Lujia Wang, Ph.D., Dec. 2022

Contact Information	Dept. of Electronics and Computer Engineering Hong Kong University of Science and Technology Clear Water Bay, Kowloon Hong Kong	Mobile: 15814401779 office: +852 24692748 Fax: +852 23581458 Email: eewanglj@ust.hk

Summary

- She established and is leading a creative research group in the area of cloud robot learning and system with around 10 members;
- She is one of the earliest and most influential researchers working in the cloud robotics area;
- Her earlier work on "Cloud Robotic System Fairness" and recent work "Cloud Robot Lifelong Federated Learning" are both listed in the Wikipedia Topic of "Cloud Robotics" as important works in this area;
- Awarded **6 best paper awards** or were finalised at international conferences;
- 20+ field patents or other IPs;
- Awarded **8 research grants** and secured **CNY 7 Million** of funding in the capacity of Principal Investigator(PI) and involved in research projects totaling more than CNY 20 Million;
- Co-authored four standards in the autonomous driving field in the mainland of China
- Delivered 10+ invited seminar talks in reputable universities/institutes around the world.

Research Interests

Cloud Robotics, Lifelong federated learning, Transfer learning, Multi-agent reinforcement learning and Game theory, Resource/Task allocation for multi-robot systems and logistics, Multi-sensor fusion, Localization, etc.

Awards

Paper Award

- Best Paper Award of International Conference on Robotics and Biomimetics (ROBIO 2019), Dali, China, Dec. 2019
- Best Student Finalist of International Conference on Intelligent Robots and Systems (IROS 2018), Madrid, Spain, Dec. 2019
- Best Paper Award of International Conference on Information and Automation (ICIA 2017), Macau, Jul. 2019
- Best Student Finalist of International Conference on Information and Automation (ICIA 2013), Yinchuan, China, Aug. 2013
- Best Student Paper Award of International Conference on Multisensor Fusion and Information Integration (MFI 2012), Hamburg, Germany, Sep. 2012
- Best Paper Finalist of International Conference on Multisensor Fusion and Information Integration (2nd paper, MFI 2012), Hamburg, Germany, Sep. 2012

Research Experience

Research Assistant Professor Apr. 2021 till now

Electronics and Computer Engineering Department, Hong Kong University of Science and Technology, Hong Kong

- Area of work: Cloud Robotics, Lifelong Federated Robotic Learning, Resource/Task Allocation for Robotic Systems, and Applications on Autonomous Driving.

Associate Professor Mar. 2016 to Apr. 2021

Institute of Advanced Computing and Digital Engineering, Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China

- Area of work: Transfer Learning for Lifelong Federated Cloud Robotic Systems, Multi-agent Reinforcement Learning and Applications on Autonomous Driving

Research Fellow Apr. 2015 to Feb.2016
Dept. EEE, Nanyang Technological University, Singapore

- Supervisor: Professor Guoqiang Hu
- Area of work: Mobile robot localization and navigation, multi-sensor data fusion, and smart pricing for cloud robot systems

Research Assitant Sept. 2013 to Feb. 2015
Dept. EE, CUHK, Hong Kong

- Supervisor: Professor Max Q.-H Meng
- Project(proposal drafter): A Cloud Robotic System with Optimized Perception for Complex Tasks (RGC General Research Fund)

Visiting Scholar Feb. 2012 to Sep. 2012
Autonomous System Lab,
Swiss Federal Institute of Technology Zurich (ETH), Switzerland

- Supervisor: Professor Roland Y. Siegwart
- Area of work: Robotics, Multi-robot collaboration, SLAM

Research Assistant Aug. 2008 to Aug. 2010
Research Center for Intelligent Sensing, Chinese Academy of Sciences/The Chinese University of Hong Kong Shenzhen Institute of Advanced Integrating Technology, Shenzhen, China.

- Supervisors: Professor Chao Hu and Max Q.-H Meng
- Area of work: RSSI-based localization in the GI tract

Research Assistant May. 2007 to Aug. 2008
Intelligent Antenna Lab, Northeastern University, Shenyang, China

- Supervisors: Professor Jinkuan Wang
- Area of work: Indoor localization, Wireless sensor networks, Kalman filter

Education

Ph.D., EE Department,The Chinese University of Hong Kong, Hong Kong, Sep. 2010 - Nov. 2014

- Thesis Topic: *A Study on Resource Allocation Strategies for Cloud Robotic Systems*
- Advisor: Professor Max Q.-H. Meng
- Area of study: Distributed Multi-robot Systems, Netowrking and Resource Allocation, Cloud Robotics, Mapping and Localization

M.S., Department of Information Engineering, Northeastern University, Shenyang, China, Aug. 2006 - Aug. 2008

- Topic: *Research of UKF-based Localization Method for Wireless Sensor Network in Indoor Environment*
- Advisor: Professor Jinkuan Wang
- Area of study: Localization, Wireless Sensor Networks, Kalman Filter

B.S., Department of Information Engineering, Shenyang Ligong University, Shenyang, China, Sep. 2001 - Jul. 2005

- Topic: *DCT-based Image Compression*
- Advison: Lizhong Zhu
- Area of study: Image Compression

