Hangyo **Cho**

UAVs · SLAM ENGINEER

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Education

Hanseo University — *Taean, Rep. of Korea*

B.S. in Unmanned Aircraft Systems — *Mar. 2021 - Current*

- **Advisor: Professor Dongjin Lee**
- **GPA: 4.3 / 4.5**

Research Interests

SLAM/Spatial AI	Interests on LiDAR(-inertial)SLAM(Odometry)
Autonomous Exploration	Exploring unknown areas autonomously using LiDAR or cameras
Multi Robot Systems	Multi Robot Systems and Cooperative Systems for UAVs and UGVs
Sensor Fusion	Spatial-temporal calibration of LiDAR, camera, and other sensors

Skills

Tools	CATIA, AirSim, Gazebo, Unreal Engine, Fusion 360
Programming	ROS, C/C++, Python, MATLAB, LaTeX
Languages	Korean, English
License & Certificate	Pilot of an Ultra Light Vehicle (Unmanned Multicopter / 1st)

Honors & Awards

Awards

2024. 05	**2nd Prize**, The 1st UV Challenge	*Ministry of Science and ICT.*
2024. 04	**Gold Prize**, 2024 AI Drone Challenge	*INTOSKY*
2023. 12	**2nd Prize**, 2024 Start-Up Competition	*Hanseo Univ.*
2023. 11	**2nd Prize**, The 21th Korea Robot Aircraft Competition	*Korea Aerospace Industries Association*
2023. 11	**Participant's Award**, 2023 CARBON IDEA Challenge	*CAMTEC KOREA*
2023. 09	**3rd Prize**, 2023 Cooperative education essay competition	*Hanseo Univ.*
2023. 06	**1st Prize**, The 1st 2nd Operations Commander's Dronebot Battle Competition	*2nd Operations Command*
2022. 12	**Participant's Award**, 2022 Capstone Design Competition	*Hanseo Univ.*
2022. 11	**3rd Prize**, 2022 DNA+DRONE Challenge	*Electronics and Telecommunications Research Institute*

Honors

2023 ~	**National Science & Technology Scholarship**,	*Korea Student Aid Foundation*
2023 - 2	**Half-tuition Scholarship**, For Second Seat last Semester	*Hanseo Univ.*
2022 - 2	**Full-tuition Scholarship**, For Top Seat last Semester	*Hanseo Univ.*
2022 - 1	**Half-tuition Scholarship**, For Second Seat last Semester	*Hanseo Univ.*
2021 - 2	**Half-tuition Scholarship**, For Second Seat last Semester	*Hanseo Univ.*

Research Experience

HanulDrone Inc. — *Pangyo, Rep. of Korea*

Research Engineer — *mar. 2023 - exp. Jun. 2024*

- Researched on Facility inspection drone, Drone Delivery Service and Fire Extinguish drone.

Aerospace Control and Unmanned Aircraft Systems (ACUS) Lab. (Prof. Dongjin Lee) *Taean, Rep. of Korea*

Research Student *Mar. 2022 - Current*

- Researched Quadcopter Controls and Unmanned Aircraft Systems, focusing on Navigation, Sensor fusion, Obstacle avoidance and SITL (Software-In-The-Loop) Simulation.

Publication

Domestic Conference

2024. 04	**H. G. Cho**, D. J. Lee, "Frontier-Based Autonomous Exploration Simulation in GNSS-Denied Environments", *Korean Society for Aeronautical and Space Sciences 2024 Spring Conference* (KSAS)	*Jeju, Rep. of Korea*
2024. 04	**H. G. Cho**, T. G. Lee, J. H. Kim, S. G. Eom, "Structural Crack Detection through Sensor Fusion in Various Environments", *Korean Society for Aeronautical and Space Sciences 2024 Spring Conference* (KSAS)	*Jeju, Rep. of Korea*
2024. 04	T. G. Lee, **H. G. Cho**, J. H. Kim, S. G. Eom, "Design and Fabrication of Quadcopter for Indoor Inspections with a Foldable Mechanism", *Korean Society for Aeronautical and Space Sciences 2024 Spring Conference* (KSAS)	*Jeju, Rep. of Korea*
2023. 10	S. T. Oh, **H. G. Cho**, H. S. Kim, J. H. Son, B. I. Lee, S. W. Kim, H. Kang, J. M. Kim, D. J. Lee, "Development of Mother and Child Multicopter UAV based Delivery Mission System", *Korean Society for Aeronautical and Space Sciences 2023 Fall Conference* (KSAS)	*Jeju, Rep. of Korea*
2023. 10	J. H. Kim, S. G. Eom, **H. G. Cho**, T. G. Lee, H. E. Jung, Y. S. Jo, "Configuring UAV Integrated System and Building scenario for Automatic Fire Monitoring and Suppression", *Korean Society for Aeronautical and Space Sciences 2023 Fall Conference* (KSAS)	*Jeju, Rep. of Korea*
2023. 10	B. H. Kang, H. S. Kim, C. W. Han, **H. G. Cho**, D. J. Lee, "A study on delivery location and direction estimation based LiDAR and camera sensor fusion for performing urban delivery missions of Unmanned Aerial Vehicles", *Korean Society for Aeronautical and Space Sciences 2023 Fall Conference* (KSAS)	*Jeju, Rep. of Korea*
2022. 10	Y. T. Song, **H. G. Cho**, S. G. Eom, S. B. Lee, D. J. Lee, "Study on geometric path generation and guidance algorithm for passing urban obstacles based on unmanned aerial vehicles", *Society for Aerospace System Engineering 2022 Fall Conference* (SASE)	*Yeosu, Rep. of Korea*
2022. 10	S. C. Sung, W. S. Kang, **H. G. Cho**, D. J. Lee, "A study on delivery position estimation through ROI-based image and LiDAR fusion algorithm using UAV", *Society for Aerospace System Engineering 2022 Fall Conference* (SASE)	*Yeosu, Rep. of Korea*

