Aryaman Shardul

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Education

Veermata Jijabai Technological Institute **2020 – 2024**
B.Tech in Computer Engineering *Mumbai, India*
CGPA : 8.52/10

Prakash Junior College of Commerce And Science **2018 – 2020**
HSC : 91.54% *Mumbai, India*

Experience

Research Intern at Multi-Robot Autonomy Lab **Dr. P. B. Sujit**
IISER Bhopal ***Jan 2023 - Present***

- Working on implementing **Dynamic Collision Avoidance Algorithms for UAVs using Neural Radiance Fields(NeRF)**.
- Researched and understood about **Signed Distance Fields(SDF)** and **Incremental Signed Distance Fields(iSDF)** and how they can be used for **perception** in UAVs.
- Currently understanding and trying to modify the code of iSDF for our use case.
- Doing a Literature Survey on **dynamic obstacle avoidance** algorithms.

Research Intern at Multi-Robot Autonomy Lab **Dr. P. B. Sujit**
IISER Bhopal ***Dec 2022 - Present***

- The changing **wind patterns** around obstacles can increase the **turning radius** for **Unmanned Aerial Vehicles (UAVs)**.
- Working on developing a **machine learning model** to predict these wind patterns around obstacles.
- Studied and designed a **Model Predictive Controller (MPC)** using the **Multiple Shooting Method** to move the UAV from one point to another along an optimized trajectory against a **constant wind flow** and implemented **obstacle avoidance** using the MPC controller.
- Currently working on **generating flow fields** around random points in the UAV's workspace.

Research Intern at Multi-Robot Autonomy Lab **Dr. P. B. Sujit**
IISER Bhopal ***Oct 2022 - Present***

- Working on developing an **Autonomous Underwater Vehicle (AUV) Simulator** based on an existing simulator and expanding it to include **swarm capabilities**.
- Tested existing controllers on different AUV models.
- Currently developing a **custom controller** to move **multiple AUVs simultaneously** from one point to another.

Summer Research Intern **Dr. Kavi Arya**
E-Yantra, IIT Bombay ***June 2022 - July 2022***

- Worked on **"Prota: The ROS Bot"**, a project whose main goal was to create an **efficient and modular** design of an Unmanned Autonomous Ground Vehicle from scratch, assemble it in hardware and implement **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* **Oct 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.
- Used concepts like **Euler-Lagrange mechanics** and **State-Space modelling** to create a mathematical model of our bike.
- Used **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 wrote some **optimization algorithms** for the efficient picking and placing of the dairy products.
- After building the bot, we navigated it in an arena to complete a set of tasks.

Wall-e-Simulation-ros2 | *ROS2, Gazebo, Rviz, SolidWorks, C++, Python* **Sept 2021 - Oct 2021**

- The project's aim was to design a two-wheeled **self-balancing** and **line-following bot**.
- **SolidWorks** was used to design the robot.
- Used **ROS 2** framework and **Gazebo** Simulator to implement the algorithms on the bot.
- Implemented self-balancing and line-following algorithms using **Proportional Integral Derivative (PID)**.

Street Racer | *HTML, CSS, Phaser.js, Python, OpenCV, Mediapipe* **Nov 2021 - Jan 2022**

- Made a **Gesture-controlled** 2D Car Racing game using **phaser.js**.
- Implemented steering control using hand gestures with help of **OpenCv** library of Python.

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

- Implemented **obstacle-avoidance** algorithm on a **differential drive robot**.
- Used **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, Coppeliasim, Rviz, MATLAB, CasADi, SolidWorks, Arduino IDE, TensorFlow
Domains explored	: Robotics, Control Systems, Simulation, Computer Vision, SLAM

Achievements

E-Yantra Robotics Competition by IIT Bombay

3rd Place

- Winner of the **3rd Position** in E-Yantra Robotics Competition **(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.

MHT-CET Examination

100 percentile, State rank 11

- Secured **100 percentile**, **State rank 11** in the **MHT-CET** examination, a state entrance examination for engineering majors in PCM.

Committees/Extracurricular

Society of Robotics and Automation, VJTI **Dr. A. S. Rao**

Software Head June 2022 - Nov 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 Aug 2021 - Nov 2022

- Taught concepts like **line-following, self balancing, PID Tuning** of a two wheeled bot in **Coppeliasim** 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.