Major Grants

1. **Jan.2022 – Dec.2024**: Guangdong Key Science and Technology Foundation, "Key Technology of Autonomous Driving V2X and Simulation System", **PI, CNY 1,000,000**
2. **Jan.2017 – Dec.2019**: National Science Foundation of China (NSFC), Youth Researcher Award, "Resource Allocation Algorithms for Real-time Perception in Cloud Heterogeneous Cloud Robotic Systems", 61603376, "Resource Allocation Algorithms for Real-time Perception in Dynamic Heterogeneous Cloud Robotic Systems", **PI, CNY 200,000**
3. **Jan. 2018 – Dec. 2020**: Key Basic Research Project of Shenzhen Science and Technology Innovation Foundation, "Intelligent Cloud Service 6Robotic System", **PI, CNY 3,000,000**
4. **Jan. 2019 – Dec. 2021**: Guangdong Science and Technology Plan Guandong-Hong Kong Cooperation Innovation Platform, "Key Technologies of MEMS based Lidar for Autonomous Driving", **PI, CNY 1,500,000**
5. **Jan. 2020 – Dec. 2022**: National Program on Key Basic Research Project of Macau, "Key Technology and Platform of Cooperative Intelligent Driven Autonomous Driving", **Co-PI, MOP 120,000,000**
6. **Jan.2017 – Dec.2021**: Shenzhen Overseas High Level Talent (Peacock Plan) Project, **PI, CNY 1,600,000**
7. **Jan.2016 – Dec.2018**: Key Technology Research and Development Program of the Ministry of Science and Technology of Guangdong, "Key Technology Research on Intelligent Cloud Service Robots", **Co-PI, CNY 5,000,000**
8. **Jun.2016 – Jun.2021**: National Key Technology Research and Development Program of the Ministry of Science and Technology of China,"Resource Allocation for Software Defined Cloud Computing", **Co-PI, CNY 2,120,000**

Refereed Journal Publications

1. Feiyi Chen, Liang Li, Shuyang Zhang, Jin Wu and **Lujia Wang**, "PBACalib: Targetless Extrinsic Calibration for High-Resolution LiDAR-Camera System Based on Plane-Constrained Bundle Adjustment", in IEEE Robotics and Automation Letters, accepted Nov 2022.
2. Yingbing Chen, Ren XIN, Jie CHENG, Qingwen Zhang, Xiaodong Mei, Ming Liu, **Lujia Wang**, "Efficient Speed Planning for Autonomous Driving in Dynamic Environment with Interaction Point Model", in IEEE Robotics and Automation Letters, vol. 7, no. 2, Sept 2022.
3. Zhenhua Xu, Yuxuan Liu, Lu Gan, Xiangcheng Hu, Yuxiang Sun, Ming Liu, **Lujia Wang**, "csBoundary: City-Scale Road-Boundary Detection in Aerial Images for High-Definition Maps," in IEEE Robotics and Automation Letters, vol. 7, no. 2, pp. 5063-5070, April 2022, doi: 10.1109/LRA.2022.3154052.
4. Qing Liang, Yuxiang Sun, Chengju Liu, Ming Liu, **Lujia Wang**, "LedMapper: Towards efficient and accurate LED mapping for visible light positioning at scale", IEEE Transactions on Instrumentation and Measurement, doi: 10.1109/TIM.2021.3123293.
5. Huaiyang Huang, Haoyang Ye, Yuxiang Sun, **Lujia Wang**, Ming Liu, "Incorporating learnt local and global embeddings into monocular visual SLAM". In Autonomous Robots. Springer, Cham. 2021.

6. Huaiyang Huang, Yuxiang Sun, Jin Wu, Jianhao Jiao, Xiangcheng Hu, Linwei Zheng, **Lujia Wang**, Ming Liu, "On Bundle Adjustment for Multiview Point Cloud Registration," IEEE Robotics and Automation Letters (RA-L), 2021 (Early Access).

7. Qing Liang, Yuxiang Sun, **Lujia Wang**, Ming Liu, "A novel inertial-aided visible light positioning system using modulated LEDs and unmodulated lights as landmarks", IEEE Transactions on Automation Science and Engineering (TASE), 2021.

8. Sukai Wang, Peide Cai, **Lujia Wang**, Ming Liu,"DiTNet: End-to-End 3D Object Detection and Track ID Assignment in Spatio-temporal World," IEEE Robotics and Automation Letters (RA-L), 2021.

9. Jin Wu, Chong Li, Chengxi Zhang, Yi Jiang, Yulong Huang, **Lujia Wang** and Ming Liu, "Trust-Region Solver of a Nonlinear Magnetometer Disturbance Estimation Problem," in IEEE Sensors Journal, vol. 21, no. 20, pp. 22569-22577, 15 Oct.15, 2021, doi: 10.1109/JSEN.2021.3092678.

10. Boyi Liu, **Lujia Wang**, Ming Liu, Cheng-zhong Xu,"Federated Imitation Learning: A Novel Framework for Cloud Robotic Systems with Heterogeneous Sensor Data", IEEE Robotics and Automation Letters (RA-L), 2020.

11. Yandong Liu, **Lujia Wang**, Ming Liu, Cheng-zhong Xu, "A Novel Labour Division Strategy based on Fixed Response Threshold Model for Warehouse Systems", International Journal of Robotics and Automation, vol. 35, no. 2, pp:642-647, 2020.

