Puen Xu

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Research Interests

Robotics, Control, Optimization, Robot Learning, Multi-Agent Systems

Education

University of Pennsylvania (Penn) — Philadelphia, PA
M.S.E. in Robotics, GRASP Lab, GPA: 3.95/4.0 — Aug 2024 - Present

Worcester Polytechnic Institute (WPI) — Worcester, MA
B.S. in Robotics Engineering, with High Distinction, GPA: 3.95/4.0 — Aug 2020 - May 2024

Research

Resilient Market-Based Multi-Robot Exploration under Byzantine Threats — Philadelphia, PA
Master's Thesis | Advisor: Prof. Linh Thi Xuan Phan — May 2025 – Present

- Extending RoboRebound, a first-of-its-kind Byzantine fault-tolerance framework for multi-robot systems, to real world scenarios, enabling resilient operations beyond constrained testbeds like flocking.
- Demonstrating robustness in market-based exploration and RVO navigation, mitigating bid manipulation and map poisoning while ensuring safe multi-robot coordination under adversarial conditions.
- Investigating rendezvous mechanisms to enable intermittent communication, addressing proximity constraints in RoboRebound for distributed and realistic multi-robot deployments.
- Collaborating with electrical engineers to develop Secbot, our custom mobile robot, and demonstrating RoboRebound's effectiveness beyond simulation using physical hardware.

Bimodal Quadruped Robot — Worcester, MA
Senior Capstone | Sponsor: Unitree Robotics | Advisor: Prof. Mahdi Agheli — Aug 2023 – May 2024

- Designed and manufactured a 3-DOF robotic arm with a 2-DOF gripper for the Unitree Go1 quadruped robot, using SolidWorks for design and 3D printing for fabrication.
- Developed a custom motor controller board running PID control, integrated with the Jetson Nano on the Go1 to receive and execute ROS commands for precise motion control.
- Worked in a team to integrate the robotic arm into Galileo, WPI's in-house trajectory optimization solver, and a whole-body controller framework, enabling agile loco-manipulation of the robot.

Projects

Game-Theoretic Task Allocation with Dynamic Trust for Drone Swarms — Philadelphia, PA
CIS 6200 Course Project | Advisor: Prof. Aaron Roth — Aug 2025 – Present

- Implementing a leader–citizen voting system for cooperative, game-theoretic task allocation in drone swarms, where leaders collect citizen votes and compute an approximate Nash Equilibrium to assign tasks efficiently.
- Developing a dynamic trust mechanism to mitigate compromised drones, including trust-weighted voting and leader evaluation, enhancing swarm resilience, security, and overall utility under adversarial conditions.

Decentralized Flocking Control for Dynamic Object Tracking — Philadelphia, PA
MEAM 6240 Course Project | Advisor: Prof. Cynthia Sung — Jan 2025 – May 2025

- Developed a Python simulation of a flocking-based algorithm for tracking dynamic targets while avoiding obstacles using a mobile sensor network.
- Designed adversarial scenarios and evaluated system performance under these conditions, verifying robustness, sustained flocking behavior, accurate tracking, and effective obstacle avoidance.

Biped Gymnastics Robot — Philadelphia, PA
MEAM 5170 Course Project | Advisor: Prof. Michael Posa — Aug 2024 – Dec 2024

- Designed and implemented an operational space controller (OSC) in simulation using the Drake toolbox for a planar humanoid robot to achieve stable walking and jumping.
- Developed an energy-shaping controller enabling the robot to swing up from a horizontal bar, demonstrating gymnast-like agility and control.

Robotic Bird Deterrent — Worcester, MA
Independent Study | Sponsor: Eversouce Energy | Advisor: Prof. Greg Lewin — Aug 2023 – Dec 2023

- Designed, fabricated, and wired a mobile robot to patrol power transmission lines to deter ravens using a combination of audio and visual stimuli from tampering with high-voltage wires.
- Developed a YOLOv5 raven detection algorithm integrated with a ROS controller framework to interface with actuators and sensors.

Teaching Assistantship

GRASP Lab, Penn — Philadelphia, PA
Course: ROBO Master's Summer Course — Jul 2025 – Aug 2025

Robotics Engineering Department, WPI — Worcester, MA
Courses: Unified Robotics III - Manipulation, Unified Robotics IV - Navigation — Aug 2023 – May 2024

Academic Resources Center, WPI — Worcester, MA
Courses: Introduction to Static Systems, Introduction to Dynamic Systems — Aug 2023 – Dec 2023

Mathematical Sciences Department, WPI — Worcester, MA
Courses: Calculus III, Applied Statistics I, Ordinary Differential Equations — Aug 2022 – May 2023

Skills

Robotics & Software: ROS, Linux, Robot Programming (C++, Python, MATLAB)
Mechanical & Embedded Systems: SolidWorks, Embedded Development, PCB Design, Controller Design
Mathematical & Analytical Tools: Convex Optimization, Optimal Control, Graph Theory, Machine Learning
Languages: Fluent in English and Mandarin; Competent in Japanese, French, and Spanish

Honors & Awards

MQP (Senior Capstone) Award Honorable Mention, *WPI* — May 2024
Tau Beta Pi (Engineering Honor Society) — Apr 2023
Presidential Scholarship, *WPI* — Aug 2020