Xukun Li

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EDUCATION

Xi'an Jiaotong University   *Xi'an, Shaanxi, P.R. China*

MASTER OF ENGINEERING. ELECTRONIC AND INFORMATION ENGINEERING, EXPECTED JULY 2025   *Sept. 2022 – Present*

- **Relevant Coursework:** Optimal Control; Machine Learning; Stochastic Process; Linear System Theory; Intelligent Robot technology; Intelligent Control Theory and Application; System optimization and Scheduling; Computer Vision and Pattern Recognition; System Engineering and System Integration.
- **Research Project During Study**
  – **Project: Painting Robot in Construction Scene.**(Topic of my Master's thesis.) **more details**
  In this project, I developed software for a painting robot to automate interior finishing tasks in construction.
  The project involved designing a method for wide-range wall perception using an RGB-D camera and extracting wall information from 3D point Cloud data. Additionally, I implemented coverage path planning (CPP) for the robot's arm, lift, and chassis, ensuring efficient and precise wall coverage painting under procedural constraints. This Windows-based software aims to enhance the efficiency and accuracy of construction spraying operations compared to manual labor.
  – **Project: Online Phase-Recognizing Movement Primitives for Robotic Assembly Tasks. more details**
  In this research, we proposed Phase-Recognizing Movement Primitive (PMP).
  In assembly tasks that require high precision and online adjustments, typical Movement Primitives (MPs) methods do not work well, particularly when the trajectory is executed with limited controller gains, or when the task is hindered by some obstacles. Therefore, we propose Phase-Recognizing Movement Primitive (PMP), which can make a stable estimation of the task phase online, make suitable adjustments when the assembly task is hindered by external disturbances, and achieve precise assembly while using a low gain compliance controller. Specifically, given the robot state, we assume the phase is a random variable with a Gaussian distribution. Consequently, the phase velocity can be computed, enabling us to determine whether the task is hindered and to retry if the task is stuck.

Xi'an Jiaotong University   *Xi'an, Shaanxi, P.R. China*

BACHELOR OF ENGINEERING. AUTOMATION   *Sept. 2018 – July 2022*

- **Relevant Coursework:** Advanced Mathematics; Linear Algebra and Analytic Geometry; Principles of Automatic Control; Motion Control System; Operations Research; Digital Signal Processing; Digital Logic Circuit; Data Structure and Algorithm; Introduction of Computer Science and Technology; Engineering Drawing; Signals and Systems; Electronic Technical Practice
- **Research Project During Study**
  – **Project: Building Information Modeling-based Simultaneous Localization and Mapping for mobile robot in construction scenes.**(Topic of my Bachelor's thesis.) **more details**
  In this research, I use Building Information Modeling(BIM) information in 2D Simultaneous Localization and Mapping(SLAM).
  I use the BIM to generate a 2D ideal map as prior knowledge of the building. Then the mobile robot uses this global map for initial localization and path planning, which can be a coverage path for map updating or a path to a target working position. Besides, the mobile robot can update this prior map based on its following exploration. In conclusion, the advantage of this method is that it can help the robot reach its desired target without generating a map by SLAM first, which save lots of time. Instead, the robot can reach the desired position based on prior knowledge and update the map while moving. The SLAM approach used in this project is based on Cartographer, and the method is tested in simulation in Gazebo with some random obstacles. All the work was done by myself.
  – **Project: Lightweight Transport Robot. more details**
  This project aims to make a lightweight transport robot for a material-carrying competition.
  Robots are asked to catch materials from several specific positions and carry them to some other positions. The more accurately the materials are placed, and the more materials are handled, the shorter the time used, resulting in a higher score. In this project, a mobile robot with a lightweight arm is designed, and two 2D cameras are used, which are mounted on the end effector of the arm and the side of the robot chassis, respectively. In this project, I was responsible for the control of the chassis, arm, and camera. I use a visual serving strategy, which use RANSAC-based method to detect the target and do a close-loop control, for placing action. I also participated in the design of the robot, including the layout, the type of arm selected, and the carrying strategy.
  – **Project: Racing Robot. more details**
  This project aims to participate in a robot racing competition.
  In the competition, the robot is asked to finish the track and hit the target at the destination without getting into the black area as fast as possible. Robots are requested to use a humanoid robot with an omnidirectional chassis comprising three Mecanum wheels and a webcam on its backpack. All programs were running on a Raspberry Pi 4B in the backpack. In this project, I was responsible for the simulation, vision, and control algorithm. I built a simulation environment in the V-REP simulator, tested an edge detection-based method for track detection, and used vision-based PD control for the chassis. Besides, we use Keras and TensorFlow to solve a classified problem and rotate the robot in the right direction since the robot is placed in a random direction at the starting point.

HONORS AND AWARDS

– Xi'an Jiaotong University second prize scholarship for Master students	November	2023
– Xi'an Jiaotong University second prize scholarship for Master students	November	2022
– National Undergraduate Engineering Practice And Innovation Ability Competition, Silver Prize	November	2021
– Xi'an Jiaotong University second prize scholarship for Bachelor students	October	2021
– The 4th National University Contest on Intelligent Robotic Innovations, First Prize	August	2021
– Intelligent Robot Fighting Competition, First Prize	November	2020
– Xi'an Jiaotong University second prize scholarship for Bachelor students	October	2019