12. Tianyu Liu, Qing hai Liao, Lu Gan, Fulong Ma, Jie CHENG, Xupeng XIE, Zhe Wang, Yingbing Chen, Yilong Zhu, Shuyang Zhang, Zhengyong Chen, Yang Liu, Meng Xie, Yang Yu, Zitong Guo, Guang Li, Peidong Yuan, Dong Han, Yuying Chen, Haoyang Ye, Jianhao JIAO, Peng Yun, Zhenhua Xu, Hengli Wang, Huaiyang Huang, Sukai Wang, Peide Cai, Yuxiang Sun, Yandong Liu, **Lujia Wang**, Ming Liu, "Hercules: An Autonomous Logistic Vehicle for Contact-less Goods Transportation During the COVID-19 Pandemic", IEEE Robotics and Automation Magazine, 2020.

13. Boyi Liu, **Lujia Wang**, Ming Liu, Cheng-zhong Xu, "Lifelong Federated reinforcement Learning: A Learning Architecture for Navigation in Cloud Robotic Systems", IEEE Robotics and Automation Letters (RA-L), vol. 4, no. 4, pp. 4555-4562, 2019.

14. **Lujia Wang**, Ming Liu, Max Q.-H Meng, "A Hierarchical Auction-based Mechanism for Real-time Resource Allocation in Cloud Robotic Systems", Conditionally accepted by IEEE Transactions on Cybernetics. vol. 47, no. 2, pp. 473-484, Feb. 2017.

15. **Lujia Wang**, Ming Liu, Max Q.-H Meng, "Real-time Multi-sensor Information Retrieval for Cloud Robotic Systems", IEEE Transactions on Automation Science and Engineering (T-ASE) volume 12, number 2, pp. 507–518, April 2015.

Book Chapter

Lujia Wang, Ming Liu and Max Q.-H Meng, "A Pricing Mechanism for Task-Oriented Resource Allocation in Cloud Robotics," in Robots and Sensor Clouds, Chapter 1, pp. 3–31, ISBN 978-3-319-22168-7, Springer, 2015.

Conference Publications

1. Sukai Wang, Jianhao Jiao, Peide Cai, **Lujia Wang**, "R-PCC: A Baseline for Range Image-based Point Cloud Compression", International Conference on Robotics and Automation (ICRA), 2022, Philadelphia, the US.

2. Hengli Wang, Rui Fan, Peide Cai, Ming Liu, **Lujia Wang**, "UnDAF: A General Unsupervised Domain Adaptation Framework for Disparity or Optical Flow Estimation", International Conference on Robotics and Automation (ICRA), 2022, Philadelphia, the US.

3. Zhenhua Xu, Yuxuan LIU, Lu Gan, Xiangcheng Hu, Yuxiang Sun, Ming Liu, **Lujia Wang**, "CsBoundary: City-Scale Road-Boundary Detection in Aerial Images for High-Definition Maps", International Conference on Robotics and Automation (ICRA), 2022, Philadelphia, the US.

4. Jianhao Jiao, yilong zhu, Haoyang Ye, Huaiyang Huang, Peng Yun, lingxin jiang, **Lujia Wang**, Ming Liu, "Greedy-Based Feature Selection for Efficient LiDAR SLAM", International Conference on Robotics and Automation (ICRA) 2021 , Xi An, China.

5. Yuxuan Liu, **Lujia Wang**, Ming Liu, "YOLOStereo3D: A Step Back to 2D for Efficient Stereo 3D Detection", International Conference on Robotics and Automation (ICRA), 2021 , Xi An, China.

6. Zhenhua Xu, Yuxiang Sun, **Lujia Wang**, Ming Liu, "CP-loss: Connectivity-preserving Loss for Road Curb Detection in Autonomous Driving with Aerial Images," 2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2021, pp. 1117-1123, doi: 10.1109/IROS51168.2021.9636060.

7. Boyi Liu, **Lujia Wang**, Ming Liu, Cheng-Zhong Xu, "Federated Imitation Learning: A Novel Framework for Cloud Robotic Systems with Heterogeneous Sensor Data", International Conference on Robotics and Automation (ICRA), 2020, Paris, France.

8. Hengli Wang, Peide Cai, Yuxiang Sun, **Lujia Wang**, Ming Liu, "Learning Interpretable End-to-End Vision-Based Motion Planning for Autonomous Driving with Optical Flow Distillation," 2021 IEEE International Conference on Robotics and Automation (ICRA), 2021, pp. 13731-13737, doi: 10.1109/ICRA48506.2021.9561334.

9. Bojie Yan, Boyi Liu, **Lujia Wang**, Ming Liu, Chengzhong Xu, "FedCM: A Real-time Contribution Measurement Method for Participants in Federated Learning," 2021 International Joint Conference on Neural Networks (IJCNN), 2021, pp. 1-8, doi: 10.1109/IJCNN52387.2021.9534451.

10. Xinquan Chen, **Lujia Wang**, Xitong Gao, Chengzhong Xu, "Cloud-based Robot Path Planning in Dynamic Environments," 2021 IEEE International Conference on Real-time Computing and Robotics (RCAR), 2021, pp. 1355-1360, doi: 10.1109/RCAR52367.20

11. Yuxiang Sun, **Lujia Wang**, Yongquan Chen, Ming Liu, "Accurate Lane Detection with Atrous Convolution and Spatial Pyramid Pooling for Autonomous Driving", **Best Paper Award**, 2019 IEEE International Conference on Robotics and Biomimetics (ROBIO 2019), 2019

12. Boyi Liu, **Lujia Wang**, Ming Liu, Cheng-zhong Xu, "Lifelong Federated reinforcement Learning: A Learning Architecture for Navigation in Cloud Robotic Systems", IEEE Conference on Intelligent Robots and Systems (IROS), Nov. 2019, Macau.

