# Neha Pusalkar

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## EDUCATION

**Oregon State University, Corvallis, OR** **2026 (Expected)**
Ph.D. Robotics and Artificial Intelligence

**University of Michigan, Ann Arbor, MI** **2021**
Master of Science in Engineering in Robotics (3.6/4.0).

**Visvesvaraya National Institute of Technology (VNIT), Nagpur, India** **2018**
Bachelor of Technology in Electronics and Communication Engineering (8.78/10).

## TECHNICAL SKILLS

- Programming Languages: C, C++, Python, Embedded C, MATLAB, Basic Javascript and C#.
- Software and libraries: Unity, ROS, Pytorch, TensorFlow, OpenCV, MATLAB, SolidWorks, Eagle CAD, Gazebo, Cura.
- Other: Docker, Git, Linux, Arduino, OpenCM, Atmega series microcontrollers.

## SELECTED PUBLICATIONS

- **Neha G. Pusalkar**, Julie A. Adams, 'Leader-based Coalition Formation for Extremely Large Scale Collectives', 2025 IEEE Conference on Artificial Intelligence, pp. 701-706, May 2025 (Best Paper Award in Robotics/UAV Vertical).
- **Neha Girish Pusalkar**, Mark-Robin Giolando, Julie A. Adams, 'Decision Support System for Autonomous Underwater Grasping', Late Breaking Report, Companion of 2023 ACM/IEEE International Conference on Human-Robot Interaction, pp. 198-202, March 2023
- **Neha Girish Pusalkar,** Mark-Robin Giolando, Julie A. Adams, 'Autonomous Underwater Robot Grasping Decision Support System', Videos and Demos, Companion of 2023 ACM/IEEE International Conference on Human-Robot Interaction, pp. 887-888, March 2023
- Alphonsus Adu-Bredu, Zhen Zeng, **Neha Pusalkar,** Odest Chadwicke Jenkins, 'Elephants Don't Pack Groceries: Robot Task Planning for Low Entropy Belief States', IEEE Robotics and Automation Letters, vol. 7, no. 1, pp. 25-32, Jan. 2022
- Xiaoxiao Du, **Neha Pusalkar,** Ram Vasudevan, Matthew Johnson-Robertson, 'Angle-Regulated Transformer Network for Pedestrian Trajectory Prediction', AI for Autonomous Driving (AI4AD) Workshop, International Joint Conference on Artificial Intelligence (IJCAI) 2021.
- **Pusalkar, N.*,** Karmakar*, S., Aggrawal, R., Mali, P., Singh, A., Sarkar A., Krishna M.K., 'SMA Actuated Dual Arm Flexible Gripper', In Proceedings of the Advances In Robotics 2019 (AIR 2019) , Association for Computing Machinery, New York, NY, USA, Article 59, 1-6.
- Banerjee, H.*, **Pusalkar, N.***, and Ren, H., 'Preliminary Design and Performance Test of Tendon-Driven Origami-Inspired Soft Peristaltic Robot', 2018 IEEE International Conference on Robotics and Biomimetics (ROBIO), pp. 1214-1219, December 2018.
- Banerjee, H., **Pusalkar, N.**, and Ren, H., 'Single-Motor Controlled Tendon-Driven Peristaltic Soft Origami Robot', ASME Journal of Mechanisms and Robotics 10(6), 064501.
- Patent for Humanoid Robot Swayat – Granted by The Patent Office, Government of India.

## RESEARCH

**Human-Machine Teaming Lab, OSU | Graduate Research Assistant** **2021 - present**

- Developing methods for real-time coalition reformation and online planning for multi-robot systems operating in uncertain and dynamic conditions for my dissertation research. Specifically, the focus is on developing techniques that address mission contingencies such as the arrival of new tasks, continuously evolving task requirements, and changing task priorities by reallocating robot coalitions and replanning during mission.
- Developed a hedonic-game based leader-follower coalition formation algorithm that demonstrated a 10 times runtime reduction compared to an existing hedonic coalition formation algorithm for extremely large scale collectives (i.e., up to 10,000 simulated robots)
- Formulated a dependency graph explaining the interrelationships of factors affecting coupling in multi-robot systems, thus attempting to broaden the concept of coupling beyond task and robot-oriented perspectives.
- Performed a detailed literature review in dynamic multi-robot coalition formation and team reformation techniques.
- Developed a Decision Support System and a User Interface that provided visualization and interaction capabilities to assist a human operator in autonomous underwater grasping.

**Laboratory for Progress, UM | Graduate Researcher** **2020 - 2021**

- Developed a high-level planner that used spatial relations derived from scene graph to choose preferred actions for object search using Monte Carlo Tree Search (MCTS).
- Established baseline POMCP method for the multi-object domain while maintaining beliefs over objects via Bayesian updates, and graphically visualized belief propagation at each step of the simulation.
- Developed a node graph visualizer in Javascript to show the supporting relations among cluttered objects as received from a ROS message.

**UM Ford Center for Autonomous Vehicles, UM | Graduate Research Assistant** **2020 - 2021**

- Developed angle-regulated transformer models that specifically accounted for shape and smoothness of trajectories to improve pedestrian trajectory prediction.
- Implemented SOTA pedestrian trajectory prediction methods like SGAN, Social LSTM, Next Prediction, DAGnet, Social-STGCNN, and created a data loader for evaluating these methods on the Stanford Drone Dataset (SDD).
- Achieved crosswalk detection using template matching, Haar cascade classifier, and Laplacian of Gaussian.
- Performed Semantic Segmentation using FCNN, DeepLabv3, encoder-decoder model, SegNet.

