

# 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

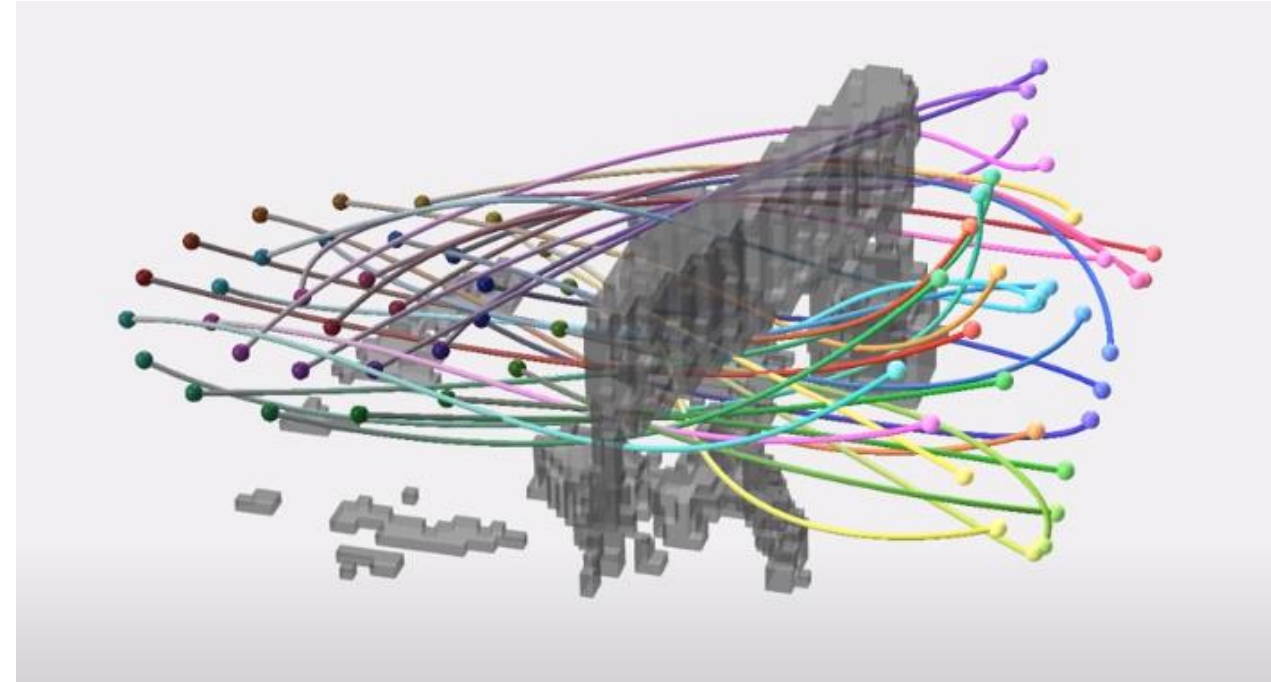
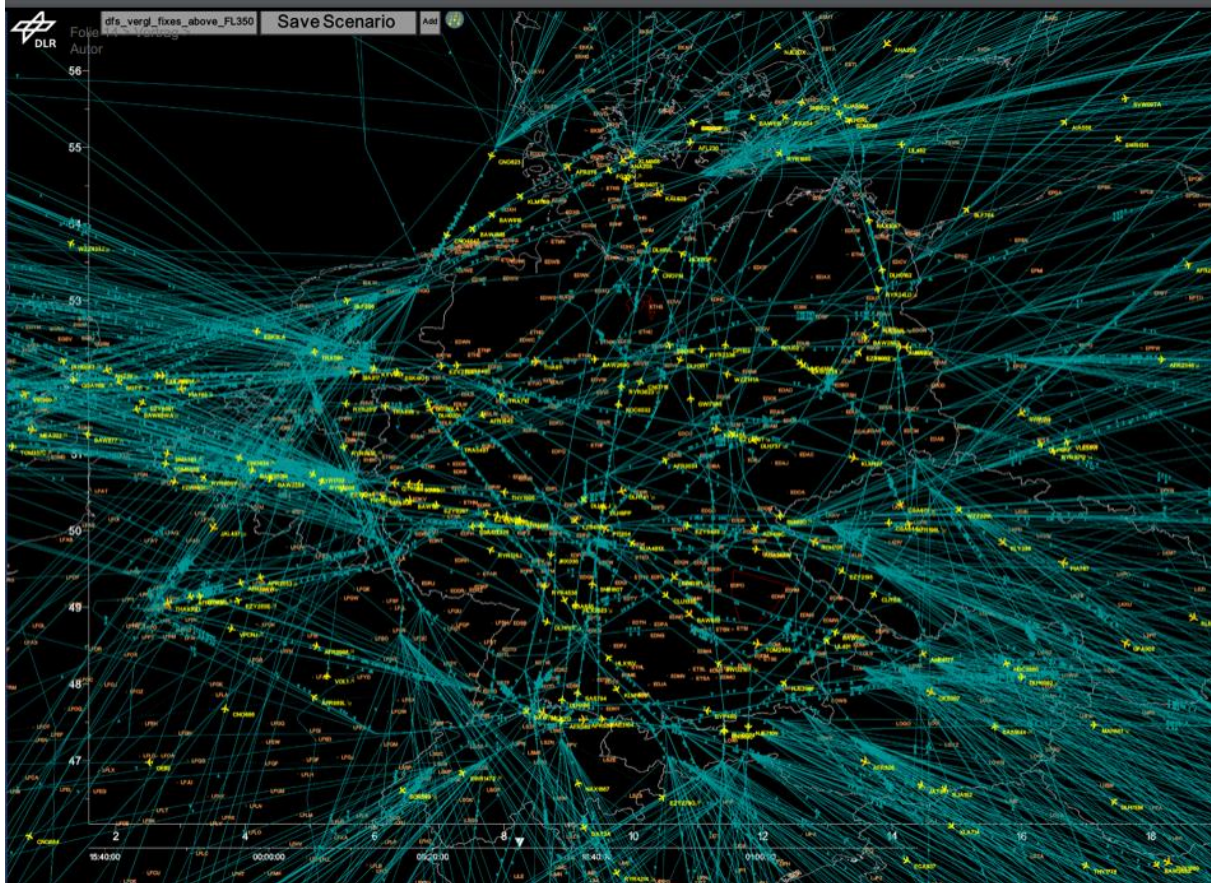


