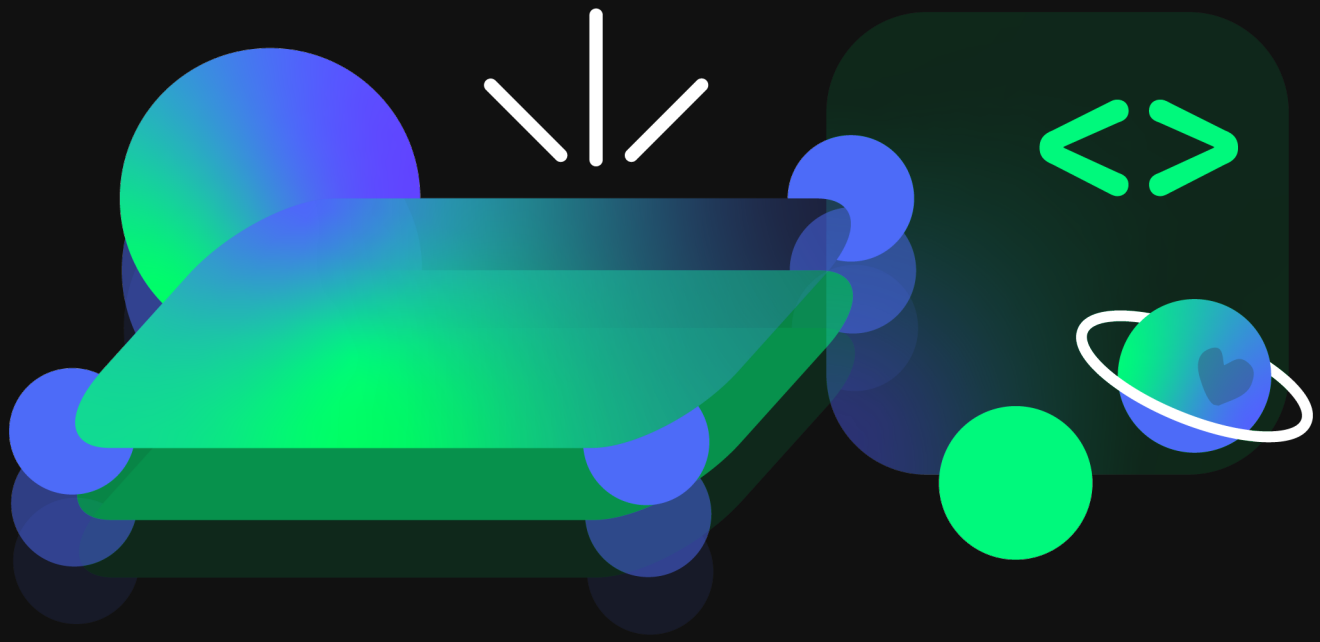
Inter IIT Tech Meet 11.0
IIT Kanpur



DRONA AVIATION

High Prep

PLUTO DRONE SWARM CHALLENGE

Drones are fun objects to look at, but understanding what goes behind flying one, might be quite the opposite. No worries - we'll send you a drone or two and let you have some time (and Python!) to figure out how to make it swerve the way you want. Make it go rectangles, and play seek with them, when the fun doubles up.

WHAT IS A PLUTO DRONE?

Pluto[1] is a drone platform that gives users an extraordinary flying experience as well as along with that; it allows users to integrate with external hardware.
So, that means you can program your drone to add multiple applications with the help of our readily made software i.e., Cygnus IDE, PlutoBlocks. For ROS also, we have developed our own package so you can operate drones using ROS-based applications as well.

The drone has an onboard microcontroller that helps implement various algorithms to stabilize and fly the drone. This software is called firmware. Understanding drone firmware is complicated as many processes are going on under the hood to keep the drone stable. This native implementation is available on GitHub. With hundreds of files and complex algorithms, it can be very overwhelming for beginners. So we created a firmware API that allows users to access the drone's firmware easily.

[1] Visit **https://create.dronaaviation.com/software** for an overview of Pluto.

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PROBLEM STATEMENT

Task 1 Develop a Python wrapper for India's one and only number-one-selling educational nano drone, The Pluto. (Users can control the drone using python without a mobile application) Check MSP and socket communication for Pluto.

A. Check the existing communication method used to communicate with Pluto. (**Pluto Communication MSP packets**[2])

B. For reference, you can check out the Pluto ROS package. (**Tutorial ROS**[3])

C. Create a Python wrapper to control the drone movements. (Eg. Pitch forward, Roll left, take off - Land, etc.)

D. Fly the drone using a Python wrapper (from a Linux Machine/Windows PC)

The first drone will be sent to you by the company on the Shipment Address provided by you to the Organising Team, only if you have registered for this Problem Statement. Use the Python wrapper developed in Task 1 to complete other tasks.

Task 2 Hovering a pluto drone on a particular height using ArUco Tag. Set a web camera (which is not included in the kit) on the ceiling.

A. Generate the ArUco tag and place it on the drone.

B. Using ArUco tag, get a pose estimation of the drone.

C. Add PID to the script for controlling the drone

D. Hover the drone in one position.

E. Move the drone in rectangular motion (1 x 2 meter)

F. Record a video and send the code and video in the zip file to the sponsors.

G. Then the sponsor will dispatch another drone for the next task.

[2] **https://bit.ly/plutomsppackets**

[3] **https://bit.ly/tutorialros**

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PROBLEM STATEMENT

Task 3 Pluto Swarming (*A second drone will be provided - both the drones should fly at the same time*)

A. Generate one more ArUco tag and place it on the second drone.

B. Initially, Drone2 will be at position0, and drone1 will be at position1. Write commands to move Drone1 from position1 to position2. When Drone1 reaches position2, drone2 should follow drone1 and reach position1 automatically.

C. Same way, create a rectangle motion. (1 x 2 meter)

D. Record a video and make the final submission similarly as the previous one.

EVALUATION CRITERIA

Task 1: 150 points

Task 2: 80 points (hover) + 100 points (control)

Task 3: 70 points

SUBMISSION

The team has to submit their final Python package along with proper documentation for its installation. Documentation must also include working principles and algorithm explanations. There will be two submissions:

Submission 1 The codes, documentation, video and reports associated with Task 1 and Task 2, as specified before. Submission via Google Form, which will start taking submissions from 3 days after release of the PS. No resubmission allowed.

Submission 2 Once Submission 1 gets verified by the company, a second drone will be dispatched for Task 3. This submission is the final submission. A separate Google Form for submission will be sent. No resubmission allowed.

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RESOURCES

Primus - X flight controller
https://create.dronaaviation.com/hardware/flight-controllers/primus-x

Primus - V4 flight controller
https://create.dronaaviation.com/hardware/flight-controllers/primus-v4

Drone Parts - Technical specifications
https://create.dronaaviation.com/hardware/parts/introduction

Build your own controller - Pluto Communication MSP packets
https://docs.google.com/document/d/1c2tjbeAuTYk3JZrkazImayqjCKx9w3rND4RTN41ol6U/edit

Python wrapper ROS - Tutorial ROS
https://create.dronaaviation.com/software/tutorials/ros/basic-integration-using-keyboard-for-control

Pluto firmware - MAGIS
https://github.com/DronaAviation/Magis

Basics of Drone - Drone concepts Youtube Link
https://www.youtube.com/watch?v=CnXm22ZxHP4&list=PLmchdkS6advHZ9QWAET3DqOH4MoTcijPt

Pluto tutorials: Pluto Tutorials Youtube Link
https://www.youtube.com/playlist?list=PLmchdkS6advEBLLz0ygo83trlnUhX-o-N