Peng Sun

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RESEARCH INTERESTS

My research centers on motion control, navigation, and human-robot interaction, with the aim of enabling robots to develop semantic understanding of uncertain human environments and generate contextually appropriate responses.

EDUCATION

Harbin Institute of Technology, Shenzhen   *Sep 2022 - Jun 2026 (Expected)*
B.E. in Automation, GPA: 91.25/100.0
Honors:

- First-Class Academic Scholarship   *2023*
- Second-Class Enterprise Scholarship   *2023*

RESEARCH

GSON: A Group-based Social Navigation Framework with Large Multimodal Model

Oct 2023 – Sep 2024

Research Intern with Prof. Xueqian Wang   Center for Artificial Intelligence and Robotics, Tsinghua SIGS

- Presented a group-based social navigation framework (GSON) to enable mobile robots to perceive and exploit the social group of their surroundings by leveling the visual reasoning capability of the Large Multimodal Model (LMM).
- Applied visual prompting techniques to zero-shot extract the social relationship among pedestrians and combined the result with a robust pedestrian detection and tracking pipeline to alleviate the problem of low inference speed of the LMM.
- Proposed a novel planning framework that integrates a social structure-based mid-level planner between global path planning and local motion planning to preserve the global context and reactive response.

PROJECT

Wheeled Biped Robot   *Dec 2022 – Dec 2023*
Project Lead; Advisor: Lab. Tech. Yaming Ge   Education Center of Experiment and Innovation, HITsz

- Conducted systematic modeling of the wheel-leg inverted pendulum system, followed by linearization. Utilizing VMC principles, derived the joint motor torques and designed a LQR controller for effective control.
- Designed the chassis structure and electrical system of the wheel-leg robot, utilizing the STM32 as the primary control unit to effectively implement the control algorithms.
- Conducted simulation and validation of motion control within the Simscape Multibody framework, followed by deployment on the physical robot platform. The robot was capable of executing advanced maneuvers, including walking on a balance beam.

Autonomous Driving System   *Oct 2023 - Dec 2023*
Project Lead; Advisor: Lab. Tech. Yaming Ge   Education Center of Experiment and Innovation, HITsz

- Designed an autonomous driving system that leverages traffic cones for trajectory tracking while employing the Gmapping algorithm for real-time mapping, with integrated path planning and navigation functionalities.
- Applied the A* algorithm for global path planning, optimized the trajectory with Minimum Snap, and used Pure Pursuit for local tracking.
- Utilized YOLO for object detection, converted it to an RKNN model to facilitate NPU acceleration for efficient inference.

Motion Target Control and Autonomous Tracking System   *2ed - 5th Aug 2023*
Advisor: Lab. Tech. Yuanqing Li   Education Center of Experiment and Innovation, HITsz

- Developed two independent laser gimbal systems: one for edge detection and tracking of two-dimensional objects, and the other for tracking the first system's motion.
- Utilized the Sobel operator for edge extraction and applied a PD controller for accurate tracking.

- The designed system tracks any rotational motion of an A4 paper frame within 0.5 seconds and maintains an inter-laser error of less than 0.02 meters.

Competition award

- National Undergraduate Electronics Design Contest **National First Prize** *Aug 2023*
- National Undergraduate Smart Car Contest(ROS Racing Competition) **National First Prize** *Dec 2023*
- National Undergraduate Smart Car Contest(Intelligent Inspection Competition)

  National First Prize *Aug 2024*

Skills

- **Programming:** C/C++, Python, MATLAB, Visual Basic
- **Software** & **Tools:** ROS, OpenCV, CubeMX, Keil, Solidworks
- **Hardware:** Multiple Motors and Sensors, STM32, Arduino