Lingkai ZHANG

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EDUCATION

Nanjing University of Posts and Telecommunications Nanjing, China
Bachelor of Engineering (Degree to be conferred in June 2027) Sep 2023 – Jun 2027
Major: Electronic and Information Engineering Average Score: 81.10/100.00
Core Coursework: *Advanced Mathematics, Linear Algebra and Analytic Geometry, Probability Statistics and Random Process, Fundamentals of Circuit Analysis, Signals & Systems, Digital Signal Processing, Python Language Programming and Engineering Practice, Microcomputer Principle and Interface Technology*

INTERNSHIPS

Hong Kong University of Science and Technology (Guangzhou) Guangzhou, China
Research Assistant under Prof. Renjing Xu's Research Group of Hong Kong University of Science and Technology (Guangzhou) Jul 2026 – Present

- Algorithm Design & Training Framework Development: Participated in the design of state space, action space, reward functions, and training frameworks; conducted research on Centralized Training with Decentralized Execution (CTDE) and cooperative multi-agent reinforcement learning.
- Simulation Environment Development & Algorithm Validation: Built multi-agent simulation environments, reproduced algorithms, trained policies, tuned parameters, and performed comparative experiments.
- System Integration & Platform Deployment: Integrated learning-based decision-making algorithms with UAV planning and control systems using ROS, PX4, MAVROS, Gazebo, and Mujoco; completed simulation validation and experimental data analysis.

Nanjing Feiying Intelligent Technology Co., Ltd. Nanjing, China
UAV Development Engineer Mar 2026 – Jul 2026

- Autonomous Systems & Swarm Coordination Algorithm Development: Developed algorithms for multi-UAV formation, cooperative search, task allocation, swarm obstacle avoidance, and heterogeneous platform joint scheduling; built a full technology pipeline encompassing perception, localization, planning, decision-making, and control.
- Visual Perception & Multi-Sensor Fusion: Developed vision-based target detection, tracking, localization, visual servoing, and precision delivery functions; fused LiDAR, vision, GNSS/Beidou, and IMU data for environmental mapping and multi-source localization.
- Flight Control & System Deployment: Implemented autonomous takeoff and landing, trajectory tracking, Offboard control, and task state machines using PX4, ROS, and MAVROS; conducted simulation validation, real-world system deployment, flight testing, and engineering delivery.

RESEARCH PROJECTS

Lead-Time Synchronized Formation Control for Multi-UAV Systems Nanjing, China
Nanjing University of Posts and Telecommunications Jun 2025 – Feb 2026

- Research Background & Objectives: Multi-UAV formation systems face challenges in achieving synchronized convergence under composite disturbances, requiring position and velocity errors to converge within a prescribed time bound.
- Methodology & Approach: Designed an LTSTDO disturbance observer and an LTSFC formation controller; completed Lyapunov-based stability proof and convergence time derivation. Conducted numerical simulations in MATLAB and built a mixed-reality hardware-in-the-loop platform based on ROS, Gazebo, PX4, and Intel NUC for algorithm deployment, real-world formation flight tests, and experimental data analysis.
- Contributions: Independently designed the controller and observer, proved system stability, and derived convergence time bounds. Built the HIL simulation platform, deployed algorithms, tuned parameters, executed real-world formation flights, and drafted the manuscript.
- Outcomes: Manuscript Lead-time Synchronized Formation for Multi-UAV Systems: Design and Mixed-Reality Verification under minor revision at ISA Transactions (SCI Q1, third author).
- **RIS-CENet: Module-Aware Deep Learning for Cascaded Channel** Nanjing, China

Nanjing University of Posts and Telecommunications Nov 2025 – Jul 2026

- Research Background & Objectives: Cascaded channel modeling in Reconfigurable Intelligent Surface (RIS)-assisted communication systems. Existing deep learning methods treat channel processing as a black-box mapping and fail to utilize the structural priors inherent in the channel itself.
- Methodology & Approach: Proposed a module-aware deep learning framework, RIS-CENet, that organizes network architecture according to different functional modules and channel structures in communication systems. Constructed cascaded channel datasets and completed model training, hyperparameter tuning, and

ablation experiments using Python and PyTorch.

