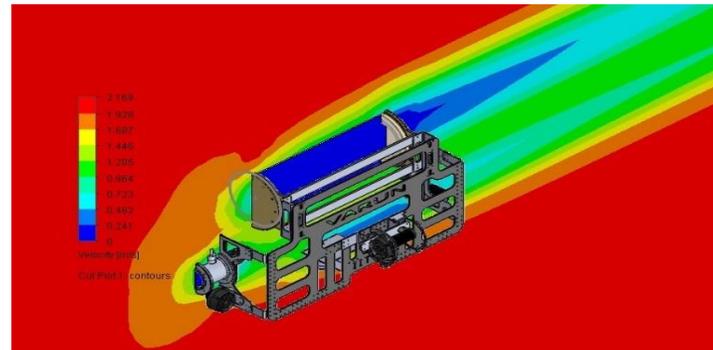
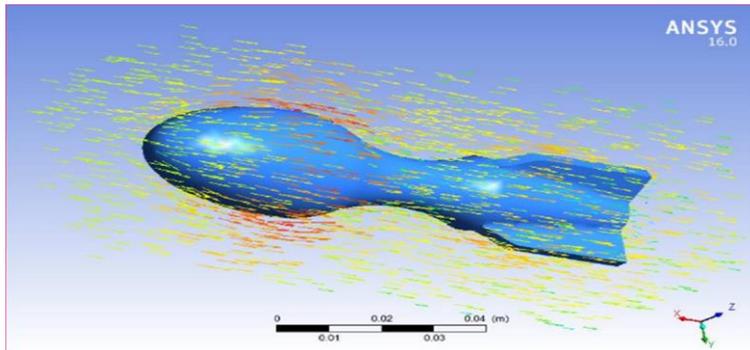


Design Analysis

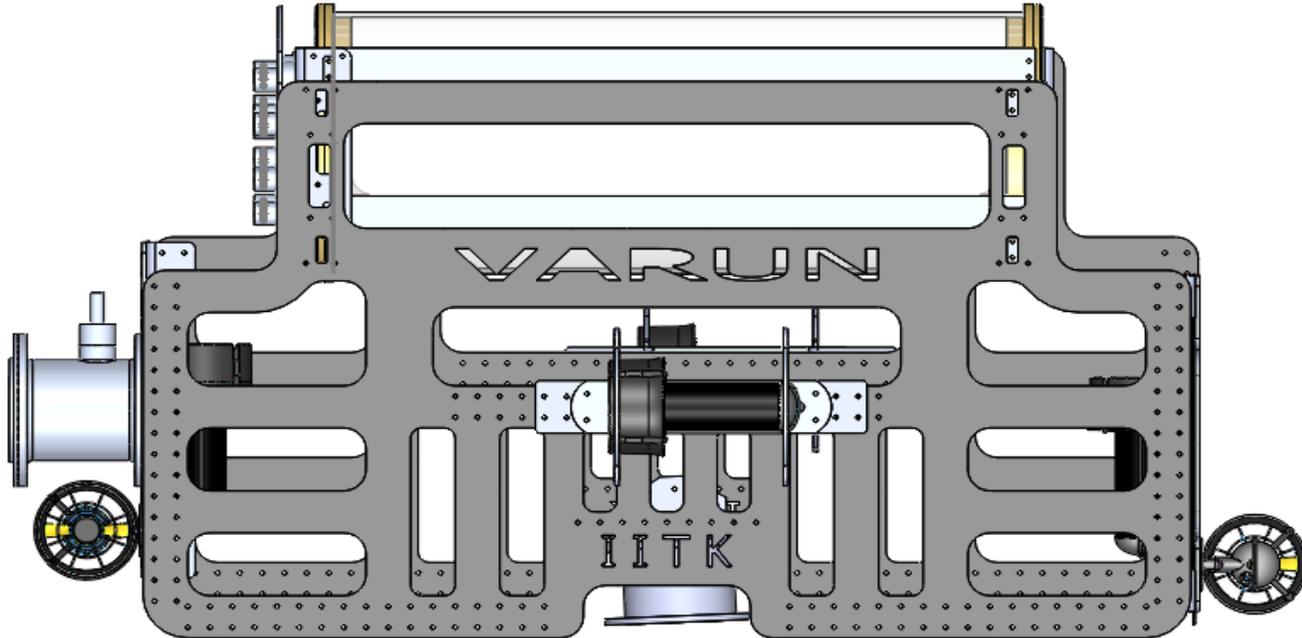


Used for analyzing the design for optimizing it's performance in terms of:

