

Education

BITS Pilani, KK Birla Goa Campus

Goa, India

B.E. IN ELECTRICAL ENGINEERING

Aug 2019 - Mar 2023

- Major in Electrical and Electronics Engineering
- Minor in Physics
- *CourseWork:* Calculus, Linear Algebra, Probability and Statistics, Differential Equations, Signals and Systems, Communication Systems, Control Systems, Modern Control Systems, Digital Image Processing
- CGPA: 7.8/10

Sri Chaitanya Educational Institutions

Vijayawada, India

CLASS XII

Aug 2017 - Mar 2019

- CGPA: 10/10

Kendriya Vidyalaya Minambakkam

Chennai, India

CLASS X

Mar 2016 - Mar 2017

- CGPA: 10/10

Experience

Peppermint Robotics

India

ROBOTICS ENGINEER - II

May 2024 - Present

- Implemented a Model Predictive Controller to enhance path tracking and reduce jerkiness in robot movements.
- Contributed to the development of the architecture and design of the new Navigation stack.

Peppermint Robotics

India

ROBOTICS ENGINEER - I

Feb 2023 - April 2024

- Collaborated within a team to develop and maintain software and algorithms for the autonomous navigation of Industrial Cleaning and Material Handling Robots.
- Designed and implemented control algorithms, specifically focusing on precise turning behaviour, leading to improved turn accuracy and reduced water spillage.
- Developed a Mission Planning framework that isolates core functionalities of the Robotics stack, enabling users to construct complex, long-horizon missions for Cleaning and Material Handling Robots.
- Crafted decision trees and algorithms to facilitate the robot in executing safety manoeuvres when facing obstacles near the walls, ensuring seamless navigation even in challenging situations.
- Enhanced the general logging and debuggability of the Robotics software through the implementation of custom loggers and log interpreters.

RBCCPS, Indian Institute of Science

India

RESEARCH INTERN (BACHELOR THESIS)

Jun 2022 - Dec 2022

- Worked under the supervision of Prof. Shishir Kolathaya and Prof. Debashish Ghosh at IISc.
- Conducted primary research and developed an efficient area coverage algorithm for a heterogeneous swarm of robots to be deployed in agricultural farms.
- Validated the developed algorithms by implementing them on a DJI Matrice drone, ensuring safe traversal around biomass clusters by processing depth camera images and position measurements.

Black Coffee Robotics

India

ROBOTICS SOFTWARE INTERN

Mar 2022 - May 2022

- Built software for simulation of Multi-Robot Systems for industrial sorting robots, interfacing the simulation packages with ROS/ROS2 and Rviz.
- Designed and developed simulation packages for AMRs in Gazebo Simulator and Unity Game engine.

Otonomy Inc.

India

ROBOTICS INTERN

Sep 2021 - Dec 2021

- Built software for simulation of robots in a 3D urban environment with ramps, walls, etc., in Gazebo Simulator.
- Worked on the integration of various 3D volumetric mapping frameworks like Spatio-Temporal-Voxel-Layer, Voxblox, Octomap into a move-base plugin.
- Analyzed volumetric mapping and the usage of Voxblox for path planning in 3D.
- Compared planners like BIT*, AIT*, RABIT* for efficient path planning in 3D environments.
- Developed a 3D Path Planning algorithm using Multi Heuristic Search A-Star with custom heuristics suitable for urban navigation.

Peppermint Robots

India

ROBOTICS INTERN

May 2021 - Jul 2021

- Built a User Interface (UI) based on Qt Quick and QML for Cleaning Robots, directly put into production on real-world deployment.
- Integrated the UI with ROS2 and the core Robotics Stack to gather and display data.
- Conducted primary research on using State Lattice-Based Path Planning for obstacle avoidance for Indoor Robots, analyzing better ways to perform local planning using incremental Graph Search Techniques.
- Developed a Motion Primitives-based local planning algorithm for obstacle avoidance in tight constrained spaces and implemented the algorithm as a move-base-flex plugin for integration with Robotics stack.

Research

Multiagent Path Planning for Optimal Coverage of Agricultural Farms

RBCCPS, Indian Institute of Science

BACHELOR'S THESIS

Jun 2022 - Dec 2022

- Worked under the guidance of Prof. Shishir Kolathaya and Prof. Debashish Ghosh
- Developed a graph-search based algorithm to solve the problem of cluster coverage. In comparison, our solution performs 3.7x faster and produces near optimal results when compared to standard coverage problem solvers
- Extended single cluster coverage algorithm for heterogeneous multi agents

State Estimation for Autonomous UAV

Bits Goa

UNDERGRADUATE RESEARCH

Sept 2021 - Dec 2021

- Conducted research under Prof. Rakesh Warier on State Estimation Techniques for transitions between Indoor and Outdoor Autonomous flight.
- Learnt and compare different paradigms of State Estimation, i.e., Filtering, Fixed-lag smoothing etc.
- Analysed Optimisation based methods with tightly coupled VIO measurements.

