Eungchang Mason **Lee**

Robotics Researcher · UAVs Expert

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About Me

I am a well-organized, fast-learning, and hard-working researcher. My research interests include UAVs, exploration, path planning, SLAM, and active SLAM.

You can find more about my works on my Github and Youtube

Employment

Korea Advanced Institute of Science and Technology (KAIST) — *Daejeon, Rep. of Korea*

Postdoc in School of Electrical Engineering, Urban Robotics Lab — *Aug. 2025 - **Current***

Education

Korea Advanced Institute of Science and Technology (KAIST) — *Daejeon, Rep. of Korea*

Ph. D. in School of Electrical Engineering, Urban Robotics Lab — *Mar. 2021 - Aug. 2025*

- Dissertation: Degeneracy-Robust LiDAR-Inertial Odometry and Topological Exploration for Autonomous UAVs toward Enhanced Indoor and Outdoor Mapping and Navigation

Korea Advanced Institute of Science and Technology (KAIST) — *Daejeon, Rep. of Korea*

Master in School of Electrical Engineering, Urban Robotics Lab — *Mar. 2019 - Feb. 2021*

- Dissertation: Exploration with Active Loop-Closing toward Large-Scale 3D Mapping for Unmanned Aerial Vehicle

KyungPook National University — *Daegu, Rep. of Korea*

Bachelor in School of Electronics Engineering — *Mar. 2012 - Feb. 2019*

- Graduation with top honors, **GPA: 4.23/4.3**, **rank: 2/354**

Skills

Tools	MATLAB, SolidWorks, Blender, SketchUp, Gazebo, Unity
Programming	ROS, C/C++, Python, MATLAB, Markdown, LaTeX, HTML
Languages	Korean, English

Honors & Awards

2020 - 2025	**Best paper awards**: Five conference papers and one journal paper	
2022. 10	**Only one team that finished the course**: Autonomous Flight Competition in Battlefield Situations	*Rep. of Korea*
2019. 12	**3rd prize/424**: AIRR AlphaPilot (LockheedMartin & The Drone Racing League)	*U.S.A*
2019. 02	**Grand prize**: The Right Person of University (SmartKey-KyungPook National University)	*Rep. of Korea*
2019. 02	**2nd prize/354**: Best Graduates of The Year (KyungPook National University)	*Rep. of Korea*
2018. 11	**MathWorks Korea special prize**: R-BIZ Challenge Turtlebot3 Autorace (ROBOTIS & MathWorks Korea)	*Rep. of Korea*

Activities

Associate Editor (AE) - Intelligent Service Robotics (ISR) (SCIE), 2025. 09. - **Current**

KETI Invited Seminar - “Indoor and Outdoor Mapping and Navigation Using Autonomous UAVs in GNSS-denied Environments”, 2024. 10.

2022 UVS Symposium Invited Talk - “How we won Autonomous Flight Competition in Battlefield Situations”, 2022. 12.

Experiences & Projects

Development of Drone System for Diagnosis of Porcelain Insulators in Overhead Transmission Lines
Rep. of Korea

[Team Leader] · Supported by KEPCO and KEPRI, Conducted at Urban Robotics Lab in KAIST *Feb. 2023 - Jul. 2024*

- In this project, we developed a autonomous drone manipulation framework for diagnosis of porcelain insulators in transmission lines. We developed a robust multi-LiDAR SLAM, real-time obstacle avoidance path planner, and adaptive attitude / trajectory tracking controllers.
- I mainly developed the multi-LiDAR SLAM and the overall framework.
- Related materials - video1, video2, video3

Research of Coverage Path Planner for 3D Reconstruction with UAVs
Rep. of Korea

[Team Leader] · Supported by CONFIDENTIAL, Conducted at Urban Robotics Lab in KAIST *in 2022*

- In this project, we developed a energy-efficient and obstacle-aware coverage path planner for UAVs to accurately reconstruct the target structures with high-resolution. The detailed information is confidential.
- I developed the main coverage path planner.
- Related materials - video, paper

Autonomous Flight Competition in Battlefield Situations
Rep. of Korea

[Team Leader] · Hosted by ADD, Conducted at Urban Robotics Lab in KAIST *May. 2022 - Oct. 2022*

