BHARATH KUMAR RAMESH BABU

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EDUCATION

Worcester Polytechnic Institute (WPI) Aug 2021 - Present
Masters Degree, Robotics Engineering.

National Institute of Technology Tiruchirappalli, India (NIT-T) (CGPA: 7.8/10) Jul 2016 - Sep 2020
Bachelor Degree, Instrumentation and Control Engineering.
Minor Degree, Computer Science Engineering.

Relevant Courses: Computer Vision, Vision Based Manipulation, Foundation of Robotics, Control Systems, Neural Networks, Embedded Systems, Data Structures and Algorithms.

TECHNICAL SKILLS

Programming Languages	**Proficient:** Python, **Intermediate:** C, C++, C#, Embedded C
Software Skills	**Proficient:** ROS, Matlab, Simulink, Linux **Intermediate:** Unity, Gazebo **Beginner:** Blender, Fusion 360
Areas of Interest	Robotics, Perception, Control, Motion Planning, Artificial Intelligence

WORK EXPERIENCE

Robotics Engineer, Flytbase, Pune, India Jul 2020 - May 2021

- Developed a drone-based warehouse inventory automation product (FlytWare) end to end. Developed features for a drone surveillance product (FlytNow) as per customer needs.
- Implemented barcode detection pipeline, created segmentation models, designed pose estimation algorithms, programmed localization module, to progress FlytWare to the stage of deployment.
- Developed web APIs for path planning and navigation of drone across flight restricted areas and improved the reliability of the drone fleet management feature in FlytNow.

RESEARCH EXPERIENCE

Directed Research, Worcester Polytechnic Institute, *Prof Berk Calli* Nov 2021 - Present

- Researching and Developing Learning Based Grasp Detection for manipulators with parallel jaw grippers in pick and place applications.

Research Intern (Fault Tolerant Control of a Quad-rotor using Super-Twisting SMC) May 2019 - Jul 2019
Artificial Intelligence and Robotics Lab, **Indian Institute of Science** *,Prof Suresh Sundaram*

- Developed PID, LQR and SMC control for a Parrot drone model with and without an absent rotor and carried out a comparative analysis in Matlab.
- Implemented and simulated Super-Twisting Sliding Mode Controller and designed a Control Allocation algorithm for robust trajectory tracking of the Quadrotor under faulty circumstances. Achieved stable landing of the drone in simulation with 70% underactuation in one of the rotors.

Research Intern (Control of Medical Assistive Devices using Electroocculography) May 2018 - Jul 2018
Biomedical Instrumentation and Signal Processing Lab, **IIT Madras** *Prof Ramasubba Reddy*

- Designed a python interface to acquire and process EOG signals obtained from ADS1299 EEG signal acquisition board. Designed a classifier based on steady state visually evoked potential of EOG signals achieving 98% accuracy with realtime output.
- Developed a CNN to classify the processed signals into eye ball movements. Achieved an accuracy of 88%. Implemented the classifier in a messaging software meant for paralysed people.

PROJECTS

Pose Estimation and Augmented Reality on a Rubik's cube — Nov 2021 - Dec 2021

- Implemented Rubik's cube bounding box prediction using ORB based feature matching and Homography. Implemented Kalman filter and removed significant noise during bounding box detection.
- Implemented Perspective Projection of virtual 3D objects from world frame to image frame to augment the object on the Rubik's cube's face.
- Estimated the position and orientation of the camera with respect to the cube using Perspective-N-Point.

Grasp Synthesis and Manipulation using Point Cloud Processing — Aug 2021 - Oct 2021

- Developed a pipeline to synthesize grasp points by processing point clouds obtained from eye in hand kinect sensor mounted on Panda manipulator using PCL in Gazebo.
- Implemented End Effector control using ROS MoveIt package to reach the synthesized grasp points for pick and place operations.
- Implemented a Image based visual servoing controller for pick and place operations.

Simultaneous Localization and Mapping of an indoor Agricultural Robot — Dec 2017 - Mar 2018

- Built a differential drive robot that can map and navigate indoor farmlands using Gmapping and ROS navigation stack with Kinect's RGB-D data and wheel/IMU odometry.
- Built plowing, sowing and spraying mechanisms on the robot. Developed an android application for monitoring of the sensor data.

Shadow Detection and Removal using Unsupervised Segmentation — Dec 2018 - Jan 2019

- Implemented a CNN based Unsupervised Segmentation algorithm for segmentation of the image into sub regions. Detected shadows using pixel luminance and image processing techniques.
- Designed a pipeline that extracts the texture features from the sub regions, matches the subregions based on space and texture similarity and transfer the luminance across subregions to remove the shadow.

End-Effector Trajectory Control of a 4DOF Manipulator using EEG signals — Dec 2018 - Dec 2019

- Designed a 4-DOF pick and place manipulator and simulated in Gazebo. Implemented end effector path planing and control using MoveIt library.
- Designed CNN classifiers for the classification of preprocessed Motor imagery and EOG signals obtained from OpenBCI Ganglion board.

Autonomous Differential Drive Robot — Dec 2018 - Mar 2019

- Built a differential drive robot to drive through lanes in a custom indoor setup using Watershed segmentation and Hough Line Transform.
- Designed a PID controller with visual feedback to control the robot through the lane.
- Implemented OCR and Template Matching to recognize traffic signs and take appropriate actions.

POSITIONS OF RESPONSIBILITY

- Researcher at **Spider R&D**, Research and Development Club of NIT-T
- Robotics Teacher at, **Sensors**, Instrumentation and Control Engineering Department Symposium, NIT-T
- Teaching volunteer at **U&I**, a charitable organization for education of underprivileged students
- Workshops Head at, **Sensors**, Instrumentation and Control Engineering Department Symposium, NIT-T
- Deputy Manager at **Festember**, National level cultural festival of NIT-T
- Event Manager at **Pragyan**, ISO certified techno-managerial festival of NIT-T

EXTRA CURRICULARS

- Winners of Sparkon, Hardware Hackathon conducted by IIT Madras
- Finalist of Sangam, (Indoor Agricultural Robot) Product development competition conducted by NIT Trichy
- Quater Finalist of Eyantra, (Planter Robot) National level Robotics competition conducted by IIT Bombay