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



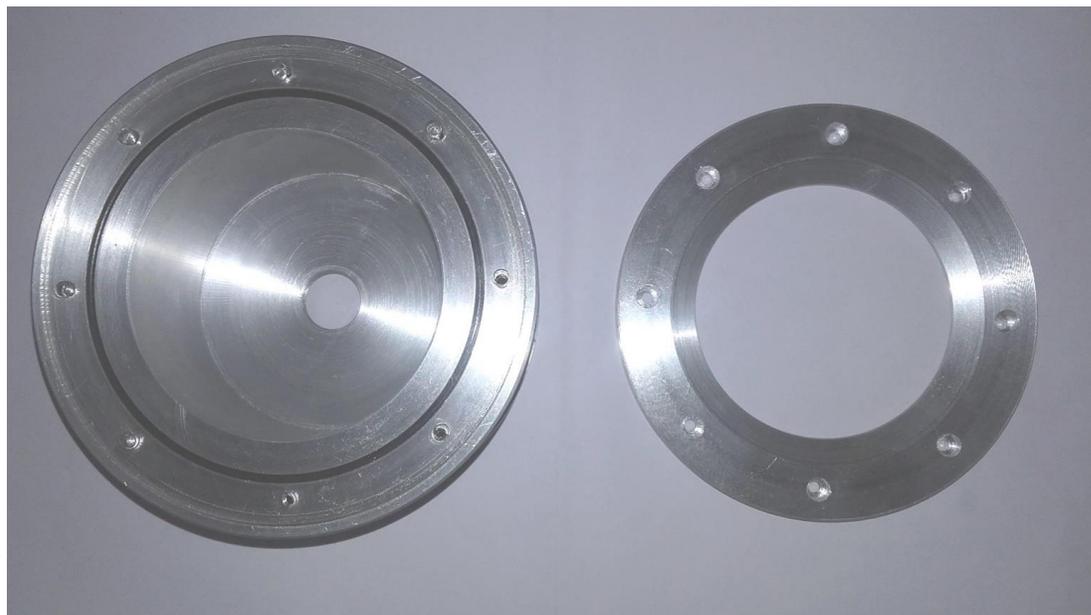
Varun's Design Specification



Name:	Varun
Degree of Freedom:	5
Number of thrusters:	6
Weight:	41.550 kg
Buoyancy:	+1%
Dimensions (in mm):	1081*434*530

Custom- Made Waterproof Casings

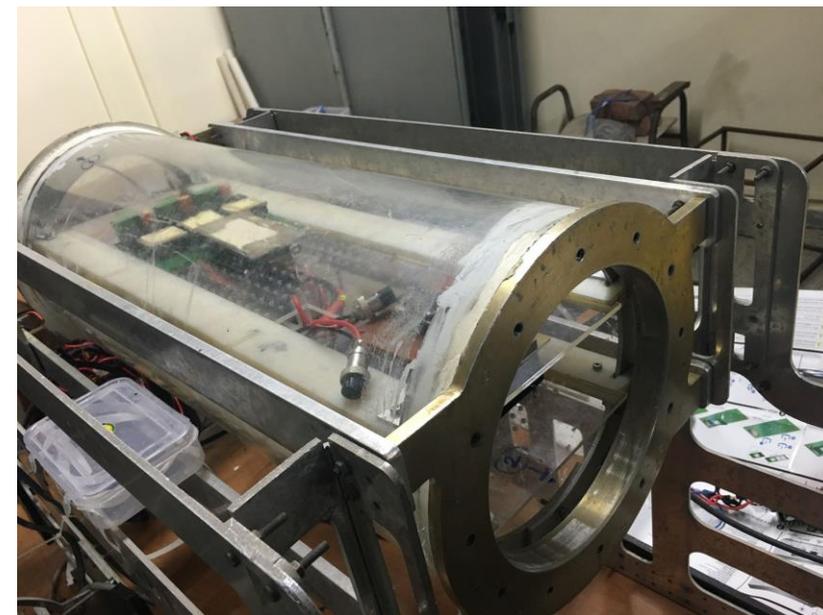
Manufactured using in-house facilities available at Tinkering Lab and 4-i Laboratory under Mechatronics Lab



Front Camera Casing



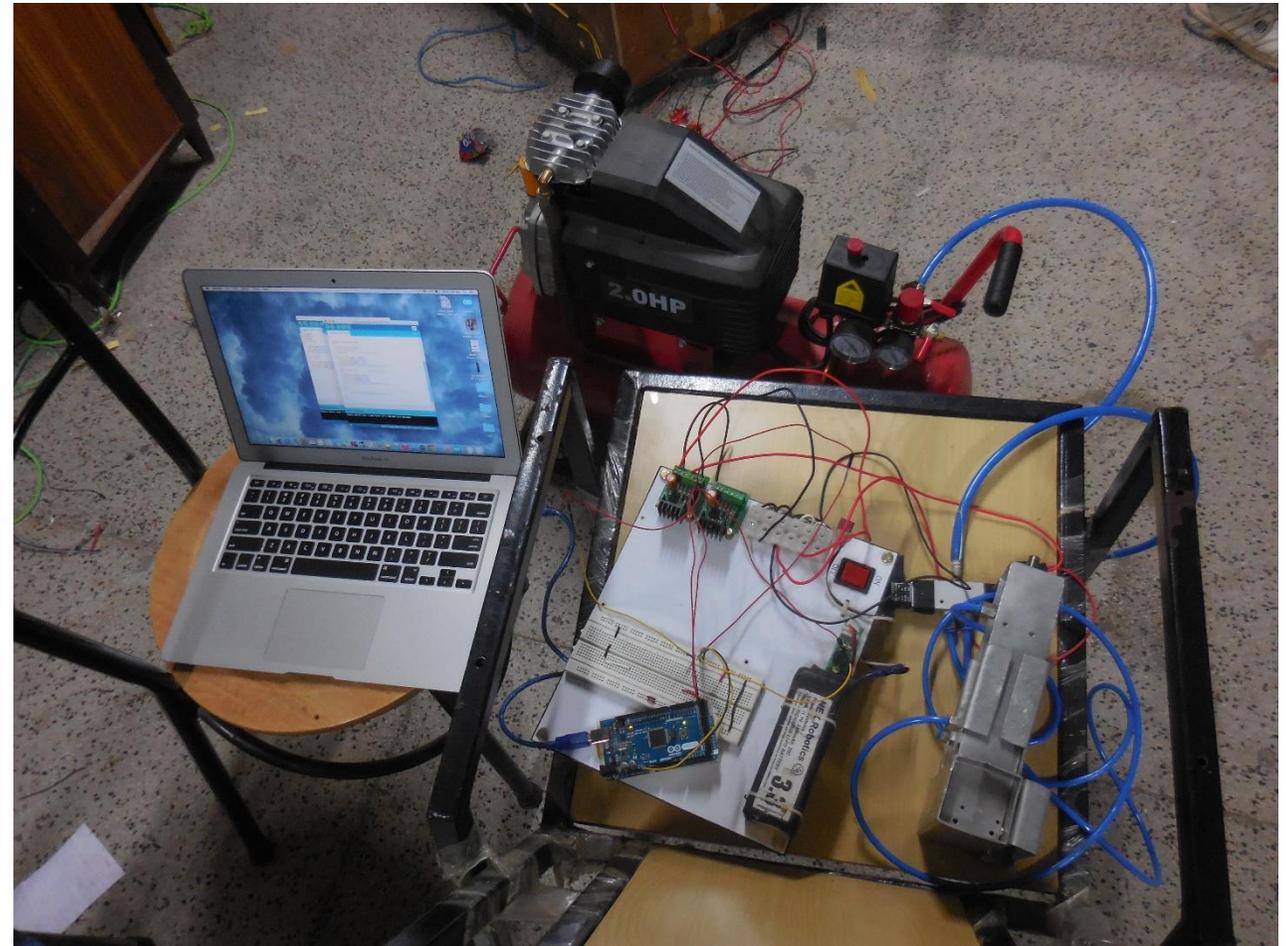
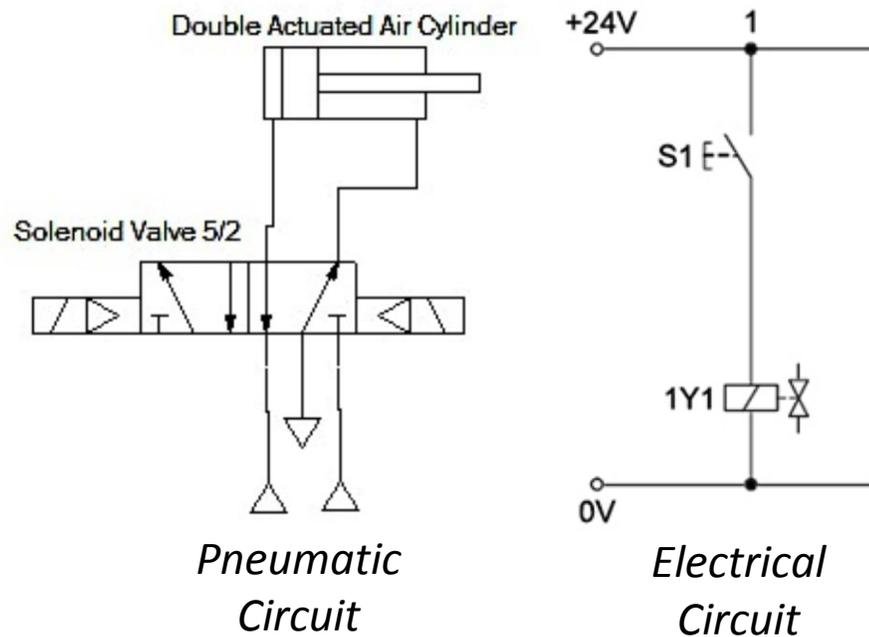
Hull Cap with Connectors



