SUMUKH PORWAL

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ACADEMIC QUALIFICATION

- **MS Robotics Engineering,** Worcester Polytechnic Institute — Aug '24 - May '26(expected)
- **B. Tech Mechanical Engineering,** Indian Institute of Technology Tirupati (***CGPA***: 8.69/10) — Jul '20 - June '24

INTERNSHIPS

SeiAnmai Technology, Delhi — **Development of TeleOperation and TeleObservance Robot** — **May '23 - Jul '23**

- Developed an autonomous robot using ROS2 and micro-ROS as the communication framework.
- Seamlessly integrated SLAM, autonomous navigation, and teleoperation.
- Leveraged ArUco marker detection for precise autonomous docking.
- Employed a Docker container for micro-ROS using C language, also merging mechanical design and control expertise to enhance hardware performance.

BluJ Aero, Hyderabad — **Design and Analysis of an EVTOL Aircraft Bulkhead** — **Jun '22 - Aug '22**

- Created a Computer-Aided Design and performed Finite Element Analysis on the bulkhead, which functions as the key load-bearing element within the fuselage of an EVTOL aircraft, along with the link connecting bulkhead and wing's I-beam.
- Employed CATIA for CAD modeling to form the solid bulkhead model and wing attachments.
- Subsequently, employed Abaqus for the simulation of the bulkhead's mechanical behavior under different loads, moments, and boundary conditions.

PROJECTS

Trigger Word Detection — **Jun'24 - Present**

Team Size: 1

- Developed a deep learning model to detect the trigger word "activate" in audio streams.
- Synthesized and processed diverse audio datasets for training and evaluation.
- Utilized a neural network with a 1D convolutional and 2 GRU layers to achieve high accuracy.

Semantic Image Segmentation — **May'24 - Present**

Team Size: 1

- Developed a U-Net CNN for pixel-level semantic image segmentation on a self-driving car dataset.
- Achieved precise object recognition, crucial for autonomous vehicle navigation and safety.
- Implemented, trained, and evaluated the model, demonstrating high accuracy with detailed mask predictions.

Face Recognition using Siamese Network — **Jun '24**

Team Size: 1

- Developed a face recognition system using Multi-Task Cascaded Convolutional Neural Networks (MTCNN) and Inception ResNet.
- Implemented a triplet loss function to use 128-dimensional encodings generated by a deep learning model from face images to effectively distinguish between similar and dissimilar faces.

Navigation and Control of Cooperative Mobile Robots — **Jan '23 - May '24**

Team Size: 2 — **Role:** Team lead

- Developed omnidirectional 3-wheel mobile robots with cameras and laser sensors for seamless SLAM and self-navigation.
- Integrated Cooperative Navigation system with linear and triangular formations for collaborative tasks.
- Utilized Raspberry Pi 4, Raspberry Pi Pico, and ROS2 for core components and communication framework.

Modeling and Estimation of Satellite Attitude Kinematics and Dynamics — **Aug '23 - Nov '23**

Team Size: 1

- Developed a MATLAB model to simulate satellite attitude kinematics and dynamics under thruster-generated moments.
- Incorporated sensor models with noise characteristics to represent real-world measurements accurately.
- Implemented Triad algorithm, q-method, and extended attitude Kalman filter for diverse attitude estimation.

Sentinel Drone — **Sep '22 - Feb '23**

Team Size: 4 — **Role:** Navigation system lead

- Developed an automated surveillance drone for accident, fire, and anomaly detection using computer vision algorithms.
- Uploaded data to GIS, utilized ROS Noetic for communication, and Gazebo for simulation.
- Conducted hardware testing with a nano drone, incorporating navigation, controls, and a PID controller.

Alexa controlled Robotic Manipulator — **Oct '22 - Dec '22**

Team Size: 1

- Simulating a 3-DoF robotic manipulator capable of autonomously reaching desired destinations and executing tasks via Alexa voice commands, utilizing ROS, Gazebo, RViz, and MoveIt.
- Upon successful simulation, a hardware model will be built using an Arduino UNO microcontroller, with ROS serving as the communication link between the system and the microcontroller.

TECHNICAL SKILLS

Operating Systems: Windows, Linux
Programming Languages: Python, C, C++, MATLAB
Framework: Robotics Operating System (ROS), TensorFlow
Simulation Tools: Gazebo and MATLAB Simulink
CAD and CAE Software Packages: DS Catia, DS Solidworks, DS Abaqus, Autodesk Fusion 360, Autodesk Inventor, Autodesk Ansys, AutoCAD for Mechanical

TECHNICAL COURSES

Worcester Polytechnic Institute, MA:

- Reinforcement Learning *
- Motion Planning *
- Robot Control *

(* - to be completed by Dec ‘24)

Indian Institute of Technology, Tirupati:

- Machine Learning for Mechanical Engineers (May ‘24)
- Mechatronics (May ‘24)
- Mechanics and Control of Robotic Manipulators (Dec '23)
- Attitude Estimation and Control (Dec '23)
- System Dynamics and Control (Oct '23)
- Modeling and Control of Autonomous Mobile Robots (May '23)
- Numerical Analysis (May '22)
- Complex Variables (Nov '21)
- Differential Equations and Matrices (Jul '21)
- Calculus (Feb '21)

Coursera:

- Deep Learning (Jun ‘24)
- Linear Algebra (Nov '23)
- Probability and Statistics (Nov '23)

NPTEL:

- Computer Vision (Nov '23)
- Robotics (Sep '22)

EXTRACURRICULAR

- Team Lead of the Organizing Committee for Robotics Events at IIT Tirupati's Annual Techno-Cultural Fest in 2022 and 2023.

LEADERSHIP ROLES

- Technical Affairs Secretary, IIT Tirupati, May '23 - May '24
- Robotics Club Head, IIT Tirupati, Jul '22 - Jun '23
- Contingent Leader, Inter IIT Tech Meet, IIT Tirupati, Oct '22 - Feb '23