Changhun Park

University of Illinois Urbana-Champaign

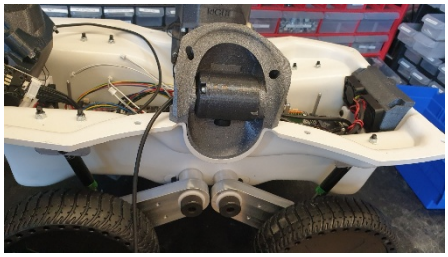
MS: Computer Science-data science
BS: Mechanical Engineering(major), Computer Science(minor),
Electrical & Computer Engineering(minor)

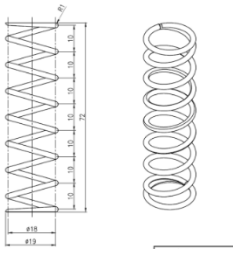
☎ 217-419-9084 ✉ chp2@illinois.edu

Introduction

This portfolio highlights R&D outcomes directly relevant to robotics research and development, particularly in autonomous systems, perception, and hardware–software integration.
Using Python, C++, ROS, and Doosan Robotics Language, I have developed robotic arm control algorithms and autonomous navigation logic. I have also implemented systems that reliably operate in real-world environments by fusing data from LiDAR, cameras, and infrared sensors.

Suspension Improvement in Terra Sentia (Earthsense, 2021)





Problem/Background

TerraSentia is an autonomous agricultural robot operating over 10 hours per day in field environments. During operation, excessive vibration caused frequent sensor data errors and mechanical failures. Vibration suppression was therefore identified as a critical requirement for ensuring reliable autonomous performance.

Solution:

- Designed coil springs with elastic coefficients optimized for vibration absorption
- Fabricated custom mechanical components via CNC machining
- Measured and analyzed shock and vibration patterns using the TRACKER system

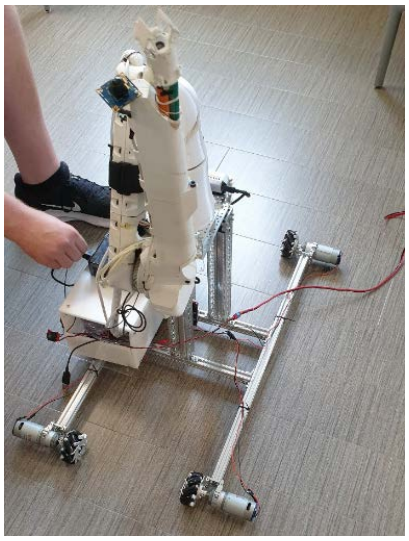
Result:

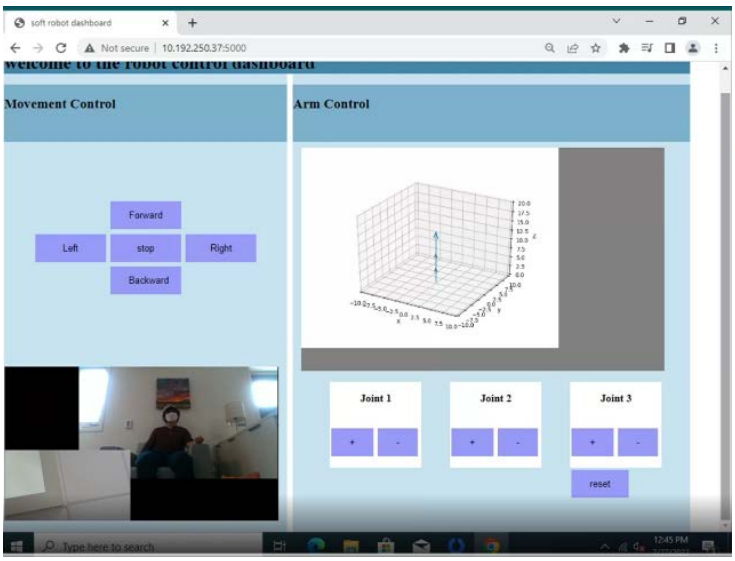
- Improved robot durability → approximately 20% reduction in field failure rate
- Significantly improved sensor data stability

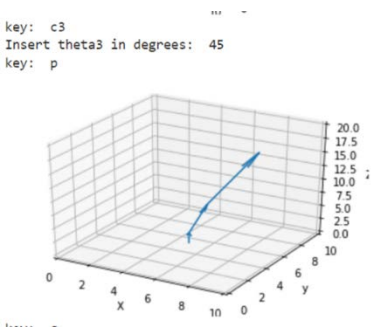
Lesson Learned:

This project strengthened my understanding of the relationship between mechanical design and sensor data reliability, demonstrating that physical vibration mitigation is directly linked to robust autonomous perception.

