Hanquan Wang

Mechanical Engineering Student at the University of Washington | Autonomous Insect Robotics Lab

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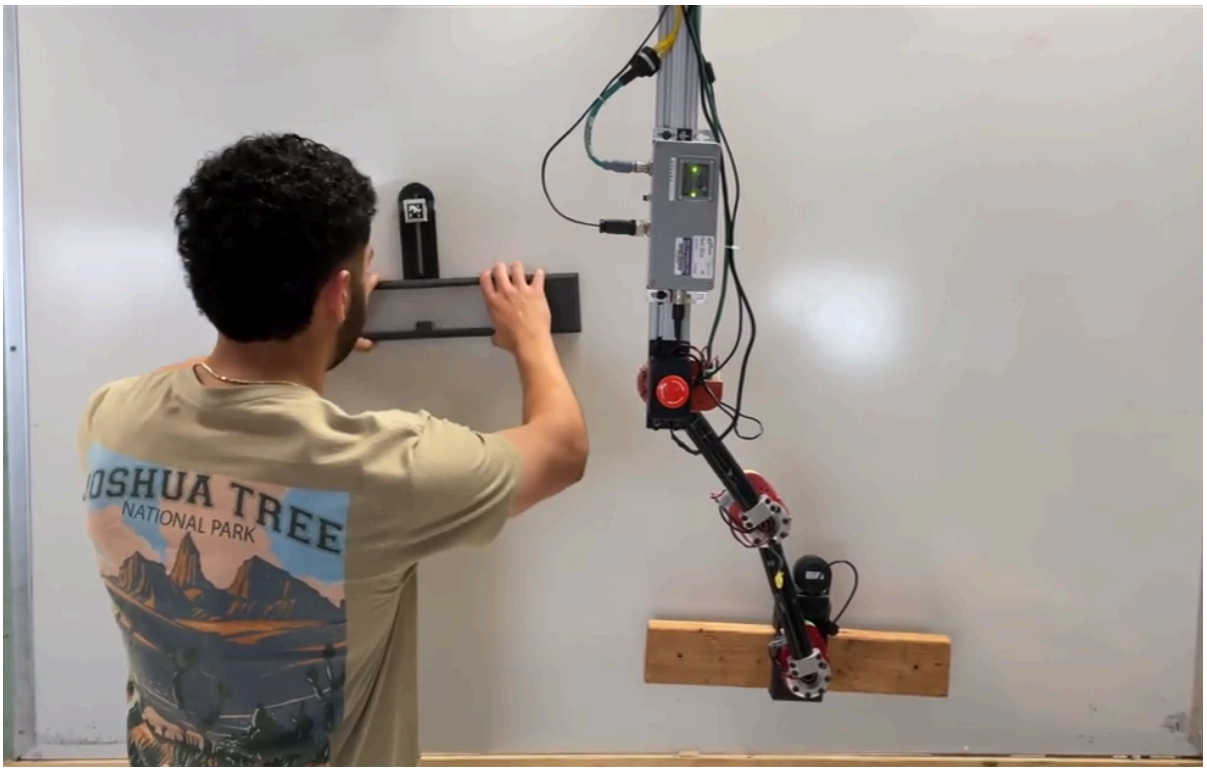
About Me

Welcome to my personal website! My name is Hanquan Wang and you can call me John if you like. I'm currently pursuing M.S. in Mechanical Engineering in the Autonomous Insect Robotics Lab under supervision from Prof. Sawyer Fuller. I obtained B.S. degree at the UW in Mechanical Engineering with a concentration in Mechatronics. My passion lies in control systems and robotic manipulation—fields where I can blend mechanical design, software integration, and precision control to build impactful engineering solutions. I am super intrigued on robot locomotion and bio-inspired adaptability. I am eager to learn from everyone and free feel to reach out using my email or LinkedIn listed on the bottom of the page.

Projects

Smart Robotic Arm for Construction

The Force-Controlled/Autonomous Robot system is designed to aid in lifting and precise positioning tasks through two control regimes. In Regime 1, the robot uses admittance control to respond to user-applied forces, allowing intuitive guidance during lifting and movement. Once the robot is near the target area, Regime 2 activates autonomous control, using AprilTag detection via a camera to snap to the final desired position with high accuracy. The system includes auto-leveling and angular adjustments to ensure precise hole alignment with the target board, enabling efficient and accurate assembly or alignment tasks.