- The competition aims to develop an autonomous drone to pass through complex and dangerous outdoor obstacles, infiltrate an unknown two-story building, detect hidden targets, create precise 3D maps including target types and coordinates, and return to the starting point safely.
- I developed main framework including exploration, local/global path planners, 3D map logger with the detected target positions, and a decision-making system.
- Related materials - video

KHNP Virtual Robot Challenge 2022
Rep. of Korea

[Main Developer] · Hosted by KHNP *Sep. 2022 - Dec. 2022*

- The goals of the competition was to develop a autonomous navigation algorithm and a robust controller for a quadrotor UAV to complete diverse and challenging tasks including obstacle avoidance, exploration, and enduring the wind disturbances.
- I made Gazebo maps for the competition and coded scoring GUI. Additionally, I coded sample controllers for the the quadrotor UAV.
- Related materials - video

Palm Tree Field Exploration and Tree Identification with UAV / UGV
Rep. of Korea

[Main Developer] · Conducted at AKA-AI Robotics *Nov. 2021 - May. 2022*

- The final goal of this research project is to develop an exploration system for monitoring unknown palm tree orchard environments while avoiding collisions and figuring out appearances of trees (phenotyping).
- I developed the whole system including pointcloud data processing, path planning, and controller. A state-of-the-art open-sourced SLAM algorithm is utilized.
- Related materials - video1, video2

IEEE UAV Competition
U.S.A

[Team Leader] · Hosted by LPCV, Conducted at Urban Robotics Lab in KAIST *Jan. 2022 - Feb. 2022*

- The goals of the competition was to track the non-uniform motion vehicle at constant distance away with a quadrotor UAV, while avoiding obstacles.
- We estimated the trajectory of the moving vehicle in the form of 5th order polynomial using the detected center point with YOLO network. Then, Adaptive weight Model Predictive Controller (AMPC) is designed to track the target effectively.
- I mainly developed state estimator and MPC controller.
- Related materials - video

KHNP Virtual Robot Challenge 2021
Rep. of Korea

[Main Developer] · Hosted by KHNP *Sep. 2021 - Dec. 2021*

- The goals of the competition was to develop a autonomous navigation algorithm and a robust controller for a quadruped robot to complete diverse and challenging tasks including obstacle avoidance, manipulation for grasping a cube, climbing stairs, and enduring the disturbances.
- I made Gazebo maps for the competition and coded scoring GUI. Additionally, I coded sample controllers for the manipulator and the quadruped robot.
- Related materials - video

Unmanned Swarm CPS Research Lab
Rep. of Korea

[Team Leader] · Supported by ADD, Conducted at Urban Robotics Lab in KAIST *Jan. 2021 - Dec. 2021*

- In this project, we developed adaptive multi robot localization method. With the high fidelity networking, artificial intelligent cooperative control, and mobile ground control station, unmanned swarm system has been researched to operate cyber-physical systems.
- As my lab was in charge of managing all 10 labs and developing multi robot localization, as a person in charge, I mainly managed all members in the project, validated whole system for the demonstration, and developed localization algorithm.
- Related materials - video, paper

Autonomous Drone Navigation for Power Line Inspection in Underground — *Rep. of Korea*

[Team Leader] · Supported by KEPCO and KEPRI, Conducted at Urban Robotics Lab in KAIST — *Aug. 2020 - Dec. 2022*

- In this project, we developed indoor SLAM, navigation, and exploration method to operate an UAV exploring the underground power line tunnel safely. In addition, the robust and autonomous landing framework of the UAV on moving mobile robot was developed to charge battery during operation.
- I mainly developed path planner, exploration, landing framework, and navigation system. In consideration with the limited payload and computational resource of the UAV, the precomputed and lightweight local exploration planner was developed.
- Related materials - video1, video2, video3, video4, paper1, paper2, paper3

A Study on the Visual-Inertial Navigation System of Artificial Intelligent Unmanned Aerial Vehicle for Reconnaissance and Exploration — *Rep. of Korea*

[Team Manager] · Hosted by ROND, Conducted at Urban Robotics Lab in KAIST — *May. 2020 - Nov. 2020*

