Yuseop Sim

West Lafayette, IN 47906 +1 (765) 237-2349 sim46@purdue.edu
LinkedIn: https://www.linkedin.com/in/yuseopsim/

EDUCATION

Purdue University, West Lafayette – Doctoral Degree (Mechanical Engineering) **Jun 2023 - Present**
Concentrations: Cell-based manufacturing, Machine monitoring with ML, Digital Twin, Mobile Robot Path planning

Kyungpook National University, Daegu – Master's Degree (Mechanical Engineering) **Mar 2020 – Aug 2022**
Concentrations: Field Robot & Circuit Development, Rehabilitation Robot Control, Mobile Robot SLAM

- Dissertation: Optimal Design of 2-DOF Wearable Upper Limb Rehabilitation Robot in Activities of Daily Living

Kyungpook National University, Daegu – Bachelor's Degree (Mechanical Engineering) **Mar 2014 – Feb 2020**
Concentrations: Mechatronics, Computer vision & Path planning

- Thesis: Implementation of Optimal Path through Hardware Improvement of Caterpillar Robots

PROFESSIONAL / TEACHING EXPERIENCE

Purdue University - *Graduate TA*

- Control Lab (ME375 – 2024S, ME365 – 2023F), IIoT in manufacturing (ME597 – 2025S)

Keyon System, Daegu – Research Engineer **Sep 2022 – May 2023**
Concentrations: Develop mobile robot for soil compaction (caterpillar typed), Design mechatronics learning modules

Visiting Scholar (Purdue University), West Lafayette **Sep 2019 – Mar 2022**
Concentrations: Develop virtual robot-haptic force feedback system, Design haptic device

Kyungpook National University - *Graduate TA & Head TA*

- Microcontroller (MCU) Lab (2020S, 2021S, 2022S), Basic Electrical and Electronic Lab (2020F)

LEADERSHIP AND INVOLVEMENT

Vertically Integrated Projects (VIP) – Mentor **working w/ Prof. Ali Shakouri**
Concentrations: Deploy internal sound sensor (ISS) and make data pipelines in Indiana SMEs

- AI_Industrial IoT Implementation (AI IIOT)

SE-KNU Project - Mentor
Concentrations: Development and control mobile robot combined with delta-robot

AWARD AND HONORS

- Student Best Poster Award (DigiTwin 2024 for Manufacturing, Sustainability, Safety, and Resilience)
- Young Professional NET Award 2024
- **NAMRC Blue Sky Competition Finalist 2024**
- **2nd Best Poster Award (VIP Tutoring)**
- Scholarship for Academic Excellence (2014-2015 & 2018-2021)

PUBLICATIONS

(Under Review)

- H. Lee, **Y. Sim**, C. Han, M. B. G. Jun, and J. Lee*, “GRAVITON: Generalized Resampling Algorithm for Visual Inference in Target Object Localization” (Computers in Industry, Under Review, 2024)
- **Y. Sim**, S. Choi, H. and H. Yi*, "Moving Window-based Active Assisted Mode Control using Upperlimb Wearable Rehabilitation Robots" (Intelligent Service Robotics, Under Review, 2025)
- E. Kim, H. Lee, **Y. Sim**, J. Lee, M. B. G. Jun*, “Overcoming Sparse Run-to-Failure Challenges in Manufacturing: A Contrastive Mixer Framework for Remaining Useful Life Prediction” (CIRP annals, Under Review, 2025)
- H. Lee, C. Han, T. Gabor, **Y. Sim**, S. Akin, M. B. G. Jun, and J. Lee* “Cold Spray-Enabled Physically Unclonable Identifier and its Spectral Authentication via Implicit Neural Representation” (IEEE Transactions on Industrial Informatics, Under Review, 2025)
- **Y. Sim**, J. Lee, H. Lee, D. Yun, N. Myeong, Y. Hwang, H. Park, M. B. G. Jun and E. Kim* “Sound Data Augmentation Using Frequency Response Superposition for Machine Tool State Recognition” (Journal of Manufacturing Science and Engineering, 2025)