Main Pressure Hull

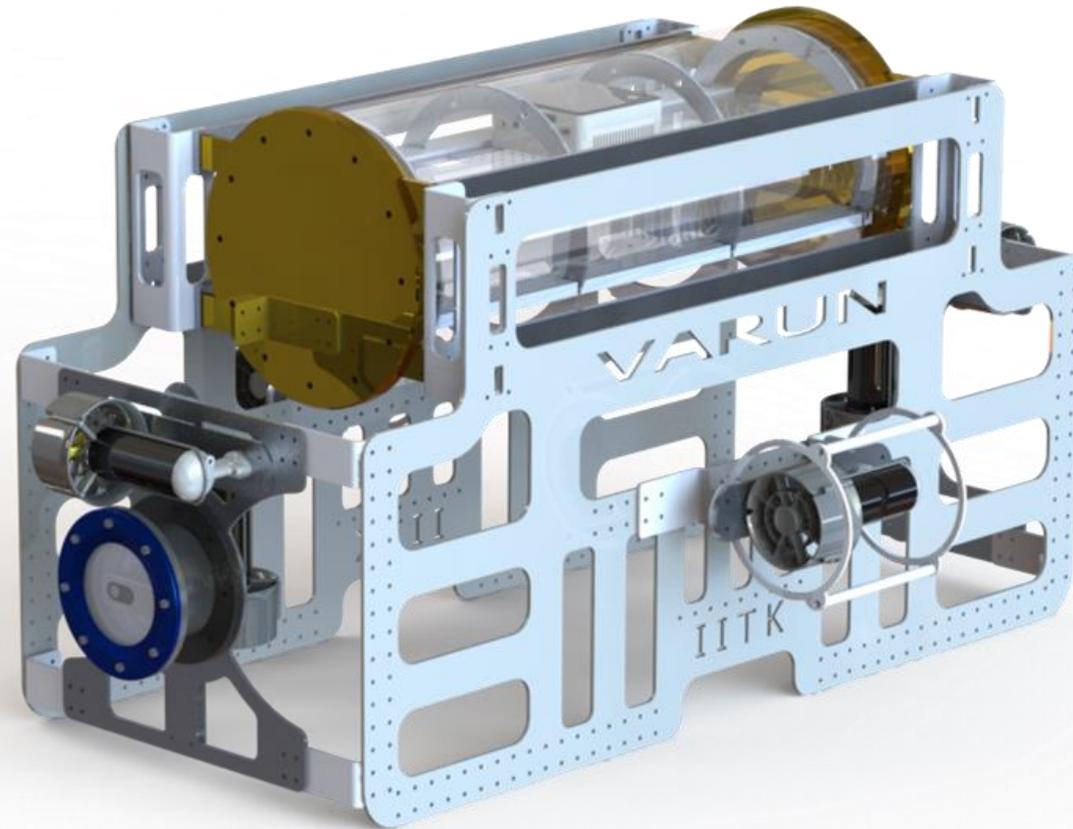
Pneumatic System

- For grabbing and dropping manipulator
- For torpedo shooting
- For marker dropping