- The main goal of this project is to develop an UAV system with Visual-Inertial Navigation System for 3D mapping of unknown environments adopting single RGB-D camera.
- I mainly implemented whole system including VIO, YOLO object detection, mapping system, and controller.
- Related materials - video

AIRR AlphaPilot (Artificial Intelligence Robotic Racing) — *U.S.A*

Hosted by Lockheed Martin and The Drone Racing League, Conducted at Unmanned Systems Research Group in KAIST — *Mar. 2019 - Dec. 2019*

- AlphaPilot is the first large-scale open innovation challenge of its kind focused on advancing artificial intelligence (AI) and autonomy. The main goal of this competition is to finish the drone racing track as soon as possible autonomously.
- I mainly implemented a VIO (Visual-Inertial Odometry) and Kalman filter-based state estimator and basic controller.
- My team won the 3rd prize among 424 teams over 81 countries.
- Related videos - Youtube playlist

R-BIZ Challenge Turtlebot3 Autorace — *Rep. of Korea*

[Team Leader] · Hosted by ROBOTIS, MathWorks Korea, KIRIA, and MOTIE, Conducted at Physical Intelligence Lab in KyungPook Natl. Univ. — *Jun. 2018 - Nov. 2018*

- ROS based autonomous driving system for a mobile robot (Turtlebot3) is developed for completing the racing track with diverse missions.
- I mainly developed Lyapunov functional to control the robot, HOG-based object detector, and decision-making mission planner.
- My team won the MathWorks Korea Special Prize.

Research on Multi-Rate Sensor Fusion based Mobile Robot Model Predictive Control System — *Rep. of Korea*

Supported by ETRI, Conducted at Physical Intelligence Lab in KyungPook Natl. Univ. — *Apr. 2018 - Dec. 2018*

- The final goal of this research project is to design multi-rate State Estimator that can assume exact state using asynchronized data from a vehicle's multi sensor system.
- I mainly developed ROS based data processing system, LiDAR based path planning for the mobile robot.
- Related materials - paper

Military service — *Rep. of Korea*

Republic of Korea Army — *Mar. 2013 - Dec. 2014*

- Served as a Signaller in Combat Support Company
- Discharged as Sergeant

Technology Transfer

1. **Eunchang Lee**, Junho Choi, Duckyu Choi, Nahrendra I Made Aswin, Hyungtae Lim, Seunghyun Lee, Seungwon Song, and Hyun Myung "SLAM-Based Autonomous Flying Patrol Drone System and Remote Control Interface", 2023.11.14, *Rep. of Korea*
2. **Eunchang Lee**, Hyungtae Lim, and Hyun Myung, "Adaptive and Robust 3D SLAM Method that Adjusts Parameters Depending on The Environments, and Application of SLAM Method for Unmanned Aerial Vehicle Flight in GNSS-Denied Environments", 2023.05.01, *Rep. of Korea*

Patents & SW

Registered Patents

1. Sungjae Shin, Kwangyik Jung, **Eungchang Lee**, Junho Choi, and Hyun Myung, "Tightly Coupled UWB-Visual-Inertial Odometry for Robust Localization," Patent Reg. No.10-2654852 (2024.04.01), Application Number: 10-2021-0154973, 2021.11.11, *Rep. of Korea*

Applied Patents

1. **Eungchang Lee**, Seungwon Song, Nahrendra I Made Aswin, Junho Choi, Duckyu Choi, Seunghyun Lee, and Hyung Myung, "Drone Unit for Unmanned Exploration and Reconnaissance, Autonomous Flight System and The Method Thereof," Application Number: 18/783,703, 2024.07.25, *U.S.A*

2. **Eungchang Lee**, Seungwon Song, Nahrendra I Made Aswin, Junho Choi, Duckyu Choi, Seunghyun Lee, and Hyung Myung, "Drone Unit for Unmanned Exploration and Reconnaissance, Autonomous Flight System and The Method Thereof," Application Number: 10-2023-0099161, 2023.07.28, *Rep. of Korea*
3. Minho Oh, Wonho Song, Hyungtae Lim, **Eungchang Lee**, Euigon Jung, Sumin Hu, Jung-Hee Park, Chae Hyun Lee, Jae Kyung Kim, and Hyun Myung, "Method and Apparatus for Recognizing a Moving Environment Based on Sensor Data," Application Number: 10-2023-0075575, 2023.06.13, *Rep. of Korea*
4. Nahrendra I Made Aswin, Byeongho Yu, Tirtawardhana Christian, **Eungchang Lee**, and Hyun Myung, "METHOD AND APPARATUS FOR CONTROL OF DRONE PERFORMING NOMINAL CONTROL REINFORCEMENT BASED ON DEEP REINFORCEMENT LEARNING," Application Number: 10-2023-0054096, 2023.04.25, *Rep. of Korea*

