

# Thanikai Adhithiyam Shanmugam

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📁 Portfolio

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## Education

**MS Worcester Polytechnic Institute (WPI)**, Robotics GPA: 4.0/4.0

**Aug. 2023 - May 2025**

**BTech Indian Institute of Technology, Indore (IIT)**, Mechanical GPA: 8.58/10.0

## Technical Skills

**Programming:** Python, C/C++, MATLAB, Pytorch Lightning, Regresions, Bazel ,AWS, R, RasPi, Distributed Data Parallel (DDP)

**Software:** ROS, ROS2, CI/CD, TensorFlow, Keras, Pandas, NLTK, CUDA, Git, Linux, SLAM/NERF, LLMs, Kalman Filter, VLM

**Design/Simulation:** Issac Gym, Gazebo, OMPL, AirSim, TrajOpt, Pybullet/Algym, Mujoco, MoveIt, TCP

## Experience

**Robotic AI Algorithm Intern, Advanced Robotics Group, Magna RnD**

**May - Dec '24**

**Mentor:** [Dr Mochan Shrestha](#) - *Generative AI, LLMs, Imitation Learning, Pytorch, Behavior Cloning, VLMs, Transformers*

- Recreated a sim2real framework in MuJoCo, replicating customized robot movements for accurate **dexterous manipulation**.
- Customized **Action Chunking Transformers** and **Diffusion Policy** with calibration of 3 point cloud cameras and tactile feedback, achieving **77%** sim2real success (ACT) and **82%** (Diffusion), optimized GPU usage by 0.2 via Nsight.

**Graduate Student Researcher at ELPIS Lab, Worcester Polytechnic Institute**

**Dec '23 - Present**

**Research Guide:** [Dr Constantios Chamzas](#) - *RL, Pybullet, Neural Volume Rendering, SfM, Representation Learning, Guassian Splatting*

- Constructed learning pipeline with Residual Learning and Physics Informed Models on UR10 manipulator to perform precise tossing tasks using 3D reconstruction with Guassian Splatting (RGB-D). Integrated **ROS2 Moveit control** with real-time OS.
- Achieved **87.6% success** with on-head calibrated monocular depth camera through optimal SfM in Pybullet, StableBaselines (Action Critic policies) and achieving **84.21% success** real-time. Will submit in **IROS'25**.

**Research Assistant Robot Healthcare Lab, Worcester Polytechnic Institute**

**Aug'24 - Present**

**Research Guide:** [Dr Fengpei Yuan](#) - *Reinforcement Learning with Human Feedback (RLHF), Causality, LLMs, Embodied AI*

- Fine Tuned (PEFT) LLMs (GPT-4o, Llama) for transition from MDP (PPO) to free policy estimation, improving Robot Reminiscence cognitive state estimation by 0.14 using causal DAGs and Double Bayesian Networks with real patient simulated data.
- Embedded entire framework in **Pepper Humanoid** and benchmarked performance with standard Therapy. Drafting for **RA-L**.

**Undergraduate Thesis at Autonomous Cyber-Physical Systems Lab, IIT Indore**

**Jan'22 - Mar'23**

**Research Guide:** [Dr Gourinath Banda](#) - *Reinforcement Learning, Unreal Enigne, AirSim, Multi-agent control*

- Personal Aerial Vehicle Developed a heuristic approach to futuristic Air Traffic scenarios using **multi-agent RL** for **ANCS PAVs** and system architecture integrating **LIDAR with ROS (PID Control)**, **Extended Kalman Filter for sensor fusion**, **PX4, QGC, AirSim**. Created one of **first synthetics datasets** for PAV in various virtual environments using Docker and Kubernetes database systems.

**Research Intern at I3D Lab, Indian Institute of Science, Bangalore**

**May'22 - Nov'22**

**Research Guide:** [Dr Pradipta Biswas](#) - **(Funded by Spatics Society of India)** - *Mixed Reality, C++, Unity, DL*

- **MR for Assisted Assembly:** Developed interface for visual and optical tactile (DIGIT) force instruction for pneumatic assembly using MRTK-Unity (MR) in C++ for tangibility. Achieved RMS error of **2.03cm** and **0.96mAP**. Work featured in UNESCO magazine.

## Publications

**PAVeDS: A Synthetic dataset for developing Autonomous Personal Aerial Vehicles** - IEEE Access' 23

**Augmented Reality and Deep Learning based System for Assisting Assembly Process** - ICRA'23

**Comparing the accuracy of open-source pose estimation methods for measuring gait kinematics** - Gait n Posture '22

## Projects

**3D Traffic Scene Perception and Understanding (Dashboard Simulation)** [Github](#) - *Pytorch, Object detection, Optical Flow, OpenCV*

- Built real-time Tesla Autopilot dashboard with auto-calibration, Detic (**0.89**), YOLO3D (**0.83**), and Marigold (**0.94**), rendered in Blender.
- Developed pipeline for optical flow (RAFT) with **.87** accuracy for static and dynamic objects and trajectory estimation.

**IEEE Singapore Autonomous Underwater Vehicle Challenge (SAUVC)** [Github](#) - *PD control, NERF, Homography, Motion Planning*

- Implemented obstacle avoidance based on **ORB\_SLAMv3** (NERF) with **CLAHE** for efficient underwater traversal.
- Developed goal-state estimation with **acoustic beamforming** and ultrasonic DSP for precise localization in noisy environments

**DRDO Bird Eye View L4 UGV Navigation Challenge, 10th Inter-IIT, IIT KGP** [Github](#) - *SLAM, Segmentation, Mapping, Localisation*

- Trained **D-Link** with **DeepGlobe** dataset to skeletonize roadmap and enforced non-linear **MPC** with **GQC** for tracking.
- Integrated the **Waymo Open Motion Dataset** for real trajectory forecasting, improving optimization under dynamic conditions.

## Other Projects

- **ASR+LLM** - Integrated End-to-End (ASR) module and SayCan (VLM) for intent of speech on manipulator control [Github](#)
- **Visual Inertial Odometry** Designed a seminal VIO with EKF and also with LSTM and Convolutional Networks. **(Best Project)**