

AAE2004 Introduction to Aviation Systems

AAE

Design of Path Planning Algorithm for Aircraft Operation

Week 8 (Introduction to the project)

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Assisted by

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Why coding/programming is important for Aviation Engineering (specially after COVID-19)?

What are challenges to make this happen?

Infrastructure inspection

- Parcel Delivery

Infrastructure inspection

- building and bridge defects, etc.

Search and Rescue (SAR)

- disaster prevention and rescue,

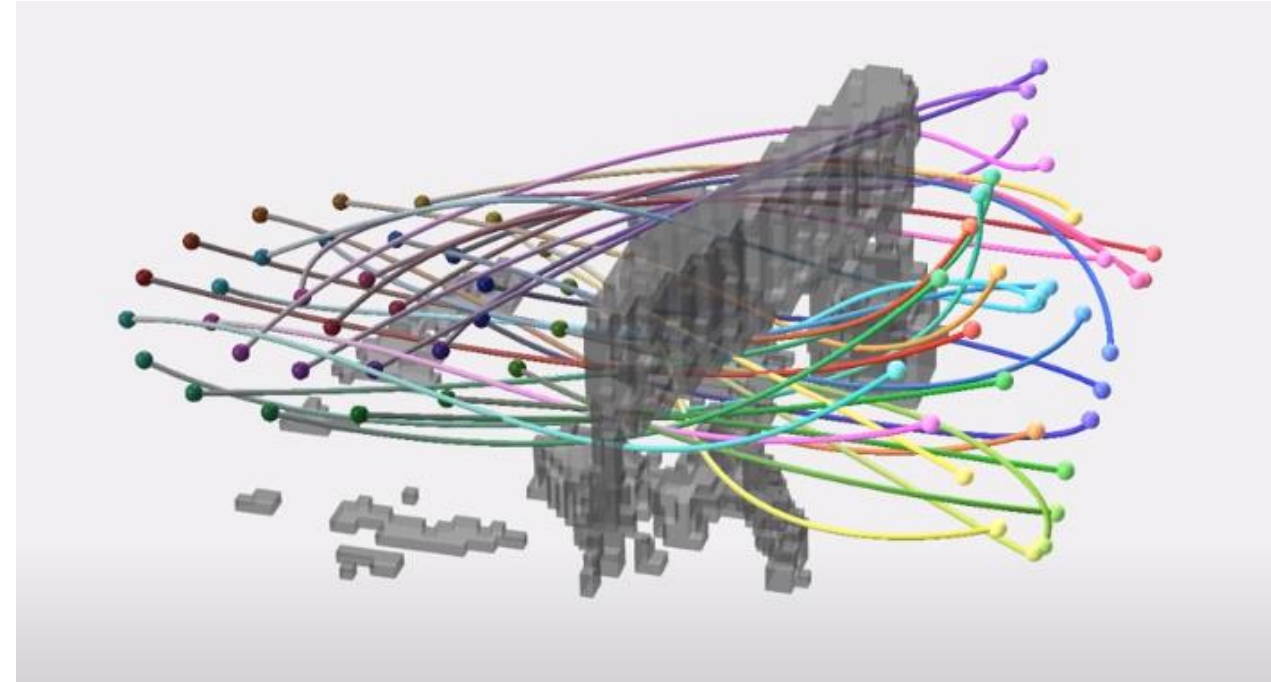
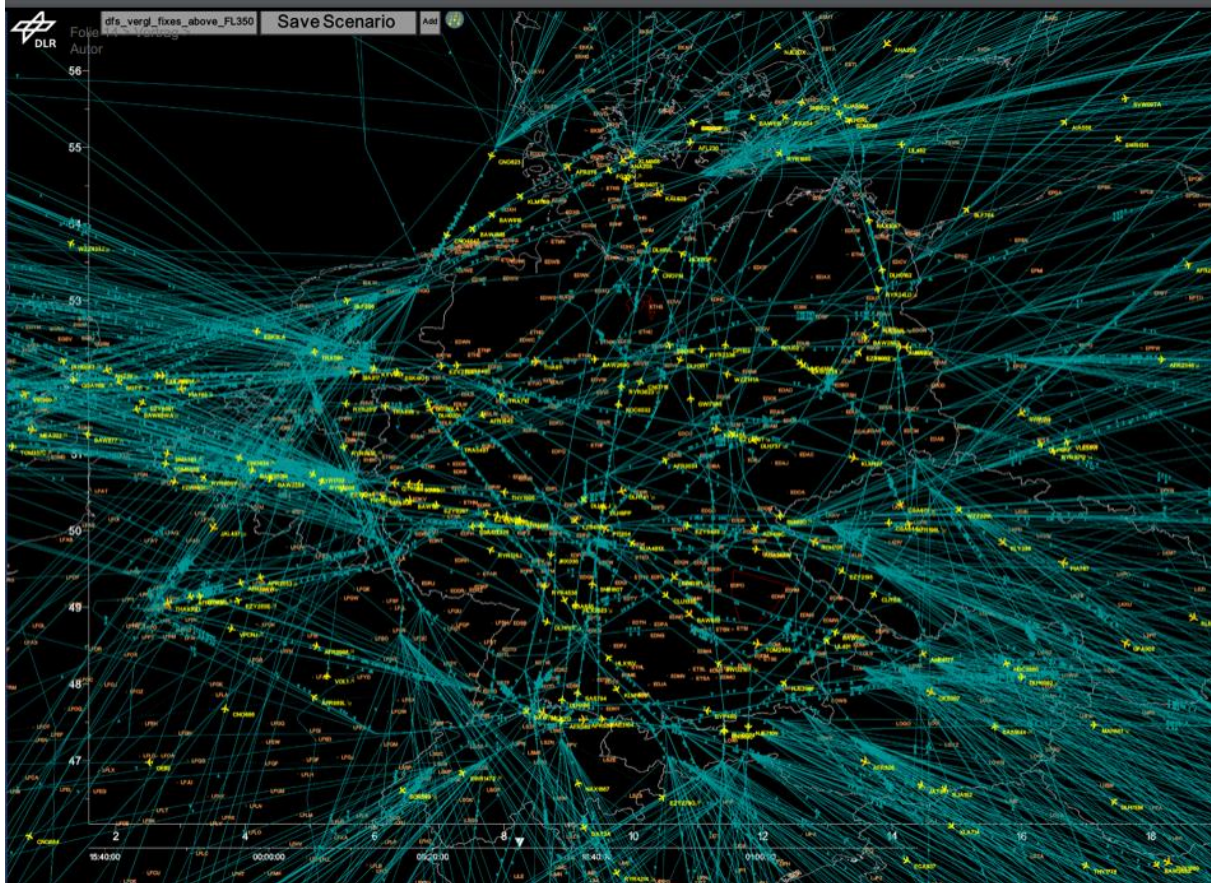
Smart transportation

