Aryaman Shardul

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Education

Veermata Jijabai Technological Institute **January 2021 – June 2024**
B.Tech in Computer Engineering *Mumbai, India*
CGPA : 8.25/10

Prakash Junior College of Commerce And Science **April 2018 – May 2020**
Secured Distinction (91.54%) in Higher Secondary Certificate Examination. *Mumbai, India*
Secured 100 percentile, State rank 11 out of 152,000 students in the MHT-CET examination.

Relevant Coursework

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

Experience

Research Intern **Dr. P.B. Sujit and Dr. M.K. Tripathi**
Multi-Robot Autonomy Lab, IISER Bhopal ***January 2023 - Present***

- 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 **newly designed MPC planner** to be **more efficient**.
- Currently writing a **research paper** on it.

Summer Research Intern **Dr. Kavi Arya**
Embedded Real-Time Systems Laboratory (ERTS/e-Yantra Lab), 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* **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 wrote 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.
- Designed 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.

Street Racer | *HTML, CSS, Phaser.js, Python, OpenCV, Mediapipe* **November 2021 - January 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**.
- 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, Coppeliasim, 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 **(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 **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.