

ARYAMAN SHARDUL

+91 7506850482 aryashardul2002@gmail.com aryaman22102002.github.io
in aryaman-shardul-31150a227 Aryaman22102002

Education

Veermata Jijabai Technological Institute

Bachelor Of Technology in Computer Engineering

CGPA : 8.25/10

January 2021 – June 2024

Mumbai, India

Prakash Junior College of Commerce And Science

Secured Distinction (91.54%) in Higher Secondary Certificate Examination.

April 2018 – May 2020

Mumbai, India

Secured 100 percentile, State rank 11 out of 152,000 students in the MHT-CET examination.

Relevant Coursework

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|---|----------------------------------|------------------------------------|---------------------------|
| • Internet Of Things | • Linear Algebra | • Python Programming | • Artificial Intelligence |
| • Discrete Mathematics and Applications | • Data Structures and Algorithms | • Data Interpretation and Analysis | • Machine Learning |

Experience

Multi-Robot Autonomy Lab, IISER Bhopal

January 2023 - Present

Research Intern, Supervisors: Dr. P.B. Sujit and Dr. M.K. Tripathi

Remote

- Worked on a project titled “MPC-based UAV Path Planning Algorithm With CFD-Based Wind Field Estimation”.
- Studied the shortcomings of **traditional Model Predictive Control (MPC) planners** that assume the flow of the wind field in the environment to be **constant**, and designed a **new MPC planner** for the Unmanned Aerial Vehicle (UAV), which takes into account the **dynamic nature** of the wind field.
- Used **MATLAB** and **CasADi** to write code for the MPC planner and simulate the trajectory of the UAV from a start point to a goal point, against different number of **obstacles** in it's path, and under the influence of a **constantly changing wind field**. The wind field was generated by designing a **neural network** that was created using **Computational Fluid Dynamics (CFD)** and **DeepXDE**.
- Conducted a **comprehensive comparative analysis** of the results produced by the dynamic wind field MPC planner and the traditional constant wind field MPC planner, and found the results produced by the **new, dynamic MPC planner** to be **more efficient**.
- Currently writing a **research paper** on it, which is in its final stages of completion and **ready to be submitted** to the “**IEEE Control Systems Letters (L-CSS)**” journal for review.

Embedded Real-Time Systems Lab (ERTS/e-Yantra Lab), IIT Bombay

June 2022 - July 2022

Summer Research Intern, Supervisor: Dr. Kavi Arya

Mumbai, India


- Worked on “**Prota: The ROS Bot**”, a project whose main goal was to create an **efficient and modular** design of an Autonomous Unmanned Ground Vehicle from scratch, assemble it in hardware and implement **Simultaneous Localization And Mapping (SLAM)** using it.
- Calibrated and tested different sensors like **RPLidar**, **MPU9250**, **Time of Flight sensors (VL53L0X)**, **Intel Realsense D435i depth camera**, etc, and contributed to assembling the bot in hardware.
- Implemented **SLAM algorithms** on the Prota Bot in **simulation** as well as **hardware**.
- Developed the **navigation stack** for the bot using **ROS Noetic**.

Projects

Dairy Bike | Coppeliasim, Octave, Lua, Solidworks, Fusion 360

October 2021 - April 2022

- Designed a Dairy Bike comprising a **Two-Wheeled Self-Balancing Robot**. The robot loads and unloads dairy products from a dairy farm to designated delivery points.
- Employed concepts like **Euler-Lagrange mechanics** and **State-Space modelling** to create a mathematical model of our bike.
- Made use of **Linear Quadratic Regulator (LQR)** control strategy for balancing the robot equipped with a **flywheel mechanism**.
- Designed a **4 Degree of Freedom custom arm** and used **Inverse Kinematics** and devised some **optimization algorithms** for the efficient picking and placing of the dairy products.
- Navigated the bot in an arena to complete a set of tasks.

Wall-e-Simulation-ros2  | *ROS 2, Gazebo, Rviz, SolidWorks, C++, Python* **September 2021 - October 2021**

- The project's aim was to design a two-wheeled bot and implement **self-balancing** and **line-following** algorithms on it.
- Used **SolidWorks** to design the robot.
- Utilized **ROS 2** framework and **Gazebo** to simulate the algorithms on the bot.
- Developed a **Proportional Integral Derivative (PID)** controller and combined it with the sensor data to generate appropriate outputs for the **self-balancing** and **line-following** algorithms.

RRT  | *Python, Numpy, Pillow, Matplotlib* **July 2023 - September 2023**

- Implemented the **Rapidly Exploring Random Trees (RRT)** Algorithm from scratch using **Object-Oriented Programming** in Python.
- Created a **simulation** to visualize the workings of the algorithm using Matplotlib.
- Made some of the **parameters dynamic**, such as having **random start and goal positions** each time and taking the **number of obstacles** as input from the user within a specific range.
- Devised some parameters, such as the **number of iterations required**, the **number of final waypoints needed**, and the **total distance traversed**, to evaluate the performance of the algorithm.

Obstacle-Avoidance  | *ROS, Gazebo, Python* **July 2021**

- Implemented **obstacle-avoidance** algorithm on a **differential drive robot**.
- Utilized **ROS** and **Gazebo** Simulator to simulate the robot and implement the algorithm on it.

Technical Skills


Languages	: C, C++, Python, Octave, Lua
Web Developer Tools	: HTML, CSS, JavaScript
Technologies/Frameworks	: Linux, GitHub, ROS, ROS 2, Gazebo, Coppeliassim, Rviz, MATLAB, CasADi, SolidWorks, Arduino IDE, TensorFlow
Domains explored	: Robotics, Control Systems, Simulation, Computer Vision, SLAM, Path Planning

Achievements

E-Yantra Robotics Competition by IIT Bombay 

3rd Place

- Winner of the **3rd Position** in E-Yantra Robotics Competition 2021 - 2022 (**Theme: Dairy Bike**), an **international level** competition held by **IIT Bombay**.

SRA Autosim Challenge 

3rd Place

- Winner of the **3rd Position** in the **SRA Autosim Challenge** organized by the Society of Robotics and Automation, VJTI.

Committees/Extracurricular

Society of Robotics and Automation, VJTI





Software Head

June 2022 - November 2022

- Made **improvements** and did **research** in the domain of **programming and allied fields**.
- Fine-tuned the **programming content** for workshops.
- Maintained the committee's **GitHub repositories**.
- **Automated** tasks such as **registration** for workshops and seminars.

Active member and Lecturer

August 2021 - November 2022

- Delivered lectures on concepts like **line-following**, **self-balancing**, **PID Tuning** of a two-wheeled bot in **Coppeliassim**  to **150+** first-year students in the **Walle**  workshop.
- Introduced first-year students to **Morphology** in Image Processing and a few basic **Morphological Operations** in the **Pixels**  workshop.
- Taught about **ROS file systems** and some basic **ROS commands** to first-year students in the **MARIO**  workshop.
- Mentored a team of second-year students on a project called **SLAM-CV-Navigation**, which aims to implement **SLAM** on a differential drive bot in gazebo. Using a convolutional neural network called **YOLO**, the bot detects and follows humans in an indoor environment.