Yixiao Liu

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EDUCATION

University of Illinois at Urbana-Champaign GPA: 3.96/4.0 **Expected: May 2027**
Ph.D. in Mechanical Engineering
Advisor: Elizabeth T. Hsiao-Wecksler, PhD

University of Illinois at Urbana-Champaign GPA: 3.99/4.0 Bronze Tablet (top 3% of the class) **May 2022**
B.S. in Agricultural and Biological Engineering, Highest Honors
B.S. Liberal Arts and Science in Mathematics, Summa Cum Laude

SKILLS

Programming & Tools	Python, MATLAB/Simulink, C, C++, Git, Linux, PyTorch
Embedded & Systems	Embedded C, Microcontrollers, Real-time control, SPI/UART/CAN, Mechatronics prototyping
Robotics	ROS/ROS2, MuJoCo, Gazebo, Reinforcement Learning (RSL-RL), Model-based Control (PID, LQR), Quadratic Programming (qpOASES), Trajectory Optimization (CasADi)

EXPERIENCE - University of Illinois at Urbana-Champaign **Champaign, IL**

Human Dynamics and Control Laboratory - Graduate Research Assistant **August 2022 - present**

- Developing **control strategies** for a novel omnidirectional handsfree wheelchair in the form of a **self-balancing ballbot.**
- Exploring **reinforcement learning** with **RSL-RL** for balance and torque distribution; mentored an undergraduate student on simulation work and currently working on **bridging the sim-to-real gap** toward deployment.
- Derived the robot's **dynamic equations** in **MATLAB** and built a **MuJoCo simulation** to test and tune control strategies prior to hardware implementation.
- Designed and implemented a real-time **LQR-PI balancing controller** for pitch and roll dynamics, and a **PD controller** for yaw, enabling stable upright balance and commanded motion.
- Executed **end-to-end system bring-up**, integrating motors over **CAN**, IMU and load cells over **SPI**, and power electronics across a **real-time TI C2000 microcontroller** and a **Raspberry Pi**, achieving stable closed-loop balancing at 1 kHz.
- Designed and experimentally validated **Quadratic Programming**-based torque distribution strategies to resolve actuator redundancy, isolate traction limits, and improve system stability during aggressive maneuvers.

College of Engineering Control Systems Laboratory - Control Courses Lab Developer **May 2021 - Present**

- Supported the development and operation of 10+ control-related courses spanning **robotics, embedded systems, and real-time control**. Provided technical support during labs to help students debug controllers and understand system dynamics.
- Migrating robotics lab UR3 robot's codebase from **ROS to ROS2**, ensuring compatibility and real-time performance.
- Upgraded mechatronics robot cars with OpenMV camera, Raspberry Pi, AprilTag **localization**, and LiDAR **mapping**; developed Python/C starter code for Launchpad-Raspberry Pi serial communication and OpenCV-based **vision**.
- Designed **PCBs** for multiple courses, including upgraded robot car boards and a **high-speed data acquisition board** capable of real-time logging and PC interfacing.

Distributed Autonomous Systems Laboratory – Undergraduate Research Internship **June 2021 - Dec 2021**

- Developed and deployed **perception algorithms** on an outdoor field robot, focusing on **terrain understanding** and **navigation** in agricultural environments.
- Designed data-generation and labeling pipelines using depth and point-cloud information, improving the reliability of **learning-based perception models** during real-world robot operation.

SELECTED PROJECTS

Autonomous GEM e2 Vehicle (Team Project) **January 2025 - May 2025**

- Developed an **autonomous parking system** in **ROS**, integrating LiDAR–IMU SLAM (FAST-LIO), vision-based lane following with PID control, click-to-goal navigation, and automated parking maneuvers.
- Built a **ROS middleware bridge** to convert AckermannDrive commands into the GEM car's PACMod interface, ensuring reliable actuation and gear control across planning and control layers.
- Designed, simulated (**Gazebo**), and deployed **diagonal and parallel parking maneuvers**, achieving 100% and 80% success rates in real-world testing.

Acrobot (Independent Robotics Project) **January 2023 - July 2023**

- Designed, 3D-printed, and assembled a **two-link underactuated pendulum robot**, from CAD to hardware integration.
- Modeled system dynamics and implemented a **swing-up controller** using **energy-based methods**, validated stable upright balancing performance in **MATLAB simulation** prior to hardware deployment.
- Deployed the controller to **embedded hardware** and validated performance through **real-time experiments**.