

# AAE2004 Introduction to Aviation Systems

## AAE

### Design of Path Planning Algorithm for Aircraft Operation

#### Discussion and Outlook

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# Why coding/programing 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

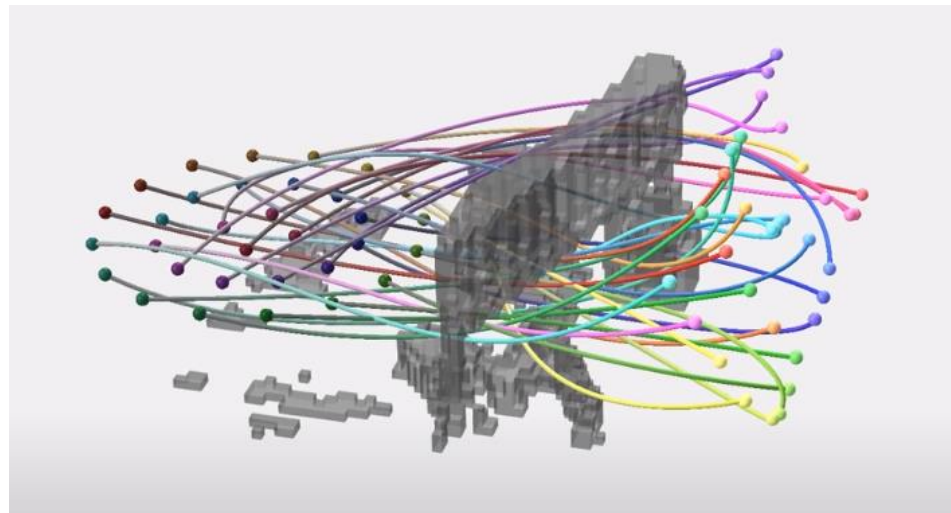
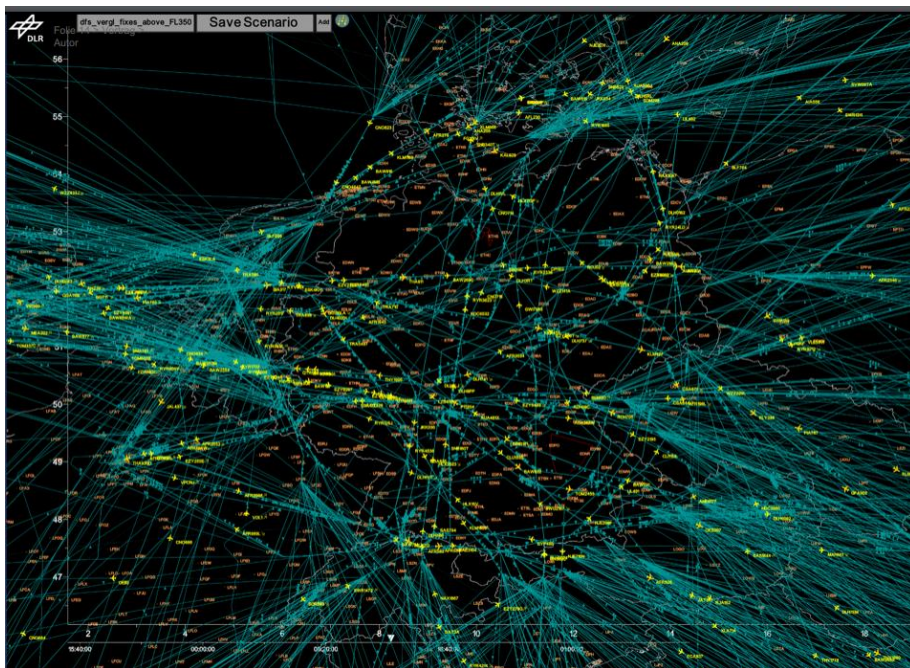
- traffic monitoring management
- air quality monitoring