# Crowded Airspace in Cities





# Challenges - Collaborative Path Planning

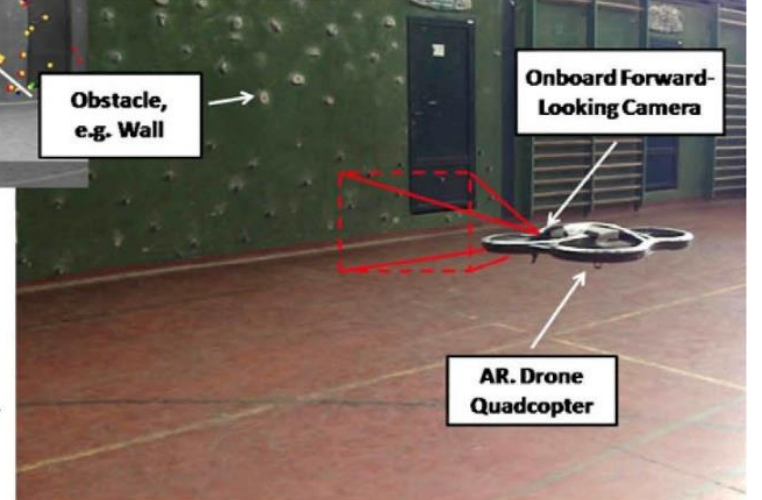
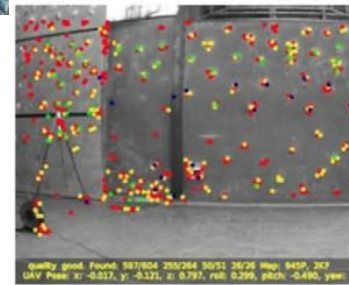


