

Yuzhen Song

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Research Interests: Reinforcement Learning, Learning-based Control, Human-Robot Interaction, and Sim-to-Real Transfer

EDUCATION

B.Eng. in Robotics Engineering

Southern University of Science and Technology

Aug 2023 – Present
Shenzhen, China

- **Overall GPA:** 3.85/4.0, Weighted Avg: 92.63/100
- **Core Courses:** Robot Operating System (100), Mechanics of Materials M (100), Robot Modeling and Control (97), Mechanical Design (97), CAD and Engineering Drawing (93), Signals and Systems (95), Linear Algebra (94), Introduction to Machine Learning (93), Theoretical Mechanics I-B (93), Advanced Manufacturing Practice (93), Fundamentals of Control Engineering (90), Probability and Statistics (90)
- **Leadership:** President of Robotics Club & Student Organizations Council (SOC)

RESEARCH EXPERIENCES

Southern University of Science and Technology

Undergraduate Researcher, Advisor: Prof. Chenglong Fu

Shenzhen, China

Jul 2025 – Present

○ Project: Slope Center-of-Mass (CoM) Assistance System for Human Gait

- Designed and built an experimental human-in-the-loop testbed, integrating a motor-driven winch and a compound pulley system to deliver dynamic traction (up to 200 N peak) with **<5% force control error**.
- Developed **STM32 closed-loop control** for real-time torque/speed regulation, synced with force telemetry.
- Performed **biomechanical modeling** to analyze the correlation between slope gradients and gait parameters (e.g., step length, impulses, and CoM fluctuations) across multi-slope kinematic datasets.
- Achieved an estimated **20–30% reduction** in metabolic cost under various incline conditions, confirming the model's efficacy in predicting and synthesizing energy-efficient walking patterns.
- *Manuscript in preparation; target submission to **IEEE Robotics and Automation Letters (RA-L)**.*

Undergraduate Researcher, Advisor: Prof. Boyu Zhou

Oct 2025 – Jan 2026

○ Project: Autonomous UAV Mission Navigation via Fast-Planner Framework

- Deployed the **Fast-Planner** framework within **ROS**, configuring it for real-time trajectory generation.
- Engineered a **custom sequential waypoint navigation pipeline** in **RViz**, designing a novel ring-track scenario and developing the autonomous mission logic for sequential traversal.
- Empirically tuned critical stability and deviation tolerance parameters, effectively bridging framework capabilities with the custom scenario to ensure stable return-to-origin flight performance.

Undergraduate Researcher, Advisor: Prof. Zhao Tang

Jun 2025 – Oct 2025

○ Project: Simulation Infrastructure for RL-based Dexterous Manipulation

- Led the development of a high-fidelity simulation infrastructure in **NVIDIA Isaac Sim** and **Webots** to support the lab's Reinforcement Learning (RL) research on multi-fingered robotic palms.
- Refined the **URDF** model and resolved closed-loop kinematic constraints to ensure accurate physical behaviors and collision geometries within the physics engine.
- Configured critical physics parameters (e.g., friction, joint limits) to create a valid training environment, **successfully facilitating lab** to achieve underactuated concave-to-convex state transitions.

PROJECTS

Southern University of Science and Technology

Shenzhen, China

Project Leader, Advisor: Prof. Wende Ke

Sep 2025 – Dec 2025

- **Project: ROS2-Based Mobile Manipulator with Multimodal HRI**
 - Architected a differential drive mobile base integrated with a 4-DOF manipulator; optimized its **URDF/xacro** model with Gazebo plugins for LiDAR, RGB camera, and IMU.
 - Deployed **ROS2 Nav2** and LiDAR-based **SLAM** for autonomous navigation; engineered an **Image-Based Visual Servoing** pipeline combining HSV segmentation and dual-loop **PID control**, achieving ± 5 mm alignment accuracy.
 - Integrated an **Extended Kalman Filter (EKF)** to fuse IMU and wheel odometry data, mitigating sensor drift.
 - Implemented a multimodal Human-Robot Interaction (HRI) interface using **MediaPipe** for gesture recognition and **Vosk API** for offline voice-command execution.
 - *GitHub Repository:* <https://github.com/amysong-robotics/ros2-mobile-manipulator>

Project Leader, Advisor: Prof. Chenglong Fu

Mar 2025 – Jun 2025

- **Project: CV-Guided 6-DOF Robotic Sketching System**
 - Engineered a custom **compliant end-effector** with a spring-buffered linear guide, enabling adaptive Z-axis pressure regulation to replicate authentic brushstrokes.
 - Developed an **OpenCV** vision pipeline and a greedy Euclidean search algorithm to extract sub-pixel contours and generate optimized continuous toolpaths.
 - Solved 6-DOF **inverse kinematics (IK)** via **D-H parameters** to execute precise **2D robotic drawing tasks** on planar surfaces via **MATLAB**; expanded the framework to generate 3D spatial trajectories in **Simulink**.

Project Leader, Advisors: Prof. Dong Lu, Yuanjian Huang

Dec 2024 – Aug 2025

- **Project: Autonomous Intelligent Rescue Vehicle (National Competition)**
 - Curated a dataset using **X-AnyLabeling** and deployed a custom **YOLOv11** model for robust real-time recognition of prioritized colored targets (red, yellow, blue, black) and safe zones.
 - Programmed **STM32 (C/C++)** to process UART visual telemetry and execute an autonomous retrieval pipeline: aligning targets to the visual center, advancing fixed distances for PWM-servo capture, and fusing vision with wheel odometry to navigate and deliver balls sequentially.
 - **Achievement: Led the team to win the National Second Prize and Provincial First Prize (3rd out of 46 teams)** in the China Undergraduate Engineering Practice and Innovation Ability Competition.

SKILLS

- **Programming Languages:** C/C++, Python, MATLAB
- **Mechanical Design & Manufacturing:** AutoCAD, SolidWorks, Edgecam, Abaqus
- **Integrated Development Environments (IDEs):** Visual Studio, VScode, Keil5, Arduino
- **Simulation & Visualization:** Gazebo, Webots, NVIDIA Isaac Sim, Rviz2

HONORS & AWARDS

- National Second Prize, China Undergraduate Eng. Practice and Innovation Ability Competition 2025
- Provincial First Prize, Guangdong Undergraduate Eng. Practice and Innovation Ability Competition 2025
- First-Class Scholarship for Outstanding Students (Top 3%) 2025
- Provincial Second Prize, Guangdong Undergraduate Mechanical Innovational Competition 2025
- Outstanding Student Award 2024, 2025
- Second-Class Scholarship for Outstanding Students (Top 8%) 2024