Bharadwaj Chukkala

(503)-268-3042 | bchukkal@terpmail.umd.edu | linkedin.com/in/bharadwaj-chukkala/ | github.com/bharadwaj-chukkala

Education

University of Maryland College Park, MD
Master of Engineering in Robotics (3.83/4) *May 2023*
BML Munjal University Gurgaon, India
Bachelor of Technology in Mechanical Engineering (8.3/10) *Sept 2020*

Work Experience

Founding Engineer for Robotics and AI August 2023 - Present
Surgical Automations Inc. *Dallas, TX*

- Designed and developed full-stack robotics software architecture for endoscopic surgical devices using Python, PyQt, and Tkinter, with real-time UI overlays, diagnostics, and intuitive surgeon-facing controls.
- Ported the robotics software from Python to C++ for enhanced robustness and performance, applying principles of OOP, multithreading, and multiprocessing across both frontend and backend systems.
- Built and deployed deep learning pipelines leveraging models like Faster R-CNN, YOLO, UNet, and DepthAnything for anomaly detection, depth estimation, and autonomous navigation, optimized using TensorRT and CUDA.
- Developed and integrated custom computer vision algorithms in-house for surgical scene understanding, visual servoing, and pattern recognition, demonstrating strong algorithmic problem-solving skills.
- Integrated multi-modal navigation using computer vision and sensor fusion—combining shape-sensor tracking, vision-based depth estimation, and ToF-based collision avoidance via Kalman filtering—for stable endoscope control.
- Engineered embedded communication systems using USB-based sensors and ESP32 microcontrollers to interface cameras, motors, limit switches, and ToF sensors, enabling fully closed-loop control.
- Invented a cost-effective flexible shape sensor and contributed to patents on both the sensor and the colonoscope's distal tip design, significantly improving navigation accuracy and manufacturability.
- Created and managed the world's most comprehensive annotated dataset for lower GI tract navigation, while authoring FDA-aligned technical documentation and collaborating closely with firmware and design teams to deliver compliant, production-ready surgical robotics systems.

Co-Founder and Robotics Engineer Jan 2020 - June 2021
Solbots Technologies *Hyderabad, India*

- Spearheaded the designing, development, and programming of a robotic arm prosthetic using Python and C++ from initial concept to final product, resulting in a 30% reduction in production time and a 15% increase in efficiency.
- Led the ROS simulation, manufacturing, and production of a food serving machine, which increased customer satisfaction by 25% and boosted revenue by 20%.
- Conducted market research and user testing by reaching out to amputees to validate prosthetic functionality, comfort, and usability, directly influencing design iterations.
- Led business outreach and sales of food serving robots to companies looking to improve employee safety and well-being during the COVID-19 pandemic, securing multiple successful deployments.

Skills

Languages: C/C++, Python, Shell/Bash, MATLAB, Javascript, HTML, CUDA
Technical: Linux, ROS1, ROS2, Labview WeBots, Gazebo, Rviz, MoveIT, Raspy, UML, QML
Developer Tools: CMake, Git, GitHub, Docker, CI/CD, AWS, GTest, GMock, PyTest, Agile, Scrum, TDD, Jira, Kanban
Libraries: Tensorflow, Scikit-Learn, PyTorch, Keras, OpenCV, OpenGL, NumPy, SciPy, SymPy, Pandas, Matplotlib
Domain: Motion Planning, Trajectory Optimization, Planning under Uncertainty, Probabilistic Robotics

Projects

Real-Time Motion Control Software Development for Robotic Articulation December 2022

- Developed and implemented real-time motion control software in C++ for a robotic endoscope articulation system, utilizing EtherCAT and event-driven state machine architectures to achieve jitter-free control.
- Collaborated cross-functionally with systems, mechanical, and robotic engineers to design and develop a robust, distributed multi-platform system with clean software APIs and interfaces, providing excellent technical communication throughout the project lifecycle.

Multi-Objective Motion Planning Framework for Autonomous Vehicles December 2022

- Designed and implemented a hybrid motion planning framework for autonomous vehicles, combining an informed RRT-A* algorithm with machine learning, resulting in a 20% improvement in trajectory accuracy and a 40% reduction in planning time for dynamic and unpredictable environments.
- Collaborated cross-functionally with systems, mechanical, and robotic engineers to design and develop a robust, distributed multi-platform system with clean software APIs and interfaces, providing excellent technical communication throughout the project lifecycle.

