Practical Report: UUV Mission

Checkout the Github Repo Here: link

a) Background and Motivation

The control system for the uncrewed underwater vehicle (UUV) is completed, including mission data input and the controller setup.

b) Changes to Codebase

The following changes were made to the codebase (listed chronologically):

- **dynamic.py**: Updated the *from_csv()* method of the *Mission* class to:
  - Handle file paths using the *os* package
  - Extract data using the *pandas* package
- **control.py**: Created to modularize controller classes:
  - **Controller** (parent class):
    - Defines the method *compute_action()* returning a float
  - **PDController** (child class):
    - Initializes with K_P and K_D
    - Implements PD control in *compute_action()*
- **dynamic.py**: Updated the *ClosedLoop* class:
  - Accepts a *Controller* instance on initialization
  - Evaluates controller action in the *simulate()* method

c) Justification of Design Choices

The class-based design with inheritance was chosen for:

- **Modularity**: Easily extendable by adding new controllers.
- **Parameter management**: Controller parameters are managed within individual classes.
- **Code clarity**: The structure minimizes repetition and enhances readability.

d) Difficulties Encountered

- **Issue**: Virtual environment was mistakenly included in GIT.
  - **Solution**: Restarted early and added *"venv/"* to *.gitignore*.
- **Issue**: Jupyter Notebook didn't recognize the local package *uuv-mission*.
  - **Solution**: Installed *uuv-mission* in the virtual environment.

e) Possible Improvements

- **UUV Safety Feature**: The PD controller only follows the reference.
  - **Suggestion**: Clamp controller action near height or depth limits to prevent collisions.
- **Limited DOF**: Only vertical motion is controlled.
  - **Suggestion**: Implement a state-space approach to manage both depth and horizontal positioning.

Attachment: Screenshot of Simulation Result