

# CHIH-HAO (ANDY) TSAI

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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

- Designing a multi-agent pedestrian controller in **CARLA** with **Python** using a pre-trained **Social LSTM model and an RL-based model** to simulate realistic and aggressive behaviors.
- Extracted BEV features with Vision Transformer and trained the RL model via a **Twin Delayed Deep Deterministic Policy Gradient (TD3) pipeline**.
- Integrating the pedestrian model into reinforcement learning (RL) pipelines to improve autonomous vehicle behavior and safety.

### Test Research Inc.

Intern

Jul. 2022 – Sep. 2022

Taipei, Taiwan

- Assembled and performed troubleshooting of main AOI machines, ensuring compliance with operational standards.

## 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)**.