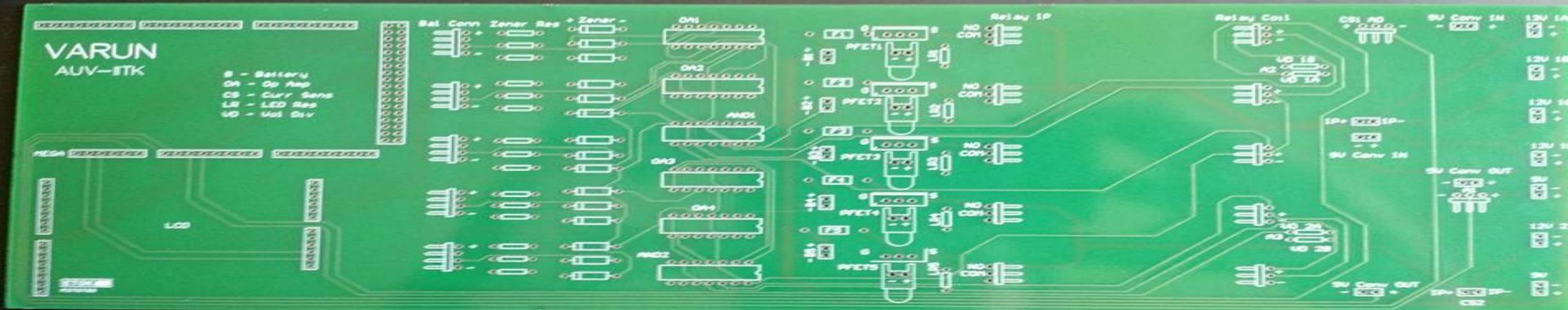
Testing of marker dropper assembly

ELECTRICAL



Battery Management System

- Divide the batteries into two power lines
- Measure Voltage and Current in both the lines to calculate Power consumption of the Vehicle
- Protect the components from damage due to overcurrent and reverse polarity
- Protect the batteries from over discharge.

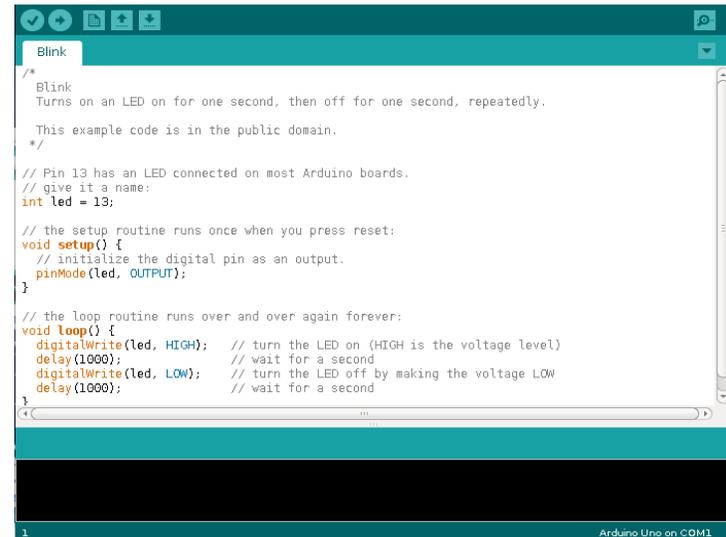


Arduino

Single board microcontroller
Open-source electronics platform created by Strong Friend
in Ivrea, Italy
Coding done using programming languages like C, C++,
Java



Experiment using Arduino Uno



```
Blink
/*
 * Blink
 * Turns on an LED on for one second, then off for one second, repeatedly.
 * This example code is in the public domain.
 */

// Pin 13 has an LED connected on most Arduino boards.
// give it a name:
int led = 13;

// the setup routine runs once when you press reset:
void setup() {
  // initialize the digital pin as an output.
  pinMode(led, OUTPUT);
}

// the loop routine runs over and over again forever:
void loop() {
  digitalWrite(led, HIGH); // turn the LED on (HIGH is the voltage level)
  delay(1000);             // wait for a second
  digitalWrite(led, LOW);  // turn the LED off by making the voltage LOW
  delay(1000);             // wait for a second
}

```

Arduino IDE

Intel NUC: Processor

- Integrate Intel's Next Unit of Computing (NUC), a compact computer, into the Vehicle.
- Power the NUC using the existing 11.1 V LiPo batteries via a boost converter. Output stabilised using capacitors.
- Isolate the power lines of NUC and other peripherals of the processor from remaining circuit like actuators, sensors.



Previous Processors



Odroid U3

- Micro-processor
- 1.7 GHz Quad Core Processor
- 2 GB RAM
- Supports Ubuntu (14.04 LTS)



