Preet Patel

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EDUCATION

Carnegie Mellon University Pittsburgh, PA
Master of Science in Mechanical Engineering – Advanced Study (Robotics and Controls) Dec 2025
Coursework: Multivariable Linear Control, Modern Control Theory, Robot Localization and Mapping

Birla Institute of Technology and Science, Pilani (BITS Pilani) Pilani, India
Bachelor of Engineering (Honors) in Mechanical Engineering July 2024
Coursework: Mechanisms and Robotics, Control Systems, Autonomous Mobile Robotics, Image Processing

SKILLS

Programming: Python, MATLAB, C++
Control and Estimation: Model Predictive Control, LQR, PID, Robust Controllers (H2, H-infinity, etc.), Sensor Fusion
Frameworks and Libraries: Numpy, Pytorch3D, PyTorch, Matplotlib, Pandas, Scikit-Learn

PROJECTS

Environment Aware Controller for Lower Limb Prosthetic | Legged Systems Group May 2025 – Present

- Developed and deployed an environment-aware gait phase controller for lower-limb prosthetics, integrating sensor fusion and real-time control logic to adaptively switch between swing and stance phases based on dynamic terrain and motion cues.
- Integrated state estimation techniques using IMU and prosthetic joint data, enabling robust control performance across varying gait conditions with low-latency responses on embedded hardware.
- Designed and optimized control algorithms in Python, incorporating forward kinematics and dynamic gait heuristics for responsive and stable locomotion under real-world disturbances.
- Prototyped and validated control strategies in simulation (MATLAB) and on-device, ensuring safety, responsiveness, and robustness in real-time operation with constrained computational resources.

Deep Learning based Leg motion prediction | Legged Systems Group Oct 2024 – Present

- Designed a versatile ML framework that automates data conversion, dynamic feature selection, and preprocessing, enabling efficient training and evaluation of various ML architectures on different datasets for gait phase classification.
- Deployed a machine learning model to classify gait cycle into swing or stance phase using prosthetic sensor data, achieving 98% classification accuracy. Refined a 2.34M-samples dataset, cleaning and refining it to 1.6M-samples.
- Developed and benchmarked MLP, CNN, LSTM and Transformer model for knee angle prediction. Analyzed the performance of models using MSE loss, identifying challenges in time-series prediction and proposing refinements in dataset quality for future improvements.

Real-time Particle Filter based Localization for Mobile Robots | CMU Oct 2024 – Dec 2024

- Developed a Monte Carlo Localization system using a particle filter, fusing LiDAR and IMU data through custom motion and sensor models for accurate robot localization in a known map.
- Achieved real-time performance with up to 5,000 particles by optimizing the ray casting module through vectorized computation in Python, resulting in a ~25% speedup over the non-vectorized implementation.
- Improved localization accuracy and convergence speed in noisy environments by tuning noise parameters in sensor model, enabling reliable pose estimation within just 10 sensor updates.

Simulating Autonomous Vehicle Driving Stack in WeBots | CMU Oct 2024 – Dec 2024

- Designed and tunes PID, state-feedback and LQR controller for trajectory tracking for an autonomous car, achieving fast and robust convergence with average lateral tracking error under 0.23m and fast recovery in sharp turns.
- Integrated EKF-SLAM for localizing the vehicle in environment, maintaining localization error below 0.5m, enabling closed loop control with the tracking controller.
- Developed A* path planning for real-time obstacle avoidance, enabling vehicle to detect and overtake dynamic obstacles on its reference trajectory with minimal lateral deviation of 0.7m.

WORK EXPERIENCE

Robotics Research Center, IIIT Hyderabad, India | Research Intern June 2023 – Dec 2023

- Designed and optimized a 6DOF bipedal robot in Fusion360, reducing weight by 50% (compared to previous prototype) while ensuring structural integrity through iterative design and material research. Conducted FEA in ANSYS, achieving Factor of Safety (FoS) of 3.4.
- Engineered a compact split-ring planetary gearbox achieving a 48:1 reduction ratio, transmitting 24Nm torque. Validated structural integrity through FEA (Factor of Safety 2.4) and lab testing.