# Thanikai Adhithiyan Shanmugam

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## Objective

Robotics graduate interested for **internship(May'24), Co-Op(Fall'24)** with experience in **Perception, Vision, Control** focusing on **HRI(XR), Autonomy, Assistive Devices and Collaborative Robots**.

## Education

**Worcester Polytechnic Institute** *Aug'23-May'25*
*Masters, Major: Robotics* **GPA:4/4**
*Coursework: Motion Planning, Human-Robot Interaction, Robot Control*

**Indian Institute of Technology, Indore** *Aug'19-May'23*
*B.Tech, Major: Mechanical, Minor: Humanities* **CPI:8.58/10**
*Coursework: Industrial Robotics, Deep Learning, Control and Instrumentation, Data Structures, Kinematics and Dynamics*

## Technical Skills and Certifications

**Programming**: Python, C/C++, HTML, CSS(inter), MATLAB, Deep Neural Networks, Machine Learning, R
**Software**: ROS, Numpy, TensorFlow, Keras, SQL, Pandas, NLTK, CUDA, Javascript, Git, Linux, SLAM
**Design/Simulation**: Autocad, ANSYS, Solidworks, Gazebo, Blender, AirSim, SimuLink, 3D Printing, Unity
**Electronics**: Arduino, RasPi, RF-microcontrollers, PCB, Butterworth Filters

## Experience

- **Research Intern at I3D Lab, Indian Institute of Science** *May'22-Oct'22*
  *Research Guide: Dr Pradipta Biswas, -**(Funded by Spatics Society of India)*** Bangalore, India
  - **Eye-Gaze Controlled Robot Toys for SSMI**: Designed **3D printed economical controller**(Eye-Gaze, Head and Iris control) for SSMI and integrated with a **user-friendly interface** in MR and AR. Collected Work featured in UNESCO magazine.
  - **MR for Assisted Assembly**: Developed system for visual instruction in assembly using MR to reduce cognition and increase awareness. Achieved RMS error of **2.03cm** mapping and **0.96mAP** efficiency**(Fine-tuning Yolov5)** by designing an workspace for pneumatic cylinder assembly using **MRTK-Unity** and integrated with Yolov5 for object detection.
- **Undergraduate Thesis at Autonomous Cyber-Physical Systems Lab, IIT Indore** *Mar'22-Jan'23*
  *Research Guide: Dr Gourinath Banda* Indore,India
  - **Personal Aerial Vehicle**: Developed a heuristic approach to futuristic Air Traffic scenarios using **MTRL** for **ANCS PAVs** and system architecture integrating **LIDAR with ROS(PID Control), PX4, QGC, AirSim**. Created one of **first synthetics datasets** for PAV in various virtual environments
  - **Parachute Module**: Designed Autonomous Parachute Module for quadcopters and validated with COTS systems. Curated drone-wide integration guidelines. Reduced crash force by **310N(for 2.5kg)** $\approx$ **1.6x** other systems.**(Working Patent)**
- **Research Intern at NeuRRo Lab, University of Michigan, Ann Arbor** *Apr'21 -Dec'21*
  *Research Guide: Dr Chandramouli Krishnan* Michigan, USA
  - Evaluated existing open-source pose algorithms to perform on par with **MOCAP** systems in estimating gait kinematics
  - Achieved **.26** increased detection speed, **.16** reduced model size through **FMGs** and **Fusion Block** to utilise depth maps.
  - Prototyped interface on MATLAB to report gait parameters(**32 unsupervised samples**) for different pose methods.
- **Research Intern at Mechatronics, Controls and Robotics Lab,New York University** *Jul'21-Dec'21*
  *Research Guide: Prof.Vikram Kapila, Nishitha Bhagat* New York, USA
  - Analyzed **324** samples for dependence of upper extremity for motion**(ROM)** and effects from restriction of joints
  - Devised economical **PCB** with **BNO055(RFDunio), IMU(EG)** with MATLAB to integrate WISE with **Assitive Gym**
  - Reviewed and tested statistical tests such as **Mixed Model ANOVA, t-tests and post-hoc Tukey-Kramer** tests in R
- **Research Intern at Mechatronics Lab, IIT Indore** *Dec'20-Feb'21*
  *Research Guide: Dr Palani IA* Indore,India
  - Achieved structural integrity of 3D-printed prosthetic(lower-limb) **NiTi-SMA** actuation **FDTD FEA** validation

## Projects

- **IEEE Singapore Autonomous Vehicle Challenge (SAUVC)** *Drive*
  - Led 12 undergraduates to **Singapore**. Implemented obstacle avoidance algorithm based on **ORBSLAMv3** with **CLAHE** filter for efficient underwater traversal**(QES** $\approx$ **56points)**.Fabricated underwater simulation with **UWSim** and **Gazebo**.
  - Planned, spearheaded the manufacturing of an autonomous **5-DOF** robotic arm with precise **non-linear PD control**
- **Programmable Quadruped Robot - Defence Research and Development Organisation Funded** *Github*
  - Designed a **6-DOF** Quadruped, simulated for walking, sitting, hand-shaking in Matlab and **PID control** in **Simulink**
  - Tested with **MDP** and **A*** algorithms for achieving path planning in known static environments.
- **DRDO UAV Guided UGV Navigation Challenge, 10th Inter-IIT, IIT KGP** *Github*
  - Integrated **D-Link** with **DeepGlobe dataset** to skeletonize roadmap of RGBD images for tracking.
  - Enforced a **non-linear PID controllercustom ROS node** with **QGC** and **PX4** for control. Instated **RRT*** algorithm for generating waypoints, **spline interpolation** for smoothness. Led team of 8 and won **bronze** from 23 IITs

## Publications

**PAVeDS: A Synthetic dataset for developing Autonomous Personal Aerial Vehicles** (Accepted - IEEE Access)
**Augmented Reality and Deep Learning based System for Assisting Assembly Process** Paper (ICRA Video Paper, JMUI)
**Comparing the accuracy of open-source pose estimation methods for measuring gait kinematics** Paper- (Gait and Posture)