1. J. Jeon, **Y. Sim**, C. Han, D. Yun, H. Lee, M. B. G. Jun, Y. J. Kim, S. W. Lee, and J. Lee*, “ChatCNC: Conversational Machine Monitoring via Large Language Models and Real-Time Retrieval Augmented Generation,” Journal of Manufacturing Systems 79 (2025): 504-514.
2. J. Lee, S. Akin*, **Y. Sim**, H. Lee, E. Kim, J. Nam, K. Song, M. B. G. Jun*, “A Stethoscope Sound-Guided Interpretable Deep Learning Framework for Powder Flow Diagnosis in Cold Spray Additive Manufacturing” Manufacturing Letters, 41, pp. 1515-1525 (2024)
3. C. Han, J. Lee, H. Lee, **Y. Sim**, J. Jeon, and M. B. G. Jun* “Zero-shot Autonomous Robot Manipulation via Natural Language” Manufacturing Letters, 42, pp. 16-20 (2024)
4. S. Akin*, T. Chang, S. S. H. Abir, Y. W. Kim, S. Xu, J. Lim, **Y. Sim**, J. Lee, C. Nath, H. Lee, W. Wu, J. Samuel, C. H. Lee*, and M. B. G. Jun*, “One-step Manufacturing of Functionalized Electrodes on 3D-Printed Polymers for Triboelectric Nanogenerators” Nano Energy, 129, pp. 110082-110097 (2024)
5. H. Park, M. Shin, G. Choi, **Y. Sim**, J. Lee, H. Yun, M. B. G. Jun, G. Kim, Y. Jeong and H. Yi*, “Integration of an Exoskeleton Robotic System into a Digital Twin for Industrial Manufacturing Applications” Robotics and Computer-Integrated Manufacturing, 89, pp. 102746-102754 (2024) (Top 10% in Robotics & Computer Science) ·
6. H. Park, **Y. Sim**, O. Kwon, H. Yi *, S. Lee, “Design of Compound Planetary Gear Reducer for Mobile Robot Actuator”, Journal of the Korean Society of Mechanical Technology, 23(2), 254-259. (2021)
7. M. Kim, **Y. Sim**, S. Lee, H. Yi*, “Enhancing Mobility Using Optical flow Estimation of a Tracked Mobile Robot on Unstructured Environment”, Journal of the Korean Society of Mechanical Technology, 21(6), 1131-1135. (2019)

CONFERENCE

(Under Review)

- H. Lee*, **Y. Sim**, C. Han, J. Lee, A. Bera, M. B. G. Jun, "NeuroSafe: Implicit Neural Function for Safe Set Composition" (IEEE/RSJ International Conference on Intelligent Robots and Systems, Under Review 2025)

1. **Y. Sim**, J. Lee, H. Lee, D. Yun, N. Myeong, Y. Hwang, H. Park, M. B. G. Jun and E. Kim* "Sound Data Augmentation Using Frequency Response Superposition for Machine Tool State Recognition" International Manufacturing Science and Engineering Conference, 2025
2. M. B. G. Jun, J. Lee, C. Han, J. Jeon, **Y. Sim**, "Language of Everything in Manufacturing (LEM)," 52nd SME North American Manufacturing Research Conference (NAMRC), 2024. – SME Blue Sky Competition Finalist
3. J. Lee, S. Akin, **Y. Sim**, H. Lee, E. Kim, J. Nam, K. Song, M. B. G. Jun, "A Stethoscope Sound-Guided Interpretable Deep Learning Framework for Powder Flow Diagnosis in Cold Spray Additive Manufacturing," 52nd SME North American Manufacturing Research Conference (NAMRC), 2024.
4. H. Lee, **Y. Sim**, H. Park, H. Park, H. Yi*, "Development of Educational Mobile Soccer Platform Teaching Mechanical Design and Fabrication for Mechanical Engineering", ASME 2020 International Mechanical Engineering Congress and Exposition, 2020
5. H. Yi*, J. Kong, D. Kim, Y. Won, **Y. Sim**, "Design of Hand Rehabilitation Device with Four Bar Linkage", Korean Society for Precision Engineering Conference, 2020
6. J. Kong, J. Ha, **Y. Sim**, Y. Kwon, H. Yi*, "Design of Robotic Manipulator for Rehabilitation Education", The Korean Society of Mechanical Engineers Conference, 2018