Autonomous Navigation, Motion Control and Planning for Mobile Robots March 2022

- Built a software package for a Robotis Turtlebot to find the most optimal path in a maze by using 8 Search Algorithms like **DFS, BFS, Dijkstra, A*, RRT, RRT*, GMR-RRT*, D* Lite** and compared the results, after which Autonomous Navigation was performed using **Hector-SLAM** and **G-SLAM** in various custom made Gazebo test Environments.

SLAM for a Mobile Robot in an Urban Search and Rescue Operation November 2021

- Modeled a USRV inspired by Mobile Robot and Embedded the vehicle with a Lidar sensor module for collection of data from the environment and mapping the disaster-affected area.
- Coded ROS subscribers and publishers in C++ for the mobile robot to perform autonomous path planning and navigation while implementing SLAM for the search and rescue operation.

Mobile Autonomous Grasping Robot for Collection and Disposal Of Medical Waste December 2022

- Created and Launched an end-to-end Robot Software system for Hazardous waste disposal which was built using modular programming and OOP concepts, it had Perception, Navigation, and Manipulation capabilities and achieved a remarkable 140% efficiency and reduced hazardous waste exposure by 85%.
- Implemented Agile Iterative model and Test Driven Development, to deliver modularized, scalable, and flexible code base, achieving significant cost savings of about 40%.

Data-driven Motion Planning for a Mobile Robot using Deep Neural Networks December 2022

- Successfully achieved 96% model prediction accuracy on fresh data by training, validating, and testing a Deep Neural Network for the motion planning of a mobile robot, utilizing Scikit-Learn and Tensorflow for model training and testing, and conducting an in-depth comparative analysis of DNN with other algorithms.

3D Reconstruction and Depth Estimation using Image Processing and Stereo Vision February 2022

- Performed **I**mage processing to stitch two images and create a scenic panorama and further used **K**-means clustering on the resultant image for target detection.
- Deployed Algorithms to correctly estimate **D**isparity and **D**epth through Heat Map of the Panorama by using **S**tereo **V**ision principles like Fundamental, Essential Matrices and Rectification of Epipolar lines for feature correspondence.

Human Detector and Tracking Software Development using Support Vector Machines November 2022

- Developed an end-to-end Software product that upon deployment can detect humans and track them in a continuous video stream with **92%** accuracy.
- Programmed several Support Vector Machines in C++ using OpenCV library to create a perception module as a part of the software, which can be interfaced with an Autonomous Ground Vehicle to avoid collisions actively.

Development of a Perception Software System for Autonomous Vehicles using ROS and OpenCV March 2022

- Engineered a software system from scratch that implements a multi-sensor fusion algorithm that combined data from LiDAR, monocular cameras, and RADAR to achieve a 40% improvement in obstacle detection accuracy.
- Implemented Deep learning techniques to optimize sensor fusion which resulted in a 25% reduction in the detection of false positives, enabling precise tracking and ensuring safe and reliable operation in challenging environments.

Lane detection and Turn prediction for Autonomous Vehicles February 2022

- Generated 2 Computer Vision algorithms to detect a Lane using **H**ough Transforms and **H**istogram Equalization.
- Attained **87%** Accuracy in Turn Prediction by calculating shift in lane angle using concepts of **H**omography, **P**erspective Transformation and **W**indow based Moving Average.

Building a Robotic Software System for Automated Material Handling April 2022

- Designed, Implemented, and Coded several algorithms from scratch in ROS using C++ to automate production tasks, including part kit creation and assembly using UR10 Robot Manipulators.
- Programmed and integrated over 100 publishers, subscribers, and service clients in a Gazebo environment for Agile Robotics, resulting in a substantial boost in production efficiency and accuracy.

LQG and LQR Control for a Gantry Crane with two suspended masses October 2021

- Designed LQG and LQR control by linearizing the dynamic model of a gantry crane carrying 2 suspended masses to minimize the oscillations and control effort
- Analyzed controllability and observability of the system with limited number of observable states.
- Implemented Kalman filter to account for Gaussian noise in the sensor measurements.