# Crowded Airspace in Cities





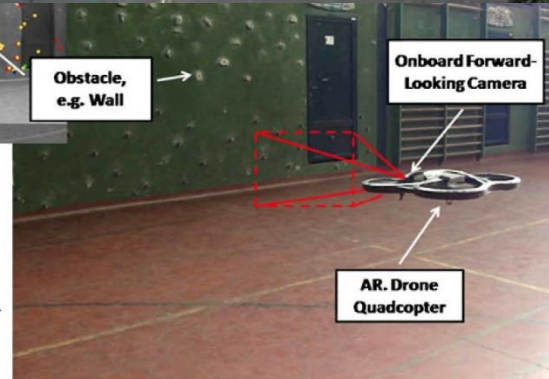
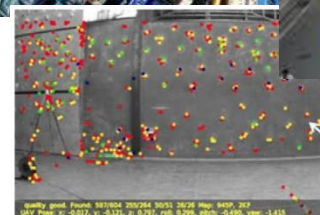
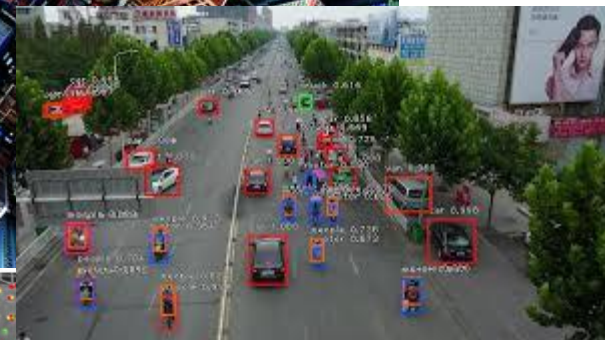
# Challenges - Collaborative Path Planning



<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

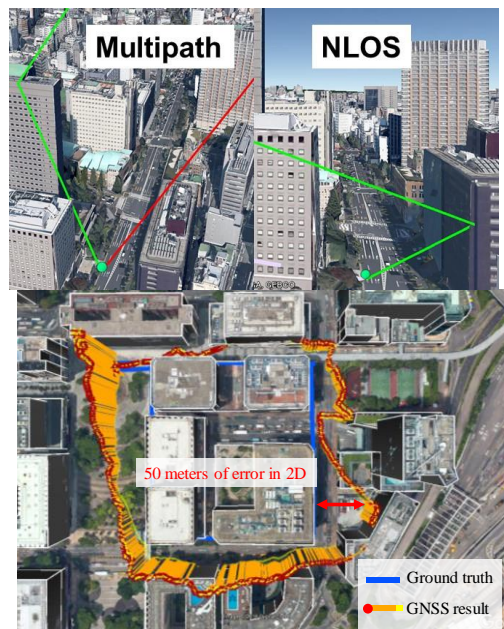
Onboard Image  
↑

External Image →



# Challenges – Navigation in Challenged Environments

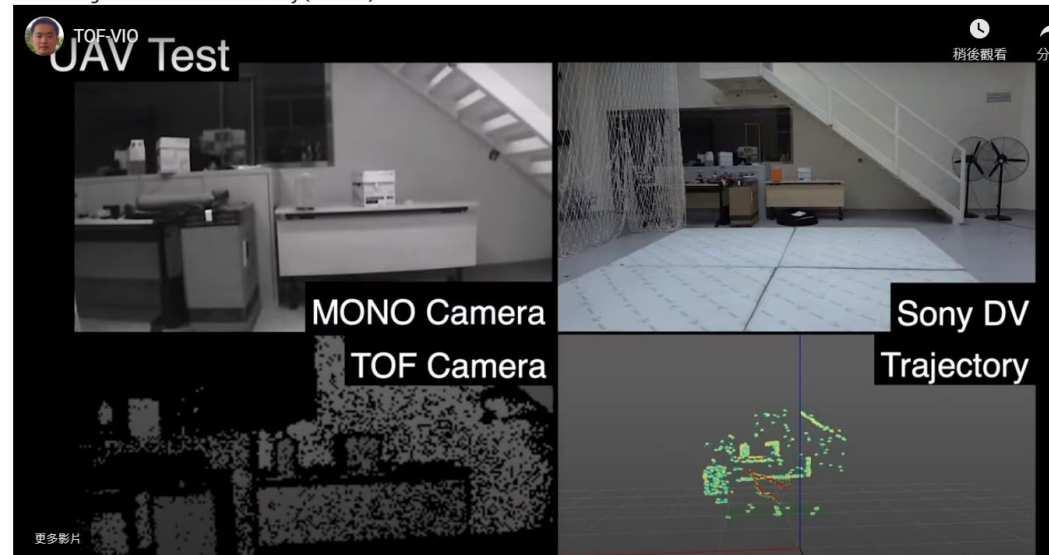
## Challenge in GNSS Positioning



## 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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**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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**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** ...

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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.

