

# Achyuthan Unni Krishnan

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## EDUCATION

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### Worcester Polytechnic Institute (WPI)

Worcester, MA

- PhD, Robotics Engineering, GPA: 4.00 / 4.00

Aug. 2020 – Present

### Worcester Polytechnic Institute (WPI)

Worcester, MA

- Master of Science, Mechanical Engineering, GPA: 3.93 / 4.00

Aug. 2018 – Aug. 2020

### Amrita University

Coimbatore, India

- Bachelor of Technology, Mechanical Engineering, GPA: 8.52 / 10.00

Aug. 2012 – Aug. 2016

## SKILLS

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- **System and Software:** ROS, Unity, OpenCV, Tensorflow, Pytorch
- **Programming Languages:** Python, C#, MATLAB, C++

## WORK EXPERIENCE

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### Associate Design Engineer, Rober Bosch Engineering And Business Services Coimbatore, India, Sep. 2016 – May 2018

- Worked on design and development of heating solutions for diesel exhaust treatment systems.
- Worked on sensor integration for level sensing applications in coolant pumping systems.

## RESEARCH EXPERIENCE

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### Intuitive and Efficient Control Interfaces for Teleoperation

Worcester, MA, May. 2019 - Present

- Developed and compared various teleoperation control interfaces for a mobile bi-manual nursing robot (TRINA).
- Implemented control interfaces based on a gamepad, Phantom Omni and Vicon human motion capture system.
- Developed an object localization system using a Mask-RCNN architecture for shared autonomous teleoperation.
- Ran a user study to validate the efficiency of motion-mapping interface based on user performance and reduced workload.
- Identified precise motions and task-specific actions require robot assistance and interface augmentation.

### Augmented Reality and Haptic Cues for Remote Manipulation Interfaces

Worcester, MA, Aug. 2021 – Present

- Developed a motion mapping interface for a Kinova Gen3 arm with an HTC Vive VR system.
- Different levels of autonomy were designed to assist the operator with a pick and place manipulation task to varying degrees.
- Developed a vibro-tactile haptic interface to notify operators about object distance, successful object grasping and placing.
- Developed Augmented reality interfaces indicating intent of autonomy, environmental obstacles and task success.

### Gaze Based Intent Inference and Workload Estimation

Worcester, MA, Jan. 2022 – May 2023

- Implemented a gaze adaptive visual interface for manipulation based on gaze motion detected by Tobii Nano screen tracker.
- Identified gaze allocation in regions of interest and correlated with task state, AR cues for object pick/place was provided.
- Developed a novel cognitive workload index based on gaze motion, gaze allocation and pupil-based stress inference.

### Reward Engineering for Autonomous Pick and Place Actions

Worcester, MA, Aug. 2019 – Dec. 2019

- Engineered autonomous pick and place with a robotic arm using DDPG with Hindsight Experience Replay in OpenAI Gym.
- Implemented several reward designs based on distance and motion based heuristics to improve the baseline implementation.
- Achieved a 40% improvement from the baseline architecture in terms of time of convergence for optimal solution.

## SELECTED PUBLICATIONS

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[1] Achyuthan Unni Krishnan, Tsung-Chi Lin and Zhi Li, “Human Preferred Augmented Reality Visual Cues for Remote Robot Manipulation Assistance: from Direct to Supervisory Control.”, Accepted by IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2023.

[2] Achyuthan Unni Krishnan, Tsung-Chi Lin, and Zhi Li, “Design interface mapping for efficient free-form tele-manipulation.”, by IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2022.