# DONGHEON LEE

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## EDUCATION

**M.S. in Electrical and Computer Engineering: Electrical and Computer Engineering**                    *Aug 2025 - Present*
*Purdue University, West Lafayette, IN, U.S.A*                                                            *GPA 3.61/4.0*
- Specializing in Automatic Control with interests in reinforcement learning, autonomous system and distributed robots

**B.E. in Computer Science Engineering: Computer Science Engineering**                    *Mar 2017 - Feb 2023*
*Chungnam National University (CNU), Daejeon, South Korea*                                 *GPA 3.88/4.0*
- GPA: 3.88 / 4.0 (3rd in a class of 102)

## RESEARCH EXPERIENCE

**Optimization-Based Control of Fixed-Wing UAVs**                                        *Sep 2025 - Present*
*Networked Control Systems Lab  |  West Lafayette, IN, U.S.A.*
- Developed MPPI- and MPC-based control frameworks for a 4-channel fixed-wing UAV to enable aggressive pylon navigation.
- Designed cost functions and tuning strategies, and performed simulation-to-flight transfer with real-world flight validation.
- Analyzed controller robustness and failure modes under wind and sensing uncertainty.

**Federated Learning on Resource-Constrained Edge Devices**                              *Mar 2022 - Jun 2022*
*Distributed Networks & Computing Lab  |  Daejeon, Korea*
- Analyzed foundational research on federated and distributed learning, implementing aggregation techniques that improved model accuracy from 70% on individual agents to 90% after aggregation
- Established a federated learning system using five Raspberry Pi devices to collect data and train individual models locally, transmitting model weights to a central server for aggregation and performance evaluation

**Vision–Based Shot Group Measurement System for Remote Ballistic Analysis**            *Jan 2022 - Feb 2022*
*Purdue University  |  West Lafayette, U.S.A*
- Led a Shot Group Measuring System project to remotely measure shot group size, developing algorithms for bullet hole detection and image matching, resulting in a published paper [1]
- Audited courses on English pronunciation for exchange students and mobile network

**Automated Cross-Platform Mobile Application Testing**                                  *Aug 2021 - Dec 2021*
*Data Networks Lab  |  Daejeon, Korea*
- Engineered an automated testing system using a JavaScript-controlled tapping robot to test mobile applications on both iOS and Android platforms, enabling execution time comparisons across devices
- Acquired comprehensive research skills, including problem definition, implementation, and academic writing [2]

## WORK EXPERIENCE

**Software Engineer**                                                                    *Nov 2024 - Jul 2025*
*Applied Intuition  |  Seoul, Korea*
- Integrated EpiSci's 3D Mapping project into Applied Intuition's simulation platform by migrating ROS1 to ROS 2
- Evaluated LiDAR specification changes on drone autonomy performance in simulation with a Tier-1 sensor supplier
- Conducted simulation training workshops for a Korean automotive OEM and an airline R&D center, demonstrating autonomy testing and scenario design capabilities

**Software Engineer**                                                                    *Oct 2023 - Nov 2024*
*EpiSci (Acquired by Applied Intuition)  |  Seoul, Korea*
- Developed autonomous drone systems with modules for efficient data exchange and swarm management, enabling coordinated multi-agent operations
- Applied machine learning in computer vision to implement user-friendly markers and used 3D Gaussian Splatting for enhanced 3D visualization
- Designed and developed sim-to-real deployments by leading the transition from Gazebo sim to actual drones on ROS 2, PX4, and the VOXL platform to ensure performance consistency across environments
- Demonstrated UAV applications by implementing a 3D mapping system for the NIST and presenting a multi-agent autonomous mesh networking system for the US Army and DARPA

**Software Engineering Intern**                                                          *Sep 2022 - Sep 2023*
*EpiSci (Acquired by Applied Intuition)  |  Poway, CA, U.S.A*
- Applied and tested various simulated-based Visual-Inertial Odometry and Visual Obstacle Avoidance algorithms on real indoor drones using ROS 1 to optimize 2D and 3D mapping accuracy
- Developed frontier search algorithm and object detection modules for PX4-based drone, gaining practical hardware insights
- Implemented a custom plugin app for Android Team Awareness Kit (ATAK) to control and monitor drones, supporting military demonstration purposes
- Earned FAA Part 107 certification to legally operate small UAVs commercially under U.S. regulations

## PROJECTS

**Evaluating Trade-offs Between LiDAR Specifications and Autonomy Performance**          *Apr 2025 - Jul 2025*
*Applied Intuition  |  in collaboration with a Korean Tier-1 sensor supplier*
- Migrated EpiSci's GPS-denied indoor navigation project from ROS 1 to ROS 2 and integrated it with Applied Intuition's simulation platform by using the API to retrieve ego-vehicle state data and issue control commands

- Applied RRT path planning and collision avoidance in urban drone navigation scenarios with dense city environments and mapping objectives
- Built evaluation pipelines to quantify the effects of LiDAR range, field of view, resolution, and point density on autonomy performance using metrics such as success rate, completion time, replanning count, and path length
- Analyzed the relationship between LiDAR specifications and autonomy performance, providing critical insights that resulted in a proof-of-concept agreement between the two companies

### SQUad Intelligent Robotic Radio Enhancing Links (SQUIRREL)                     *May 2024 - Nov 2024*
*EpiSci | funded by DARPA*

- Architected and refactored a collaborative multi-agent autonomous system for UAVs, strengthening the mesh network between ground station and soldier agents
- Reduced 50% of network overhead by implementing data serialization/deserialization and replacing SSH connection with JSON-RPC for retrieving network status data from Doodle Labs radio
- Led hardware development and testing on diverse drone platforms, designing 3D-printed parts with Fusion 360 to integrate radio modules and optimizing mesh network setup to ensure consistent software performance
- Implemented a swarm manager module to enable real-time exchange data of network status, battery status, and GPS information between agents