Soft and Dexterous Service Robot Configuration **(Health Care Engineering Systems Center, Jump Arches, UIUC 2022)** jump | ARCHES







Problem/Background

In medical tele-diagnosis robots, limited joint degrees of freedom (DoF) and the lack of an intuitive user interface significantly reduced usability, making clinical deployment difficult.

Solution:

- Redesigned the robotic arm using DFM principles, increasing DoF from 2 to 4
- Developed detailed 3D CAD models using AutoCAD and Inventor
- Implemented a GUI-based remote control and monitoring system

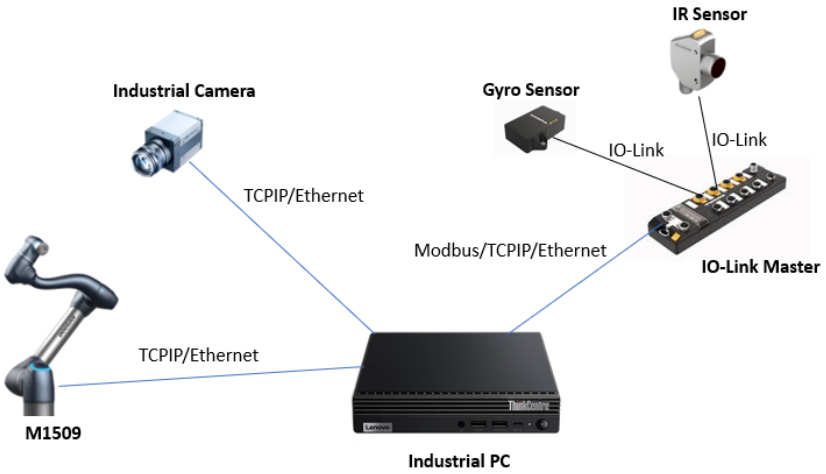
Result:

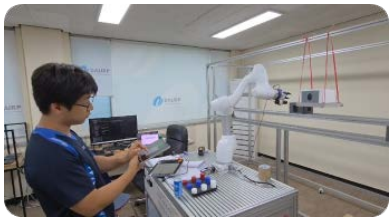
- Expanded joint workspace and dexterity
- Improved usability through a user-friendly interface
- Enabled real-time remote control and monitoring

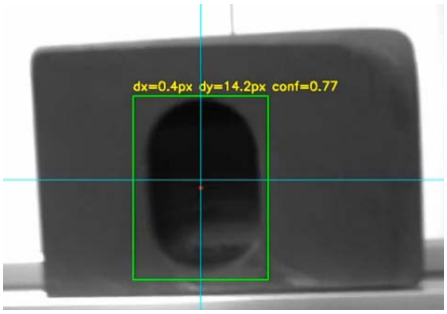
Lesson Learned:

Effective real-time remote operation requires **low-latency sensor data processing and robust control algorithms**, especially in healthcare environments.

Autonomous Lashing Robot System (Smart Applied Technology Research Center, Dong-A University 2025)







Problem/Background

Container lashing operations in port terminals are still largely labor-intensive, posing significant safety risks during typhoon conditions. The goal of this project was to develop an autonomous lashing robot system using the Doosan collaborative robot M1509. The main key challenges were accurate recognition of container corner castings using cameras at 13m elevation under strong wind and compensation for robot body tilt during operation

Solution:

- Reduced outdoor image noise using Kalman filtering and Gaussian blur
- Fine-tuned using YOLOv8 model for robust corner casting detection in outdoor environments
- Measured robot-to-target distance using IR sensors
- Measured robot body tilt via gyro sensors and corrected posture using hydraulic cylinders
- Developed robotic arm control programs using Doosan Robotics Language
- Designed a TCP/IP-based communication architecture ensuring stable real-time data exchange between robot, camera, and sensors

Result:

- Achieved 95% corner casting recognition accuracy in outdoor conditions
- Successfully demonstrated autonomous lashing fastening and release

Lesson Learned:

This project provided practical experience in:

- Computing 3D object center coordinates using industrial cameras and distance sensors
- Designing real-time TCP/IP communication systems for robots and sensors
- Applying industrial communication standards such as IO-Link and Modbus