- traffic monitoring management
- air quality monitoring

Crowded Airspace in Cities



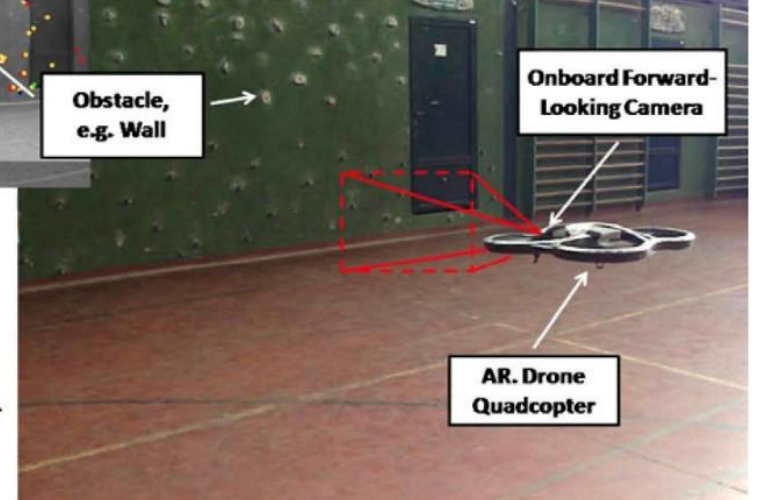
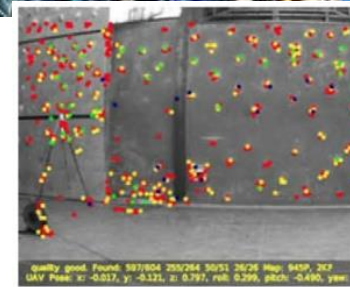
Challenges - Collaborative Path Planning