- Contributions: Conducted literature review, modeled the system, and built the datasets. Designed the network architecture and training pipeline; independently trained models, searched hyperparameters, and analyzed experimental results. Wrote the manuscript and prepared submission materials.
- Outcomes: Manuscript RIS-CENet: A Module-aware Deep Learning Framework for Cascaded Channel under review at Sensors (SCI Q2, second author).

Swarm Intelligence-Based UAV Ferry Cruising Optimization Nanjing, China

Nanjing University of Posts and Telecommunications Aug 2025 – Dec 2025

- Research Background & Objectives: In post-disaster rescue and emergency communication scenarios, ground base stations are often destroyed, causing communication failures. UAV swarms are needed to construct an integrated air-space-ground communication network. The ferry UAV's cruising path and hovering positions among relay nodes directly affect system communication latency.
- Methodology & Approach: Established a layered air-space-ground UAV communication architecture and a system latency model. Proposed the FCO (Ferry Cruising Optimization) algorithm, which solved relay node visiting sequences through an improved shortest-path method and optimized ferry UAV 3D hovering positions using geometric similarity principles. Completed numerical simulations, parameter tuning, and comparative experiments in MATLAB.
- Contributions: Independently completed system modeling, algorithm design, simulation experiments, and data analysis; wrote and submitted the manuscript.
- Outcomes: Manuscript Ferry Cruising Optimization Algorithm for UAV Based on Swarm Intelligence published in Radio Communications Technology (Peking University Core Journal, fourth author). The algorithm achieved approximately 4.7% path length reduction in 15-node scenarios. This work was supported by the National Key R&D Program (2021ZD0140405) and the Jiangsu Natural Science Foundation (BK20241885).

Provincial Key STITP – Hierarchical UAV Path Planning Nanjing, China

Nanjing University of Posts and Telecommunications Jun 2025 – May 2026

Project Lead

- Research Background & Objectives: Urban low-altitude environments are obstacle-dense, making it difficult to balance global path planning efficiency with local trajectory safety. Furthermore, effective spatiotemporal allocation mechanisms for low-altitude airspace resources are lacking.
- Methodology & Approach: Designed a hierarchical autonomous UAV planning system combining Bi-RRT for global planning and EgoPlanner for local trajectory optimization; built simulation environments in ROS/Gazebo and completed PX4-based real-world deployment. Extended the research to spatiotemporal allocation and collaborative optimization of low-altitude airspace resources by establishing UAV airway networks, dynamic isolation zones, traffic flow optimization models, and spatiotemporal diversity reservation mechanisms.
- Contributions: Served as project lead, responsible for research planning, team task allocation, and project progress management; led system architecture design, algorithm reviews, and real-world deployment; performed experimental analysis, paper writing, and results summarization.
- Outcomes: Granted one national invention patent as a co-inventor: A Low-Altitude Economy-Based Airspace Resource Allocation Method for UAVs (CN121260052B).

Machine Learning-Assisted SPR Biosensor Optimization Nanjing, China

Nanjing University of Posts and Telecommunications Sep 2024 – Jan 2025

- Research Background & Objectives: Traditional SPR biosensor structural parameter optimization relies on extensive repetitive electromagnetic simulations, requiring substantial computational resources and resulting in low optimization efficiency.
- Methodology & Approach: Generated sensor datasets under various material thickness and medium refractive index combinations using the transfer matrix method. Built a multi-output gradient boosting regression model in Python to jointly predict sensitivity, FWHM, detection accuracy, and figure of merit. Integrated the trained surrogate model with intelligent optimization algorithms for rapid structural parameter search.
- Contributions: Generated the data, preprocessed the datasets, and performed correlation analysis. Built and trained the multi-output regression model, evaluated its performance, and integrated optimization algorithms for parameter search.
- Outcomes: Established a complete experimental pipeline from physical simulation and data modeling to intelligent optimization, replacing traditional parameter sweeps with machine learning surrogate models and significantly reducing computational costs.

COMPETITION PROJECTS

National Undergraduate Electronic Design Contest – Aerial-Ground Cooperative Firefighting System Nanjing, China

Provincial Second Prize Apr 2025 - Aug 2025

- Project Overview: Designed an aerial-ground cooperative firefighting system consisting of a UAV and a ground

firefighting vehicle, enabling autonomous UAV cruise, fire source detection, target tracking, precision payload release, continuous-operation waypoint return, and automatic return, with real-time mission status transmission to the ground platform.

