# VISVAJIIT CHEZHIAN

visvajiit23@gmail.com Visvajiit Chezhian Portfolio

*Budding roboticist with extensive research experience in SLAM and Trajectory Planning. Highly enthusiastic about advancing cutting-edge research in mobile robotics*

## EDUCATION

**Bachelor of Technology in Mechanical Engineering,** Jul 2018 – Oct 2022 | Manipal, India
*Manipal Institute of Technology*
**CGPA:** 8.48/10 (Minor specialization: Fundamentals of Computing)

## PUBLICATIONS

In preparation :- **Visvajiit Chezhian** and Sachit Rao, *Zero-Clamped C2-Continuous Quintic Time trajectories*, **IEEE Robotics and Automation Letters**, 2025

Submitted :- **Visvajiit Chezhian** and Sachit Rao, *A Vectorial Approach to Particle Filter Weighting and Resampling for Robot Localization,* **IEEE International Conference on Acoustics, Speech, and Signal Processing**, 2025

## RESEARCH EXPERIENCE

**Research Associate,** *Advisor: Prof. Sachit Rao* Oct 2022 – present
*Ascend Studio, Machine Intelligence and Robotics Center (MINRO)*
*International Institute of Information Technology, Bangalore(IIITB)*

**Zero-clamped C2-continuous Quintic Time Trajectories** Jul 2024 – present
- Implemented a path smoothing algorithm using quintic time trajectories to achieve **C2 continuous global trajectories** for a self-navigating ground robot.
- Identified and **resolved** path divergence issues caused by **angular velocity discontinuities** in initial cubic trajectory models.
- Developed **quintic blending** for seamless transitions between linear path segments generated by Orientation Aware A* algorithm.
- Identified conditions to confine the trajectory within the convex hull of consecutive linear segments.
- Derived a novel **analytical solution** for determining permissible **range of blend times** based solely on boundary conditions, eliminating computationally expensive iterative checks.

**Vectorial approach to Particle Filter weighting** Jan 2024 – Jun 2024
- Developed a novel vector-based weighting method for particle filters, improving robustness to outliers and symmetric map ambiguities in global localization.
- Achieved more successful global localization by replacing the standard sensor model implementation with proposed method in localization pipelines.
- Authored a **first-author** manuscript on this innovative approach, currently under review at ICASSP 2025.

**Cross-Sensor Point Cloud Registration** Oct 2023 – Dec 2023
- Implemented cross-sensor point cloud matching using ArUco markers, integrating camera and depth sensor data.
- Developed a robust method for **detecting** and estimating the pose of ArUco markers with up to **90% accuracy** on viewing angles less than 45 degrees, enhancing the precision of 3D mapping.
- Achieved seamless point cloud alignment, improving the efficiency and accuracy of multi-sensor fusion in complex environments.

**Multi-agent path planning using HCA*** Sep 2023 – Sep 2023
- Implemented Hierarchical Cooperative A* (HCA*) for a warehouse management-oriented startup.
- Generated collision-free multi-agent trajectories, optimizing the efficiency and safety of warehouse operations.

**Orientation aware modified A* algorithm** Jul 2023 – Aug 2023
- Developed an orientation-aware A* algorithm respecting non-holonomic constraints of ground robots.
- Optimized the search space by biasing easier motions, narrowing down to more likely waypoints and **reducing the number of steps** to reach the goal by **up to 50%** .

- Implemented a method to **prevent sharp turns**, aiding higher curvature blends.
- Achieved faster cornering as a result of the implemented method.

**Localization and Autonomous Navigation** Jan 2023 – May 2023
- Achieved real-time global localization using **particle filter** with mean error of 10 cm and 0.4 rad in a 13x15 meter room on all successful attempts using MATLAB.
- Implemented the **A*** algorithm for path planning.
- Applied piecewise-stitched cubic time trajectories using obtained waypoints, ensuring **global velocity continuity** and piecewise acceleration continuity.

**Rhythmic flight with Quadcopter** Oct 2022 – Dec 2022
- Achieved music-synchronised quadcopter movement in a confined three-dimensional space using MATLAB.
- Utilized **Fast Fourier Transform** to identify prominent frequencies and track their intensity changes over the piece of music.
- Identified patterns in varying intensities over multiple octaves to determine the time to traverse segments.
- Applied 1-dimensional cubic time trajectories to ensure smooth velocity profiles.

## PROJECTS

**SLAM and Autonomous Navigation on Mobile Robot using ROS 1** Feb 2022 – Sep 2022
*Advisor: Prof. Sivayazi Kappagantula, MIT Manipal*
- Designed, 3D printed and assembled a mobile robot.
- Used LiDAR as sensor input and wheel encoder data for odometry input.
- Utilized ROS1 Gmapping and Navigation Stack for peripheral integration, SLAM implementation and autonomous navigation.

**Turtlebot3 Simulation in Gazebo** Nov 2021 – Dec 2021
- Constructed a custom world using Gazebo in ROS1.
- Implemented Gmapping package on Turtlebot3 model to perform slam on Gazebo simulation.

**Vending Machine for MIT Manipal Innovation Centre** May 2019 – Jul 2019
- Collaborated with seniors in developing the dispensing mechanism of an inhouse vending machine.
- Installed an IR-based system to ensure failproof transactions, enhancing the overall reliability.

## ROLES OF RESPONSIBILITIES

- Held the position of **Class-Representative** for three academic years (2019-2022).
- **Point of Contact** for **Outreach efforts** of Ascend Studios, IIIT Bangalore.

## OUTREACH AND WORKSHOPS

**ROS Workshop :** Conducted a week-long workshop on setting up a ROS environment and various simulations for faculty members of the Myanmar Institute of Information Technology.

**STEM Outreach :** Conducted over 15 lab demonstrations showcasing drone shows and 6-DOF manipulator operations, simplifying complex algorithms for undergraduate and school students.

**Poster Presentation :** Presented a poster titled "Localization and Navigation methods" at the annual RISE event at IIIT Bangalore, showcasing innovative research and developments.

## SKILLS

**Programming** — *Matlab, Python, Bash* | **Softwares and Tools** — *ROS 1, Gazebo, Fusion360* |
**Sensors and Hardware** — *LiDAR, Kinect, Encoders*

## ADDITIONAL COURSES

**Artificial Intelligence for Robotics,** *Udacity offered by Georgia Institute of Technology*

**Modern Robotics, Course 2: Robot Kinematics,** *Coursera offered by Northwestern University*

**Modern Robotics, Course 1 : Foundations of Robot Motion,** *Coursera offered by Northwestern University*