

EDUCATION

- **Columbia University** New York, NY
M.S. in Mechanical Engineering with concentration in Robotics & Control (GPA: 3.85/4.0) Sept 2022 – Current
- **Chung-Ang University** Seoul, Republic of Korea
B.S. in Mechanical Engineering Feb 2022

RESEARCH EXPERIENCE

- **Creative Machines Lab** Columbia University
Graduate Research Assistant, Robot Metabolism Project May 2023 - Current
 - **AprilTag Detection:** Developed a real-time AprilTag detection system using the AprilTags 3 library
 - **Camera Calibration:** Computed the calibration matrix for the camera to enhance detection accuracy
 - **Pose Estimation:** Employed OpenCV to compute the 3D pose of each detected tag relative to the camera
 - **Coordinate Transformation:** Transformed detected tag poses into a predefined global coordinate system
 - **Visualization:** Designed a visualization interface that displays the video feed with detected tags highlighted, indicating tag ID, global pose, and reprojection error
 - **Error Calculation:** Implemented a system to calculate and visualize reprojection errors for all detected tags, ensuring optimal system performance

RESEARCH PROJECTS

- **Robot Walking via Deep Deterministic Policy Gradient** Chung-Ang University
Implemented DDPG for RL agent training via MATLAB Simulink (Advisor: Dr. Seungtae Choi) Sept 2021 - Dec 2021
 - **Algorithm Implementation:** Utilized DDPG on MATLAB's standard robot model for reinforcement learning to optimize walking postures.
 - **Reward Function Design:** Defined a multi-parameter reward function factoring in forward velocity, power consumption, and displacements (both vertical and lateral) for guiding the RL agent's actions
 - **Simulated Testing:** Set up a MATLAB simulated sidewalk environment, spanning 25 meters in length, where the robot learned to walk efficiently, showcasing trajectories without significant deviations
 - **Data Analysis:** Observed and interpreted fluctuations in rewards and potential convergence to local maxima throughout training episodes.
 - **Performance Outcome:** Successfully achieved robot walking with an episode reward of 846.6369, following real-world sidewalk constraints, and maintained an average of 554.65 steps per episode
- **Optimization of 3-DOF Humanoid Robot Leg Posture** Chung-Ang University
Determined optimal joint angles to minimize torque (Advisor: Dr. Dongjun Shin) Mar 2021 - June 2021
 - **Kinematic Modeling:** Employed forward kinematics, Jacobian matrices, and dynamic equations for modeling
 - **Design & Assembly:** Designed and assembled robot components using CATIA, exporting the design as a URDF
 - **Control System:** Developed block diagrams in MATLAB Simulink, integrating PD controllers
 - **Performance Outcome:** Achieved a torque reduction of 1.5% on average and 11.3% at the knee joint by optimizing joint angles to ($j_1 = -32.3^\circ$, $j_2 = 87.6^\circ$, $j_3 = -85.5^\circ$)
- **Drowsiness Detection via Eye Movement Tracking** Chung-Ang University
Leveraged flex sensors and OpenCV for drowsiness detection (Advisor: Dr. Giuk Lee) Mar 2021 - June 2021
 - **Sensor Integration:** Assembled a system using flex sensors, breadboard, electrical wiring, and Arduino Uno to quantify neck bending as an indicator of drowsiness.
 - **Visual Processing:** Implemented facial recognition using Raspberry Pi 4, Python, and OpenCV. Deployed Dlib library for face and eye detection and applied Histogram of Oriented Gradients for brightness-based object identification. Developed a blink ratio system using OpenCV's bilateral filter and thresholding for binary data conversion.
 - **System Fusion:** Synchronized mechanical and computer vision systems, introducing a time-based parameter. Triggered an LED warning if neck bending and eyelid closure persisted for over 2.5 seconds.

- **Practical Application:** Potential to enhance safety for long-haul truckers, mitigating risks from unintended microsleep episodes.

UAV Wing Structural Analysis

Chung-Ang University

Optimized carbon thickness in a sandwich beam structure (Advisor: Dr. Youngsik Choi)

Sept 2020 - Dec 2020

- **Material Selection:** Constructed a sandwich beam wing structure using Expanded Polypropylene (EPP) and carbon, denoted as C-EPP-C
- **Analytical Modeling:** Employed the sandwich beam equation to forecast stress, shear force, and deformation dynamics of the wing
- **CAD Analysis:** Integrated EPP and carbon material properties into a CAD model for structural analysis, utilizing CATIA's GSA function. Incorporated XFLR5 for evaluating wing and airfoil performance under low Reynolds numbers
- **Optimization Outcome:** Identified optimal carbon thickness at 1.5mm, achieving a maximum principal strength of 3.6MPa for carbon and 0.25MPa for EPP. Given allowable stresses of 1470MPa (Carbon) and 2.4MPa (EPP), the design proved to be stable with a considerable safety margin

PROFESSIONAL EXPERIENCE

Kia Motors

Seoul, Republic of Korea

Engineer, North America Safety Engineering Team, Global HQ

July 2022 - Sep 2022

- **Safety Oversight:** Led diagnostics and management of safety quality issues within powertrains, engines, and electric motors; collaborated extensively with KUS NASO and NHTSA

Hyundai Motor Group

Seoul, Republic of Korea

Engineer, North America Field Analytic Engineering Team, Global HQ

Mar 2022 - July 2022

- **Project Leadership:** Directed the development of a safety data system for HMG's automotive brands (Kia, Hyundai, and Genesis) in collaboration with Deloitte. The final system was presented in partnership with Deloitte at a NHTSA event in Washington DC

NAVER LABS

Seongnam, Republic of Korea

Data Assistant, AI Translation Team

Dec 2016 - Mar 2017

- **Deep Learning:** Engaged in a DNN initiative using TensorFlow aimed at enhancing the capabilities of the PAPAGO AI translator
- **Data Management:** Curated and annotated a specialized speech dataset to advance ML models for translation

LEADERSHIP AND SERVICES

Literary Society Leader

Chung-Ang University

Directed reading groups, curated reading lists, and facilitated literary discussions

Oct 2018 - Feb 2022

- **Literary Exploration:** Guided discussions on seminal works by authors including Orwell, Hemingway, Emerson, Whitman, and Faulkner
- **Publication:** Spearheaded the compilation and publication of a book featuring select literary contributions from society members

Military Interpreter

Korea Military Academy

Served in the Office of International Affairs

Jan 2015 - Oct 2016

- **Military Service:** Completed mandatory military service as a Korean citizen, serving in a pivotal role at KMA
- **International Relations:** Managed communications with renowned military academies globally, including the U.S. Military Academy at West Point
- **Collaborative Efforts:** Orchestrated Memorandum of Understanding (MOU) processes with diverse entities, notably the National Medical Center

TECHNICAL PROFICIENCY

- **Programming Languages:** Python, C++, MATLAB, Java, JavaScript
- **Robotics & AI:** ROS (Gazebo, RViz), OpenCV, TensorFlow, PyTorch, Simulink
- **CAD & Hardware:** NX(NX Design Academic Certified), CATIA, Solidworks, Arduino, Raspberry Pi
- **Databases & Cloud:** MySQL, MongoDB, AWS (EC2, S3, Lambda)
- **Version & Collaboration:** Git, GitHub, Slack