<https://www.youtube.com/watch?v=7Kla9FlmbRc>

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



# Challenges – Navigation in Challenged Environments

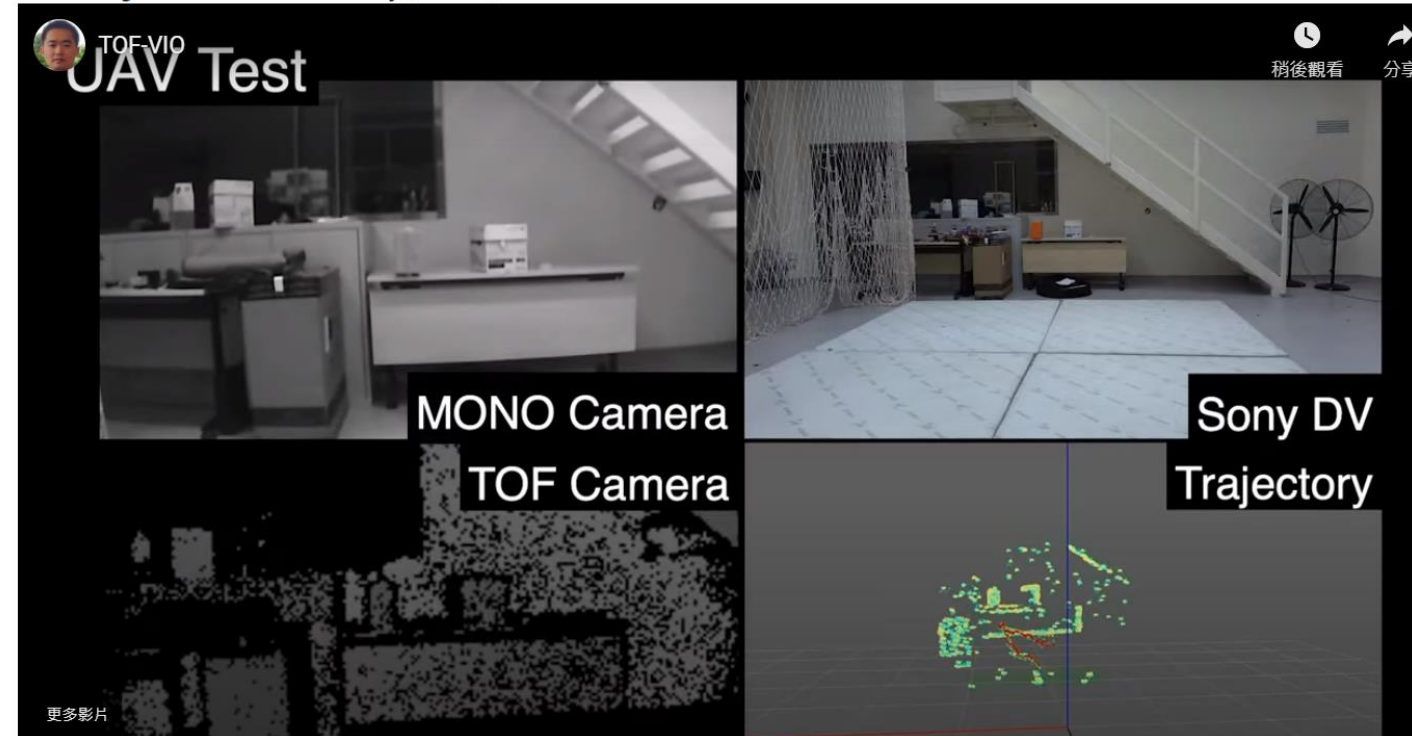
## Challenge in GNSS Positioning



## 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:

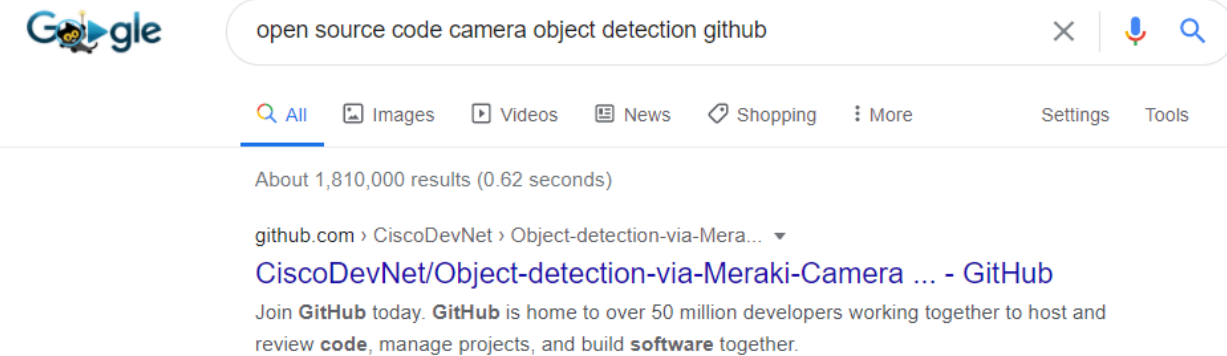
Airworthiness, Reliability, Compliance (regulation-wise)

Statistics and modelling (mathematics-wise)

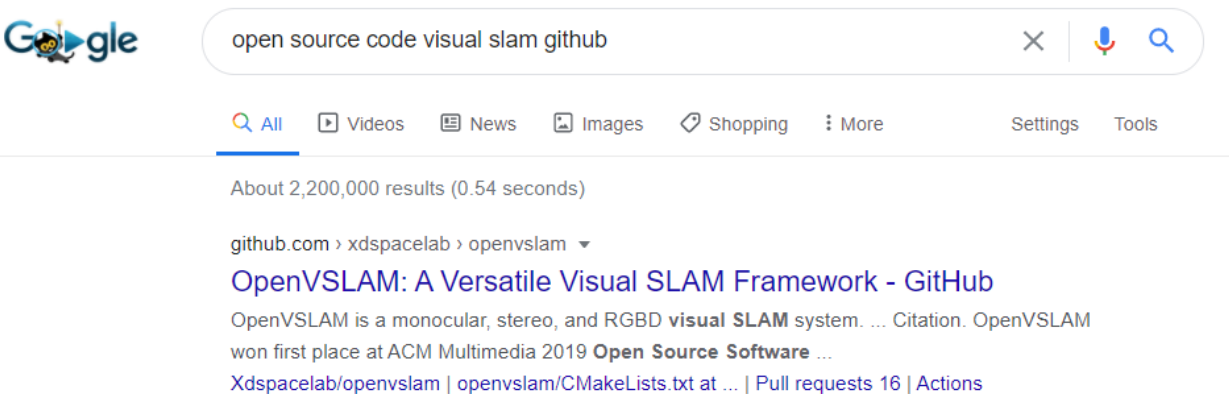
# Most of the sample open-source codes can be found in GitHub



