

# Chenghao Lin

Web: <https://linden713.github.io>

chenghaolin2023@163.com | +1 3136969093 | 4001W. McNichols Rd, Detroit, MI 48221, US

## EDUCATION BACKGROUND

<b>University of Michigan-Ann Arbor (U-M)</b> , Ann Arbor, US	09/2024-05/2026
➤ Degree: Master of Science	
➤ Major: Robotics	
<b>University of Detroit Mercy (UDM)</b> , Detroit, US	09/2023-05/2024
➤ Degree: Bachelor of Engineering	
➤ Major: Mechatronics, Robotics, and Automation Engineering	
➤ GPA: 3.93/4.0	
<b>Beijing University of Chemical Technology (BUCT)</b> , Beijing, China	09/2020-05/2024
<i>An international joint degree program with UDM</i>	
➤ Degree: Bachelor of Engineering	
➤ Major: Mechanical Design, Manufacturing, and Its Automation	
➤ GPA: 3.96/4.3 (3.88/4.0   92.1/100)	
➤ Scholarships: National Scholarship (12/2021), Jingbo Scholarship (11/2023), Second Prize Scholarship (05/2021), Third Prize Scholarship (01/2023)	

## INTERNSHIP

<b>Institute for AI Industry Research, Tsinghua University</b> , Beijing, China	04/2022-05/2023
<i>Intern, ARX Research Group</i>	
Project: Research on the collaborative control of wheeled-legged robots for handling and transferring objects	
➤ Aimed to study the simultaneous stabilization and tracking problems of non-holonomic wheeled mobile robots based on kinematics models	
➤ Applied the leader-follower algorithm to conduct robot simulation and testing based on Gazebo and TurtleBot3, improved the dynamic window approach (DWA) algorithm to achieve formation control for multi-robot systems with obstacle avoidance in real-world	
➤ Created virtual simulation environments with NVIDIA Isaac Sim, conducted simulation experiments for robots to collaboratively handle and transfer objects using pure pursuit path tracking algorithm	
➤ Applied a control law based on a Lyapunov function to realize quick and accurate trajectory tracking, used the Kalman filter to predict the real-time movement trajectory of the robot	
➤ Developed the follow_joint_trajectory_server for a robotic arm, created an interface with MoveIt to implement motion planning	

## PROJECTS

<b>Design of Snake-like Soft Robot</b>	04/2023-07/2023
➤ Designed a three-chambered fiber-reinforced soft robot and conducted simulation with SOFA, made molds using 3D printing, and conducted mold testing	
➤ Developed snake-like scales to enhance the anisotropic friction and improve maneuverability of the soft robot	
<b>Design and Development of an Integrated Home Service Robot</b>	08/2022-11/2022
<i>Project Leader, RoboCup@Home Open Platform Competition</i>	
➤ Developed an intelligent home service robot with functions of navigation, voice interaction, object recognition, and grasping, ultimately achieving room cleaning and guest reception	
➤ Constructed the robot using Kinova Gen2 robotic arm to realize object grabbing and moving, added LakiBeam1 Lidar and Azure Kinect DK for environmental perception and obstacle detection, equipped with a laptop with Intel Core i9 processor and NVIDIA GeForce RTX 3080 graphics card as a mobile computing platform	

- Implemented robotic arm operations, including door opening, object grasping, and precise motion control, utilized MoveIt with Open Motion Planning Library (OMPL) for motion and path planning, RRT\* algorithm for efficient trajectory generation, and TRAC-IK for accurate inverse kinematics solver
- Applied Google Cartographer for 2D indoor mapping, used IRIS LaMa (Localization and Mapping) for robot localization, achieved local path planning based on the Dynamic Window Approach (DWA) and global path planning based on the A\* algorithm
- Adopted Azure AI Speech SDK for speech recognition and voice output, combined with a finite state machine to realize human-computer simple voice interaction
- Utilized Azure Human Joint Recognition SDK for posture recognition and incorporated a PID controller for human tracking
- Created a dataset in accordance with competition requirements and trained YOLOv5 to perform object detection on specific objects, applied voxel filtering to point cloud data of the target objects and calculated their 3D coordinates relative to the robot's coordinate system

### **Sim-to-Real Transformation for Object Transport**

03/2022-05/2022

*Project Member, RoboMaster University Sim2real Challenge*

- Focused on optimizing and testing algorithms within a simulation environment to enhance the performance of real-world robotic systems, encompassing perception, navigation, and manipulation, with a commitment to achieving seamless deployment in the physical world
- Employed an Extended Kalman Filter (EKF) alongside an omnidirectional motion model for state projection and correction using sensor data, including IMU and odometry. Additionally, integrated VINS-Mono (Visual-Inertial Navigation System) as an auxiliary visual odometry to enhance localization accuracy through sensor fusion
- Applied A\* algorithm for global path planning and Timed Elastic Band algorithm for local path planning
- Utilized *iris\_lama\_ros* package for efficient robot localization, featuring fast scan matching and continuous likelihood field support. It is ideal for laser-equipped robots with less reliable odometry

### **Simulation of Multi-robot Mapping based on ROS2 Communication**

09/2021-11/2021

- Utilized *multirobot\_map\_merge* package and TurtleBot3 in a ROS1 environment for Gazebo simulation
- Employed *ros\_bridge* to facilitate topic conversion between ROS1 and ROS2, realized data transfer between robots based on ROS2

## **ACTIVITIES**

### **Teaching Assistant, Course: Robot Workshop, BUCT**

04/2023-05/2023

- Supervised and guided 60 sophomores to design and build Arduino robotic cars, helped students solve problems encountered in robotic car design and development

### **Teaching Assistant, Course: Foundations of Electrical Engineering, BUCT**

04/2023-06/2023

- Assisted a foreign teacher from the University of Detroit to conduct classroom teaching, served as a Chinese-English interpreter for the teacher, conducted Q&A sessions to support student learning

### **Student Leader, Robotic Center, BUCT**

07/2022-07/2023

- Facilitated students' access to research and internship opportunities by creating information channels and recommending talented students to familiar professors
- Negotiated with the university to secure learning and competition facility for the Robotics Center
- Led a team of 12 members to participate in competitions, delivered technical training sessions, and organized ROS (Robot Operating System) lectures for team members, excelled in project management and competition engagement

### **Student Judge, Intelligent Service Robotics Competition, BUCT**

05/2023

- Scored for student participants' performance in practical robot tasks and technical report defense

## **HIGHLIGHTS**

**Computer Skills:** C++, Python, MATLAB, ROS 1, AutoCAD, SolidWorks, Multisim, Fusion360, MCU

**Awards:** The First Prize, RoboCup China Open (11/2022)

The Third Prize, ICRA RoboMaster University Sim2Real Challenge (05/2022)

The Second Prize, China Robot Skills Competition (12/2021)

The First Prize, Intelligent Service Robotics Competition of BUCT (07/2021)