UAS-DTU

Unmanned Aerial Systems

Delhi Technological University

ROUND 2:
Technical Round Avionics Department

Task Statement

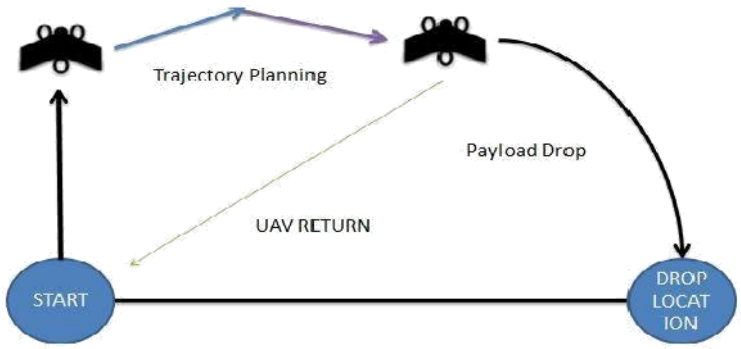
You are required to write a python program such that a UAV traversing towards a specific target drop location estimates its current position and decides whether to drop payload or not for successful payload delivery at target point.

Task Details

Objective:

Develop a python function/script for Autonomous drop of Payload by a moving UAV using Haversine Formula such that a spherical Payload of 1.5 Kg drops along a **parabolic trajectory** in an **acceptable range of distance from drop Location** and **print a confirmation message** that payload has been Dropped. Drone needs to follow a set of checkpoints to before reaching the target drop location. Consider a time lag of 1.5 seconds between execution of drop command and actually dropping of body. The minimum safe checkpoint reach radius is 5m.
(Assume Constant Air Density)

Given:
Takeoff Location: **28.748611,77.117222**
Flight Altitude: **100m**
Constant Velocity: **40m/s** *
Checkpoint 1 Location: **28.744444,77.138056**
Checkpoint 2 Location: **28.740833,77.157500**
Target Location: **28.723611,77.113333**



Submission:
You are required to submit a python file along with the simulation log in which you need to print the distance remaining between drone's current location the upcoming checkpoint every 5 seconds. Print the angle turn between each and every Checkpoint. Make a document of your working and daily base progress of your task. Explain your working in detail.

Language: Python 3

Terminal Logs:

```
----------Current Status----------
Flight Time: 100 seconds
Current Coordinates: (28.746829, 77.116945)
Distance to Waypoint: 2605.63 meters
Current Bearing: -172.23 degrees
Current Altitude: 100 meters
Airspeed: 2.00 m/s
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----------Current Status----------
Flight Time: 200 seconds
Current Coordinates: (28.744606, 77.116599)
Distance to Waypoint: 2356.19 meters
Current Bearing: -172.23 degrees
Current Altitude: 100 meters
Airspeed: 3.07 m/s
-----------------------------------
```

Hints: Use Haversine Bearing Formulas and Python Libraries for distance measurements.

Relevant Links:

Learn Python 3: https://automatetheboringstuff.com/ (First 6 chapters are sufficient)
Python3 Youtube tutorial playlist:
https://www.youtube.com/playlist?list=PLsyeobzWxl7poL9JTVyndKe62ieoN-MZ3
Haversine Formulas: https://www.movable-type.co.uk/scripts/latlong.html

OR

Task Statement

To autonomously navigate a UAV on SITL (Simulation) from one Geo-location location to another using velocity control.

Task Details

Objective:

This task is designed to help you set up and get comfortable with a basic environment for working with automated UAVs. You'll have plenty of time to complete the task, and if you run into any issues, don't hesitate to reach out to any of the admins for assistance.

Pre-Requisites:

Dual Boot Ubuntu 22.04 on your PC. Install the following software/packages in Ubuntu that will be required for this task:

- Ardupilot, Mavproxy, SITL, Python, Dronekit

To make the tasks easier to understand, we've divided them into small checkpoints

Checkpoints:

1. Install required software/packages
2. Successfully load a map and console on Ardupilot.
3. Write a drone-kit python code for drone to takeoff at an altitude of 10 metres,
4. Write a drone-kit python code to autonomously navigate from one gps coordinate to another.

Brief Overview:

Ardupilot is an open source autopilot software

SITL (Software In The Loop) is a simulator. Which allows you to run ArduPilot on your PC directly, without any real hardware. Dronekit Development kit allows you to code Ardupilot autonomous missions in python.

