# XIANGYU CHEN

Mobile: +8613393402613 | Email: changerc77@gmail.com | Homepage: https://changerc77.github.io/

## EDUCATION

**Liverpool John Moores University, UK** Sep 2019 - Jun 2023
**Degree:** BEng Electrical and Electronic Engineering
**Award Classification:** UK First Class with Honours
**Research Interest**: Embodied AI, Mapping and Navigation, Manipulation, Robot Learning

## PUBLICATIONS

**Accepted**

1. Yixiao Feng**,** Zhou Jiang, Yongliang Shi, Yunlong Feng, **Xiangyu Chen,** Hao Zhao, Guyue Zhou. ***Block-Map-Based Localization in Large-Scale Environment.*** **(**ICRA 2024)
2. Yuhang Zheng, **Xiangyu Chen**, Yupeng Zheng, Songen Gu, Runyi Yang, Bu Jin, Pengfei Li, Chengliang Zhong, Zengmao Wang, Lina Liu, Chao Yang, Dawei Wang, Zhen Chen, Xiaoxiao Long, Meiqing Wang. ***GaussianGrasper: 3D Language Gaussian Splatting for Open-vocabulary Robotic Grasping***. (RA-L)

**In submission**

1. Yancheng Cao, Xinyi Li, Xinning He, **Xiangyu Chen**, Lishuang Zhan, Qinshan Sun, Ma Ji, Guyue Zhou, Haipeng Mi, and Jiangtao Gong. ***WorkDoggy: Concept Design of Robotic Pet Dog for Emotional Regulation in the Workplace***

## RESEARCH EXPERIENCES

**EncoSmart Technology (Beijing) Co., LTD.** Nov 2023 – Feb 2024, Jul 2024 - Present
*Research Intern* *Supervised by Dr. Xiaoxiao Long*

**GaussianGrasper: 3D Language Gaussian Splatting for Robotic Grasping**

- **3D Reconstruction based Manipulation Design**: proposed a method utilizes 3D Gaussian Splatting to explicitly represent the scene as a collection of Gaussian primitives. The method takes *fewer* views RGB-D to *solve the inconsistency issue* between geometry and semantic information in vision-based manipulation, as well as the *inability to dynamically update the scenes*.
- **Data Collection:** Hand-eye calibration of robotic arm and camera is performed to improve the accuracy of multi-view point cloud fusion during data collection.
- **Method Design**: Using visual language models (VLMs) to achieve *scene understanding* and *object grounding*, and employ Grasp Models (AnyGrasp) to generate the 6-Dof pose for grasping.
- **Experiment**: Design strategies to operate robotic arm and gripper, enabling *long-horizon and continuous* manipulation, as well as *update scenes.*

**GAIRLAB, City University of Hong Kong** Mar 2024 – June 2024
*Research Assistant* *Supervised by Prof. Peng Yin*

Mobile Manipulation Policy based on Imitation Learning

- **Learning-based Mobile Manipulation System Design**: Proposed robot policies based on the ACT network for mobile manipulation to *improve the robustness* in performing long-horizon and fine manipulation tasks.
- **Data collection**: data collection by using whole-body teleoperation system.
- **Method Design**: *Increase* the degrees of freedom of whole-body control to 17 and *optimize* the control strategy through position control and object-centered coordinate relationships to *address the high task failure rate.*
- **Navigation Module Design**: Focus on learning-based navigation method and how to leverage VLMs to *improve* the indoor visual navigation *efficiency* and localization *accuracy*.

**Institute for AI Industry Research, Tsinghua University** Sep 2021 – Nov.2023
*Research Intern* *Supervised by Prof. Guyue Zhou, Dr. Yongliang Shi and Prof. Jiangtao Gong*

Block-Map-Based Localization in Large-Scale Environment Mar 2023 - Sep 2023

- **Block Maps Localization System Design**: Proposed a subgraph localization system based on generating block maps and corresponding switching strategies. The method can *address the issue of easy loss of robot localization, improving localization accuracy* by at least *3 times* while *increasing computational speed by 150%*
- **Perception Module Design**: Used multi-line LiDAR and LIO-SAM algorithms to create maps in large-scale scenes. Used C++ and PCL point cloud library to downsample point clouds for removing ground points.

- **Navigation Module Design**: Using the A* algorithm and TEB algorithm as planners to enable robots to achieve dynamics obstacle avoidance. These planners assist robots in conducting localization experiments.

