

# Ruixiang Du

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## Education

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**Worcester Polytechnic Institute (WPI)** MA, USA  
**Master of Science in Aerospace Engineering**, GPA: 3.92/4.0 01/2019-12/2019  
(*PhD Candidate in Mechanical Engineering*, GPA: 3.93/4.0) 01/2016-12/2018  
**Master of Science in Robotics Engineering**, GPA: 3.83/4.0 08/2011-06/2013

**North China Electric Power University (NCEPU)** Hebei, China  
**Bachelor of Engineering in Automation**, GPA: 87.9/100 09/2007-07/2011

## Technical Skills

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**Robotics:** Mobile Robot Simulation, Control, Motion Planning, Trajectory Optimization

**Programming Languages:** C++ 11/14, Embedded C, Python, Matlab

**Software & Frameworks:** DDS/LCM, ROS/ROS2, Webots/CoppeliaSim/Gazebo

**Embedded Development:** STM32, FreeRTOS/Zephyr, Nvidia Jetson Xavier NX/AGX

## Work Experience

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**Reliable Mobile Robot Platform and Autonomous Navigation Middleware** **WestonRobot**  
*Senior Software Architect (Tech Lead), Singapore* 04/2019-Present

- Re-designed low-level control system for mobile robot platforms manufactured by AgileX
  - Developed core control/peripheral boards and firmware to ensure reliable platform behavior and seamless integration with low-level safety sensors (ultrasonic, bumper) and upper-layer navigation system
  - Proposed the specifications of an intelligent multi-channel, multi-voltage DC-DC power regulator for onboard computing units and sensors to enable robot health monitoring and self-recovery
- Implemented an integrated development and testing framework for autonomous mobile navigation system that allows fast prototyping and reliable deployment
  - In-house robot and sensor numerical simulation integrated with POSIX-port firmware on Linux for fast and repeatable development and testing of control logic and algorithms
  - Integration with open-source physics-based simulator (Gazebo/Webots) with more realistic sensor and environment simulation for application development
  - Shared code base between simulated and real robot with support of hardware-in-the-loop testing and unified application programming interface through SDK
  - Navigation middleware based on open-source mapping and localization framework and in-house motion planning and control implementations
  - Complete DevOps pipeline to support agile development and automated testing with conan for C++ package management and docker for consistent deployment
- Collaborated with the Digital Services Lab (DSL) at IMDA and led the technical development of social distance and UV disinfection robots, deployed at Ministry of Communications and Information (MCI)

**Maneuver Intent Inference and Motion Planning for Self-Driving Cars** **nuTonomy**  
*Autonomous Vehicle Intern, Boston USA* 05/2017-08/2017

- Conducted literature review on maneuver intent inference for path planning of autonomous vehicles
- Developed an HMM-based inference model and implemented the model in C++
- Tested the implementation with real-world data collected in Boston by nuTonomy

## Research

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**Motion Prediction and Planning for Connected and Automated Vehicles** **WPI**  
*Research Assistant in Autonomy Control and Estimation Laboratory* 10/2017-12/2018

- Conducted literature review on autonomous vehicle motion prediction and risk assessment
- Collaborated with the Wireless Innovation Laboratory and studied vehicular wireless network
- Implemented a lattice planner with a scalar field that uses stochastic reachable sets to evaluate collision risk
- Proposed an interactive prediction and planning framework with the goal to concentrate computational resource on vehicles that are more likely to affect safe maneuver of ego vehicle

### **Path Repair and Motion Planning for Small Unmanned Aerial Vehicles**

**WPI**

*Research Assistant in Autonomy Control and Estimation Laboratory*

*01/2016-10/2017*

- Proposed a path repair algorithm for small UAVs equipped with FOV-limited onboard 3D sensor to efficiently navigate in large indoor environments where only a 2D map is available beforehand
  - Analyzed potential benefits of taking possible 3D path shortcuts in 2D map
  - Designed optimal sensor pointing policy to actively look for high-rank shortcuts
  - Evaluated A\* and RRT\* implementations for optimal global path finding with a hybrid map that incorporates information from 2D map and real-time sensor data
- Implemented minimum-snap trajectory optimization and a quaternion-based motion tracking controller for algorithm validation within a physics-based simulator

### **DARPA Robotics Challenge Trials & Finals, Team WPI-CMU**

**WPI**

*Research Assistant in Robotics and Intelligent Vehicles Research Laboratory*

*09/2013-06/2015*

- Evaluated control strategies for the door task to enable the robot to traverse different types of doors
- Developed motion primitives and human-robot interface for the door task to better blend human supervision into the semi-autonomous task execution of the robot and minimize operation-error
- Implemented planning and control algorithms and designed finite-state machine for the wall cutting task
- Collaborated with the CMU team on the whole-body manipulation controller to support task-level features

## **Other Projects**

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### **Robotics Enabled In-Home Environment Screening for Fall Risks**

*01/2014-05/2014*

- Worked out a robotic framework for home fall risk assessment, including setting up the software for both the Turtlebot2 platform and the Gazebo simulator, adding new sensors and developing drivers, implementing a web interface based on the "Robot Management System" to make the system accessible from a web page
- Studied the navigation of mobile robots in home environment and potential applications of robotic technologies for improving the life quality of elderly people, prepared preliminary results for proposal of further research on this topic

### **Intelligent Portable Aerial Surveillance System - IPASS**

*12/2012-05/2013*

- Developed the dynamics model of the aircraft and designed controller with Matlab simulation
- Collaborated with the undergraduate team of this project for improving the mechanical design of the aircraft, based on the theoretical analysis
- Evaluated different image stitching techniques to get panoramas from cameras on the aircraft

## **Additional Experience**

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### **Conference/Journal Reviewer**

- American Control Conference (ACC) ● IEEE Conference on Decision and Control (CDC) ● IEEE International Conference on Robotics and Automation (ICRA) ● IEEE Transactions on Robotics (T-RO) ● IEEE Transactions on Aerospace and Electronic Systems (TAES) ● IEEE Transactions on Automation Science and Engineering (T-ASE)

### **Book Technical Reviewer**

- Mastering ROS for Robotics Programming, by Lentin Joseph, Packt Publishing
- ROS Robotics Projects, by Lentin Joseph, Packt Publishing