# Runxuan (Jerry) Wang

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## EDUCATION

**University of Pennsylvania** — **Philadelphia, Pennsylvania**
*Master of Science in Engineering, Robotics* — *May 2026*

**University of Illinois Urbana Champaign** — **Urbana, Illinois**
*Bachelor of Science in Computer Engineering* — *May 2024*

## TECHNICAL SKILLS

**Programming:** Python, C, C++, MATLAB, x86 Assembly, SystemVerilog
**Libraries and Tools:** PyTorch, OpenCV, Robot Operating System (ROS), KiCAD, RTOS, Git, GDB, OpenOCD
**Other Skills:** Computer Aided Design (CAD), 3D Printing, PCB Design, FPGA Design

## PUBLICATIONS

**Gotta Scoop 'Em All: Sim-and-Real Co-Training of Graph-based Neural Dynamics for Long-Horizon Scooping**
*Kaiwen Hong, Haonan Chen*, **Runxuan Wang***, Kaylan Wang*, Mingtong Zhang, Shuijing Liu, Yunzhu Li, and Katherine Driggs-Campbell*
**Under Review**

**DRAGON:A Dialogue-Based Robot for Assistive Navigation with Visual Language Grounding**
*Shuijing Liu, Aamir Hasan, Kaiwen Hong, **Runxuan Wang**, Peixin Chang, Zachery Mizrachi, Justin Lin, D. Livingston McPherson, Wendy A. Rogers, and Katherine Driggs-Campbell*
**IEEE Robotics and Automation Letters (RA-L), 2024**
Website Paper Videos Code

## EXPERIENCES

**Amazon Robotics** — **Worcester, Massachusetts**
*Applied Scientist Intern, advised by Prof. Taskin Padir* — *July 2025 - Present*

- Developing a modular reinforcement learning framework for **sequential multi-object grasping**, with focus on policy generalization and **sim-to-real transfer**.
- Designed a **curriculum-based RL** training pipeline in **NVIDIA Isaac Lab** to improve sample efficiency and grasp stability across objects.
- Developed a teleoperation system integrating a **UR10e robot** and a **16-DOF robotic hand**, significantly increasing the speed and consistency of data collection.

**Janus Intelligent Robots Lab (JIRL)** — **University of Pennsylvania**
*Research Assistant, advised by Prof. Antonio Loquercio* — *August 2024 - July 2025*

- Developed a **zero-shot long-horizon multi-target** semantic navigation system in **HabitatSim**, preparing for DARPA TIAMAT challenge.
- Leveraged **BLIP2** to generate a 2D value map, integrated **YOLO** and **GroundingDINO** for object detection, and utilized **MobileSAM** for segmentation and point cloud generation.
- Developed a **3D memory module** to store and manage segmented point cloud data for more efficient long-horizon navigation.

**Robotic Perception, Interaction, and Learning Lab (RoboPIL)** — **University of Illinois Urbana Champaign**
*Undergraduate Research Assistant, advised by Prof. Yunzhu Li* — *June 2023 - July 2024*

- Developed a **sim-to-real framework** on a Kinova Gen3 robotic arm for **long-horizon granular object manipulation**, leveraging a **Graph Neural Network (GNN)-based dynamics model** trained in simulation and adapted to real-world scenarios.
- Designed **parameterized behavior primitives** for efficient granular object manipulation, forming a skill library that enables a **Monte Carlo Tree Search (MCTS)**-based planner to empty filled containers completely.
- Developed a **perception pipeline** that processes RGB-D data from four OAK-D Pro Cameras, using **colored-ICP** to accurately align pre-scanned container meshes with real-world point clouds.
- Performed **approximate convex decomposition** on container and tool meshes to enhance physical environment accuracy in Issac Gym, minimizing the sim-to-real gap between simulated and real-world data.
- Designed and implemented both hardware and software components for a **16-DOF robotic hand teleoperation system**, optimizing data collection for dexterous manipulation tasks.

**Human-Centered Autonomy Lab (HCA Lab)** — **University of Illinois Urbana Champaign**
*Undergraduate Research Assistant, advised by Prof. Katie Driggs-Campbell* — *May 2022 - May 2023*

- Developed a **dialogue-based wayfinding robot** for assisting visually impaired users in navigating complex indoor environments using **open-vocabulary** voice commands, with **real-time** performance on an NVIDIA Jetson Nano.
- Fine-tuned a **Contrastive Language-Image Pre-training (CLIP)** model with a custom dataset to interpret **free-form commands** and overcome camera limitations such as low mounting angles, achieving **100% success** in **landmark recognition** during real-world trials.
- Conducted extensive user studies, demonstrating a **32% improvement** in overall user experience compared to baseline navigation methods. Participants consistently reported enhanced system responsiveness, accurate intent recognition, and more intuitive dialogue-based interaction.

- Implemented a **body pose-estimation system** using a D435i depth camera based on the TensorFlow BodyPix model, enabling accurate motion tracking.