Multi-Agent Swarm Formation Navigation Algorithms May 2022 - Feb 2023

- **Multi-Agent Navigation Strategies**: Proposed multi-agent collaboration system is proposed to *improve* work *efficiency* through cooperation of multiple robots.
- **Method Design**: Develop Leader-follower, artificial potential field and pure pursuit algorithms to enable robots to flexibly achieve single-agent and multi-agent collaborative obstacle avoidance.
- **Sim2Real Pipeline**: Use Gazebo and Isaac Sim simulators to test algorithms in simulation, then algorithms are fine-tuned and deployed to the real robots to ensure the desired *instantaneity* and *robustness* for multi-agent obstacle avoidance.

Obstacle Avoidance Algorithm for Indoor Racing Unmanned Vehicles Sep 2021 - May 2022

- **Motivation and hardware**: We aim to develop navigation system that can *improve* the robot's localization and real-time obstacle avoidance *robustness* in *corridor and glass* environments. The hardware includes single-line Lidar, IMU and depth camera, with differential drive model as the kinematic model.
- **SLAM Experiment**: We benchmark the performance of Lidar-based SLAM (Gmapping, Cartographer) algorithms and vision-based SLAM algorithms (Rtabmap, ORB_SLAM) and design a multi-sensor fusion algorithm utilizing particle filtering, extended Kalman filtering and graph optimization to *improve real-time localization accuracy* during motion.
- **Navigation Experiment & Results**: We benchmarked path planning algorithms based on graph search and sampling methods. Experiments revealed that using the A* algorithm and TEB algorithm as planners *outperformed other methods* in avoiding static and dynamic obstacles during long-horizon navigation, with robots *successfully avoiding all tested obstacles.*

End-to-end Visual Navigation based on Reinforcement Learning Jun 2021 - Sep 2021

- **Motivation**: We explored the performance of end-to-end vision-based navigation for robots, drawing inspiration from the end-to-end approach used in autonomous driving.
- **Pipeline Design**: We used a CNN network as the backbone for feature extraction and collected camera data and control data in a simulator to create the dataset. After fine-tuning, the system was deployed on a robot for real-world experiments. Results showed that the system *successfully completed* all obstacle avoidance tasks during the day, but many tasks *failed* at night due to factors such as low lighting.

## PROJECTS EXPERIENCES

**" 2023 iFLYTEK Global 1024 Developer Festival" Embodied AI Applications** Oct 2023

- **Contribution**: Designed system incorporating perception, localization, and navigation algorithms, leveraging LLM to enable the robot to complete mobile manipulation tasks in industrial environments.

**Tsinghua (AIR) & ICRA2022 RoboMaster Mech Master University Sim2Real Challenge (RMUS)** Dec 2022

- **Contribution**: built a competition scenario in the simulation and provided a baseline for the competition.

**Baidu Apollo V2X Vehicle-Road Cooperative Technology Model Construction and Validation** Jun 2021

- **Contribution & Results**: we developed a safety model based on two scenarios: ring road conflicts and unprotected left turns, and evaluated the safety performances in both individual vehicle intelligence and V2X scenarios. The results indicate that V2X improved safety metrics by *30% to 90%*.
- **Result**: In collaboration with Baidu, contributed to the release of the first Chinese white paper on vehicle-road cooperative technology: ***Key technologies and prospects of vehicle-road collaboration for autonomous driving***.

## AWARDS

**City Special Prize** - "Unbounded·2023 Shanghai International Student - (Nationalized University Students) Innovation and Entrepreneurship Competition" 2023

**City Top 10, Best Popularity Award, Second and Third Prizes** - 2020、2022 China-U.S. Maker Competition (Shanghai Regional) 2020, 2022

**Third Prize** - 2021 Cross-Strait Maker Competition National Finals 2021

**City Second and Third Prizes** – 2019、2022 Shanghai College Student Maker Competition 2019, 2021

**First Prize (National Level)** - 2017 International Youth Innovation Design Competition China Region 2017

## SKILLS

**Robotics Technology:** ROS1/2, SLAM, Motion Planning
**Software Technology:** C/C++, Python, MATLAB, OpenCV, Linux and Git, PyTorch
**Hardware Technology:** embedded development (STM32, ESP32), SolidWorks, PCB Design
**Language Proficiency:** Mandarin (Native), English (Working Proficiency)