Odroid X2



Raspberry Pi2

Sensors and Systems

**Currently sensors
being used:**



**Pressure
Sensor**



Camera

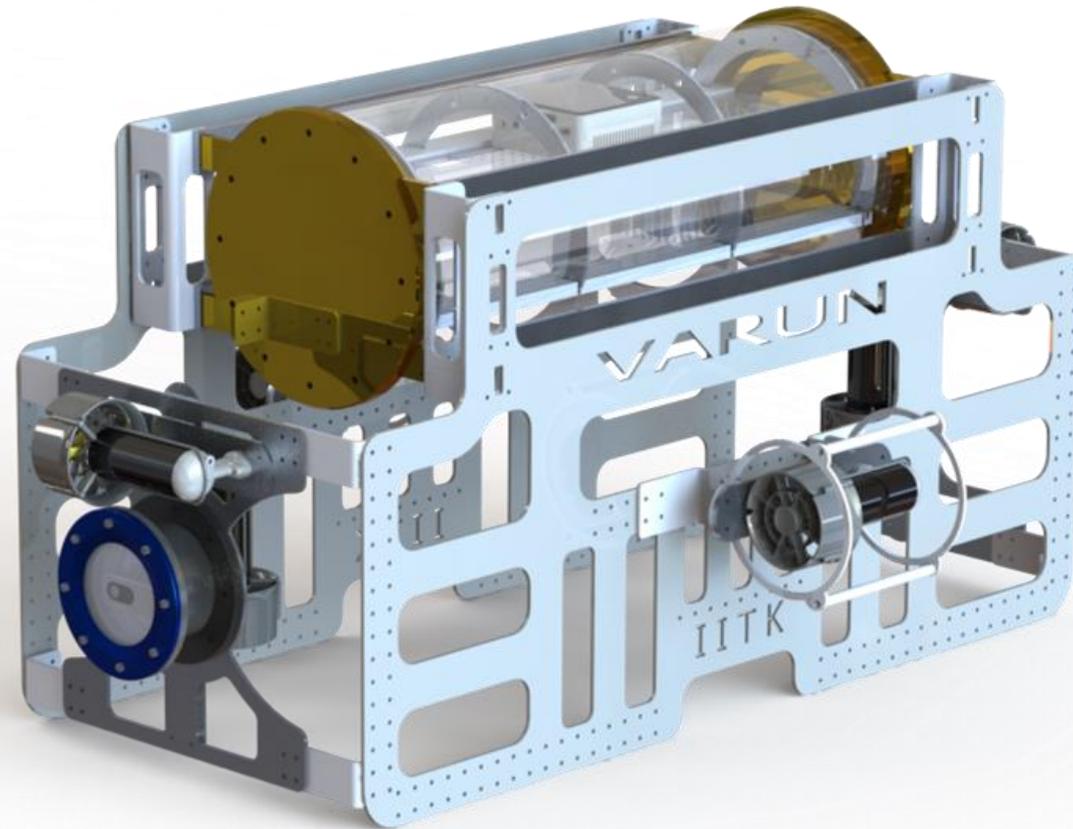


IMU

**Future
Additions:**

Water Detection Unit
Acoustic localization system
Doppler Velocity Log

SOFTWARE



Vision



Logitech C270

FRONT CAMERA

ROS NODE

Buoy Detection

Torpedo Firing

Bar Crossing



Logitech C270

BOTTOM CAMERA

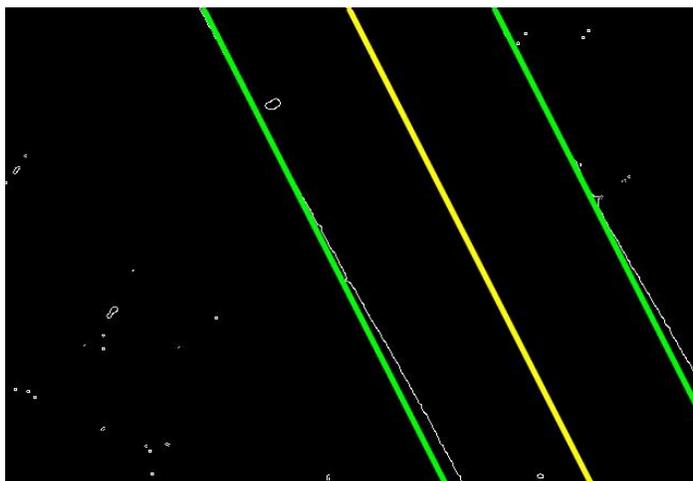
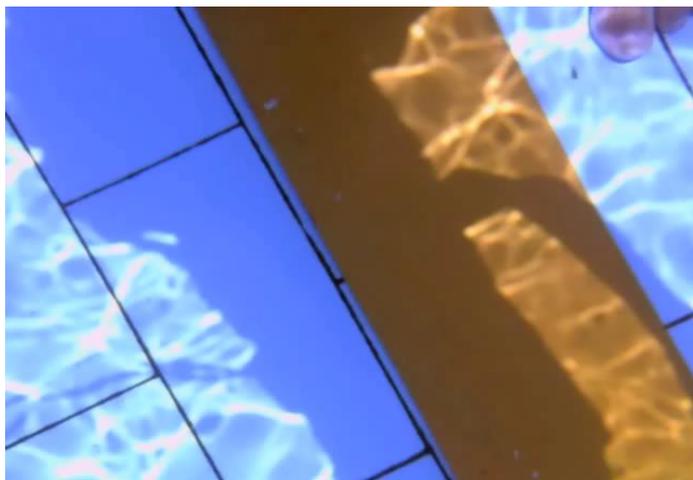
ROS NODE