Registered SW

1. **Eungchang Lee** and Hyung Myung, "RGB-Colorized 3D Mapping Program with LiDAR and Camera," Registration Number: C-2023-054561, 2023.10.07, *Rep. of Korea*
2. Sungjae Shin, Sungwon Hwang, **Eungchang Lee**, Junho Choi, Kwangyik Jung, and Hyung Myung, "Multi-Robot Relative Pose Estimation Algorithm Using Polar Histogram Matching," Registration Number: C-2021-043064, 2021.05.19, *Rep. of Korea*

First Author Publications

(†: Co-first author)

International Journal Papers

1. **E. M. Lee**, C. J. Park, J. Lee, and H. Myung, "TopoPillar: Incremental topological graph-based safe and efficient LiDAR-based exploration," *In preparation*, 2025
2. **E. M. Lee** and H. Myung, "LODESETAR: Degeneracy-robust LiDAR-inertial odometry with adaptive Schmidt-Kalman filter and data exploitation," *Submitted to IEEE Robotics and Automation Letters (**RA-L**)*, 2025

International Conference Papers

1. **E. M. Lee**†, C. J. Park†, and H. Myung, "SSF-Exploration: Safe Segments Forwarding-Based Seamless Replanning and Tracking for Fast UAV Exploration," in *Proc. IEEE International Conference on Control, Automation and Systems (ICCAS)*, 2025
2. **E. M. Lee**, D. Youn, and H. Myung, "THE-Planner: Topological and hierarchical exploration path planner for fast 3D mapping of outdoor structures with UAVs," in *Proc. IEEE International Conference on Ubiquitous Robots (UR)*, 2023
3. **E. M. Lee** *et al.*, "CEO-MLCPP: Control-efficient and obstacle-aware multi-layer coverage path planner for 3D reconstruction with UAVs," in *Proc. International Conference on Robot Intelligence Technology and Applications (RiTA)*, 2022
4. **E. M. Lee**, J. Jeon, and H. Myung, "TROT-Q: Traversability and obstacle aware target tracking system for quadruped robots," in *Proc. Asian Control Conference (ASCC)*, 2022
5. C. Kim†, **E. M. Lee**†, J. Choi, J. Jeon, S. Kim, and H. Myung, "ROLAND: Robust landing of UAV on moving platform using object detection and UWB based extended Kalman filter," in *Proc. IEEE International Conference on Control, Automation and Systems (ICCAS)*, 2021
6. **E. M. Lee**, D. Seo, J. Jeon, and H. Myung, "QR-SCAN: Traversable region scan for quadruped robot exploration using lightweight precomputed trajectory," in *Proc. IEEE International Conference on Control, Automation and Systems (ICCAS)*, 2021
7. **E. M. Lee**, J. Choi, H. Lim, and H. Myung, "REAL: Rapid exploration with active loop-closing toward large-scale 3D mapping using UAVs," in *Proc. IEEE/RSJ International Conference on Intelligent Robots and Systems (**IROS**)*, 2021
8. **E. M. Lee**, D. Choi, and H. Myung, "Peacock Exploration: A lightweight exploration for UAV using control-efficient trajectory," in *Proc. International Conference on Robot Intelligence Technology and Applications (RiTA)*, **Best Paper Awarded**, 2020
9. **E. M. Lee**, and H. Myung, "Analysis on the performance of VIO according to trajectory planning of UAV," in *Proc. IEEE International Conference on Control, Automation and Systems (ICCAS)*, 2020
10. **E. M. Lee**, I. Wee, T. Kim, and D. H. Shim, "Comparison of visual inertial odometry using flightgoggles simulator for UAV," in *Proc. IEEE International Conference on Control, Automation and Systems (ICCAS)*, 2019