Projects

2024 Seosan drone demonstration city construction *Seosan, Rep. of Korea*

Supported by Ministry of Land, Infrastructure and Transport *Mar. 2024 - Current*

- This is a project to Commercialize K-drone delivery through drone delivery service tailored to the needs of Garorimman Island residents.
- Researched on last mile delivery system development and operation support.

Autonomous facility inspection drone *Rep. of Korea*

Conducted at HanulDrone *Aug. 2023 - Current*

- This project is about autonomously detecting defects in hard-to-reach or hazardous infrastructure and visualizing their locations on map data.
- Researched efficient infrastructure inspection using multi-camera real-time stitching and LiDAR sensor fusion.

2023 Seosan drone demonstration city construction *Seosan, Rep. of Korea*

Supported by Ministry of Land, Infrastructure and Transport *Apr. 2023 - Dec. 2023*

- This is a project to Demonstrate inter-island medicine delivery using VTOL aircraft.
- Developed a parachute-based delivery system for inter-island delivery using VTOL and conducted flight demonstrations for inter-island transportation.

2023 Taean drone demonstration city construction *Taean, Rep. of Korea*

Supported by Ministry of Land, Infrastructure and Transport *Apr. 2023 - Dec. 2023*

- This is a project to Establish rapid drone fire surveillance and initial suppression system to protect the environment and ecology.
- Developed a system that, during autonomous flight, detects fires using a thermal imaging camera and sends guidance commands to automatically extinguish the fire.

Extracurricular Activity

Design and Fabrication of a LiDAR-Based Indoor Drone Using 3D Printing

Rep. of Korea

Personal Project

Dec. 2023 - Current

- This project is about designing and fabricating a drone that can perform missions indoors using LiDAR.
- I selected and integrated the basic components of the drone, and designed the wiring and power systems for the sensors and electronic equipment required for the missions. I used CATIA to design the frame, and after printing the frame using 3D printing, I assembled the drone.

Frontier based Exploration using RRT*

Rep. of Korea

Personal Project

Dec. 2023 - Mar. 2024

- In this project, I developed a system that reconstructs map data generated from LiDAR-based SLAM using voxblox, extracts frontiers for unknown areas, and conducts autonomous exploration through RRT-based path planning. And, Simulated in AirSim.

THE 1st UV Challenge

Rep. of Korea

Host by Ministry of Science and ICT

Conducted at HanulDrone

Jun. 2023 - May. 2024

- The main goal is to detect, identify, and track unauthorized drones using initial radar information through drones.
- Participated in the challenge with a VTOL, utilizing object detection information from the camera along with the drone's altitude and position data to estimate the location of unauthorized drones.

Future mobility and marine specialized drone utilization training program

Rep. of Korea

Conducted at Hanuldrone .Inc

Sep. 2023 - May. 2024

- conducted drone education tailored to the characteristics of each department at Hanseo University.
- I mainly focused on educating the departments of Aerospace Software and Aviation Computer Engineering at Hanseo University about drone obstacle avoidance and path planning.

2024 AI Drone Challenge

Rep. of Korea

Host by INTOSKY

Jan. 2024 - Apr. 2024

- The main mission is logistics management, indoor obstacle avoidance, and precision landing missions using drones.
- By scanning QR codes placed in each area and storing the information separately, the system enables logistics management. Using RGB-D to map the surrounding terrain and perform obstacle avoidance flight with a local planner, and enabling precise landing based on ArUCo markers.

2024 Start-Up Competition

Rep. of Korea

Host by Hanseo Univ.

