

# Preliminary Ideas

Hritik Roy Chowdhury

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## 1 Aerial Projects

### 1.1 Rocket Landing

#### Description

In this idea, the project's goal will be to design an autonomous rocket which after reaching a maximum height (apogee), tries to land back to its launcher pad autonomously. This is inspired from the SpaceX Falcon 9's rocket boosters which landed autonomously. We could extend the project so that the rocket separates its booster from its payload and then land only the booster autonomously. This is what the SpaceX Falcon 9 did.

#### Research Areas

- Fluid Dynamics: Rocket movement and calculations
- Feedback Systems: Feeding back data to sensors and actuators
- Control Engineering: Controlling rocket?
- Neural Networks: (some sort of Machine Learning) Another approach to landing
- Pneumatics: Opening, closing valves
- Accelerometers and Altimeters: Reading live-data in high frequency
- Numerical Modelling: (e.g Euler's Method, Monte-Carlo Simulations) For modelling rocket parameters

#### Pros and Cons

| <i>Pros</i>         | <i>Cons</i>          |
|---------------------|----------------------|
| Several New Skills  | Unfamiliar Areas     |
| Many Research Areas | Risk of Failure      |
| Great Opportunity   | Permission Required? |

### 1.2 Steady Drone Projects

#### Description

Here, the goal is to build a drone which can sustain its acceleration, velocity and position continuously even with high wind speeds. Furthermore, to create the autonomous criterion, the drone could be a:

1. Delivery drone: for delivering goods
2. Tele-presence: similar to a walking robot, but more agile

## Research Areas

- Drone Systems: how drones work
- Weight Optimization: carry a lot of load and make the drone weigh less
- Data-transfer: Tele-presence control
- Feedback Systems: Feeding back data to sensors and actuators
- Neural Networks: some sort of Machine Learning
- Accelerometers: measuring position, rotation etc in real time.

## Pros and Cons

| <i>Pros</i>                              | <i>Cons</i>                     |
|------------------------------------------|---------------------------------|
| New Skills                               | Unfamiliar Areas                |
| Preparation for 4 <sup>th</sup> Semester | Permission Required?            |
|                                          | 4th Semester already has Drones |

## 2 Marine Projects

## 3 Land Projects