

# Hsiu-Tsu (David) Shui

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## EDUCATION

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### University of Michigan Ann Arbor

Sep. 2024 - present

*M.S.E in Mechanical Engineering*

Ann Arbor, USA

· Coursework: Math for Robotics, Vehicle Dynamics and Automation, Convex Optimization Methods in Control

### National Cheng Kung University (NCKU)

Sep. 2018 - Jan. 2023

*B.Eng. in Aeronautics and Astronautics Engineering*

Tainan, Taiwan

· Coursework: Flight Mechanics | Control System Design | Introduction to Navigation and Guidance | Introduction to Image Processing, Computer Vision, and Deep Learning | Computer Vision in Deep Learning Implementation and its Applications

· GPA: 3.84/4.3, last 60 GPA: 4.01/4.3

### Polytechnique Montréal

Sep. 2022 - Dec. 2022

*International Thematic Cluster in Dep. of Software Engineering*

Montréal, Canada

· Coursework: Software Testing Engineering | Software Architecture and Advanced Design | Laboratory Internship

· GPA: 4.0/4.0

## RESEARCH EXPERIENCE

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### Intelligent Unmanned Aircraft System Laboratory, NCKU

Aug. 2023 - Apr. 2024

*Research Assistant, supervisor: Prof. Ying-Chih, Lai*

Tainan, Taiwan

· Researched an improved particle swarm optimization (PSO) applied to multiple UAV systems, **verifying the proposed method could find a global optimal free-collision path either in simulations or real world**

· Instructed the laboratory training focused on Python programming, image processing (Gaussian filter, Hough Transform, Convolution), machine learning (KNN, SVM), and deep learning (CNN frameworks, R-CNN)

· Developed embedded systems, combining with sensor fusion for autonomous aerial and ground vehicles

### Mobile Robotics and Autonomous Systems Laboratory, Polytechnique Montréal

Sep. 2022 - Dec. 2022

*Research Intern, supervisor: Prof. Jérôme Le Ny*

Montréal, Canada

· **Validated the 2D-laser SLAM** by developing real-time platforms

### Department of Civil Engineering, National Taiwan University (NTU)

Jul. 2020 – Sep. 2020

*Research Intern, supervisor: Prof. Lap-Loi Chung*

Taipei, Taiwan

· Conducted stress analyses on 4-digit NACA airfoils, **verifying aerodynamic properties of NACA 2412 from previous studies**

## PROJECT EXPERIENCE

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### The Development of an In-Lane Level Vehicular Navigation System with Resilient MCRING Fusion Schemes for Smart Electric Vehicles

Aug. 2023 - Apr. 2024

*Project commissioned by the National Science and Technology Council, Taiwan*

Tainan, Taiwan

· Developed TDA4VM SoC, **implementing GNSS algorithms, inertia navigation algorithms, and multiple sensors for applications in autonomous vehicles**

### The Configuration before a Deployment of the 2D Laser SLAM

Sep. 2022 – Dec. 2022

*Laboratory Internship Project*

Montréal, Canada

· Developed the Create 3 iRobot by **integrating the system consisting of the Raspberry Pi 3, LiDAR, and 2D-Laser SLAM**

· Programmed customized ROS 2 subscribers and publishers, **facilitating data streaming**

· **Achieved multiple machine connections and synchronizations**

### Comparing NoSQL datastores: a Performance Evaluation of Redis, Cassandra, and MongoDB

Sep. – Dec. 2022

*Course Project for Software Architecture and Advanced Design*

Montréal, Canada

· Utilized the YCSB benchmarking tool to analyze comparatively three NoSQL datastores: Redis, Cassandra, and MongoDB

· Deployed clusters of databases, and YCSB tool through Docker Compose, **verifying the properties of various types of NoSQL databases**

## Jetbot Self-Driving Car

Sep. 2021 – Jun. 2022

### Capstone Project

Tainan, Taiwan

- Developed self-driving systems, **navigating Jetbot from waypoints to waypoints**
- **Integrated computer visions and control theories to achieve our system, including camera calibration, lane tracking, object detection, PID controller, and path planning**

## Satellite Mission: Laser Aircraft Charging (LAC)

Sep. 2021 – Jan. 2022

### Special Research Topic in Space Science and Engineering

Tainan, Taiwan

- Conceptualized a satellite capable of charging planes On Earth from space
- Calculated the satellite's orbit, designed payload systems, selected sub-systems, finalized the structure and exterior appearance of the satellite

## The Application and Evaluation of ORB-SLAM 2

March. 2021 – Jan. 2022

### Special Research Topic Contest

Tainan, Taiwan

- Surveyed different categorizations of Visual Inertial Odometry (VIO) and Visual SLAM (vSLAM)
- Implemented ORB-SLAM 2 in a real-time experiment, evaluating the TUM RGB-D datasets
- Calculated absolute trajectory estimations and RMSEs, **concluding ORB-SLAM 2 is unsuitable for fast movements and environments with light occlusion**

## HONORS & AWARDS

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- Institute of Navigation Student Full Complimentary Registration for International Technical Meeting 2024 Jan. 2024
- Study in Canada Scholarship: short-term exchange for study, Canada Sep. 2022 - Dec. 2022
- 5th Place: Special Projects Contest, "The Application and Evaluation of ORB-SLAM 2", NCKU, Taiwan Jan. 2022

## PUBLICATION

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- Cheng, Y. J., **Shui, H. T.**, Chen, C. C., & Lai, Y. C. (2024). "Path Planning and Collision Avoidance of Multiple UAV System Based on Particle Swarm Optimization with Kinematic Consideration," *Journal of Aeronautics, Astronautics, and Aviation*, 56(1), 65-75. [https://doi.org/10.6125/JoAAA.202403\\_56\(1\).07](https://doi.org/10.6125/JoAAA.202403_56(1).07)
- **Shui, H. T.**, & Lai, Y. C., "Collaborative Path Planning and Collision Avoidance for Multi-UAV Navigation based on Accelerated Improved Particles Swarm Optimization," *Proceedings of the 2024 International Technical Meeting of The Institute of Navigation*, Long Beach, California, January 2024, pp. 618-629. <https://doi.org/10.33012/2024.19519>

## Skills

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### Programming:

- Python, C++/C, MATLAB, Simulink

### Software and Tools:

- Git, LaTeX, Robot Operating System (ROS 1 & 2), OpenCV, Tensorflow, Keras, CVX, Shell Scripts, SolidWork, Ansys

### Hardware:

- Raspberry Pi, Jetson Nano, TDA4VM, Camera, IMU, Vicon Tracker

### Language:

- Chinese (native), English (fluent)