13. Zhaoran Li, **Lujia Wang**, Lingxin Jiang, Chengzhong Xu, "FC-SLAM: Federated Learning Enhanced Distributed Visual-LiDAR SLAM In Cloud Robotic System",IEEE International Conference on Robotics and Biomimetis, (ROBIO), Dec. 2019, Dali.

14. Dong Han, Zuhao Zou, **Lujia Wang**, Lingxin Jiang, Chengzhong Xu, "A Robust Stereo Camera Localization Method with Prior LiDAR Map Constrains", IEEE International Conference on Robotics and Biomimetis, (ROBIO), Dec. 2019, Dali.

15. Rui Fan, **Lujia Wang**, Ming Liu, Loannis Pitas, "A robust roll angle estimation algorithm based on gradient descent", 2019 27th European Signal Processing Conference (EUSIPCO), Sep. 2019, Spain.

16. Jianhao Jiao, Qinghai Liao, Yilong Zhu, Tianyu Liu, Yang Yu, Rui Fan, **Lujia Wang**, Ming Liu, "A novel dual-lidar calibration algorithm using planar surfaces", 2019 IEEE Intelligent Vehicles Symposium (IV), Jun. 2019, Paris.

17. Qing Liang, **Lujia Wang**, Youfu Li, Ming Liu, "Plugo: A scalable visible light communication system towards low-cost indoor localization", 2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Oct. 2018, Spain.

18. Qing Liang, **Lujia Wang**, Youfu Li, Ming Liu, "Indoor Mapping and Localization for Pedestrians using Opportunistic Sensing with Smartphones", 2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Oct. 2018, Spain.

19. Yuxuan Liu, **Lujia Wang**, Ming Liu, "Real Time Probabilistic Mapping for Sonar Sensor by Optimization", 2018 IEEE International Conference on Robotics and Biomimetics (ROBIO), Dec. 2018, Malaysia.

20. Yuying Chen, Ming Liu, **Lujia Wang**, "Rrt* combined with gvo for real-time nonholonomic robot navigation in dynamic environment", 2018 IEEE International Conference on Real-time Computing and Robotics (RCAR), Aug. 2018.

21. ZheWang, Yang Liu, Qinghai Liao, Haoyang Ye, Ming Liu, **Lujia Wang**, "Characterization of a RS-LiDAR for 3D Perception", 2018 IEEE 8th Annual International Conference on CYBER Technology in Automation, Control, and Intelligent Systems (CYBER), Jul. 2018, Tianjin, China.

22. Han Ma, Yixin Ma, Jianhao Jiao, M Usman Maqbool Bhutta, Mohammud Junaid Bocus, **Lujia Wang**, Ming Liu, Rui Fan, "Multiple lane detection algorithm based on optimised dense disparity map estimation", 2018 IEEE International Conference on Imaging Systems and Techniques (IST), Oct. 2018, Poland.

23. **Lujia Wang**, Yinting Luo, Luyu Wang and Ming Liu, "Point-Cloud Compression Using Data Independent Method - A 3D Discrete Cosine Transform Approach", **Best Paper Award**, 2017 IEEE International Conference on Information and Automation (ICIA), July 18-20, 2017, Macau, China.

24. **Lujia Wang**, Yinting Luo, Luyu Wang and Ming Liu, "Point-Cloud Compression Using Data Independent Method - A 3D Discrete Cosine Transform Approach", **Best Paper Award**, 2017 IEEE International Conference on Information and Automation (ICIA), July 18-20, 2017, Macau, China.

25. **Lujia Wang** and Guoqiang Hu, "Smart Pricing for Cloud Resource and Service Markets: A Brief Overview", 12th IEEE International Conference on Control & Automation, Kathmandu, Nepal, June 1-3, 2016.

26. **Lujia Wang**, Ming Liu and Max Q.-H Meng, "Hierarchical Auction-based Mechanism for Real-time Resource Retrieval in Cloud Mobile Robotic System", 2014 IEEE International Conference on Robotics and automation (ICRA).

27. **Lujia Wang**, Ming Liu and Max Q.-H Meng, "An Auction-based Resource Allocation Strategy for Joint-surveillance using Networked Multi-Robot Systems", **Best Paper Finalist**, 2013 IEEE International Conference on Information and Automation (ICIA), pp: 424-429.

28. **Lujia Wang**, Ming Liu and Max Q.-H Meng. "Towards Cloud Robotic System: A case Study of Online Co-localization for Fair Resource Competence", 2012 IEEE International Conference on Robotics and Biomimetics *ROBIO*, 2012, pp:2132–2137.

29. **Lujia Wang**, Ming Liu, Max Q.-H Meng and Roland Siegwart. "Towards Real-time Multi Sensor Information Retrieval in Cloud Robotic System", **Best Paper Finalist**. IEEE International Conference on Multisensor Fusion and Information Integration *MFI*, 2012, pp:21–26.

30. Ming Liu, **Lujia Wang** and Roland Siegwart. "DP-Fusion: A Generic Framework for Online Multi Sensor Recognition", **Best Student Paper**. IEEE International Conference on Multisensor Fusion and Information Integration *MFI*, 2012, pp:7–12.