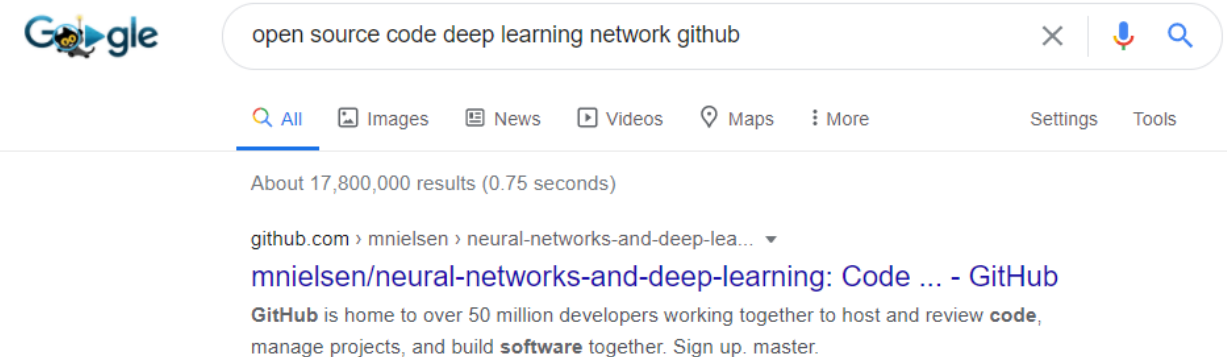
Google search results for "open source code path planning python github". The search bar shows the query and a microphone icon. Below the search bar are tabs for All, Images, Videos, News, Shopping, and More. The results show about 860,000 results in 0.64 seconds. The top result is from github.com, specifically the repository AtsushiSakai/PythonRobotics. The title is "AtsushiSakai/PythonRobotics: Python sample codes ... - GitHub". The description states: "This is a **Python code** collection of robotics algorithms, especially for autonomous navigation. Features: Easy to read for understanding each **algorithm's** basic idea." It includes links to README.md, Issues 4, AtsushiSakai/PythonRobotics, and Pull requests. It also notes: "You've visited this page 3 times. Last visit: 10/26/20".



Google search results for "open source code camera object detection github". The search bar shows the query and a microphone icon. Below the search bar are tabs for All, Images, Videos, News, Shopping, and More. The results show about 1,810,000 results in 0.62 seconds. The top result is from github.com, specifically the repository CiscoDevNet/Object-detection-via-Meraki-Camera. The title is "CiscoDevNet/Object-detection-via-Meraki-Camera ... - GitHub". The description states: "Join **GitHub** today. **GitHub** is home to over 50 million developers working together to host and review **code**, manage projects, and build **software** together."



Google search results for "open source code visual slam github". The search bar shows the query and a microphone icon. Below the search bar are tabs for All, Videos, News, Images, Shopping, and More. The results show about 2,200,000 results in 0.54 seconds. The top result is from github.com, specifically the repository xdspacelab/openslam. The title is "OpenVSLAM: A Versatile Visual SLAM Framework - GitHub". The description states: "OpenVSLAM is a monocular, stereo, and RGBD **visual SLAM** system. ... Citation. OpenVSLAM won first place at ACM Multimedia 2019 **Open Source Software** ...". It includes links to Xdspacelab/openslam, openslam/CMakeLists.txt at ..., Pull requests 16, and Actions.



Google search results for "open source code deep learning network github". The search bar shows the query and a microphone icon. Below the search bar are tabs for All, Images, News, Videos, Maps, and More. The results show about 17,800,000 results in 0.75 seconds. The top result is from github.com, specifically the repository mnielsen/neural-networks-and-deep-learning. The title is "mnielsen/neural-networks-and-deep-learning: Code ... - GitHub". The description states: "**GitHub** is home to over 50 million developers working together to host and review **code**, manage projects, and build **software** together. Sign up. master."



# 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

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

# 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