### Illini RoboMaster Robotics Team — Urbana, Illinois

*Embedded Systems Team Lead* **Code** — *Aug 2021 - Aug 2023*

- Developed a leader–follower teleoperation framework for a custom-built **6-DOF robotic arm** with **gravity compensation**, implemented on an **STM32F4** microcontroller running **FreeRTOS**, enabling precise and intuitive end-effector control.
- Developed and maintained reliable motor driver firmware utilizing **CAN** and **RS485** protocols via the **STM32 HAL** library, ensuring robust control of the robot's chassis and gimbal systems.
- Designed and deployed **gimbal stabilization** algorithms across multiple robotic platforms using **feedforward PD control**, enhancing motion smoothness and orientation accuracy.
- Mentored new team members on hands-on projects, facilitating their learning in communication protocols, feedback control algorithms, STM32 development, and git version control, fostering a collaborative and knowledge-rich team environment.
- Played a pivotal role in securing the 2nd place in the 2022 RoboMaster ICRA Challenge, and 3rd and 2nd place in the 2022 and 2023 RoboMaster University League Northern America rounds respectively.

## PROJECTS

### Reinforcement Learning-based High-Speed Drone Racing — Code — *Python, PyTorch, NVIDIA Isaac Sim*

- Developed a high-speed drone racing framework in **OmniDrones** and **NVIDIA Isaac Sim**, implementing a **PPO-based RL policy** for agile and precise flight control.
- Designed multi-objective reward functions balancing **speed**, **stability**, and **gate traversal accuracy**, enabling stable end-to-end policy learning.
- Implemented large-scale **parallelized training** on GPUs, processing over 150M simulation frames for efficient policy optimization.
- Achieved a **40.7% success rate** and **7.94 m/s average speed** on a 127 m racetrack, demonstrating robust generalization across procedurally generated track layouts.

### Autonomous "Sentry" Robot for RoboMaster Competition — Code — *ROS, Python, C++*

- Developed the complete software stack for an **autonomous omnidirectional robot**, integrating **ROS** on an NVIDIA Orin Nano board and **FreeRTOS** on an STM32F4 board. Enabled smooth navigation across diverse environments, including slopes and dynamic obstacles.
- Implemented a robust navigation system based on **FAST-LIO SLAM**, utilizing a **MID360 3D LiDAR** for precise mapping and localization.
- Utilized the **PCL** library to process raw point clouds by estimating surface normals and applying filters based on gradient, height, and proximity to the robot to enhance path planning.
- Engineered the embedded software for the robot, enabling low-latency communication between the **Jetson Orin** and **STM32** board via a **custom UART protocol**.

### Wheeled-Legged Balancing Robot - Senior Design "Best Overall Project" — Code — *C, C++, MATLAB, KiCAD*

- Led the development of a versatile wheeled-legged balancing robot, capable of **balancing, load-carrying, and jumping**.
- Designed a custom development board based on the **STM32F103 MCU**, with support for **CAN, SPI, and UART communication**.
- Developed low-level drivers for device communication based on **STM32 HAL**, with task management implemented via **FreeRTOS**.
- Integrated the **Mahony Filter** for accurate state estimation from the **Inertial Measurement Unit (IMU)**.

### 'MentOS' Multi-terminal Linux-like Operating System — *C, x86 assembly*

- Developed a **multi-terminal operating system** from scratch, supporting up to 6 terminals with independent processes.
- Expanded the functionality of the system by integrating support for 10 essential system calls including **execute, halt, open, close, read and write**.
- Engineered **virtual memory management** through assignment of page tables and directories.
- Implemented a robust **file system** supporting data reads across multiple blocks, alongside creating intuitive APIs facilitating data retrieval based on file name and inode number.
- Integrated **round-robin scheduling** to permit concurrent execution of up to 6 programs across multiple terminals.

### FPGA Double Player Street Fighter — *C, System Verilog*

- Developed a dynamic 2-player crossover fighting game housed on a **system-on-chip on FPGA**, leveraging C and System Verilog.
- Integrated a NIOS II processor to facilitate seamless USB keyboard control and efficient management of On-Chip Memory and SDRAM.
- Enhanced the gaming experience by optimizing the storage of sprites and images, characterized by specific dimensions and color depth attributes.

## AWARDS

Fall 2023 Senior Design *(Wheel-Legged Balancing Robot):* ***Grainger Best Overall Project Award***

2024 RoboMaster University Championship: **Third Prize**

2023 RoboMaster University League North America 1v1 Confrontation: **2nd Place (Top 10%)**

2023 RoboMaster University Championship: **Third Prize**

2022 RoboMaster University League North America 1v1 Confrontation: **2nd Place (Top 10%)**

2022 RoboMaster University League North America 3v3 Confrontation: **3rd Place (Top 15%)**

2022 RoboMaster ICRA Challenge: **2nd Place**