# (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

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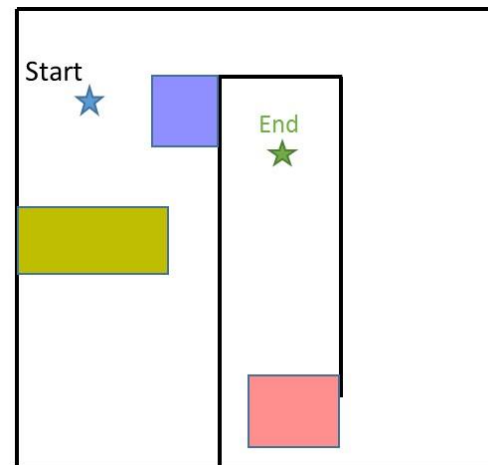
Dare to ask and communication is the first step of your  
success



# In this project, we do...

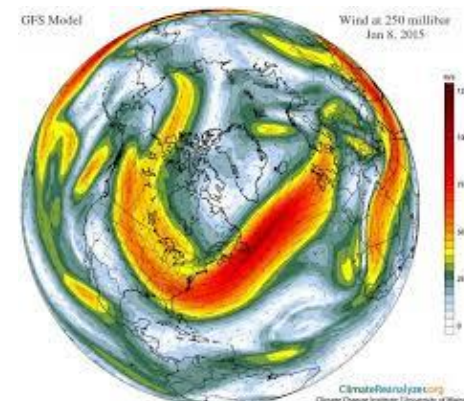
Aircraft Model	$C_F$	$\Delta F$	$C_T$	$\Delta T$	$C_c$	$\Delta F_a$	$\Delta T_a$	$C_P$	$\Delta P$
PolyU-A380	1	1	2	5	10	0.2	0.2	-2	2

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

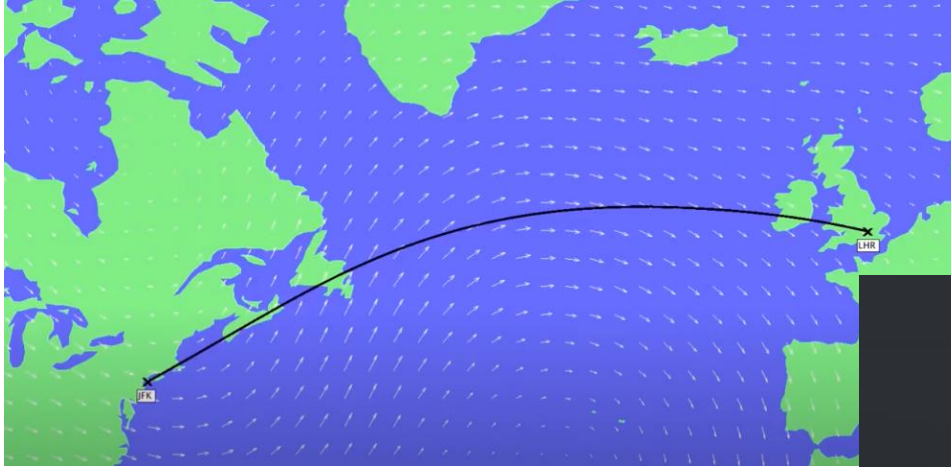


# But in the real life,

Aircraft Model	$C_F$	$\Delta F$	$C_T$	$\Delta T$	$C_c$	$\Delta F_a$	$\Delta T_a$	$C_P$	$\Delta P$	...
Your designed aircraft	?	?	?	?	?	?	?	?	?	?



# What does $C_p$ mean? Jet Stream Winds



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

# 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



# GitHub Tasks

	Group Repository	Members have Github account	Branch of Each Members	Upload Self Photo	Collaborate and Merge in Master
1	✓	✓	✓	✓	✓
2	✓	✓	✓	✓	✓
3	✓	✓	✓	✓	✓
4	✓	✓	✓	✓	✓
5	✓	✓	✓	✓	✓
6	✓	✓	✓	✓	✓
7	✓	✓	✓	✓	✓
8	✓	✓	✓	✓	✓
9	✓	✓	✓	✓	✓
10	✓	✓	✓	✓	✓

# Path Planning Tasks ✓: done some result (not sure if it is optimal)

	Task1	Task 2.1	Task 2.2	Task 3	Your own innovation
1	✓	✓	✓	✓	
2	✓	✓	✓	✓	
3	✓	✓	✓	✓	
4	✓	✓			
5	✓	✓			
6	✓	✓		✓	
7	✓	✓	✓		
8	✓	✓	✓		
9	✓	✓	✓		
10	✓	✓	✓	✓	