CONFERENCE (POSTER)

1. **Y. Sim**, J. Lee, H. Lee, D. Yun, N. Myeong, N., Hwang, Y. Hwang, H. Park, M. B. G. Jun and E. Kim*, "Sound Data Augmentation Using Frequency Response Superposition for Machine Tool State Recognition" Manufacturing And Materials Research Laboratories Symposium, 2024
2. Lee, J., Jeon, J., **Sim, Y**., Lee, H., Han, C., Yun, D., & Jun, M.* "Generative AI Based Real-Time Human-Data Interaction for Smart Manufacturing" Presented at Digital Twin for Manufacturing Sustainability, Safety, and Resilience, 2024
3. Lee, H., **Sim, Y**., Lee, J., Han, C., & Jun, M.* "Digital Twin & Vision Guided Autonomous Robotic Path Planning" Presented at Digital Twin for Manufacturing Sustainability, Safety, and Resilience, October 2024
4. Jun, M.*, Lee, J., Kim, E., **Sim, Y**., Han, C., & Lee, H. "Generalized and Generative AI for Smart Manufacturing" Presented at International Conference on Precision Engineering and Sustainable Manufacturing, July 2024
5. Lee, J.*, Kim, E., Han, C., Lee, H., & **Sim, Y**. "Generalized and Generative Smart Manufacturing" Presented at North Academy of Engineering Regional Meeting, March 2024
6. H. Park, **Y. Sim**, H. Park, and H. Yi*, "Optimal Design of 2-DOF Upper Limb Wearable robot with Particle Swarm Optimization, IEEE International Conference on Robotics and Automation, May 2023
7. H. Park, H. Park, **Y. Sim**, H. Yun, C. Park, M. B. G. Jun, and H. Yi*, "Human Involved Cyber Physical System using Virtual Reality Interface, ASME Manufacturing Science and Engineering Conference, West Lafayette, Indiana, United States, June 2023
8. **Y. Sim**, H. Park, H. Yun, D. Lee, S. Lee, M. B. G. Jun, and H. Yi*, "Development of Robot arm-type Haptic Feedback device for Virtual Reality-based robotic Manufacturing", ASME Manufacturing Science and Engineering Conference, West Lafayette, Indiana, United States, June 2022

PROJECTS

1. Advanced Battery Management System for Real-Time Flight Range Optimization and Stability Enhancement of AAM Aircraft with Non-intrusive Sensor Fusion and Battery Aging Diagnosis – funded by Korea Institute of Advancement of Technology (KIAT), South Korea (Project Budget: $4,500,000)
   (Aug 2024 ~ Present)
   - Development of a BMS for high-precision real-time diagnosis and battery state monitoring
2. A Manufacturing Monitoring System Using Sound Spectrograms and Artificial Intelligence − funded by U.S. National Science Foundation (NSF), SBIR Phase Ⅱ (Project Budget: $1,000,000)
   (May 2024 ~ Present)
   - Development of a novel sound sensor for capturing internal machine sounds
3. Human Centric, Resilient, and Sustainable Cyber Physical System (CPS) for Future Factories – funded by Hitachi American Ltd. (Project Budget: $20,000)

(May 2024 ~ Present)
- Digitalization of operators' motions during manufacturing tasks