Line Following

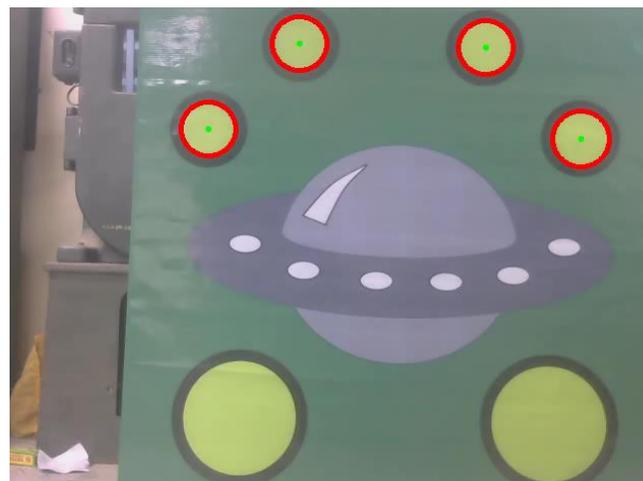
Marker Dropping

Samples

Line Detection



Circle Detection



Buoy Detection



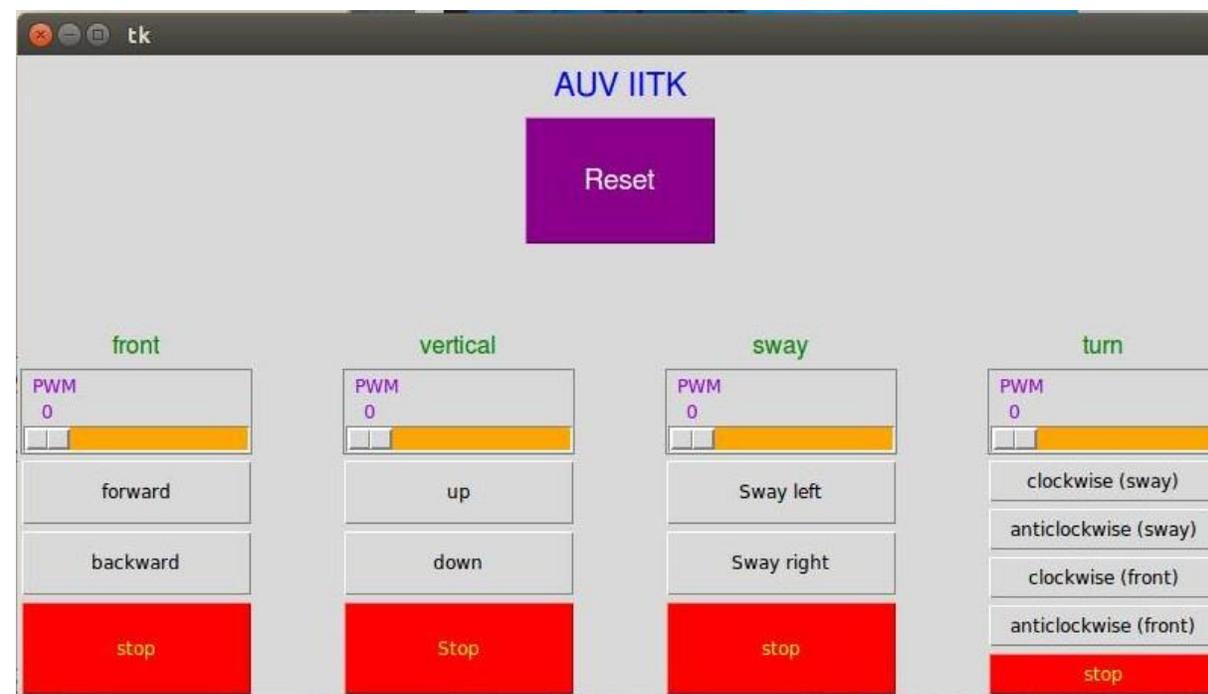
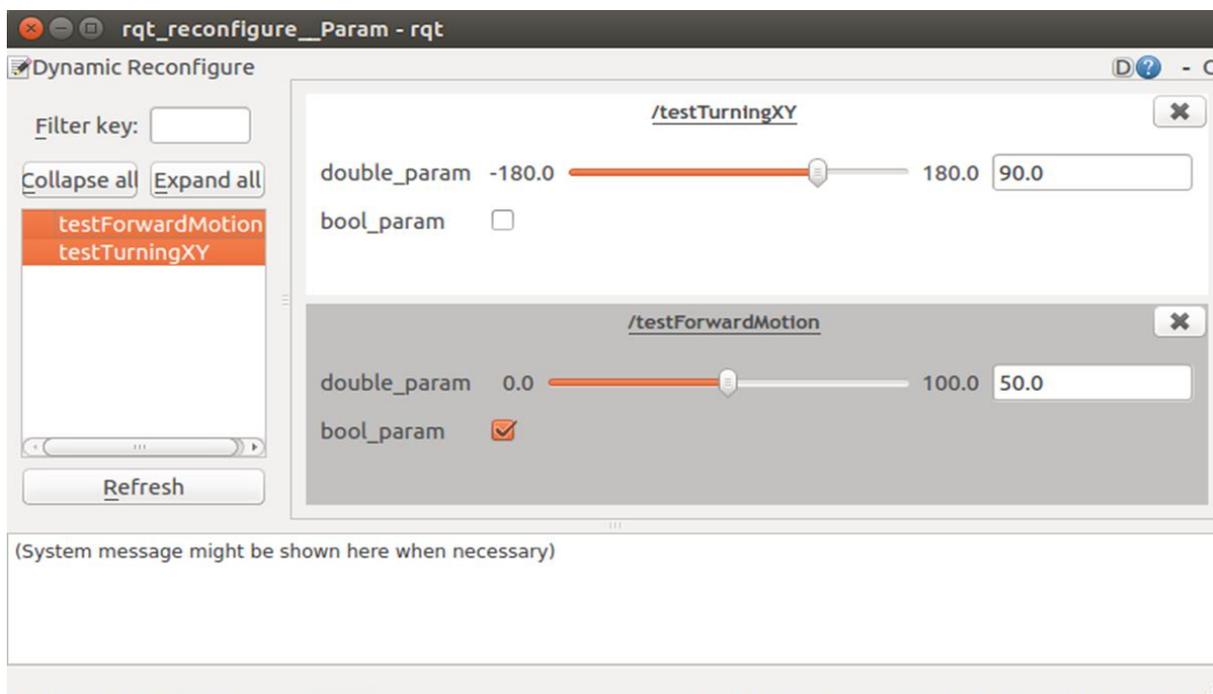
ROBOT OPERATING SYSTEM