31. **Lujia Wang** and Max Q.-H Meng. "A Game Theoretical Bandwidth Allocation Mechanism for Cloud Robotics", The 10th World Congress on Intelligent Control and Automation, *WCICA*, 2012, pp:3828–3833.

32. **Lujia Wang**, Li Liu, Chao Hu and Max Q.-H Meng. "A Novel RF-based Propagation Model with Tissue absorption for Location of the GI Tract", International Conference of the IEEE Engineering in Medicine and Biology Society, *EMBS*, Buenos Aire, Argentina. pp:654–657, 2010.

33. **Lujia Wang**, Chao Hu, Longqiang Tian, Mao Li and Max Q.-H Meng. "A Novel Radio Propogation Radiation Model for Location of the Capsule in GI Tract", 2009 IEEE International Conference on Robotics and Biomimetics, *ROBIO*, Guilin, China. pp:2332–2337, 2009.

34. **Lujia Wang**, Chao Hu, Jinkuan Wang, Longqiang Tian and Max Q.-H Meng. "Dual-modal Indoor Mobile Localization System based on Prediction Algorithm", 2009 IEEE International Conference on Information and Automation, *ICIA*, Zhuhai/ Macau, China. pp:236–241, 2009.

35. **Lujia Wang**, Jinkuan Wang, Yun Wang. "Indoor Mobile Localization Prediction based on Unscented Kalman Filter in Wireless Sensor Networks", 2008 International Conference on Microwave and Millimeter Wave Technology Proceedings, *ICMMT*, pp:96–99, 2008.

36. Yandong Liu, **Lujia Wang**, Huaiyang Huang, Ming Liu, Cheng-zhong Xu, "A Novel Swarm Robot Simulation Platform for Warehousing Logistics", 2017 IEEE International Conference on Robotics and Biomimetics ROBIO, 2017, pp:2132-2137.

37. Ming Chen, **Lujia Wang**, Cheng-zhong Xu and Renfa Li, "A Novel Approach of System Design for Dialect Speech Interaction with NAO Robot", 2017 18th International Conference on Advanced Robotics (ICAR), pp 476-481.

38. Matthew Tan, **Lujia Wang**,Danilo Tardioli, and Ming Liu, "A Resource Allocation Strategy in a Robotic Ad-hoc Network", 2014 IEEE International Conference on Autonomous Robot Systems and Competitions (IEEE ICARSC 2014).

39. Longqiang Tian, Chao Hu, **Lujia Wang**, Dongmei Chen and Max Q.-H Meng. "A Novel Radio Propogation Radiation Model for Location of the Capsule in GI Tract", 2009 IEEE International Conference on Automation and Logitics, *ICAL*, Shenyang, China. pp:1495–1500, 2009.

40. Mao Li, Shuang Song, Chao Hu, Wanan Yang, **Lujia Wang** and Max Q.-H Meng. "A Now Calibration Method for Magnetic Sensor Array for Tracking Capsule Endoscope", 2009 International Conference on Robotics and Biomimetics, *ROBIO*, Guilin, China. pp:1561–1566, 2009.

Other Intelligent Properties

1. China Patent 201911271811.4: **Lujia Wang**, Zhaoran Li, Chengzhong Xu, Asynchronous Federated Learning Infrastructure based Autonomous Driving Equipped Audio Interaction System, 2019

2. China Patent 201912211811.4: Zhaoran Li, **Lujia Wang**, Chengzhong Xu, A Novel Video Monitoring System, 2019

3. China Patent 201920416015.4: Boyi Liu, **Lujia Wang**, Ming Liu, Chengzhong Xu, Cloud Based Learnig Sharing System and Cloud Fusion Computing Based Sharing Platform, 2019

4. China Patent 201910248301.9: Boyi Liu, **Lujia Wang**, Ming Liu, Chengzhong, Xu, Cloud Based Learning Sharing System and Corresponding Methods and Platform, 2019

5. China Patent 201821300765.7: Ming Chen, **Lujia Wang**, Yandong Liu, Chengzhong Xu, Docker Based Cloud Robot Navigation System, 2018

6. China Patent 201821300765.7: Ming Chen, **Lujia Wang**, Yandong Liu, Chengzhong Xu, Docker Based Cloud Robot Navigation System and Key Methods, 2018

7. China Patent 201810874102.4: Yandong Liu, **Lujia Wang**, Ming Liu, Chengzhong Xu, A Multi-robot based Warehousing Logistic Optimization Simulation System, 2018

8. China Patent 201811425439.3: Yandong Liu, **Lujia Wang**, Chengzhong Xu, A Cloud-Edge Computing based Smart Warehousing Logistic Optimization System, 2018

9. China Patent 201810982467.9: Ming Liu, Zhengyong Chen, Qinghai Liao, **Lujia Wang**, System and Approach of Vehicle Detection, 2018

10. China Patent 201820471099.7: Ming Liu, Qinghai Liao, Yang Liu, Tianyu Liu, Zhe Wang, Huaiyang Huang, **Lujia Wang**, A Sensing Device for Data Syncronization, 2018

11. China Patent 201810478673.6: Tianyu Liu, Qinghai Liao, Yang Liu, **Lujia Wang**, Ming Liu, Robotic Estimation Method, Device and Storage Medium, 2018

12. China Patent 201810294328.7: Ming Liu, Yang Yu, Haoyang Ye, **Lujia Wang**, Navigation Algorithm, Equipment, Computer System and Storage Media of USV, 2018

