Prakrut KOTECHA

github | linkedin

EDUCATION

INDIAN INSTITUTE OF SCIENCE *2023-Current*

MTECH RESEARCH - CYBER-PHYSICAL SYSTEMS

Current CGPA: 9.00

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY,NAGPUR *2018-2022*

BTECH - MECHANICAL ENGINEERING

Bachelor's Thesis: Modelling, Control and Simulation of Quadruped Robot

[Thesis]

PATENT AND PUBLICATION

PATENT *Published*

Prakrut Kotecha, et al. "Navigation System for a vehicle and a method for navigation".

CBR Ref. Number: 201921049473

[Video]

CONFERENCE PAPER *Submitted*

Prakrut Kotecha, et al. "A Hybrid Manipulation Framework with Trajectory Optimization for Mobile Manipulators".

European Control Conference (ECC) 2024

EXPERIENCE

NON-PREHENSILE MANIPULATION *January 2022-March 2023*

RESEARCH ASSISTANT UNDER PROF. NAGAMANIKANDAN G (ASSISTANT PROFESSOR AT IIIT, HYDERABAD)

- Developed a framework for Hybrid Manipulation using a Mobile manipulator.
- Using mathematical program with complementarity constraints did planar pushing for taking a cube from one position to another using only sticking mode of contact.
- Integrated planar pushing and striking with pick-and-place to make a generalised framework.

DEVELOPMENT OF CONTROL POLICY FOR QUADRUPED ROBOT *May 2021-September 2021*

PROJECT INTERN UNDER PROF. SAM ZACHARIAH (ADJUNCT PROFESSOR AT IIST, SCIENTIST AT ISRO)

- Worked on Hybrid Dynamics based controller to produce dynamic walking gait for Quadruped.
- Implemented a controller based on classical control theory using inverse kinematics and dynamics, in Matlab. Further imported the model in Gazebo and tested various gaits in same.

PIXGUIDE (IVLABS) *May 2019- July 2019*

Summer Intern at IvLabs-Robotics and AI Lab, VNIT Nagpur

- Fabricated a navigation device for two-wheelers with a novel navigation system. A novel design was made keeping in mind the intricacies of the system.
- Used Arduino Nano paired with Bluetooth audio receiver to convert the audio frequency coming from the phone into animations on an 8x8 LED matrix.
- Each instruction was encrypted in a frequency and sent via Bluetooth receiver to Arduino nano which then sent the instructions to the LED matrix for animations.

[GitHub] [Video]

PROJECTS

MPC FOR UGV TRAJECTORY TRACKING USING WAYPOINT GENERATION *August 2023- December 2023*

- Implemented a closed loop formulation for generation of waypoint and trajectory tracking using colour based segmentation and Linear-MPC respectively.
- As a part of course project we derived dynamics for an RC car and implemented Dynamics Matrix Control(DMC) based MPC to track a trajectory.
- For waypoint generation colour based segmentation was used to segment track from the rest of the enviornment and find the centroid of the same for the waypoint.

[Details]

Reconfigurable Robot (QHuMuS) - (Snake-Quadruped-Humanoid) *August 2020- January 2021*

• Designed a novel reconfigurable robotic system that transitions between serpentine, wheeled-quadruped, and humanoid motion modes without any reconfiguration.

• Unique transition gaits were developed between the system's various mobility modes of locomotion. These gaits serve as the basis for more advanced control algorithms.

• Control framework has been developed for serpentine gaits such as lateral undulation, linear progression, side winding and rolling, and wheeled quadruped walking gaits.

[Video]

Gait and Trajectory optimization for bipeds *January 2020- September 2020*

• Implemented trajectory optimization on a 5 link kneed walker using the direct collocation method with Trapezoidal collocation followed by Hermite-Simpson collocation.

• Generated periodic gaits by optimizing the problem repeatedly and then generated non-periodic gaits by changing the initial guess.

[GitHub] [Video]

Visual Learning Based Optimal Control and Navigation *January 2022-April 2022*

• Developed navigation framework made with a combination of learning and model-based control for goal-driven navigation in indoor environments

• Using a turtlebot made a map of a room and using a preception module we generated feasible waypoints in the enviornment and used MPC to generate control inputs for turtlebot to follow the trajectory

[Report]

Passive Walker *December 2019- January 2020*

• Developed an understanding of Non-Linear dynamics and chaos theory to construct a two-link passive walker and simulated on MATLAB

• Used Euler Lagrange to derive dynamics for two leg passive walker and using ode45 on MATLAB solved the problem and simulated the results.

[GitHub]

Online Courseware

- MIT 6.832 Underactuated Robotics - Russ Tedrake, MIT
- CS287 Advanced Robotics - Pieter Abbeel, UC Berkeley
- Introduction to Reinforcement Learning - David Silver, Deep Minds

University Courseware

- E0 230 Computational Methods of Optimization
- E1 222 Stochastic Models and Applications
- MEL 401 Control Systems
- MAL 201 Intregal Transforms and Partial Differential equations
- MAL 101 Intregal and Differential Calculus and Matrices
- MAL 102 Vector Calculus and Ordinary Differential Equations

Skills

Programming Languages	Python | MATLAB | C/C++ | Java
Libraries	Matplotplib | Numpy | CasAdi | Gekko | jax
Designing and Simualtion	Solidworks | Fusion 360 | Blender | Simulink | Gazebo | PyBullet | ANSYS
Others	Git | Photoshop | HTML | LATEX | WSL

Extra-Curriculars

- Alumni Secretary of IvLabs- The Robotics and AI Lab of VNIT.
- Conducted workshops on topics such as Image Processing, Microcontrollers, CAD etc for 100+ students under IEEE students chapter.