ROS

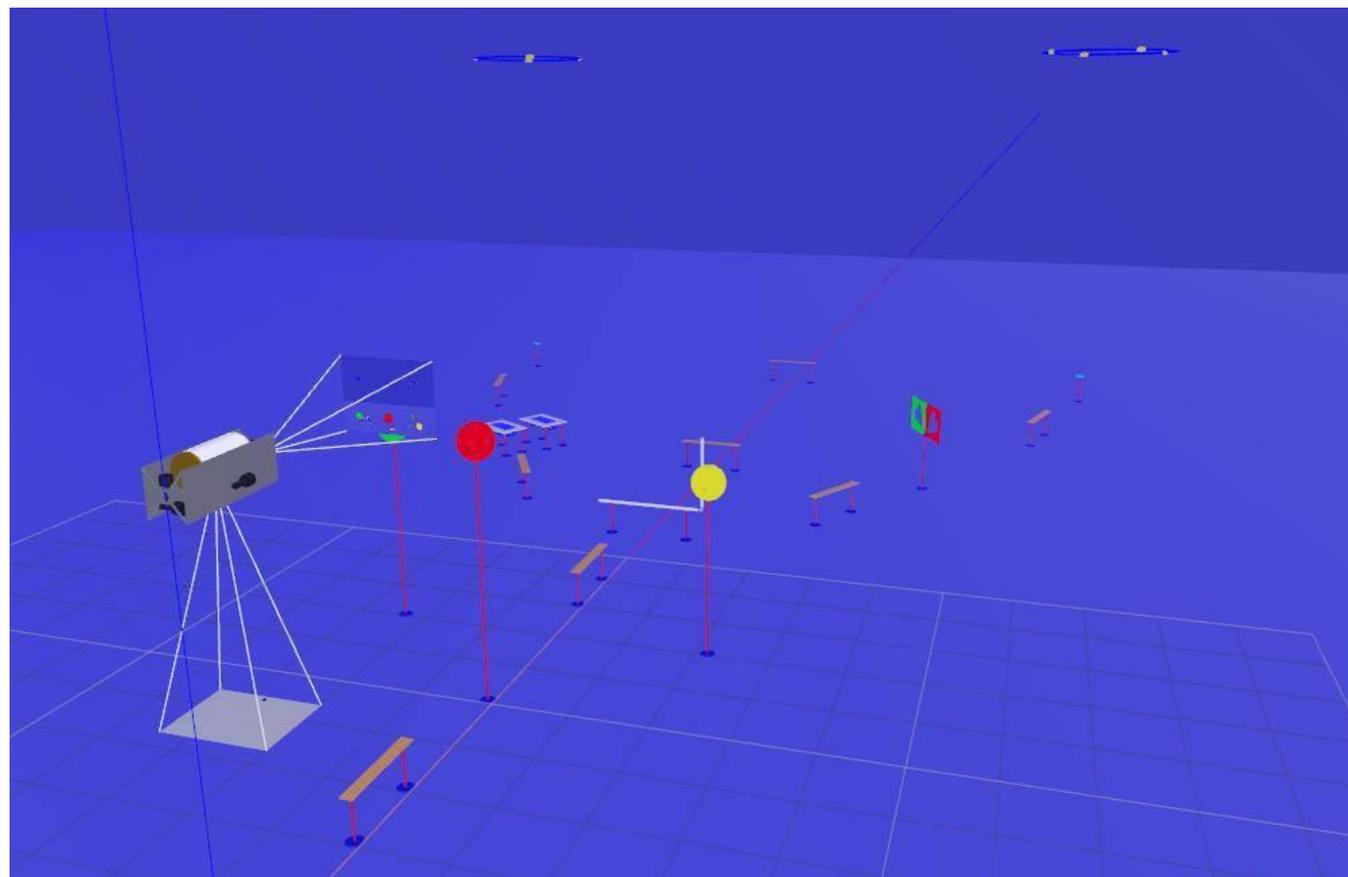
- Flexible framework for writing robot software
- Collection of tools, libraries, and conventions that aim to simplify the task of creating complex and robust robot behavior.
- Has built-in messaging system that manages details of communication between distributed nodes via anonymous publish/subscribe 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) ROS

