

Hsiu-Tsu (David) Shui

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EDUCATION

University of Michigan Ann Arbor

Sep. 2024 - Dec. 2025 (exp.)

M.S.E in Mechanical Engineering

Ann Arbor, USA

· Coursework: Math for Robotics | Vehicle Dynamics and Automation | Convex Optimization Methods in Control | Data-Driven in Control Systems | Nonlinear Systems and Control

· GPA: 3.97/4.0

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 | Computer Vision in Deep Learning Implementation and its Applications | Aircraft Design

· GPA: 3.84/4.3 | Undergraduate Special Topics Contest Award

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 | Study in Canada Scholarship

RESEARCH EXPERIENCE

Smart and Sustainable Automation Research Lab , University of Michigan

Sep. 2024 - present

Graduate Research Assistant, advisor: Prof. Chinedum Okwudire

Ann Arbor, USA

· Improving and designing the performance of model-based, quadratic-form controller to reduce thermal effects

· Executing NSF project, including report writing and paper publication

Intelligent Unmanned Aircraft System Laboratory, NCKU

Aug. 2023 - Apr. 2024

Research Assistant, advisor: Prof. Ying-Chih, Lai

Tainan, Taiwan

· Researched an improved particle swarm optimization (PSO) applied to multiple UAV systems, verified the proposed method could find a global optimal free-collision path either in simulations or the 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, combined with sensor fusion for autonomous aerial and ground vehicles

Mobile Robotics and Autonomous Systems Laboratory, Polytechnique Montréal

Sep. 2022 - Dec. 2022

Research Intern, advisor: 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, advisor: Prof. Lap-Loi Chung

Taipei, Taiwan

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

PROJECT EXPERIENCE

Control of Microscale Selective Laser Sintering (μ -SLS)

Sep. 2024 - Present

Project sponsored by U.S. National Science Foundation

Ann Arbor, USA

· Constructing uncertainty-aware, physics-based models of the μ -SLS process and designing advanced controllers tailored to these models.

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, implemented 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, facilitated 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, verified the properties of various types of NoSQL databases

Jetbot Self-Driving Car Sep. 2021 – Jun. 2022
Capstone Project Tainan, Taiwan

- Developed self-driving systems, navigated 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 RMSE, concluded ORB-SLAM 2 is unsuitable for fast movements and environments with light occlusion

HONORS & AWARDS

- 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
- 5th Place: Special Projects Contest, "The Application and Evaluation of ORB-SLAM 2", NCKU, Taiwan Jan. 2022

PUBLICATION

- 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

Programming:

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

Software and Tools:

- Software and Tools: CVX, CVXPY, Git, LaTeX, Robot Operating System (ROS 1 & 2), SolidWork, ANSYS, 3D Printing, OpenCV, Tensorflow, Keras, Shell Scripts

Hardware:

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

Language:

- Chinese (native), English (fluent)