Nov. 2023 - Dec. 2023

- Participated in a competition with ideas and implementation plans for monitoring illegal parking and urban fires, and for controlling and managing traffic using drones

2023 CARBON IDEA Challenge

Rep. of Korea

Hosted by CAMTEC

Aug. 2023 - Nov. 2023

- The main goal is to design and manufacture a drone frame with guards that can withstand specific conditions using CFRP (Carbon Fiber Reinforced Polymer).
- My team and I developed a drone frame with a folding mechanism using CFRP material for facility inspections.

The 21th Korea Robot Aircraft Competition

Rep. of Korea

Hosted by Korea Aerospace Industries Association

Aug. 2023 - Sep. 2023

- The main goal is the same as in the 20th competition, which is to perform an urban apartment delivery mission using drones. The mission involved navigating between two ladder trucks positioned as urban obstacles and delivering a pizza to an apartment balcony.
- I mainly refine the methods for estimating delivery locations and developed Mother and Child Multicopter UAV-based Delivery Mission System.

The 15th Pusan National University Creative Aircraft Competition

Rep. of Korea

Hosted by Pusan National University

Jul. 2023 - Sep. 2023

- The main goal was to perform a bell-ringing mission using the mission equipment attached to each drone, pass through gates, automatically recognize numbers, and then land on the landing pad corresponding to the recognized number.
- Inspired by turrets and soccer ball launchers, a turret capable of tracking was designed using CNN-based video detection. The turret was configured to fire when the target was centered, which was achieved through wheels located on both sides of the barrel.

The 1st 2nd Operations Commander's Dronebot Battle Competition

Rep. of Korea

Hosted by 2nd Operations Command

Conducted at Aerospace Control and Unmanned Aircraft Systems Lab. in Hanseo Univ.

Apr. 2023 - Jun. 2023

- The main goal is to utilize drones to gather critical target information in areas seized by enemy special forces and transmit this information in real-time to the headquarters.
- I mainly developed integrating YOLO with the geometric model of the imagery and the aerial vehicle's navigational data to accurately identify targets and locations in mountainous regions. Additionally, I conducted research on real-time streaming via TURN servers.

Image-based multicopter precision landing project

Rep. of Korea

Undergraduate Research Program

Dec. 2022 - Jan. 2023

- This project aims to detect landing pads using a camera and enable precise automatic landing.
- Developed a system that utilizes YOLO for detecting the landing pad and subsequently applies a PID controller to guide the drone to the detected landing pad.

2022 Capstone Design Competition

Rep. of Korea

Host by Hanseo Univ. *Aug. 2022 - Dec. 2022*

- While taking a robotics course, I built an Unmanned Ground Vehicle (UGV) equipped with a manipulator and participated in a competition.
- Using inverse kinematics to control the manipulator and performing INS-based localization to accomplish the mission.

The 2nd Regional Cooperation Student Supporters

Rep. of Korea

Supported by Hanseo Univ. *Jul. 2022 - Dec. 2022*

- Conducted drone education for elementary, middle, and high school students in the western region of Chungcheongnam-do.

2022 DNA+DRONE Challenge

Rep. of Korea

Hosted by Electronics and Telecommunications Research Institute (ETRI)

Aug. 2022 - Sep. 2022

Conducted at Aerospace Control and Unmanned Aircraft Systems Lab. in Hanseo Univ.

- In the competition, participants are tasked with using drones to capture images of missing persons and personal effects, and to pinpoint the exact locations of these individuals within the images. Additionally, the mission includes managing evacuations and detecting illegal fishing activities in areas at risk of rising water levels due to dam discharges and floods in rivers.
- I mainly developed a method to estimate the positions of detected missing persons and personal belongings in real-time by integrating YOLO with the geometric model of the imagery and the aerial vehicle's navigational data.

The 20th Korea Robot Aircraft Competition

Rep. of Korea

Hosted by Korea Aerospace Industries Association

Aug. 2022 - Sep. 2022

Conducted at Aerospace Control and Unmanned Aircraft Systems Lab. in Hanseo Univ.

- The main goal was to perform an urban apartment delivery mission using drones. The mission involved navigating between two ladder trucks positioned as urban obstacles and delivering a pizza to an apartment balcony.
- Although not included in roster, the team took 1st place in the competition.
- I mainly developed a method to estimate delivery location in apartment using Camera-LiDAR Sensor Fusion, geometric path generation and guidance algorithm for passing urban obstacle.

The 13th Pusan National University Creative Aircraft Competition

Rep. of Korea

Hosted by Pusan National University *Jul. 2021 - Sep. 2021*

- The main goal was to perform an urban apartment delivery mission using drones.
- Inspired by the IRIS of a camera, the mission equipment was designed and completed using a 3D printer.