Varad Vaidya

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GitHub: varadVaidya

Education

Visvesvaraya National Institute of Technology Nagpur, India
B.Tech in Mechanical Engineering; CGPA: 8.66 *July 2018 – May 2022*

Research Experience

Obstacle Avoidance using Dynamic Motion Primitives Indian Institute of Technology, Delhi
Research Intern *Apr. 2021 — Oct. 2021*

- Implemented Cartesian and joint space dynamic motion primitives on Kuka LBR iiwa in PyBullet for movement reproduction of complex trajectories
- Extended the formulation to include orientation based motion primitives using quaternions for singularity free representation, and demonstrated the spatial and temporal scalability of the system
- Implemented Static and Dynamic Potential Fields to avoid multiple stationery and moving obstacles
- Reduced the error in the motion primitive's trajectory by extrapolating the obstacle's position and checking its collision with the robot's motion

Control of Flexible Manipulator using Deep Reinforcement Learning IISc, Bengaluru
Research Intern *Dec. 2021 — Present*

- Studied Reinforcement and Deep Learning to implement Deep Reinforcement Algorithms such as DQN and DDPG on OpenAI and PyBullet environments using pytorch
- Creating a custom environment to handle dynamics of flexible manipulators

Publications

- Raman et al. inc. **Vaidya,V** , "Sahayak -An Autonomous COVID Aid Bot," in *International Symposium of Medical Robotics*, (Atlanta, Georgia, United States), Nov. 2021

Projects

Visual Learning-based Optimal Control and Navigation *Jan. 2022 — Present*

- Created a custom PyBullet environment with Turtlebot2 in PyBullet and implemented PID and iLQR control to reach a provided waypoint
- Integrating iGibson dataset with our control architecture to enable realistic rendering and interaction with environments

Sahayak-v3: Product Design *Dec. 2020 — Mar. 2021*

- Designed the cyber-physical architecture of Sahayak COVID aid bot for autonomous capabilities
- Modified the CAD model of Sahayak-v2 for robust locomotion in SolidWorks and selected the components mathcing the requirements
- Added senor models to CAD model and converted entire robot stack to URDF for simulation in Gazebo

Force Control of Manipulators *Jan. 2021 — Apr. 2021*

- Applied stiffness and kinematic control of planar 2DOF manipulator in Python from scratch
- Wrote a custom wrapper over PyBullet for robotic manipulators for ease of control, trajectory generation and planning, using SLERP for quaternion interpolation
- Implemented force control methods like computed torque control and impedance control on UR5 in PyBullet

Mobile Manipulation using Kuka youBot *Oct. 2020 — Nov. 2020*

- Designed end-effector trajectory using cubic splines and rotation matrix interpolation for a cube to be picked and placed between two locations
- Simulated the kinematics of youBot wheeled manipulator, controlled using PI controller, in Python and visualised in CoppeliaSim

2 Arm Quadcopter Balance *Feb. 2020 — Mar. 2020*

- Designed and manufactured a two arm balance for quadcopter balancing using PID control
- Used MPU 9250 IMU with Arduino Uno to provide PWM signals to BLDC motors
- Implemented complementary filter to provide accurate estimate of the pitch of the system

Dynamic Modelling of Quadcopter *Mar. 2020 — July. 2020*

- Developed a dynamic model of quadcopter in MATLAB controlled using PID controller
- Implemented a planar quadrotor model in Python from scratch to follow minimum velocity, acceleration and jerk trajectories for point to point navigation

Skills

- **Programming:** Python, C, MATLAB, Simulink, LaTeX
- **Tools and Software:** Linux, PyBullet, SolidWorks, OnShape, PyTorch, ANSYS, ROS, Arduino
- **Misc:** Git/GitHub, Adobe LightRoom

Relevant Coursework

- **MOOC:** Aerial Robotics, Modern Robotics: Mechanics, Planning, and Control
- **Mechanical:** Industrial Robotics, Control Systems, Finite Element Method, Theorey of Machines I and II
- **Mathematics:** Statistical Analysis and Queuing Theory, Integral Transforms and Partial Differential Equations

ExtraCurricular

Project Head, IvLabs, VNIT Nagpur *May. 2020 — Jul. 2021*

- Led the student body responsible for deciding summer projects for sophomore students
- Conducted IEEE workshops on SolidWorks and Basic Electronics
- Guided summer projects related to Control and Dynamics at IvLabs