Week 6 Report - Dec 26, 2022 ~ Jan 1, 2023

🎇 Happy New Year!

Right after Christmas came the New Year! I hope you all enjoyed New Year's Eve, and I wish you all the best for the exciting year of 2023 and beyond 😀.

Reading more Path Following Survey Papers

As I didn't get to devote much time to actual simulations and programming side, I mainly focused on reading more path-following method survey papers, which were:

- "A Survey of Path Following Control Strategies for UAVs Focused on Quadrotors" / link / 2019
- "A Survey and Analysis of Algorithms for Fixed-Wing Unmanned Aerial Vehicles" / link / 2014
- "A review of path following control strategies for autonomous robotic vehicles: theory, simulations, and experiments" / link / 2022

Whom I will refer to as **Quad**, **FixedWing** and **Submarine** papers respectively, as they each focused on the mentioned platforms path following scenarios.

After going through them carefully, I arrived at the following conclusions:

1. All the mentioned PF algorithms don't consider the wind (external disturbance) estimate
2. TJ's NPFG (NLGL) is indeed similar to the Vector-Field approach (includes 'track error boundary', just like NPFG), but with extra feed-forward acceleration to track curvature
3. Line-of-sight and Pure-pursuit are also similar to NLGL, and it performs well (**FixedWing**)
4. All the algorithms focus on the 2D- path following and augment 3D PF by setting extra height setpoint, but it isn't embedded into the path-following aspect as coarsely as in the 2D path (**Quad**)
5. The vehicle never reached a velocity of 0 on the path for Quadrotor paper, because the velocity on the path was never varied. However, this is where the PF discrepancies would arise (**Quad**)

🥅 Therefore, I would like to aim my thesis with the following goal (sorted by importance):

1. Handle **variable velocity control** (to allow the vehicle to decelerate, stop, accelerate)
2. Include **intuitive diagrams** to help users understand the schema (algorithm)
3. Test against **time-varying wind disturbances**, approaching vehicle's nominal airspeed and above
4. Provide quantitative **metrics** that can represent the PF capability
5. Include intuitive diagrams on simulated results
6. Provide an **open-source simulation** environment to test the PF algorithm on
7. Upstream the logic to PX4-Autopilot (with documentation)

Reading the Survey papers has been helpful, but also my simulation side of things didn't progress as much as I wanted. As there are around 8 weeks left, it is time to start getting into the real formulations!
END