Domestic Papers

1. **E. M. Lee** and H. Myung, "Degeneracy-Robust LiDAR-Inertial Odometry with Adaptive Schmidt-Kalman Filter," *In Proc. Institute of Control, Robotics and Systems (ICROS)*, **Best Paper Awarded**, 2025

2. **E. M. Lee**, J. Lee, C. Park, S. Lee, T. Kim, and H. Myung, "Adaptive data exploitation-based robust multi-LiDAR-inertial odometry for UAVs," in *Proc. Korea Robotics Society Annual Conference (KRoC)*, 2025
3. **E. M. Lee**, I. M. A. Nahrendra, J. Choi, S. Lee, and H. Myung, "Autonomous flying drone for unmanned reconnaissance in battlefield situations," *Korea Robotics Society Annual Conference (KRoC) RED Show*, **Best Work Awarded**, 2023
4. **E. M. Lee** and H. Myung, "Two-Stage optimization-based energy-efficient coverage path planner for 3D reconstruction," in *Proc. Korea Robotics Society Annual Conference (KRoC)*, 2023
5. **E. M. Lee**, D. Lee, H. Lim, S. Song, and H. Myung, "Non-uniform motion target tracking system for UAVs," in *Proc. Korea Robotics Society Annual Conference (KRoC)*, 2022
6. **E. M. Lee** *et al*., "Development of a 3D mapping system including object position for UAV with a RGB-D camera in an unknown and GNSS-denied environment," in *Proc. Institute of Embedded Engineering of Korea 2020 Fall Conference (IEMEK)*, **Best Paper Awarded**, 2020
7. **E. M. Lee**, I. Wee, T. Kim, S. Moon, and D. H. Shim, "Analysis on visual-inertial state estimation(VINS-mono) for drone using FlightGoggles simulator," in *Proc. The Korean Society for Aeronautical and Space Sciences 2019 Spring Conference (KSAS)*, 2019
8. **E. M. Lee**, S. Han, Y. Jin, W. Shin, J. Yun, and S. M. Lee, "Image based visual servoing for tracking control of a mobile robot," in *Proc. IEMEK Symposium on Embedded Technology (ISET)*, 2018

Other Publications

([†]: Co-first author)

International Journal Papers

1. H. Lim, B. Kim, D. Kim, **E. M. Lee**, and H. Myung, "Quatro++: Robust global registration exploiting ground segmentation for loop closing in LiDAR SLAM," *International Journal of Robotics Research (**IJRR**)*, 2023
2. I. M. A. Nahrendra, C. Tirtawardhana, B. Yu, **E. M. Lee**, and H. Myung, "Retro-RL: Reinforcing nominal controller with deep reinforcement learning for tilting-rotor drones," *IEEE Robotics and Automation Letters (**RA-L**)*, 2022
3. M. Oh, E. Jung, H. Lim, W. Song, S. Hu, **E. M. Lee**, J. Park, J. Kim, J. Lee, and H. Myung, "TRAVEL: Traversable ground and above-ground object segmentation using graph representation of 3D LiDAR scans," *IEEE Robotics and Automation Letters (**RA-L**)*, **2022 RA-L Best Paper Awarded**, 2022
4. Y. Kim, B. Yu, **E. M. Lee**, J. Kim, H. Park, and H. Myung, "STEP: State estimator for legged robots using a preintegrated foot velocity factor," *IEEE Robotics and Automation Letters (**RA-L**)*, 2022
5. J. Jeon, S. Jung, **E. M. Lee**, D. Choi, and H. Myung, "Run Your Visual-Inertial Odometry on NVIDIA Jetson: Benchmark tests on a micro aerial vehicle," *IEEE Robotics and Automation Letters (**RA-L**)*, 2021

