Yan Yuchen

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EDUCATION

Northwestern Polytechnical University   **GPA:84.29/100**   **Master**   Sep. 2020 – Present

Supervisor: Prof. Yizhai Zhang

Majoring in Control Science and Engineering

Mainly study on Guidance、Navigation and Control

Northwestern Polytechnical University   **GPA:82.99/100**   **Bachelor**   Sep. 2016 – Jul. 2020

Majoring in Mechatronics Engineering

Mainly study on mechanical design for robots

RESEARCH EXPERIENCE

Data-driven algorithm for UAV wind field perturbation estimation   Sep.2023 – Now

- This project is going to possess rapid transient reaction ability and high-precision steady state tracking performance simultaneously in one interpretable framework;

- We already finished the process of autonomous generation algorithm of UAV trajectory and estimation of its dynamic model using UAV flight trajectory.

- We are going to separate the part of the input internal disturbance and the external disturbance from the learned dynamic model, and control the disturbance to achieve better control of the drone and other objects.

Infrastructure inspection UAV navigation system   Dec. 2020– Apr.2023

- This work was partially supported by national Key R&D Program of China with Grant Number 2019YFB1310401 and the National Science Foundation of China with Grant Number 62022067.

- The hardware part of the system includes DJI Matrix 300RTK UAV, DJI Manifold 2-C , binocular camera, IMU, etc;

- As the control centre, DJI Manifold 2-C mainly charged for processing the information camera image information and IMU information reads through USB;

- The algorithm part includes binocular vision target detection algorithm, IMU and binocular camera fusion algorithm, and UAV path planning algorithm;

- All communication and algorithm programs are written in C++ on the ROS platform;

- The hardware and software of the whole system are done by myself；

- The project culminated in an article and seven patents.

Research on planning and control technology for wide-range detection of Drones   Dec. 2018– Jan.2020

- This work was partially supported by national Key R&D Program of China with Grant Number 2019YFB1310401 and the National Science Foundation of China with Grant Number 62022067.

- This study based on research work carried out to determine the UAV path planning rules in the implementation of bridge inspection tasks detection area, studied the bridge inspection path planning of unmanned aerial vehicles;

- The study analysed bridge models and wind field environments;

- Aiming at the quadrotor UAV model, the kinematics and dynamics are analysed in the presence of certain perturbations, and a nonlinear mathematical model of the quadrotor UAV is

established, and a PID control system is designed for attitude and trajectory control;

- A full-coverage path planning algorithm based on cell decomposition combined with BIM modelling is proposed;
- The hardware and software of the whole system are done by myself;
- The project culminated in an article and one patents

A Wheel-track-leg Composite Bionic Robot Based on Multi-Sensor Fusion   Sep. 2017– Oct. 2018

- This project is funded by College Students' Innovative Entrepreneurial Training Plan Program;
- In order to improve the obstacle-surmounting performance of mobile robots and realize autonomous obstacle-surmounting, a wheel-track-leg composite bionic robot was designed.
- Taking the turtle as the bionic object, through analysing its body structure and stability mechanism, the wheel-track-leg composite mobile mechanism and the two degree of freedom leg structure of the robot were designed;
- I am responsible for the design and production of the mechanical structure of the robot;
- The project culminated in two patents.

Autonomous Inspection Vehicle Based on Multi-Sensor Fusion   Feb. 2016 – Jul. 2017

- This project is funded by College Students' Innovative Entrepreneurial Training Plan Program;
- The main goal of this project is to develop an automatic obstacle avoidance inspection trolley for unmanned scenarios such as warehouse inspections;
- In order to realize the all-terrain passing capability, the structural design of this robot puts special requirements on the design of the mechanical structure, and designs such as McNamee's wheel are used in the mechanical structure design process to realize the requirements;
- I am responsible for the design and production of the mechanical structure of the robot;
- The project culminated in two patents and our project received an excellent closing in the final defence.