13. China Patent 201810311877.0: Yilong Zhu, Qinghai Liao, **Lujia Wang**, Ming Liu, Lane Detection Method, 2018

14. China Patent 201810295249.8: Qinghai Liao, Yang Liu, Tianyu Liu, Zhe Wang, Huaiyang Huang, **Lujia Wang**, Ming Liu, A Visual-inertial Sensing Device and a Scene Segmentation and Ego-motion Estimation System, 2018

15. China Patent 201810295249.8: Qinghai Liao, Yang Liu, Zhe Wang, **Lujia Wang**, Ming Liu, System and Approach of 3D Modelling, 2018

16. China Patent 201810330247.8: Qing Liang, **Lujia Wang**, Ming Liu, An Integrated Indoor Localization Module, 2018

17. China Patent 201810432488.3: Qing Liang, **Lujia Wang**, Ming Liu, Device and System for Large-scale Visible Light Localization, 2018

18. China Patent 201810294756.X: Qing Liang, **Lujia Wang**, Ming Liu, Method, Device, Storage medium and Computer Setup for Indoor Localization and Navigation, 2018

19. China Patent 201810307102.6: Qing Liang, **Lujia Wang**, Ming Liu, Xuebin Sun, Method, Device, Storage Medium and Computer Setup for Animal Tracking, 2018

20. China Patent 201810982330.3: Qinghai Liao, **Lujia Wang**, Ming Liu, Unified Approach, Sevice of Extrinsic Parameters Calibration of Multiple Sensor, 2018

21. China Patent 201810291011.8: Ming Liu, Qinghai Liao, Yang Liu, Tianyu Liu, Zhe Wang, Huaiyang Huang, **Lujia Wang**, A Sensing Device and System for Data Syncronization, 2018

22. China Patent 201705230118.5: Ming Chen, **Lujia Wang**, Yandong Liu, Chengzhong Xu, A Docke Host and Docker based Cloud Robotic System, 2017

Professional Service

Referee Service

- IEEE Transactions on Cybernetics, 2015-now
- IEEE Transactions on Automation Science and Engineering (T-ASE), 2014-now
- International Conference on Computer Vision Systems (ICVS), 2017-now
- IEEE International Conference on Intelligent Robots and Systems (IROS), 2013-now
- IEEE International Conference on Robotic and Automation (ICRA), 2014-now
- IEEE International Conference on Information and Automation (ICIA), 2013-2019

Conference Service

- Program Committee of 2021 IEEE International Conference on Robotic and Automation (ICRA 2021)
- Program Committee of 2019 Internation Conference on Robotics and Biomimetics (ROBIO 2019)
- Program Committee of 2017 International Conference on Computer Vision Systems (ICVS 2017);
- Session Chair of 2017 IEEE International Conference on Advanced Robotics (ICAR 2017)
- Program Committee of the Communication-Aware Robotics (CAR 2015) Special Session on ROBOT 2015
- Session Chair of 2013 IEEE International Conference on Information and Automation (ICIA 2013);
- Session Chair of 2012 IEEE International Conference on Robotics and Biomimetics (ROBIO 2012).

Selected Seminar & Talks

- Key Technology for Robot Path-finding Optimization for Cloud-based Logistic System, Beijing Automation Institute, Chinese Academy of Sciences, Nov. 2017, hosted by Prof. Fengshui Jing
- Optimization of Multi-robot Path-finding for Logistic Systems, Harbin Institute of Technology (Shenzhen), Apr. 2016, hosted by Prof. Yunjiang Lou
- Resource Allocation Strategies for Cloud Robotic Systems, National University of Singapore, Oct. 2014, hosted by Prof. Hongliang Ren

- Resource Allocation Strategies for Cloud Robotic Systems, Nanyang Technological University, Oct. 2014, hosted by Prof. Guoqiang Hu

Selected Student Project Instructor

- Boyi Liu
  HKUST Ph.D candidate, Lifelong learning of cloud robotics, 2021 till now.
- Weiqing Qi
  HKUST Mphil student, Cloud based intelligent connected autonomous vehicle collaboration, 2021 till now.
- Yandong Liu
  SIAT Ph.D candidate, Multi-robot path-find optimization for logistic systems, 2016 till 2021.
- Ming Chen
  SIAT Engineer, Human-robot interaction system implementation, 2016 till 2019.
- Boyi Liu
  SIAT Master student, Affection computing for cloud-based service robot system, 2017 till 2020.
- Dong Han
  SIAT master student, Deep learning-based dynamic affection and task perception, 2018 till 2021.
- Zhe Wang
  SIAT undergraduate final year project, Multi-robot SLAM for cloud robotic systems, 2017.
- Mohamed Hafizuddin
  NTU undergraduate final year project, mobile robot navigation and localization using a stereo camera, 2015.
- Harsh Munshi
  NTU MSc thesis project, Robot localization via a RGB-D camera, 2015.
- Mahalingam Surya Prakash, NTU MSc thesis project, Localization of a mobile robot using stereo vision.
- Nguyen Minh Hoang
  NTU undergraduate final year project, formation control and coordination for multiple mobile robots guided by cameras, 2015.
- Khoo Boo Soon
  NTU undergraduate final year project, obstacle avoidance for a Pioneer Robot, 2015.
- Raymond Chung Jia Jun
  NTU undergraduate final year project, cooperative Control of multiple robots using an omnidirectional camera, 2015.
- Chaoqun Wang
  CUHK undergraduate student project, real-time wireless protocol evaluation for typical multi-robot systems in indoor environment, 2013.
- Xiao Jia
  CUHK undergraduate project, task allocation in multi-robot systems, 2013.
- Yu Zhang
  CUHK undergraduate project, auction-based methods for assignment of multi agents, 2013.
- Phoebe Lai
  CUHK undergraduate project, cooperatibe localization by netowrked robots, 2013.

