Hsiu-Tsu (David) Shui

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EDUCATION

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

Smart and Sustainable Automation Research Lab , University of Michigan Sep. 2024 - present
Graduate Researcher, advisor: Prof. Chinedum Okwudire Ann Arbor, USA
· Participating in the project regarding the precision laser control of micro selective laser sintering
· **Improving the performance of model-based controller** in order to reduce thermal effects

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, **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, 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, **verifying aerodynamic properties of NACA 2412 from previous studies**

PROJECT EXPERIENCE

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

· 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:
· 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)