PUBLICATIONS

- <u>Yuchen Yan,</u> Yizhai Zhang, Panfeng Huang, "The Navigation and Control Study of UAV for Cross-domain Bridge Collaboration Detection" *2021 IEEE International Conference on Real-time Computing and Robotics (RCAR)*
- Wenpeng Ji, Yizhai Zhang, Panfeng Huang, <u>Yuchen Yan</u> and Qilei Yang, "A Neural Network with Spatial Attention for Pixel-Level Crack Detection on Concrete Bridges," *2022 IEEE 11th Data Driven Control and Learning Systems Conference (DDCLS)*
- Zhixiang Wang, Yizhai Zhang, <u>Yuchen Yan</u>, Xudong Li, Yongwei Zhang, Panfeng Huang, "Localization, Planning, and Control of a UAV for Rapid Complete Coverage Bridge Inspection in Large-Scale Intermittent GPS Environments" (Under review)
- Yuchen Yan, Yizhai Zhang, Panfeng Huang, "UAV localization and navigation based on BIM model" (Under review)

PATENTS

- Yan Yuchen, Zhang, Huang etc. A long-span bridge detection UAV full-coverage path planning method. CN (Patent) CN202111466888.4, filed Dec 03, 2021, and published Feb 11, 2022.
- Huang, Wang, Zhang F, Zhang Y, Yan Yuchen etc. An absolute positioning method combining visual inertial odometer with intermittent RTK. CN (Patent) CN202111642896.X, filed Dec 29, 2021, and published May 27, 2022.
- Zhang Y, Ji, Huang, Yan Yuchen etc. A bridge crack detection method based on deep learning framework. CN (Patent) CN202111439887.0, filed Jul 23, 2021, and issued Feb 27, 2024.
- Zhang Y, Ji, Huang, Yan Yuchen etc. A pre-screening and calibration method for bridge crack dataset. CN (Patent) CN202111439887.0, filed Nov 30, 2021, and issued Mar 5, 2024.

- Huang, Wang, Zhang, Zhang F, Yan Yuchen etc. A robot spatio-temporally optimal coverage trajectory planning method. CN (Patent) CN202310024210.3, filed Jan 09, 2023, and published May 9, 2023.
- Huang, Yan Yuchen etc. A kind of sub-track drive device for obstacle-crossing robot platforms. CN (Patent) CN201921597731.3, filed Sep 24, 2019, and published Jun 05, 2020.
- Huang, Yan Yuchen etc. A complex terrain obstacle-crossing robot platform. CN (Patent) CN201921273847.1, filed Aug 07, 2019, and issued Apr 24, 2020.

AWARD & GRANT

- **Wu Yajun first class scholarship** (Only students in the top 1/305 of the school's comprehensive scores receive this award)
- **Champion** in Rescue Robot Group of **China Robot Competition 2018**
- **Runner-up** in the Basketball Robot Group of **China Robot Competition2018**
- **Champion** in 2018 RoboCup World Cup China Rescue Robot Group Autonomous Challenge.
- **Runner-up** in the 2018 RoboCup World Cup China rescue robot group
- **The second prize** of the 11th National College Students Energy Conservation and Emission Reduction Social Practice and Science and Technology Competition
- **The second prize** of the Northwest Division of the 9th Beidou Cup National Youth Science and Technology Innovation Competition

LEADERSHIP EXPERIENCE

Captain of the rescue group of Northwestern Polytechnical University Dance Robot Club
- Managed the daily affairs of the group and the practical training of new team members
- Lead the team to participate in the annual China robot competition and RoboCup robot competition
- As a representative, participated in various robot technology exhibitions

Assistant Counselor of the school of Mechanical Engineering
- Responsible for handling student work and scholarship work at the College

RELEVANT RESEARCH SKILLS

Language: Chinese(native), English (Proficient)

Computer Languages: C(Proficient), C++(proficient), MATLAB (proficient), Python (Beginner)

Computer Skills: Proficient in Linux, ROS and OpenCV

Robot related algorithms: SLAM, Sensor fusion, motion planning and so on.