CHIH-HAO (ANDY) TSAI

Phone: +1-480-707-7068 | Email: ctsai67@asu.edu | Linkedin: https://www.linkedin.com/in/chih-hao-tsai/ |
Github Portfolio: https://github.com/andytsai104/my-portfolio

Education

M.S. in Robotics and Autonomous Systems
Arizona State University, Tempe, Arizona, United States

Aug. 2024 – May 2026
GPA: 3.5/4.0

Study Abroad Program in Electrical Engineering
Aachen University of Applied Sciences, Aachen, Germany

Mar. 2023 – Aug. 2023
GPA: 3.3/4.0

B.S. in Mechanical Engineering
National Taipei University of Technology, Taipei, Taiwan

Sep. 2019 – Jun. 2023
GPA: 3.03/4.0

Technical Skills

- **Programming: Python** (Advanced – PyTorch, TensorFlow, OpenCV), **C/C++** (**Embedded C**), **MATLAB** (Intermediate – kinematics, control), **Bash** (Intermediate – HPC automation)
- **Robotics & Systems: ROS 2** (Intermediate), **Nav2**, **URDF/xacro**, **Multi-Robot Systems**, **Path Planning & Motion Control**, **PID/PI Control**, **Odometry/IMU Integration**, **Arduino**
- **Tools & Simulation: Linux**, **Git**, **RViz**, **Gazebo** (Fortress), **Simulink**, **CARLA**, **SolidWorks**
- **Machine Learning: Deep Learning**, **Reinforcement Learning**, **General ML Techniques** (Intermediate)

Professional Experience

BELIV Lab, Arizona State University
Research Assistant

Jun. 2025 – Present
Mesa, Arizona

- Developed a hybrid pedestrian controller in **CARLA** by integrating **Social LSTM** with **TD3 (RL)** to simulate diverse, aggressive behaviors for improving autonomous vehicle behavior and safety.
- Implemented **Imitation Learning** to pre-train policies from expert data, accelerating convergence and modeling human-like interactions at complex intersections.
- Engineered a **CNN-based** feature extractor for BEV maps to provide real-time spatial awareness for evaluating autonomous vehicle's decision-making under uncertainty.

Academic Projects

Multi-Robot Warehouse Navigation & Task Allocation *(Team Leader)*
Aug. 2025 – Dec. 2025

- Built a distributed task-allocation method using **Max-Consensus auctions** with distance-based bidding and sequential winner removal (one task per robot).
- Implemented a multi-robot warehouse demo in **ROS 2 Humble + Gazebo Fortress** with **URDF/xacro** differential-drive robots and **2D LiDAR**.
- Bridged allocations to execution by dispatching **Nav2** goals and monitoring task completion status.
- Verified **finite-time convergence** (bounded by communication-graph diameter) and conflict-free assignments under capacity constraints in simulation.

Pololu 3pi+ 2040 Embedded Robotics *(Individual Project)*
Aug. 2025 – Dec. 2025

- Built autonomous behaviors by integrating **IMU (pitch/roll)**, **encoders**, **gyroscope**, **IR line sensors**, and **bump sensors**, with telemetry displayed on the LCD.
- Implemented line/track following with IR calibration, weighted lateral-error estimation, and **P control** + differential steering with speed scheduling for curves vs. straights.
- Developed ramp edge-detection and recovery logic: classified edge position (left/center/right) and executed backup/turn maneuvers.

Vision-Based Maze Solving & Path Planning with MyCobot Pro 600 (*Team Leader*)
Mar. 2025 – Apr. 2025

- Developed a **ROS 2-based pipeline** to control a 6-DOF robotic arm using camera-captured paths.
- Built a digital twin (URDF) with **SOLIDWORKS** for simulation in **RViz** and **Gazebo**.
- Applied **OpenCV** in Python to process maze images, including path extraction and skeletonization.
- Executed joint trajectories on both simulation and physical robot via **TCP/IP**, optimizing motion smoothness.

Robot Forward/Kinematics (ROS2 & Gazebo & MATLAB) (*Team Leader*)
Feb. 2025 – Mar. 2025

- Built a simulation model in **ROS2, Gazebo and Solidworks** for the Dobot Magician Lite robotic arm.
- Simulated a SCARA robot and performed motion control in **Simulink**.
- Validated forward and inverse kinematics using MATLAB and Python scripts.

Control Systems Design and Implementation *(Individual Project)*
Feb. 2025 – Apr. 2025

- Designed and implemented digital control systems in **MATLAB/Simulink** (cruise control, liquid level, pendulum stabilization) on **Arduino Due**.
- Derived plant models and performed controller design/tuning to meet stability and tracking requirements.
- Validated **PID/PI** controllers via **HIL** testing and iterative tuning for robust performance.

Autonomous Mobile Vehicle and Robotic Arm (*Team member*)
Feb. 2022 – Nov. 2022

- Built an autonomous mobile vehicle with a robotic arm for object relocation in a 4-person team.
- Led webcam-based object detection using **TensorFlow + OpenCV** (**Python**).
- Designed the vehicle/arm in **SolidWorks** for 3D printing and integrated motor/arm control on **Arduino (C)**.