<https://www.youtube.com/watch?v=7Kla9FlmbRc>

Keywords: Path planning, traffic control, SWARM collabation, IoT, Connect vehicles, and Smart Cities

Challenges – Collision Avoidance



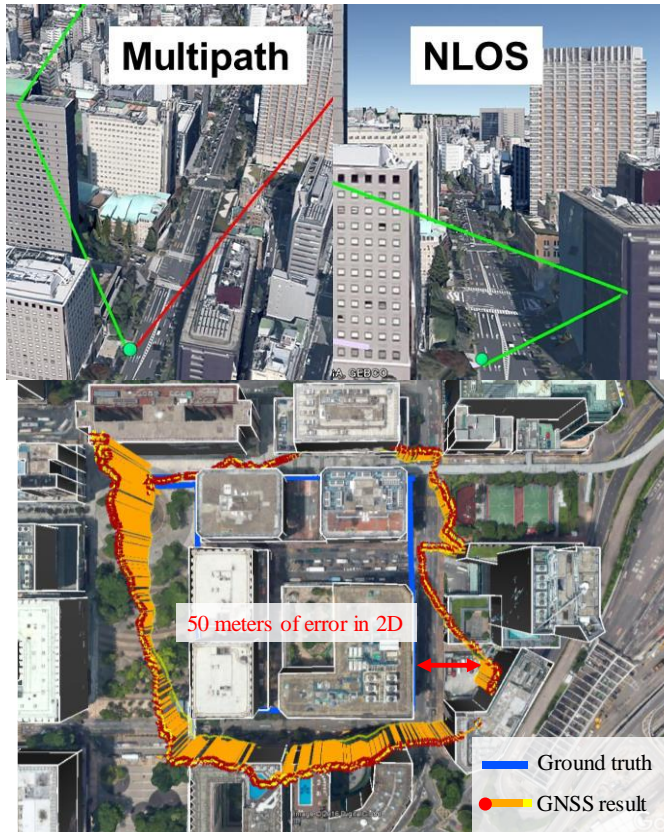
Keywords: Perception by AI (deep learning), image processing, estimation and optimization