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

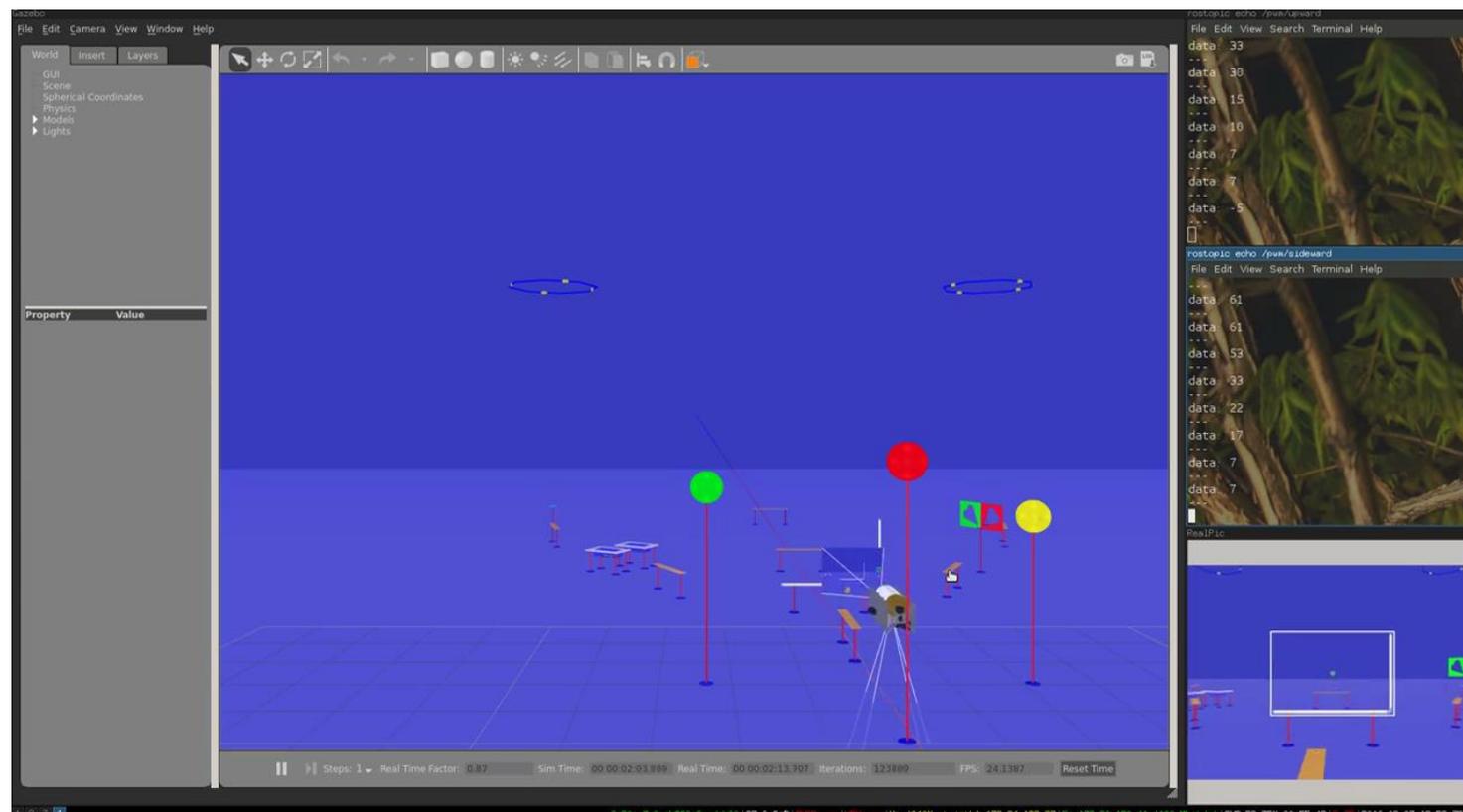


Actually testing our code rather than praying that it'll work!

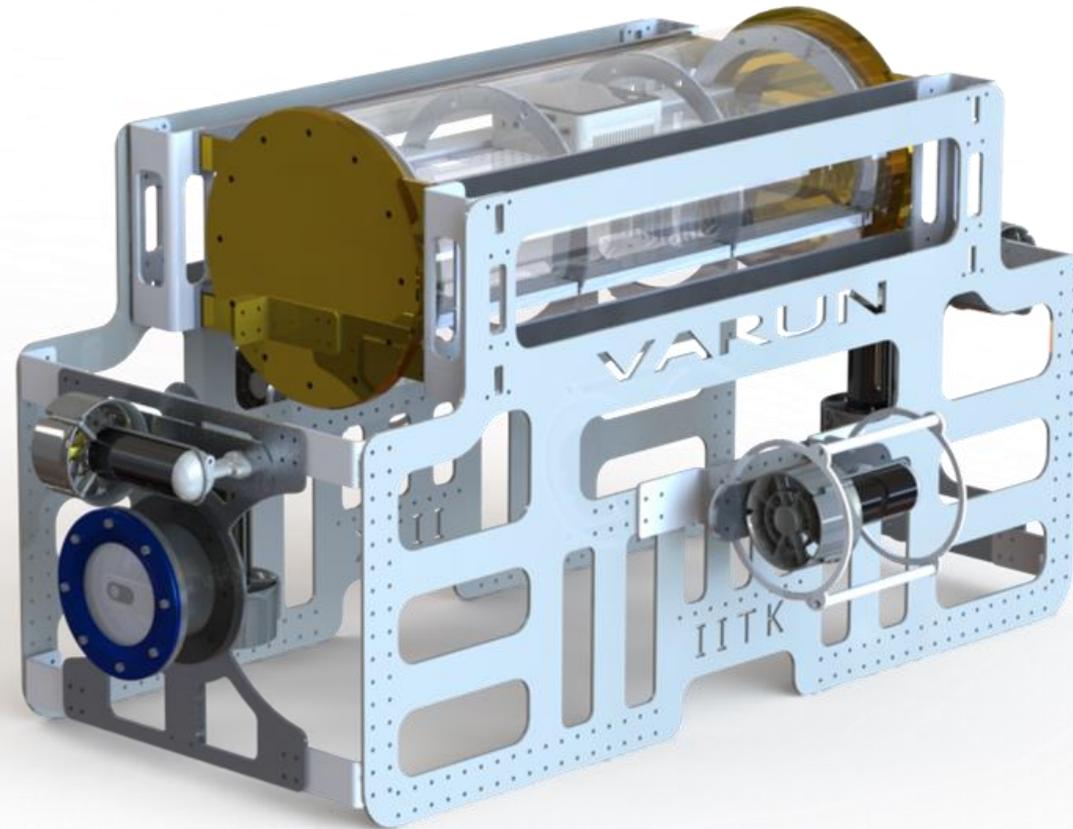


Tasks

- 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



Marketing and Sponsorships

- Establish tie-ups of the team with various goods and services providing companies
- Learn marketing strategies through market analysis along with understanding methods of influencing companies and alumni to fund the project
- Learn how to advertise and brand the team



Doppler Velocity Log



CNC Milling

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

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

Online Footprint and Graphic Designing



Expectations from the Team

- Members in each sub-systems would further be given projects relevant to a particular topic/product idea in groups of 2-3
- There would be **strict deadlines to the work** assigned and any form of negligence may lead to unpleasant consequences
- Past experience: *People don't work from their room a lot*, so on an **average estimate around 20-30 hours per week** as time spent together doing work together
- Documentation of work is important and would be done after completion of each project
- Since next competition is in less than a year, every member of the team **have to stay in the mid-sem breaks and summer vacations** (exceptions only in case of valid reasons)
- Leaving in-between from the team would lead to no recognition of your work
- Free to join other activities, however, if **any form of slackness observed** and if team is being affected by that, you **won't be allowed to further work on this project**

Any Questions?



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