

YOUNG BIN SONG

Robotics Researcher | Proximity Sensing · Reactive Motion Control
· Learning-Based Manipulation

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PORTFOLIO

RESEARCH PROFILE

M.S. researcher in mechanical engineering focused on robotic proximity sensing and reactive safety control. Hands-on experience spans capacitive/ToF sensor hardware, embedded data acquisition, signal compensation and sensor fusion, self-detection learning, and RMPflow-based motion policies validated on real manipulators. Experienced in integrating reactive safety control with diffusion-policy-based robot behaviors, connecting perception, learned motion generation, and reactive control through an end-to-end HW-SW-control pipeline.

EDUCATION

Sungkyunkwan University

M.S. in Mechanical Engineering · Robotory Lab · Advisor: Prof. Hyuk-Ryeol Choi · GPA 4.0/4.5

Mar 2025 – Feb 2027

Sejong University

B.S. in Mechanical Engineering · GPA 3.93/4.5 (Major GPA 4.05/4.5)

Mar 2019 – Feb 2025

RESEARCH EXPERIENCE

Graduate Researcher, Robotory Lab — Sungkyunkwan University

Mar 2025 – Present

1. Proximity Sensor Hardware & Embedded System

- Designed and fabricated a **robot-mounted proximity sensing system integrating single-ended capacitive and ToF sensors**, including custom sensor PCBs.
- Developed **STM32-based MCU/power boards, I2C data acquisition and CAN communication**, along with a modular mounting structure adaptable to multiple manipulators.

2. Sensor Processing & Reliability

- Implemented drift compensation, adaptive EMA filtering, real-time calibration, and **capacitive-ToF sensor fusion to generate reliable distance estimates for robot control**.
- Developed **MLP-based self-detection compensation** using joint states and sensor signals to suppress false detections caused by the robot's own structure.

3. Proximity-Based Reactive Robot Safety Control

- Integrated proximity distance measurements into **RMPflow-based reactive motion control**, enabling real-time avoidance of humans and dynamic obstacles on the RB10 manipulator.
- Evaluated proximity-based RMPflow against vision-based obstacle perception, demonstrating its effectiveness under camera occlusion and near-field observation limitations.**
- Analyzed local-minimum behavior during obstacle avoidance and developed **TG-RMP, a tangential recovery policy**, to improve recovery performance.

4. Learning-Based Robot Policy

- Integrated Diffusion Policy with proximity-based RMPflow to enable real-time obstacle avoidance during manipulation tasks.**
- Applied **LPB-based OOD detection and action guidance** to detect out-of-distribution states and steer Diffusion Policy actions toward the expert distribution.

SPONSORED RESEARCH PROJECT

실시간 충돌상황 감지 및 회피 지능이 탑재된

Project: Apr 2024 – Dec 2026

로봇충돌 안전용 SoC 통합플랫폼 개발

Ministry of Trade, Industry and Energy (MOTIE), Korea · PI: Prof. Hyuk-Ryeol Choi

- Contributing to collision-response intelligence algorithms and prototype proximity-sensor modules using commercial ADCs, including SoC requirement analysis, integrated sensor-platform architecture, embedded hardware development, and robot-level validation.
- Project objective: integrate capacitive proximity sensing, SoC hardware, and real-time safety intelligence so collaborative/mobile robots can detect nearby obstacles and execute deceleration, stop, or avoidance behaviors.

PUBLICATION & PRESENTATION

"Development of a Capacitive Non-Contact Proximity

Feb 4, 2026

Sensor Platform for Safe Human-Robot Interaction (HRI)"

21st Korea Robotics Society Annual Conference (KRoC 2026) · First author (1st of 4) & presenter

- Presented a modular capacitive proximity-sensor platform with active shielding and environmental drift compensation; robot experiments on UR10 demonstrated stable proximity detection within 20 cm and emergency-stop operation around a 10 cm threshold.

TECHNICAL SKILLS

Robotics & Control

RMPflow; reactive motion policy; collision avoidance; manipulator control; real-time robot control; PREEMPT_RT

Sensors & Signal Processing

Capacitive proximity sensing; ToF sensing; drift compensation; adaptive filtering; calibration; sensor fusion

Embedded Systems

STM32; I2C; CAN; real-time sensor acquisition

Circuit & PCB Design

Altium Designer; sensor PCB; MCU/power circuit; sensor interface circuit

Programming

C/C++, Python, MATLAB; ROS 2

Machine Learning

PyTorch; MLP; sensor self-response modeling; self-detection compensation

CAD & Simulation

SolidWorks, CATIA V5, Inventor; FEM analysis; Rviz

Robot Platforms

RB10, UR10

SELECTED ENGINEERING PROJECTS

AI Farm Protecting — Team Leader & Hardware

Mar – Jun 2023

Sejong University · Inventor, CATIA V5, Arduino

- Led a four-member team to develop a camera-based wildlife deterrence system that identifies animals and activates a water-spray mechanism.
- Owned mechanical using Inventor/circuit design using Arduino and applied CATIA V5 FEM analysis to reduce structural overspecification and optimize the hardware.

Creative Aircraft Competition — Drone Hardware & AI Software

2023

Busan National University President's Cup · CATIA V5, Python, YOLOv8

- Designed and fabricated mission hardware for a six-member drone team and implemented real-time digit recognition for the competition mission.
- Expanded/refined an approximately 1,000-image digit dataset to about 2,000 samples and achieved approximately 98% mAP using YOLOv8.

All-In-One Hand Wash — Team Leader & AI Software

Mar – Jun 2024

Sejong University · Python, MediaPipe, K-NN

- Led a four-member software team for a gesture-controlled hand-washing/drying system; used SWOT/QFD analysis to define user needs and system direction.
- Built gesture recognition with MediaPipe hand landmarks and angle features, trained a K-NN classifier, and reported approximately 96.8% recognition accuracy.

AWARDS

Top Excellence Award (최우수상), College of Engineering

Sep 2022

Sejong University · Team lead; space-elevator feasibility study using CATIA V5/FEM and MATLAB

Top Excellence Award (최우수상), Creative Aircraft Competition

Sep 2023

Busan National University President's Cup

CERTIFICATIONS & LANGUAGES

Certifications

ADsP (Advanced Data Analytics Semi-Professional), 2025 · Computer Specialist in Spreadsheet & Database, Level 1, 2022

Languages

Opic - Intermediate Mid 2 (2026)

ADDITIONAL INFORMATION

Military Service: Republic of Korea Army, Staff Sergeant (NCO) - completed service (Aug 2020 - Aug 2022).