International Conference Papers

1. J. Choi, K. Ryoo, J. Kim, T. Kim, **E. M. Lee**, M. Jeong, K. C. Marsim, H. Lim, and H. Myung, "SaWa-ML: Structure-Aware Pose Correction and Weight Adaptation-Based Robust Multi-Robot Localization," in *IEEE/RSJ International Conference on Intelligent Robots and Systems (**IROS**)*, 2025
2. S. Shin, Y. Kim, B. Yu, **E. M. Lee**, D.-U. Seo, and H. Myung, "PanoNetVLAD: Visual loop closure detection in continuous space represented with panoramic view using multiple cameras," in *Proc. IEEE International Conference on Control, Automation and Systems (ICCAS)*, 2023
3. D.-U. Seo, H. Lim, **E. M. Lee**, H. Lim, and H. Myung, "Enhancing robustness of line tracking through semi-dense epipolar search in line-based SLAM," in *IEEE/RSJ International Conference on Intelligent Robots and Systems (**IROS**)*, 2023
4. J. Choi, M. Jeong, **E. M. Lee**, D. Choi, and H. Myung, "NLOS-avoiding and obstacle-adaptive formation control by sharing obstacle information of a leader UAV in multi-UAV system," in *Proc. IEEE International Conference on Ubiquitous Robots (UR)*, 2023
5. J. Choi, **E. M. Lee**, M. Jeong, D. Choi, and H. Myung, "Range-only relative position estimation for multi-UAV," in *Proc. IEEE International Conference on Control, Automation and Systems (ICCAS)*, 2022
6. D. Lee, **E. M. Lee**, H. Lim, S. Song, and H. Myung, "FARO-Tracker: Fast and robust target tracking system for UAVs in urban environment," in *Proc. International Conference on Robot Intelligence Technology and Applications (RiTA)*, 2022
7. D. Lee, **E. M. Lee**, D. Choi, J. Choi, C. Tirtawardhana, and H. Myung, "M-BRIC: Design of mass-driven bi-rotor with RL-based intelligent controller," in *Proc. IEEE International Conference on Ubiquitous Robots (UR)*, 2022
8. S. Shin, **E. M. Lee**, J. Choi, and H. Myung, "MIR-VIO: Mutual information residual-based visual inertial odometry with UWB fusion for robust localization," in *Proc. IEEE International Conference on Control, Automation and Systems (ICCAS)*, **Best Paper Awarded**, 2021
9. S. Lee, S. Chang, **E. M. Lee**, J. Choi, J. Jeon, S. Kim, and H. Myung, "TPL: Trajectory planner for target tracking in low-light environments," in *Proc. International Conference on Robot Intelligence Technology and Applications (RiTA)*, 2021

10. J. Choi, **E. M. Lee**, S. Shin, and H. Myung, “Solving geometric constraints for relative position estimation using UWB sensors in multi-robot system,” in *Proc. World Congress on Advances in Nano, Bio, Robotics and Energy (ANBRE21)*, 2021
11. D. Choi, **E. M. Lee**, and H. Myung, “Online 3D coverage path planning using surface vector,” in *Proc. IEEE International Conference on Ubiquitous Robots (UR)*, 2021
12. Y. Jin, S. Han, **E. M. Lee**, S. M. Lee, C. Shin, and J. Yun, “Development of autonomous driving systems using state estimator with multi-rate sampled-data,” in *Proc. IEEE International Conference on Consumer Electronics (ICCE)*, 2019

Domestic Papers

1. S. Jung, J. Choi, **E. M. Lee**, D. Choi, and H. Myung, “Multi-sensor based 3D mapping for autonomous bridge inspection using unmanned aerial vehicle,” in *Proc. Korea Institute of Structural Maintenance and Inspection 2020 Fall Conference (KSMI)*, 2020
2. I. Wee, **E. M. Lee**, T. Kim, and D. H. Shim, “Dynamic model analysis of FlightGoggles simulator and autonomous flight using moving virtual target,” in *Proc. The Korean Society for Aeronautical and Space Sciences 2019 Spring Conference (KSAS)*, 2019
3. T. Kim, I. Wee, **E. M. Lee**, and D. H. Shim, “Vision based gate detection algorithm for autonomous drone racing,” in *Proc. The Korean Society for Aeronautical and Space Sciences 2019 Spring Conference (KSAS)*, 2019
4. W. Kim, **E. M. Lee**, W. Eom, S. Han, Y. Jin, and S. M. Lee, “Sampled-data control for visual servoing of 6 DOF system using TP model transformation,” in *Proc. IEMEK Symposium on Embedded Technology (ISET)*, 2018