Thanikai Adhithiyan Shanmugam

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Education

MS **Worcester Polytechnic Insitute (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,Rust, C/C++, MATLAB, Pytorch,JAX, 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, Omniverse, Gazebo, OpenGL, OMPL, AirSim, TrajOpt, Pybullet/AIgym, Mujoco, MoveIt, TCP

Experience

Founding Robot Software Engineer, RobuildX - *SLAM, Segmentation, Motion Planning, VIO, EKF* **Jan 2025 – Present**

- Led software stack to automate **SIP-based house construction** using **ROS2 Humble, NAV2 SLAM**, and multi-robot coordination
- Built planning pipelines with **OMPL** and **TrajOpt**, integrating **LiDAR and IMU** via **EKF**, and developed C++ control modules.

Robotic AI Algorithm Intern, Advanced Robotics Group, Magna International **May' 24 - Dec '24**
Mentor: Dr Mochan Shrestha - *Generative AI, LLMs, Imitation Learning, Physical AI, VLAs, Transfomers*

- Recreated a sim2real framework in MuJoCo, replicating robot movements**(8 DOF)** 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), with **DinoV2** encoder leveraging DDP for 0.35 faster time.

Graduate Student Researcher at ELPIS Lab, Worcester Polytechnic Institute **Dec '23 - May' 25**
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 **(6 DOF)** manipulator to perform precise tossing tasks using 3D reconstruction with Guassian Splatting.Integrated **ROS2 Moveit control** with real-time OS.
- Achieved **87.6% success** with on-head calibrated monocular depth camera through optimal SfM in Pybullet (transitioned Issac Sim for faster training),StableBaselines(Action Critic policies) and achieving **84.21% success** in real-time. Will submit in **IROS'25**.

Research Assistant Robot Healthcare Lab, Worcester Polytechnic Institute **Aug'24 - May' 25**
Research Guide: Dr Fengpei Yuan - *Reinforcement Learning with Human Feedback (RLHF), Causality, VLAs, Embodied AI*

- Fine Tuned(LoRA) LLMs(GPT-4o, LLama) for transition from MDP (PPO) to free policy estimation using JAX, 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 digital twin framework for 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 the **first synthetic datasets** for PAV in virtual environments using Docker and Kubernates cloud-based database.

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 **ORBSLAMv3**(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 (BEV) ADAS Challenge, 10th Inter-IIT, IIT KGP Github - *SLAM, Segemantation, 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 controlGithub
- **Visual Inertial Odometry** Designed a seminal VIO with EKF and also with LSTM and Convolutional Networks. **(Best Project)**