- System Design & Technical Implementation: Developed UAV autonomous flight control nodes based on ROS/MAVROS and designed a finite state machine managing S-waypoint cruise, fire source detection response, visual target tracking, visual deviation filtering, precision descent payload release, continuous-operation waypoint return, and automatic return. Designed topic interfaces and data links among Livox MID-360, laser SLAM, visual recognition, PX4 flight controller, and the ground firefighting vehicle.
- Contributions: Led the team, formulated the overall technical solution, and allocated team tasks. Directed ROS-side software development and system integration, and performed multi-node debugging, parameter tuning, anomaly troubleshooting, and real-world testing.
- Outcomes: Provincial Second Prize, 2025 National Undergraduate Electronic Design Contest (Jiangsu Section).

RoboCup China UAV Challenge – Dual-UAV Cooperative Transport Nanjing, China
National Second Prize (Runner-Up) Aug 2025 – Oct 2025

- Project Overview: Developed a dual-UAV cooperative cargo transport system based on PX4 flight control for GPS-denied indoor environments, enabling autonomous takeoff, cooperative navigation, obstacle avoidance, cargo transport, and precision delivery.
- System Design & Technical Implementation: Deployed FAST-LIO2 LiDAR-inertial odometry on the Jetson Orin NX platform, fusing Livox Mid-360 LiDAR and IMU data for real-time localization and state estimation. Designed an improved artificial potential field method that incorporated inter-UAV cooperative forces on top of traditional attractive and repulsive forces, addressing local minima, target unreachability, and trajectory oscillation issues. Integrated ROS, PX4 Offboard control, communication modules, and cargo delivery modules, with parameter tuning and functional validation through simulations and real-world experiments.
- Contributions: Architected the system software, deployed and optimized FAST-LIO2, and designed and implemented the improved artificial potential field collaborative obstacle avoidance algorithm. Led ROS/PX4 system integration, designed communication interfaces, and performed real-world debugging and troubleshooting.
- Outcomes: National Second Prize (Runner-Up), Multi-UAV Cooperative Operations category, 2025 RoboCup China UAV Challenge.

PUBLICATIONS & MANUSCRIPTS

- K. Xu, L. Zhang, H. Hong, **L. Zhang**, and X. Lin, "Ferry Cruising Optimization Algorithm for UAV Based on Swarm Intelligence," *Radio Communications Technology*, 2025. (Online available, in Chinese, Peking University Core Journal)
- L. Zhang, et al., "RIS-CENet: A Module-aware Deep Learning Framework for Cascaded Channel Estimation in RIS-assisted Wireless Communications" *Sensors*, 2026. (Under Review, SCI Q2, second author)
- L. Zhang, et al., "Lead-time Synchronized Formation for Multi-UAV Systems: Design and Mixed-Reality Verification," *ISA Transactions*, 2026. (Minor Revision, SCI Q1, third author)

PATENTS

- **Co-Inventor:** *A Low-Altitude Economy-Based Airspace Resource Allocation Method for UAVs*, China National Intellectual Property Administration
  Patent No. CN202511458739.1 | Status: Granted, CN121260052B (July 17, 2026)

HONORS AND AWARDS

- Third-Class Scholarship – Nanjing University of Posts and Telecommunications Sep 2025
- National Second Prize – 2025 RoboCup China UAV Challenge Oct 2025
- Provincial Second Prize – National Undergraduate Electronic Design Contest Aug 2025
- Provincial Third Prize – 4th Jiangsu Collegiate Intelligent Robot Innovation Competition(Keyou Cup) Jul 2025

LANGUAGES & SKILLS

- Language: IELTS 7.0
- Programming: Python, C/C++, MATLAB
- AI & Robotics Software: PyTorch, TensorFlow, ROS, PX4, MAVROS, Git, Linux
- Simulation & Testing: Gazebo, Mujoco, OptiTrack, HIL Simulation, Issac Sim, STM32Cubemx
- UAV & Autonomous Systems: Multi-Agent Collaboration, Path Planning, Reinforcement Learning, Embodied AI, World Model, Sensor Fusion (LiDAR/Vision/IMU/GNSS), Real-World System Deployment