Purpose of this stack is to test our code before running it on real Hardware.

Important Links for reference :

Dual Boot Ubuntu with Windows :Bootinghttps://www.freecodecamp.org/news/how-to-dual-boot-windows-10-and-ubuntu-linux-dual-booting-tutorial/ Tutorial (freecodecamp.org)
Ardupilot Documentation
documentatiohttps://ardupilot.org/dev/docs/building-setup-linux.html#building-setup-linuxn (ardupilot.org)
Installing Ardupilot, Mavproxy, SITL
https://www.youtube.com/watch?v=-nNvQon7yZ0
DroneKit Documentation :
documehttps://dronekit-python.readthedocs.io/en/latest/ntation!

OR

Task Statement

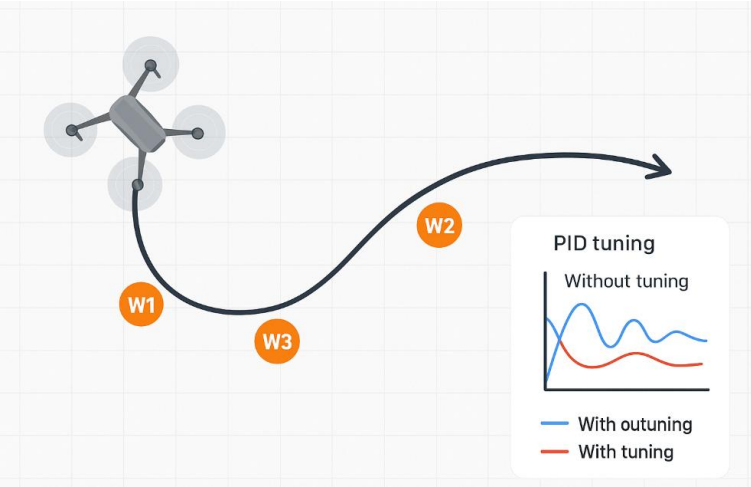
You are required to write a python program such that a UAV traversing towards a specific target location need to navigate through a specific set of checkpoints and control the velocity of UAV using PID Tuning.

Task Details

Objective:

Develop a python script for Autonomous navigation of UAV to reach a set of checkpoints by controlling their velocity during the flight. You need to use the concept of PID Tuning to decrease or increase the speed of UAV around each checkpoint. The minimum safe checkpoint reach radius is 5m. You must bring the velocity of UAV within safe limits i.e:>10m/s and the maximum speed UAV can achieve is 80m/s. (Assume Flight Altitude)

Given:
Takeoff Location: **28.748611,77.117222**
Checkpoint Location: **28.744444,77.138056**
Target Location: **28.723611,77.113333**



Submission:
You are required to submit a python file along with the simulation log in which you need to print the distance remaining between drone's current location the upcoming checkpoint and the updated velocity of UAV every 5 seconds. Make a document of your working and daily base progress of your task. Explain your working in detail.

Language: Python 3

Relevant Links:

Learn Python 3: https://automatetheboringstuff.com/ (First 6 chapters are sufficient)
Python3 Youtube tutorial playlist:
https://www.youtube.com/playlist?list=PLsyeobzWxl7poL9JTVyndKe62ieoN-MZ3
PID CONTROL:
https://www.youtube.com/playlist?list=PLn8PRpmsu08pQBgjxYFXSsODEF3Jqmm-y

Task Deadline:

31 August , 2025 10 AM
In case of any queries, feel free to contact the mentor. You free to visit the lab to review your work after discussing with your mentor

End Note:

For those of you with a background in programming and knowledge of python we assume this task won't be very difficult for you. Similarly if someone's just starting off with python this may seem overwhelming and impossible. We need you to know **that's okay and your previous knowledge will not play a role in our selection.** We will make sure it's a level playing field for everyone, so in case you're just starting out we don't expect you to complete this task 100% but we expect 100% follow through and dedication from all. If you are able to complete this task earlier than stipulated time we will assign more things to you, the purpose of this task is to see your adaptability to new environments so we encourage you to ask doubts search the internet and find solutions and most importantly enjoy (you will most likely have a good looking project by the end of this recruitment) . We wish you all the best, and hope to work with you soon!