Teaching Experience

Instructor

ELEC 3210 - Machine Learning and Information Processing for Robotics	2022 fall
ELEC 2910 - Academic and Professional Development I	2022 fall
ELEC 3910 - Academic and Professional Development II	2022 fall
ELEC 3210 - Machine Learning and Information Processing for Robotics	2021 fall

Teaching Assistant

ELEG 4190 - Biomedical Modeling	2012-2013
ELEG 3240 - Medical Instrumentation and Sensors	2012-2013
ELEG 1000 - Innovations in Electronic Engineering	2011-2012
ELEG 1130 - Introduction to Biomedical Engineering	2010-2011
ELEG 4120 - Bioinformatics	2010-2011

SELECTED PROJECTS

Autonomous Vehicle (AV) Trail at Hong Kong

I am the deputy leader of this project, where the first autonomous vehicle (AV) trial without an operator on board in Hong Kong commenced in late 2020 on the HKUST Clearwater Bay Campus. The AV is utilized to fight against the COVID-19 pandemic as the AV can make deliveries that limit human-to-human contact. Equipped with technologies such as all-terrain 3D mapping and large-scale visual and sensor navigation, the vehicle can plan its route after collecting data on the road and can detect on-road obstacles. This project is strongly supported by the HKUST and the Hong Kong Transport Department. Especially, the project has been highly praised by former Hong Kong Chief Executive Ms. Carrie Lam who visited our AV and wrote suppport letter for the team as shown in Fig. 1.

Figure 1: Chief Executive of Hong Kong Ms Carrie Lam Visit

- The summary information of this project is shown in Fig. 2. The AV experienced real-life applied research and performance optimization and went through three stages of high standard tests, including 94 tests for performance and safety as shown in Fig. 3, and accumulated more than 500 kilometers of test run mileage without human intervention as shown in Fig. 4. At the same time, I have managed a team with 30 Ph.D. students and 22 Faculty members.
- 5 permits from the Transport Department during the whole process of tests. The final permit is issued with the maximum speed of 20 km/hr and no escorting vehicles in the whole campus area as shown in Fig. 5.
- Project Impact: This project has also received a lot of attention from consul generals of the Hong Kong consulates of the 10 ASEAN countries, MTR, Airport Authority and Huawei, etc. as shown in Fig. 7. This technology has been applied in L4 autonomous driving applications, such as industrial logistics, express logistics, etc. This project led to 30+ top-tier publications. The AV was also exhibited at the Hong Kong Science Park during the World AI Conference 2021 as shown in Fig. 6. This project also received a lot of attention from many media, such as China News

