Hrushikesh Budhale

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EDUCATION

M Eng Robotics, University of Maryland, College Park, MD **Aug 2021 - Present**
Relevant Coursework: Robot Modeling and Control, Software Development, Control of Robotic System

B Tech Electronics, Walchand College of Engineering, MH, India **Aug 2015 - May 2019**
Grade: First Class with Distinction

TECHNICAL SKILLS

Languages & Tools: C++, Python, Matlab, Git, Docker, ROS1, ROS2, Tensorflow-Keras, Unix, Flask, Flutter, Vue
Software: Gazebo, R-Viz, Coppelia sim, Matlab, Simulink, SolidWorks, Eagle (PCB design), Proteus
Controls: MPC, LQG, LQR, PID, Stanley, Pure Pursuit **Filters:** Kalman, Bayesian, Particle Filter

EXPERIENCE

Maryland Robotics Center MD, USA
Graduate Research Assistant *Dec 2021 - Present*
- Developing indoor autonomous package delivery robots.
- Working on development / integration of custom Reinforcement Learning based Local planner and controller plugins.
- Developed ROS2 package of the robot for training in the gazebo simulator.
- Designed a training environment with intelligent pedestrians to mimic the real world scenario in a crowded building.

Flytbase Inc. Pune, India
Robotics Engineer *January 2020 - August 2021*
- Designed and developed Visual odometry for autonomous quad copter using onboard monocular camera. Package developed using the combination of Geometric projection, predictive filter and DL based approach, achieving 20 cm in localisation accuracy in a GPS denied environment across an 80mx40m field.
- Developed 3D path planner for the fleet of drones to efficiently reach desired locations while avoiding collisions.
- Utilized (LaneNet) Deep Learning based detection pipeline to train, test, and segment the region of interest for an environment with dynamic lighting conditions.
- Designed and developed charging pad of quad-rotor with novel designs for features like reverse polarity and short circuit protection and software back end for remote monitoring it's status through REST APIs.

CS Dept., Indian Institute of Technology Mumbai, India
Software Development Intern *June 2018 - August 2018*
- Implemented robust controller for stability of drone while tracking the drone pose using fixed overhead camera.
- Completed dynamic path planning for MAVs project which involved planning and following trajectory for quadcopter in an indoor environment while avoiding moving obstacles.
- Developed method was robust enough to make the drone fly through 40cm diameter hoops. RRT* Path planner was used to avoid moving obstacles. Effectively used simulation software (coppelia sim) to emulate the real scene and plan the trajectory accordingly.

PROJECTS

Gantry Crane Control | Control & Filtering *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. Link

Home organizing robot | Agile development & ROS *2021*
- Developed ROS package using Tiago mobile manipulator for search and manipulation of small objects in house.
- Used move base for autonomously navigating through the mapped environment, Moveit for planning manipulator trajectory for grasping and Opencv for filtering and object detection purposes.
- Complete stack was written in C++ with Continuous Integration and passing tests. Link

Pose Estimation in Structured Environment | Perception & Localization *2020*
- Developed package for pose estimation by using input from the DL models. Utilized DTW filtering for matching predictions with observations.
- Used camera model and projective geometry to predict next pose based on state variables
- Implemented complete algorithm using only Numpy and Opencv as dependencies. Real world tests showed near real time performance. Link

Monocular Human Position Estimator | Vision & Tracking *2021*

- Developed application detects and tracks humans using a pre-trained HOG descriptor and Support Vector Machine detector in OpenCV.
- Performed frame transformation to get 3D position of human w.r.t to the robot's center from the bounding box parameters. Designed unit tests using Google Test, maintained version control using Git, checked build using Travis CI and code coverage using Coveralls. Link

Collector Robot | Vision and Control *2019*

- Completed project in which ground vehicle detects and collects scattered dummy fruits in the arena and places them on a small scale moving truck. Implemented A* path planning algorithm to avoid static obstacles.Used an overhead camera to identify fruits and track the robot position using Aruco markers.
- Designed and constructed autonomous ground vehicle for efficient operation. Implemented PID control to follow the computed trajectory. Effectively used Image Processing (OpenCV), Embedded Programming, CoppeliaSim, Path Planning, Hardware design.

FPGA based microprocessor | Electronics and Hardware *2019*

- Designed and Built processor trainer kit for custom 32-bit RISC processor. Added web-based GUI to wirelessly upload and execute assembly language program using Flask in the backend. Implemented assembler in python to convert assembly language programs into binary/hex files.
- Implemented Instruction Set Architecture on FPGA with 30 supporting instructions. Technologies/Concepts – FPGA programming, Xilinx (software), Python programming, ESP32 microcontroller, Web GUI design, RISC processor. Link

ACADEMIC/VOLUNTEER EXPERIENCE

Volunteered in a campaign to teach school kids in nearby villages about computers. *2019*

Mentor: Chief coordinator of the college event in the Robotics committee. *2019*

Leadership: Led college team of 15 students in International Robotics competition 'Robocon'. *2018*

Leadership: Served as team leader of Semi-finalist Team in National level robotics competition. *2017*