Onboard Image

External Image →

Challenges – Navigation in Challenged Environments

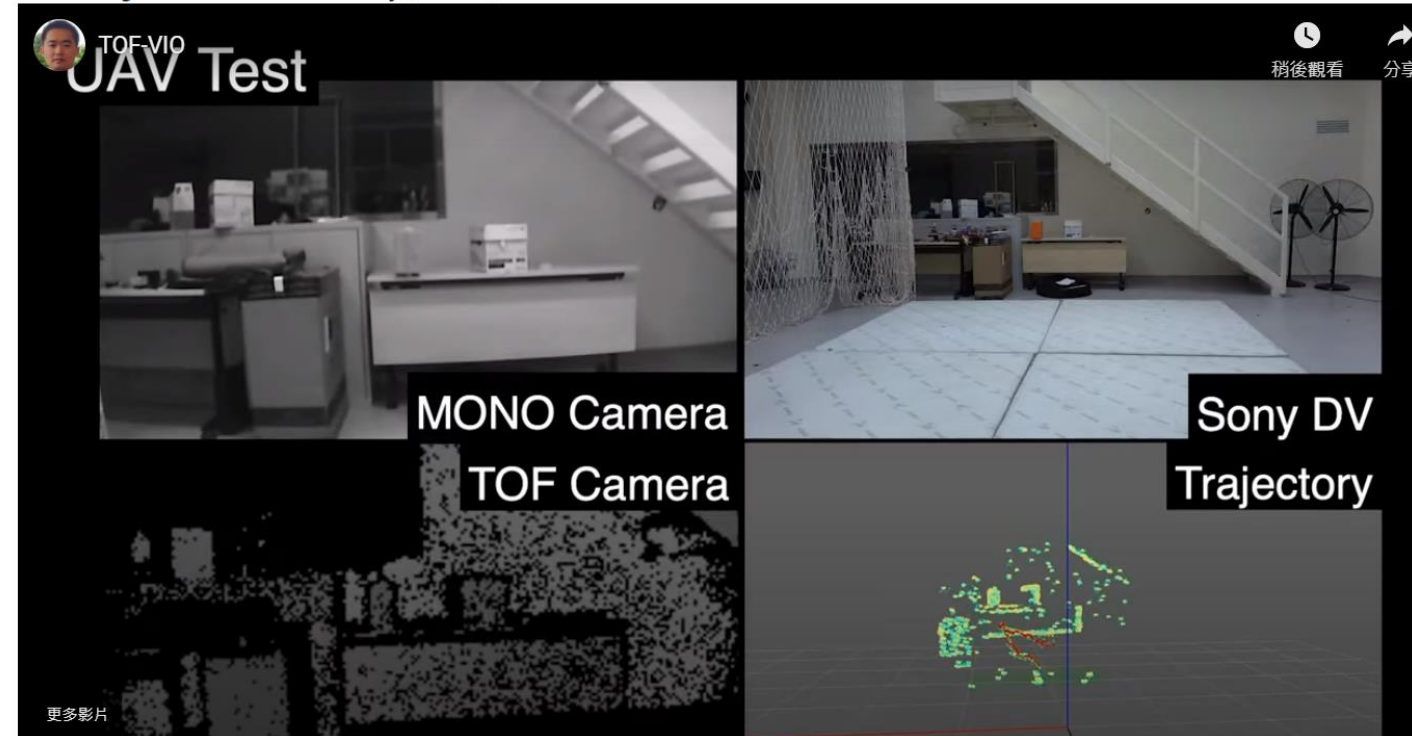
Challenge in GNSS Positioning



Visual Navigation

<https://www.polyu.edu.hk/researchgrp/cywen/index.php/en/mav-uav/perception-slam.html>

Time of Flight Visual Inertial Odometry (ToF-VIO)



Keywords: GNSS, inertial navigation system, visual positioning, simultaneous localization and mapping (SLAM), sensor fusion, filtering.

Integrity and Safety



Keywords:

Airworthiness, Reliability, Compliance (regulation-wise)

Statistics and modelling (mathematics-wise)

Most of the sample open-source codes can be found in GitHub



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About 860,000 results (0.64 seconds)

github.com › AtsushiSakai › PythonRobotics ▾

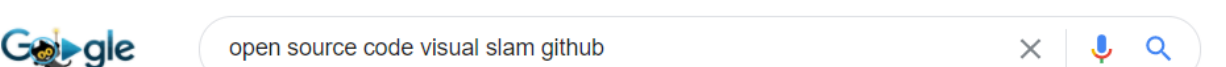
[AtsushiSakai/PythonRobotics: Python sample codes ... - GitHub](#)

This is a **Python code** collection of robotics algorithms, especially for autonomous navigation.

Features: Easy to read for understanding each **algorithm's** basic idea.

[README.md](#) | [Issues 4](#) | [AtsushiSakai/PythonRobotics](#) | [Pull requests](#)

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github.com › xdspacelab › openvslam ▾

[OpenVSLAM: A Versatile Visual SLAM Framework - GitHub](#)

OpenVSLAM is a monocular, stereo, and RGBD **visual SLAM** system. ... Citation. OpenVSLAM won first place at ACM Multimedia 2019 **Open Source Software** ...

[Xdspacelab/openvslam](#) | [openvslam/CMakeLists.txt at ...](#) | [Pull requests 16](#) | [Actions](#)



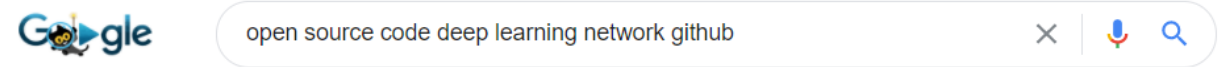
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github.com › CiscoDevNet › Object-detection-via-Mera... ▾

[CiscoDevNet/Object-detection-via-Meraki-Camera ... - GitHub](#)

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About 17,800,000 results (0.75 seconds)

github.com › mnielsen › neural-networks-and-deep-lea... ▾

[mnielsen/neural-networks-and-deep-learning: Code ... - GitHub](#)

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To do list in your 4 years...

