Mustafa Bhadsorawala

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Summary

Roboticist with expertise in **control system design** and over **3 years** of experience in **additive manufacturing** and **product development**. Proficient in **optimal control and state estimation, robot perception, embedded programming.**

Education

New York University — New York, NY
Masters in Mechatronics, Robotics and Automation; GPA: 3.8 — *Aug 2021 - May 2023*
Courses: Advanced Mechatronics, Optimal Control and Reinforcement Learning, Robot Localization, Robot Perception

K.J Somaiya College of Engineering — Mumbai, India
Bachelor of Mechanical Engineering; GPA: 3.4 — *Aug 2013 - May 2017*
Courses: Linear Algebra, Machine Design, Fundamentals of Robotics

Skills

Technical Skills: Optimal Control & State Estimation, Robot Perception, Localization, Sensor Fusion, Circuit Design, Embedded Programming, Path planning, Additive Manufacturing, PLC

Tools: C++17, Python, MATLAB, Simulink, ROS2, OpenCV, PyTorch, Nvidia Jetson, R-Pi, Linux, Solidworks

Experience

Mechatronics, Controls and Robotics Lab — New York, NY
Research Assistant — *Jan 2022 - Current*

Wi-Fi based SLAM: Desigend and implemented a smartphone based **Indoor Localization** system achieving an **accuracy of ±0.5m**
- Developed a tailored **sensor fusion** algorithm, merging state estimation from **WiFi-RTT and IMU Extended Kalman Filter**(EKF)
- Achieved **85Hz sampling** on **RP2040** microcontroller, concurrently running **embedded EKF** system and writing data using **SPI**

Teaching Assistant for Automatic Controls: Performed **Hardware-in-loop** experiments teaching **classical controls** concepts
- Performed **system identification**, linearized non-linear **system response** to develop **PID and LQR controllers** using **Simulink**
- Constructed plant models in **MATLAB SimScape**, and crafted **digital twins** of lab apparatus for simulation and hands-on practice

Amazon Robotics — Seattle, WA
Robotics Project Engineering Intern — *Jun 2022 - August 2022*

Deployed (KUKA) Robotics cells: Verified installation, performed system calibration and perception system validation
- **Established** new **standard practice** as part of **continuous improvement** project for validating robotic drive usage over installed expansion joints on the robotic floor, leading to a significant **56% reduction in process time**

Baari Labs — Indore, India
Operations & Product Development Engineer — *Oct 2019 - Jan 2021*

Product Development: Managed the end-to-end process of products from **design concepts through production**
- Collaborated with interdisciplinary team to **lead development** of UV-C disinfection box project, ensuring delivery **within 6 weeks**

Academic Projects

Cross Spherical(CS) "360º" gear actuator (Electro-Mechanical System Development): Active ball joint with custom controller
- Achieved a **360º range of motion** through an innovative **differential drive mechanism**, maintaining stationary stepper motors
- Devised a comprehensive f**ull-state feedback control loop** by strategically positioning sensors and **created a custom PCB** using Eagle CAD to accommodate motor drivers and microcontroller components
- Deployed an **optimal trajectory generator** , executing **inverse kinematics** and **embedded motor control** tasks at **1Ghz**
- Improved design iteration cycle speed by **programming CAD macros** to generate CS and monopole gears using input parameters

iLQR Control of quadcopter (Optimal Control): Modelled an **iterative LQR controller** for flight control a quadcopter
- Designed a quadratic cost function to automate optimal path generation for desired trajectory by minimizing cost

NeRF based Navigation for the blind (Computer Vision): A PyTorch-based localization pipeline for guiding the visually impaired
- Attained an **18% improvement** in indoor localization accuracy compared to standalone methods like **Visual Odometry and VPR**
- Trained a NeRF Neural Net on real-world data to create lifelike environment maps, and integrated an agent capable of navigating and capturing views within these generated environments

Training Program for UR16e (ROS2): Designed comprehensive training program for the UR16e robot with ROS2
- Established communication with ROS2 PC through **TCP/IP protocol**, enabling control using a **joint trajectory controller**
- **Interfaced** custom **soft robotic end-effector** tool with the robot and sEMG electodes to the robot control panel

Autonomous Delivery Robot (Embedded firmware/hardware): Robot delivery in urban environments
- Integrated a Raspberry Pi with a **multi-core** Propeller **microcontroller** using **UART** communication protocol
- Employed **Dijkstra**'s algorithm for real-time **path planning**, leveraging **robot perception** for obstacle detection

Honors and Awards

Selected in **top 10** for **pan-India** design competition for Mechatronic Earthworm, Aakruti 2016.

Awarded Best Capstone project for affordable Bionic prosthetic arm, 2017.