Figure 2: Summary of the AV trial proposed library

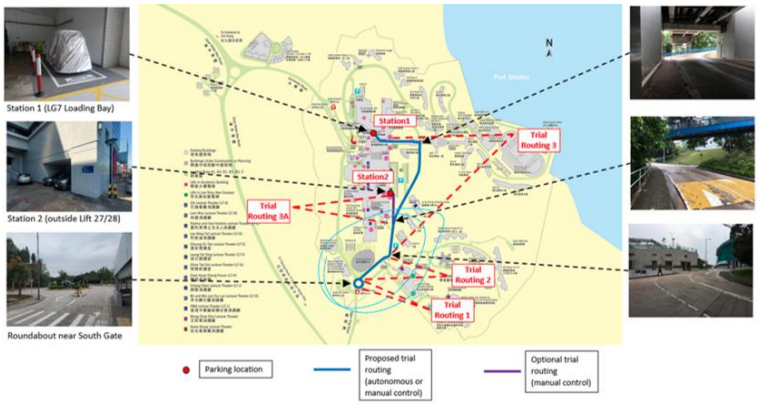


Figure 3: Stage 0.5 Testing

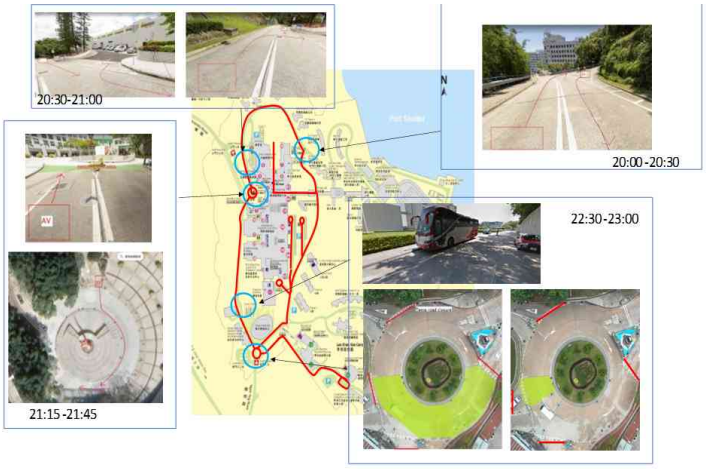
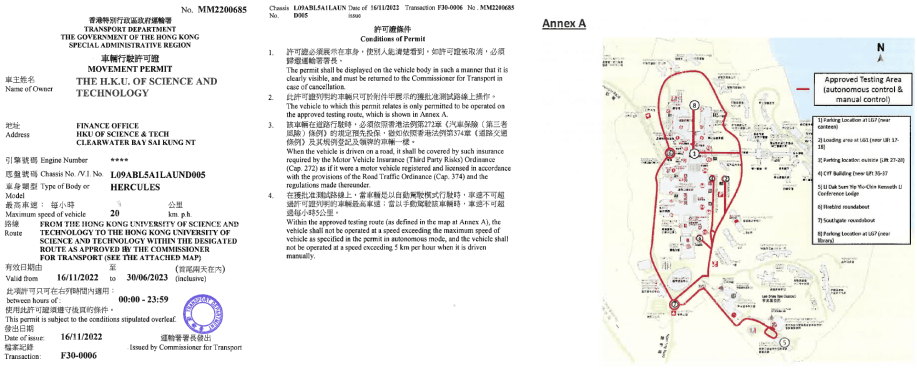


Figure 4: Stage 1.5 Testing



No. MM2200685

香港特別行政區政府運輸署
TRANSPORT DEPARTMENT
THE GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION

車輛行駛許可證
MOVEMENT PERMIT

車主姓名 Name of Owner: THE H.K.U. OF SCIENCE AND TECHNOLOGY

地址 Address: FINANCE OFFICE, HKU OF SCIENCE & TECH, CLEARWATER BAY SAI KUNG NT

引擎號碼 Engine Number: ****

底盤號碼 Chassis No. /V.I. No.: L09ABL5A1LAUND005

車身類型 Type of Body or Model: HERCULES

最高車速： Maximum speed of vehicle: 20 公里 km. p.h

路線 Route: FROM THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY TO THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY WITHIN THE DESIGATED ROUTE AS APPROVED BY THE COMMISSIONER FOR TRANSPORT (SEE THE ATTACHED MAP)

有效日期由 Valid from: 16/11/2022 至 to: 30/06/2023 (首尾兩天在內) (inclusive)

此項許可只可在右列時間內運用： between hours of: 00:00 - 23:59

採用此許可證須遵守後頁的條件。 This permit is subject to the conditions stipulated overleaf.

發出日期 Date of issue: 16/11/2022

運物署署長發出 Issued by Commissioner for Transport

檔案記錄 Transaction: F30-0006

Chassis No. L09ABL5A1LAUN D005 Date of issue 16/11/2022 Transaction F30-0006 No. MM2200685

許可證條件
Conditions of Permit

1. 許可證必須展示在車身，使別人能清楚看到，如許可證被取消，必須歸還運輸署署長。
The permit shall be displayed on the vehicle body in such a manner that it is clearly visible, and must be returned to the Commissioner for Transport in case of cancellation.
2. 此許可證所列的車輛只可於附件甲展示的獲批准測試路線上操作。
The vehicle to which this permit relates is only permitted to be operated on the approved testing route, which is shown in Annex A.
3. 該車輛在道路行駛時，必須依照香港法例第272章《汽車保險（第三者風險）條例》的規定預先投保，證明依照香港法例第374章《道路交通條例》及其附例登記及領牌的車輛一樣。
When the vehicle is driven on a road, it shall be covered by such insurance required by the Motor Vehicle Insurance (Third Party Risks) Ordinance (Cap. 272) as if it were a motor vehicle registered and licensed in accordance with the provisions of the Road Traffic Ordinance (Cap. 374) and the regulations made thereunder.
4. 在獲批准路線路線上，當車輛是以自動駕駛模式行駛時，車速不可超過許可證列明的車輛最高車速；當以手動駕駛該車輛時，車速不可超過每小時5公里。
Within the approved testing route (as defined in the map at Annex A), the vehicle shall not be operated at a speed exceeding the maximum speed of vehicle as specified in the permit in autonomous mode, and the vehicle shall not be operated at a speed exceeding 5 km per hour when it is driven manually.

Annex A

Figure 5: The Final Permit without Safe Officer

Figure 6: HKSTP Exibition

Figure 7: Vistors from the Hong Kong consulates of the 10 ASEAN countries, MTR and Huawei

Agency, Hong Kong Wen Wei Po News as shown in Fig. 8.

China News Agency, Hong Kong, September 21 Hong Kong Wen Wei Po News on August 31

Figure 8: Media Reports

Automated Port In this project, we developed an autonomous vehicle to realize intelligent port container delivery. The global positioning error is less than 10 cm The cost is 60% lower than the magnetic nail automation solution. Suitable for 24 hours of various weather operations. This technical solution has been utilized by the fourth phase project of Nansha Wharf in Guangzhou Port as shown in Fig. 9, the first batch of 70 AV has been commercialized, and the second batch of 50 units will be deployed by the end of 2022, making it the largest in China.

Figure 9: Automated Port

Based on these achievements, I was awarded the "Best Innovation Science and Technology Award in the Guangdong-Hong Kong-Macao Greater Bay Area" in 2021 by Ms. Carrie Lam, which has been considered as one of the most influential innovative awards at GBA as shown in Fig. 10.

Figure 10: Best Innovation Science and Technology Award in the Guangdong-Hong Kong-Macao Greater Bay Area