1. To initiate one hand-on project (by coding or manufacturing) related to your passion.
 - Manufacturing an UAV, Enabling autonomous function of an UAV, etc
2. To find news and articles (by hashtag or club in social networks) that related to your interests.
 - Accumulating your domain knowledge and expand your network with someone who have similar passion to you.
3. To find the issues/problems (in your network, village, city, nation, area and the world) you cared and try to find solutions to these challenges.

Undergraduate Research and

Exclusive Privileges



Scholarship up to HK\$10,000



Project grant



Hall residence



Activities, trainings & workshops

Application Eligibility

- Full-time undergraduate students
- Completed at least two semesters of studies in PolyU
- Excellent academic performance

Application Cycle

- Call for application: around March
- Application period: March - April
- Result announcement: early June

<https://www.polyu.edu.hk/en/gs/ug-research/uris/about-uris/>

<https://www.polyu.edu.hk/en/gs/ug-research/uris/application-for-uris/>

What URIS Students say?



TAI Cheuk Yiu (Year 3)
School of Optometry

Through research studies, hypothetical ideas might come to life. By participating in URIS, we aspire to identify underlying mechanisms of common visual problems.

It boosts my morale to conduct research work that benefits mankind. I gained valuable experience through URIS to learn and create knowledge.



SU Meiling (Year 3)
Department of Aeronautical
and Aviation Engineering



Scan to learn more!

(Video) AI and Data Science in Aviation

- <https://www.youtube.com/watch?v=D8NIYPtPgWA>
- [1:18 - Revenue Management](#)
- [3:36 - In-flight sales and food supply](#)
- [5:03 - Fuel consumption optimization](#)
- [6:36 - Boarding and checking bags with facial recognition](#)
- [8:33 - Preparing a plane for the next flight](#)

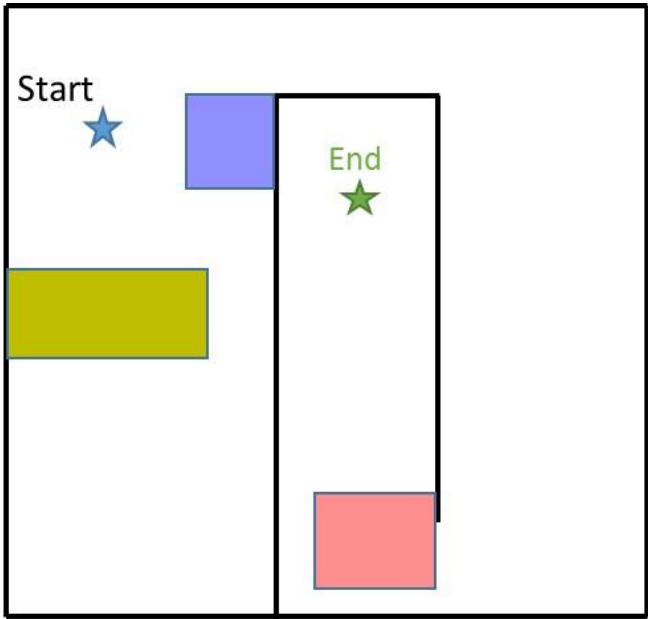
Dialogues and Discussions

Dare to ask and communication is the first step of your
success

In this project, we do...

