Ajay Anand

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Developing physiologically informed robotic systems through integrated sensing, control, and gamified interaction for upper-limb rehabilitation.

EDUCATION

University of Utah | Salt Lake City — **Ph.D. – Robotics | Aug 2024 – Current**

Research Focus: Leveraging human sensing (sEMG, motion capture, force-torque sensing, SMG) integrated with control and motion planning algorithms, and gamified interfaces to develop cohesive, physiologically informed robotic rehabilitation systems for targeted upper-limb therapy.

University of Pennsylvania | Philadelphia, PA — **MSE - Robotics and Artificial Intelligence | May 2022**

Manipal University | Dubai, UAE — **B. Tech - Mechatronics, Robotics and Automation | Oct 2019**

WORK EXPERIENCE

Recupero Robotics | Philadelphia, PA — **Software Engineer (Part Time) | Dec 2023 – Jun 2024**

Rehab Robotics Lab | Philadelphia, PA — **Research Engineer | Jul 2022 – Jun 2024**

Graduate Research Assistant | Apr 2021 – May 2022

Full-time role focused on the design, integration, and evaluation of robotic systems for telepresence rehabilitation care.

- Engineered and maintained novel robotic systems for upper-limb rehabilitation, integrating sensing, control, and software subsystems into deployable platforms.
- Upgraded humanoid robots to enable **socially assistive, telepresence-based rehabilitation**, enhancing clinician–patient engagement and remote care.
- Developed **computer vision and deep learning models** to assess rehabilitation performance and quantify motor recovery in upper-extremity impaired individuals.
- Built the **complete ROS-based software stack**, including operator control, semi-autonomous navigation (SLAM), RS485 serial communication, and motor position control (Dynamixel actuators).
- Modeled and prototyped **mechanical components in SolidWorks** for integration with sensing and actuation hardware.
- Led **research and clinical trials** evaluating robot-augmented telepresence rehabilitation, analyzing multimodal data to test user and performance hypotheses.
- Co-authored peer-reviewed publications on **EEG-based action observation** and **telepresence rehabilitation outcomes** presented at international robotics conferences.

TECHNICAL SKILLS

Programming Languages: Python, C++, MATLAB, Java

Robotics/Control Systems: Robot Operating System (ROS), Simulink, Microcontrollers, Microprocessors, Serial Communication Protocols (TTL, RS485), Siemens PLC Logic Design, SCADA System Design.

Machine Learning / Computer Vision / AI: Deep Learning (PyTorch), Scikit Learn, NumPy, Pandas, Computer Vision (OpenPose, CV2)

CAD / Mechanical Design: SolidWorks, CATIA

Cloud & DevOps: Docker Containers, Git, Bash, Build Tools (Cmake, Colcon), Apache Spark, Oracle Cloud CLI, AWS CLI,

Databases: MySQL, SQLite

Operating Systems: Linux (Ubuntu, Debian), Windows, MacOS

PUBLICATIONS IN PEER-REVIEWED CONFERENCES AND JOURNALS

Exploring EEG Responses During Observation of Actions Performed by Human Actor and Humanoid Robot in 2024 10th IEEE RAS/EMBS International Conference for Biomedical Robotics and Biomechatronics **(BioRob)**

Age, Motor Function, and Cognitive Function Influence Preferences for Telerehabilitation Mediated by a Social Robot Augmented with Telepresence in IEEE Transactions on Neural Systems and Rehabilitation Engineering, 2025

An Extensible Platform for Measurement and Modification of Muscle Engagement During Upper-Limb Robot-Facilitated Rehabilitation in 2025 International Conference on Rehabilitation Robotics **(ICORR)**

SELECTED PROJECTS

Human Pose Detection for Impairment Prediction in Clinical Rehabilitation Environments: Used OpenPose and Kalman filtering to process video data and extract smoothed joint positions to classify participants into 4 impairment groups (no, mild, moderate and severe)

Counting Machine Parts: Segmenting Dense Objects in Occluded Environments: Successfully counted machined parts in difficult, crowded, and highly occluded environments using a combination of Hough transforms, Mask-RCNN, and few-shot density estimation algorithm **(Mean Average Error of less than 2 on counting the number of machined parts in an image)**

Linear Quadratic Regulator Minimum Snap Trajectory Planning for Quadrotor in ROS: Developed a method for generating minimum snap trajectories for quadrotors by using the A* algorithm to find an initial path, the Douglas-Peucker algorithm to simplify it, and then using LQR to generate a minimum snap trajectory, with the method successfully tested in both Python and ROS Gazebo simulations.

SERVICE

Reviewer, *IEEE RAS/EMBS BioRob [2023-Current]; ACM/IEEE HRI [2025-Current]*

Governance Chair, *Engineering Graduate Student Council, University of Utah [2024–Present]*

Director of Fund Management, *Graduate & Professional Student Assembly, University of Pennsylvania [2021–2022]*

Robotics Department Representative, *Graduate Student Engineering Government, University of Pennsylvania [2020–2022]*

Mechatronics Representative, *Student Oversight Council, Manipal University [2017–2019]*

Student Organizer, *IEEE Robotics & Automation Society (RAS), Manipal University [2018–2019]*