### GPS Denied Indoor Navigation - NIST 5.0 3D Mapping Challenge                     *Jun 2023 - Oct 2024*
*EpiSci | NIST*

- Implemented post-processing by calculating transform matrices between the drone and map, producing high-quality visual mapping with 3D Gaussian Splatting and MeshLab
- Developed a 3D object detection module in ROS 1 that renders 3D bounding boxes on the Voxblox mesh map by integrating MobileNet V2-SSDlite detection results with point cloud data
- Customized VOXL-PX4 to activate a range sensor for Z-axis error correction in VIO and to enable turtle mode for self-righting after crashes
- Engineered a custom drone from a consumer FPV kit by designing CAD components and optimizing ESC/battery setup, achieving 15+ min flight time and one-sixth the commercial cost (under $2,500)

### GPS Denied Indoor Navigation - 2D Mapping                     *Sep 2022 - Aug 2023*
*EpiSci*

- Advanced a frontier search algorithm for autonomous exploration and path planning, integrating it with Cartographer (2D mapping) for drone deployment and conducting a successful real-world demo
- Developed an ATAK custom plugin Android application for military demonstration purposes, featuring video streaming, PX4-based drone control, and mission selection capabilities, and successfully tested real-time communication with actual drone
- Customized VOXL-PX4 to activate M10 GPS for seamless outdoor-indoor transitions and applied collision avoidance using 2D LiDAR sensor
- Improved point cloud filtering functions with a 2D LiDAR sensor, enhancing map quality for upgraded collision avoidance

### Automated Shot Group Size Measuring System                     *Dec 2021 - Aug 2022*
*Purdue University | published in IEEE*

- Engineered image warping functions using OpenCV to align the captured RGB images with reference images, achieving 91.8% accuracy in shot group size measurement
- Trained YOLOV3 models optimized for inference on embedded devices, triggered by sound sensor signals for automated operation
- Set up IoT components including Raspberry Pis, sound sensors, camera sensors, and LoRA modules to enable real-time data transmission

### Mobile Application UI Testing System                     *Jun 2021 - Dec 2021*
*Data Networks Lab | published in KIICE*

- Designed the architecture and implemented a mobile app performance benchmarking system to evaluate execution speed by recognizing screen transitions from click initiation to app loading completion
- Configured an open-source 3 DOF tapping robot, advancing the JavaScript-based robot control to enable precise smartphone tapping on target points

## PUBLICATIONS

1. S.Park, Dongheon Lee, J.Choi, D.Ko, M.Lee, Z.Murphy, N.Binhowidy, A.Smith, "Feasibility of Measuring Shot Group Using LoRa Technology and YOLO V5", 2022 IEEE Sensors Applications Symposium (SAS), Sundsvall, Sweden, 2022, pp.1-6 (DOI: 10.1109/SAS54819.2022.9881356), pp. 1-6, 2022
2. Dongheon Lee, H.Mun, Y.Lee, "A Case Study on Scenario-Based Mobile Application UI Action Test", Korean Institute of Information Scientists and Engineers (KIICE), pp. 1,309-1,311, 2021.12

## SKILLS

**Programming Languages:** C/C++, Python, Java, Bash, MySQL

**Software & Tools:** ROS 1/2, Gazebo, Isaac Sim, PX4 Autopilot, CMake, Fusion 360

**Machine Learning:** Tensorflow, PyTorch

**Hardware:** Pixhawk, VOXL (ModalAI), FPV Drone, 3D Printer, Microhard, DoodleLabs

## AWARDS & HONORS

### Student Engineer of the Year                     *Dec 2022*
*The Dean, College of Engineering, CNU*

- Honored for academic excellence and for raising the university's reputation through participation in various competitions, as one of only five students selected across the entire College

### Sponsor's Award, 2022 Software Talent Competition                     *Dec 2022*
*IITP Korea*

- Recognized for the Automated Shot Group Size Measuring System project, assessed for creativity and system stability in IoT-based automated measurement

**Encouragement Award, Poster Session** *Dec 2021*
*KIICE*
- Commended for well-structured design, experimental precision, and creativity in the development of the Mobile Application UI Testing System

**Full Scholarship**
*Department of CSE, CNU*
- Granted full scholarships for four semesters (2nd, 6th, 7th, 8th) by the Department of Computer Science and Engineering at CNU, in recognition of academic excellence

**Full Scholarship** *Jan 2020*
*Sejong City Foundation*
- Awarded a full scholarship from the Sejong City Foundation for outstanding academic performance

**Partial Scholarship**
*Department of CSE, CNU*
- Conferred partial scholarships for three semesters (3rd, 4th, 5th) by the Department of Computer

## EXTRA CURRICULAR ACTIVITIES

**Undergraduate Research Project Mentorship** *Mar 2024 - Jun 2025*
*CNU | Remote*
- Guided a remote senior project on Reproducing Starlink's Security Vulnerabilities with undergraduate computer science students at CNU
- Supported students in defining research problems, setting objectives, and establishing detailed project plans

**Machine Learning Bootcamp** *Aug 2023 - Nov 2023*
*Google Korea | Remote*
- Strengthened foundational mathematical knowledge and model optimization skills in machine learning through Andrew Ng's course on Coursera
- Leveraged data processing and analytical techniques in the Detect Sleep States Kaggle competition, achieving a top 30% ranking

## VOLUNTEER WORK

**Elementary Coding Education Volunteer,** *Jul 2022*
*CNU | Daejeon, Korea*
- Served as a volunteer teaching assistant in four coding workshops for elementary students using PyGame, supporting them with environment setup and debugging to enhance their learning experience