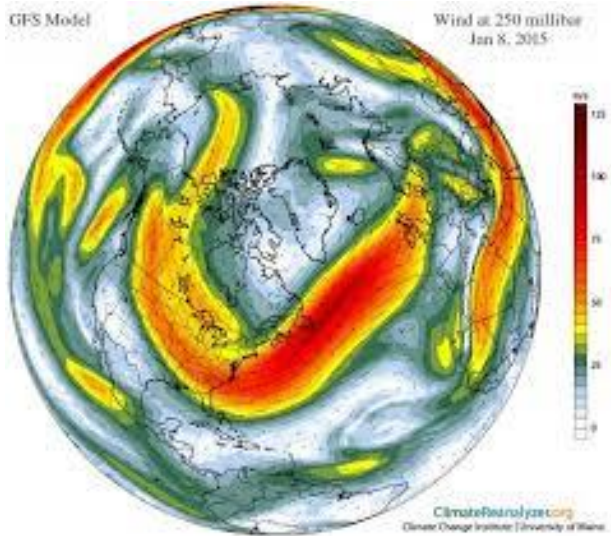
Aircraft Model	C_F	ΔF	C_T	ΔT	C_c	ΔF_a	ΔT_a	C_P	ΔP
PolyU-A380	1	1	2	5	10	0.2	0.2	-2	2

$$C = C_F \cdot \Delta F + C_T \cdot \Delta T + C_c + C_P \cdot \Delta P$$

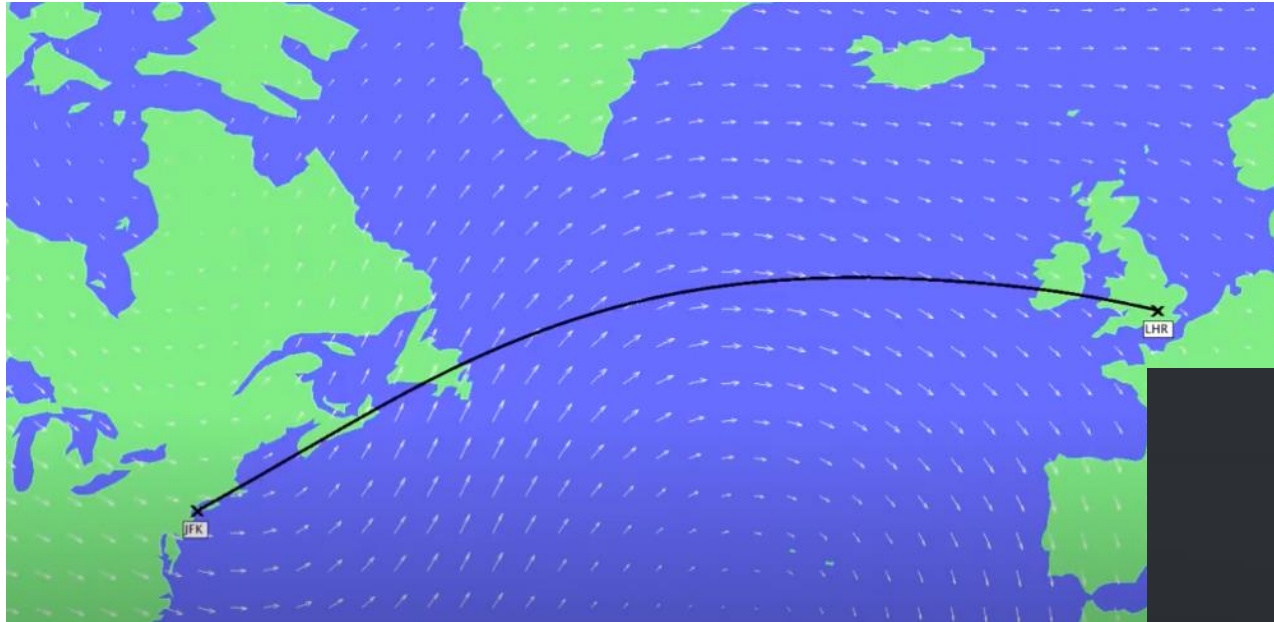


But in the real life,

Aircraft Model	C_F	ΔF	C_T	ΔT	C_c	ΔF_a	ΔT_a	C_P	ΔP	...
Your designed aircraft	?	?	?	?	?	?	?	?	?	?



What does C_p mean? Jet Stream Winds



<https://www.youtube.com/watch?v=tMN1f4dvpHI>

Final To do list in this project

1. Finish as much tasks (using Python) as you can
2. Write a report to introduce your project and reflect what you have learned
3. Make a video presentation to share and communication your ideas and projects
4. Submit the peer evaluation form individually