Projects

Xiron - 2D Robot Simulator

Open Source

PERSONAL PROJECT

Jan 2023 - Present

- Developed a simple 2D robot simulator to reduce the entry barrier to Robotics.
- Designed to be easy to install, platform-agnostic, and equipped with an intuitive interface.
- Developed and python package with planning and control algorithms that integrates with xiron

Indoor Autonomous Drone

Goa

PERSONAL PROJECT

July 2020 - Dec 2020

- Worked on the navigation stack of an Indoor Aerial Robot, focusing on agile Autonomous drones, path planning in complex 3D environments, and trajectory optimization.
- Used ROS and various open-source packages to develop a navigation stack for an Indoor Autonomous Drone, tested through RotorS Simulation.
- Wrote an article explaining the project.

Trotbot - Indoor Autonomous Robot

BITS, Goa

CLUB PROJECT

Jan 2020 - May 2022

- Led a team in building an indoor autonomous robot, Trotbot, capable of omnidirectional traversal.
- Researched and implemented State Estimation algorithms in Indoor Environments using LiDAR, IMU, and Wheel Encoders.
- Provided leadership and guidance on the use of Deep learning algorithms for Semantic Scene understanding.

Gennav - Modular Python Package for Autonomous Navigation

BITS Goa

CONTRIBUTOR

Jun. 2020 - Dec. 2020

- Contributed to building a modular Python package for autonomous navigation algorithms.
- Worked on integrating the algorithms into ROS using a wrapper, gennav ROS.

Drone Mapping of Mangrove Swamps in Goa

Goa

TEAM MEMBER

Sep. 2021 - Dec. 2021

- Under the guidance of Prof. Shibu Clement, mapped 44 sq. km of Mangrove Swamps in and around Goa using a DJI Phantom 4 Pro V2.
- Built an Ensemble model for Identification of 16 different Mangrove Species using Resnet18 and VGG (accuracy 86% and f1-score 0.86).
- Developed a desktop application using Tkinter for running the inference of the built model.
- Worked on stitching images together and using Image Processing techniques to obtain boundaries of each Mangrove.

Tech-Stack

Tools Robot Operating System, Arduino Programming, Pytorch, Tensorflow, Simulink, Fusion 360, Eagle

Programming Python, C/C++, MATLAB, Rust, LaTeX

Extracurricular Activities

Center for Technical Education

BITS, Goa

PRESIDENT

May 2021 - Apr 2022

- Led a motivated team of 30+ students from diverse backgrounds, working collectively in the largest Technical Organization at BITS Goa, with the aim of enhancing the technical culture on campus.
- Collaborate with all technical clubs on campus to host joint events and bring industry professionals to share expertise.
- Conduct courses, workshops, and hackathons while providing project funding for prospective campus projects.
- As a former Core Member, enhanced automation systems for tasks such as emailing and certificate generation.
- Lead the Academic Assistance Program, organizing informal peer-to-peer discussion sessions and study groups to support junior students academically.

Project Kratos

BITS, Goa

MEMBER

Aug 2020 - Aug 2021

- Contributed to Project Kratos, a student-run team participating in the University Rover Challenge.
- Worked in the Autonomous subsystem, focusing on the navigation pipeline of the Rover and implementing obstacle avoidance.

Teaching

Software for Embedded Systems

BITS Goa

FDCM

Jan 2022 - May 2022

- I was a First Degree Teaching Assistant for a Master's course on Software for Embedded Systems by the Dept. of CSIS, BITS Goa.
- Conducted lab sessions on Python Programming, Arduino Programming and Robot Operating System.
- Designed and Evaluated final course Projects and helped in conducting various evaluative components throughout the course.

Introduction to Aerodynamics and Aerial Robotics

BITS Goa

INSTRUCTOR, CTE

Jan 2021 - May 2021

- I was an instructor for the course and designed Course Material on Aerial Robotics
- Taught introduction to Path Planning, Perception and State Estimation

Robot Automation using ROS

BITS Goa

MENTOR, QSTP

Summer 2021

- Taught and provided resources for the basics of Robotics with the Introduction of Robot Operating System, Control and basics of Path Planning

Aerial Robotics

BITS Goa

MENTOR, QSTP

Summer 2021

- Taught Path Planning and State Estimation for Drones.
- Provided material for Path Planning in 2D and 3D environments, G-H Filter, Kalman Filters in 2D and 3D

Clubs and Departments

2020 **AAP Head**, Center for Technical Education

BITS, Goa

2020 **Senior Core Member**, Electronics and Robotics Club

BITS, Goa

2020 **Senior Core Member**, Aerodynamics Club

BITS, Goa

2020 **Core Member**, Project Kratos

BITS, Goa