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: 3.98/4.0

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 Ann Arbor, USA
· Improving and designing the performance of model-based, quadratic-form controller to reduce thermal effects
· Executing NSF-funded project, including technical report writing and academic paper publication

Intelligent Unmanned Aircraft System Laboratory, NCKU Aug. 2023 - Apr. 2024
Research Assistant 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 Assistant 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 Assistant 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
· Building uncertainty-aware, physics-based models for the μ-SLS process and designing customized control solutions (manuscript in preparation)

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
· **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, 3D Printer
Language:
· Chinese (native), English (fluent)