4. Development of Smart Manufacturing Multiverse Platform Based on Multisensory Fusion Avatar and Interactive AI - Korea Evaluation Institute of Industrial Technology (KEIT) (Project Budget: $300,000)
   (Jan 2024 ~ Present)
   - Using Multisensory avatar robots, large language/vision model-based AI agents, and a factory-scale digital twin
5. Development of AI-Based Robot Technology for Machining Chip Recognition and Removal – funded by Korea Institute of Machinery & Materials (KIMM) (Project Budget: $250,000)
   (Jan 2024 ~ Present)
   - Development of an autonomous robotic system that adaptively recognizes and removes the machining chips in CNC machines
6. Privacy Preserving Tiny Machine Learning Edge Analytics to Enable AI-Commons for Secure Manufacturing – funded by U.S. National Science Foundation, FMRG: Manufacturing USA (Project Budget: $3,000,000)
   (03/2023 ~ Present)
   - Optimization of the IoT-based Tiny Machine Learning (TinyML) framework and design of privacy and confidentiality policies for an AI-Commons, demonstrating the data aggregation and predictive technical cost modeling for foundational manufacturing processes.
7. Immersive & Interactive Cyber-Physical System Utilizing AI/ML To Train, Operate and Optimize Machine Vision Guided Sealant Robot – funded by U.S. Air Force SBIR AF21B Phase 2 (Project Budget: $275,000)
   (Mar 2023 ~ May 2024)
   - Collaboration with BCI company to automate the sealing process using digital twin-integrated collaborative sealant robots equipped with multi-vision systems and intelligent AI agents.
8. Characterization, Analysis, and Improvement of On-Body Injection Delivery System – funded by Abbvie (Project Budget: $430,000)
   (Mar 2023 ~ Present)
   - Analysis and modeling of the mechanical/electrical characteristics of the automatic on-body delivery system (OBDS), with a focus on optimizing its efficiency.

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9. Development of Mobile Robot for Soil Compaction - funded by Keyon System, South Korea
   (Sep 2022 - May 2023)
   - Developed the caterpillar typed mobile robot with two of 2-DOF compactor
10. Development of a Smart Exercise Equipment - funded by KITECH
    (Sep 2022 – Dec 2023)
    - Developed differential driving gear mechanism and relevant control circuit

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11. AI-Based Robot Monitoring & Operation for Surface Finishing - funded by Institute of Information & Communications Techonology Planning & Evaluation, Ministry of Science and ICT, South Korea
    (May 2021 - Aug 2022)
    - Developed the master haptic device considering the grinding task
12. Under Wideband Sensor Node Technology Research - funded by Defense Acquisition Program Administration, South Korea
    (Sep 2020 - Aug 2022)
    - Developed the control system of intelligent sensor with piezoelectric materials
13. Development of Warm Needling Acupuncture Procedure with Electrical Moxibustion Device - funded by Ministry of Health and Welfare, South Korea
    (Mar 2020 - Jun 2022)
    - Controlled a temperature device with MCU (ATmega88) to regulate the temperature of warm needles
14. Development of an Automated Construction System for Amha-Rets Residential Eco-Friendly Traditional Rammed Earth Wall Method
    (Jan 2021 – Feb 2021)
    - Development of Mobile Robot for Soil Compaction
15. Development of a Mobile Robot for Rough Terrain Mapping - Working with Hydrobot Tech & Research
    (Jan 2021 – Sep 2021)
16. Development of Upper Limb Rehabilitation Device for Daily Living Motion - funded by National Rehabilitation Center, Ministry of Health and Welfare, South Korea
    (May 2020 - Apr 2021)
    - Developed an exoskeleton robot arm for hand, wrist, and elbow joint rehabilitation

17. Development of an Educational Platform for Impedance Control - Funded by the Korea Institute of Industrial Technology
    (Sep 2020 – Nov 2020)
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18. Development of a hybrid robotic system with reliable capability in outdoor through self-docking of swarm-modular multi-legged robots
    (Mar 2018 – Feb 2020)
    - Developed a hybrid modular-swarm robot system that enables stable hardware capabilities required for locomotion and task execution in various external environments by transforming the robot mechanism through docking
19. Development of a Mannequin Simulator for Rehabilitation Assistant Training
    (Mar 2018 – Feb 2020)
    - Integrated 6-DOF motor controller and sensor data via CAN communication using NI-Labview