Self-balancing cart

I designed and built a real-time self-balancing cart system using an ESP32 microcontroller, dual DC motors with encoders, and an MPU6050 IMU. The project models a classic inverted pendulum, where I implemented a full-state feedback Linear Quadratic Regulator (LQR) to stabilize the system. I derived the physical model and discrete-time state-space representation from first principles, tuned the LQR using Python, and deployed it to embedded C++ code. The system uses encoder-based cart tracking and a complementary filter for angle estimation. Key challenges included tuning the controller to suppress oscillations and integrating noisy sensor data for reliable stabilization. This project demonstrates applied control theory, real-time embedded programming, and system modeling on hardware.

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Work Experience

CAD/Manufacturing Intern — Pacific Northwest National Laboratory
At PNNL, I contributed to advanced welding and robotic tooling projects. I designed a Friction Stir Tool and a precision test fixture for welding aluminum plates, selecting materials based on mechanical performance. I programmed ABB robots in C++ to perform complex welding tasks across 28 plates, resolving singularities through custom control logic. Additionally, I engineered end effectors for robotic plasma gouging, welding, and grinding—integrating linear bearing blocks to achieve high-accuracy motion. My work also involved researching cold-spray additive manufacturing for improved material durability, supported by cavitation erosion testing. I led overall process development and ensured smooth execution and control across various fabrication workflows.

Mechanical Engineer — AUTEV
At AUTEV, I led the design and rapid prototyping of a robotic end effector for EV charging, which was successfully tested in the field within three weeks. I designed a charge head holder from coated aluminum to reduce weight and resist corrosion in outdoor environments. I also programmed motion paths for a UF xARM robotic arm using Python, optimizing movement precision and efficiency for automated charging tasks.

Mechanical Sub-Lead — Superbike (UW Team)
As the mechanical sub-lead for the UW Superbike team, I led the research, design, and manufacturing of a custom motorcycle swingarm inspired by the Honda CBR600RR. I incorporated Design for Manufacturing and Assembly (DFM/DFA) principles, used GD&T for

machining accuracy, and performed Finite Element Analysis (FEA) to ensure structural integrity under load. I also led the hands-on fabrication phase, completing welding and tube bending to finish assembly in less than a month.

Research Experience

Research Engineer — NASA Cryogenic Vortex Generator (UW Applied Physics Laboratory)
At the UW Applied Physics Lab, I'm investigating vortex generator designs for cryogenic pipe systems under NASA funding. The goal is to improve thermal transfer by disrupting the Leidenfrost vapor barrier in cryogenic environments. I analyze various flow disruption geometries to balance reduced boil-off with minimal pressure drop, contributing to more efficient rocket fuel systems.

Research Assistant — UW Fluids Lab
In this lab, I developed a magnet-controlled particle releaser with eight compartments to support experimental studies of flow dynamics. I integrated camera and laser tracking to monitor over 125 experimental runs and processed velocity field data using MATLAB and PIVmat. My system allowed for controlled fluid releases, enabling precise Particle Image Velocimetry (PIV) analysis.

Mechanical/Technical Writing Lead — UW SEAL
At UW SEAL, I led a six-person writing team in preparing and submitting a National Science Foundation (NSF) proposal ahead of schedule. My technical work focused on designing a novel electrode mask to improve filtration performance by 5% while lowering production cost. I performed analytical calculations to fine-tune the design, achieving an estimated 80% filtration efficiency.

Awards & Scholarships

Library Research Award for Undergraduates - Population Health Award
Awarded June 2025
Honored for significant study in Cryogenic Vortex Transport Lab.

Brown Family Endowed Scholarship in Mechanical Engineering
Awarded June 2024
Recognized for academic excellence and leadership in the UW Mechanical Engineering department.

Ron and Wanda Crockett Endowment Scholarship in Mechanical Engineering
Awarded July 2023
Honored for outstanding performance and contributions to the field of mechanical engineering.

US provisional patent - "SYSTEMS FOR VORTEX GENERATOR ENHANCED HEAT TRANSFER"
Serial Number: 63/807,431

Contact

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