## EXPERIENCE

**Honda Research Institute (HRI) Ann Arbor, MI, USA | Student Associate** **Jan 2024 – Mar 2024**

- Conducted a detailed literature survey of dynamic coalition formation algorithms for multi-robot systems.
- Developed a market-based dynamic coalition formation algorithm for allocating tasks with different priorities and stochastic arrival times, and a designed a multi-objective utility function.
- Incorporated coalition reformation capability by prioritizing urgent tasks and disbanding coalitions of lower priority tasks whenever necessary.

**International Institute of Information Technology (IIIT-H), Hyderabad, India |Research Assistant** **2018 - 2019**

- Developed a flexible gripper with rubber belts for gripping objects with variable curvatures (25-190 mm) and different textures (wood, plastic, metal).
- Designed gripping mechanism with 1-way Shape Memory Alloy and belt interlocking mechanism with magnets.

**Autonomous Robots and Multi-Robot Systems Lab, IIT-Bombay, Mumbai, India | Intern** **Dec 2017**

- Created a differential drive robot model having Hokuyo laser range sensor in Gazebo for navigation in custom-made world built using Building Editor.
- Set up navigation stack and did mapping and localization using gmapping package and AMCL node respectively.

**Medical Mechatronics Lab, National University of Singapore (NUS), Singapore | Summer Intern** **May 2017 – Jul 2017**

- Fabricated a prototype of origami-inspired peristaltic soft robot using Yoshimura Origami Fold pattern.
- Achieved peristaltic motion with compression spring mechanism, and continuous rotation servo motor controlled by Arduino UNO.
- Designed supporting structures shaped in mountain-valley fold pattern to prevent non-axial deformation caused by spring buckling.

**Gade Autonomous Systems Private Limited, Mumbai, India | Summer Intern** **May 2016**

- Implemented image processing algorithms for marker detection and line tracking using OpenCV and Ubuntu 14.04.
- Developed independent software modules for these tasks and integrated them in the NAOqi SDK for the Nao robot.

## PROJECTS

**Robotics System Laboratory** **Jan 2020 – Apr 2020**

- Designed a cascaded PID controller with successive loop closure using wheel odometry and gyrodometry for 2-wheeled Segway robot.
- Implemented occupancy grid mapping, particle filter-based Monte Carlo Localization, and A* path planning for a two wheeled differential drive robot in simulation.
- Developed trajectories for pick and place task using inverse kinematics for a 4DOF manipulator.

**Vehicle Classification in Images** **Nov 2019 – Dec 2019**

- Implemented Transfer Learning using Mask-RCNN for classification of vehicles into 4 classes achieving about 95% accuracy.

**Firefighter Rescue System based on Indoor Localization of WSN using ANN** **Aug 2017 – Mar 2018**

- Localized randomly deployed wireless sensor nodes by calculating distances between blind and anchor nodes using log distance path loss model and estimating position coordinates using Multi-Layer Perceptron Network using the Neural Network Toolbox in MATLAB.

- Measured RSSI values for distance calculation using Crossbow IRIS motes and MoteView software.
- Experimented with various parameters like activation functions of neurons and number of neurons in hidden layer to find their optimal values.

**Swayat – 20DOF Kid-sized Humanoid Robot.** **Feb 2016 – Dec 2016**

- Assembled 20 DOF humanoid robot using Herkulex DRS 101 and DRS 201 motors connected in daisy chain, 3D printed brackets and links, and FitPC-2i as the main processor.
- Generated offline walking gaits using inverse kinematics in MATLAB and using Linear Inverted Pendulum Model while ensuring stability of Center of Mass (COM) and Zero Moment Point (ZMP).
- Proposed differential RGB colour space for robust marker detection under varying light intensity.
- Devised algorithm for pose estimation of the humanoid in with respect to a custom-made two-coloured square-in-square marker using OpenCV.
- Developed decision making node to maintain straight line motion using estimated pose from marker and pose obtained from the IMU reading in ROS Indigo.

**Dual Robotic Writing and Grasping Arms** **Dec 2015**

- Built a 3 DOF robotic writing arm capable of writing six English alphabets and 3 DOF robotic grasping arm which could grasp and move objects using Dynamixel AX-12A motors and controlled by OpenCM-9.04.
- Generated trajectories using inverse kinematics for the alphabets and plotted dextrous workspace of the writing arm in MATLAB.

**Other Robotics Projects** **2016**

- Developed an algorithm to track the movement of a coloured marker and simultaneously plot its centroid in OpenCV.
- Build a two-wheeled Bluetooth controlled robot using Bluetooth module HC-05 and Android Bluetooth Application.
- Prepared a RF controlled bot working on 434MHz RF Module and using encoder-decoder ICs for data transmission.

## OTHER ACTIVITIES

- President of the AI Graduate Student Association at OSU (2024-2025)
- Mentor with the AI Application Support Program that provides guidance to students applying to graduate programs at OSU.
- Mentored a high school student to develop an image-detection framework to identify humans in natural disasters.
- Graduate Student Mentor for UM Robotics Graduate Students and UM Undergraduates.
- Participant, Soft Material Robot Challenge, ICRA 2017 and volunteer at ICRA 2017.
- Represented India at Hurocup, Federation of International Robot-Sport Association (FIRA), Beijing, December 2016.