

Pratham Salvi

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Summary

Robotics engineer specializing in AI-driven autonomy with expertise in deep reinforcement learning, imitation learning, computer vision and building end to end robotics solutions. Experienced in developing locomotion, motion planning, and human-robot interaction systems, with a proven record of research innovation through a robotics patent and IEEE publication.

Education

M.Eng in Robotics, University of Maryland, College Park
(Expected)

Aug 2025 – Expected May 2027

B.Tech in Mechanical Engineering, Vellore Institute of Technology, Vellore
CGPA: 8.17 / 10

Work Experience

Robotics and AI Researcher, Tata Consultancy Services, Bengaluru

Jan 2024 – Aug 2025

- Pioneered locomotion policies using behavior cloning, imitation learning, and DRL, achieving 95% gait stability on a proprietary biped robot.
- Applied Model Predictive Control (MPC) and Zero Moment Point (ZMP) techniques for dynamic gait stabilization.
- Accelerated simulation by 40% by modeling locomotion in Isaac Gym using equivariant networks, a key component of my forthcoming IEEE publication.
- Enabled real-time imitation learning from live video for seamless human-robot interaction.
- Designed and prototyped a full-scale biped with a patented ankle joint mechanism, a novel solution to a long-standing challenge.

Robotics Automation Intern, Solar Industries India, Nagpur

May 2023 – Nov 2023

- Transformed warehouse workflows by redesigning layout in FlexSim, increasing operational efficiency by 25%.
 - Developed autonomous UAV missions using PX4, ArduPilot, and Gazebo for automated logistics.
 - Integrated YOLOV5 for on-board object detection, enabling autonomous UAV delivery with 92% accuracy.
 - Contributed to the design of a patented cast booster, demonstrating 3D modeling skills in an industrial setting.
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Projects

Zero-Shot Imitation Learning for Manipulator Control using Video-LLaMA3 *PyTorch, Video-LLaMA3*
— *Team Project* *August 2025 – September 2025*

- Developed a vision-language model (VLM) based framework to generate robot action plans directly from human demonstration videos.
- Leveraged Video-LLaMA3 for zero-shot policy generation, enabling task planning without task-specific training data.
- Implemented a pipeline to translate VLM-generated plans into manipulator trajectories for grasping using Graspnet.
- Demonstrated general-purpose applicability in robotic imitation learning by reducing reliance on curated datasets.

Panda Arm – Vision-Based Motion Planning *ROS2, MoveIt, OpenCV* — *Individual Project* *March 2025 – Apr 2025*

- Engineered a real-time object detection system using a camera and OpenCV for 6DOF pose estimation.
- Developed a collision-free trajectory planner using the MoveIt framework with custom cost functions.
- Implemented closed-loop visual servoing in a Gazebo simulation, achieving sub-millimeter positioning accuracy of 2mm.

Autonomous Driving in Webots

Webots, PyTorch — *Individual Project*

September 2025 - Present

- Built an autonomous driving stack in the Webots simulator integrating 3D vision, Model Predictive Control (MPC), and Reinforcement Learning (RL).
- Implemented multi-view 3D object detection and depth estimation, achieving ~95% mAP on vehicle and pedestrian recognition tasks.
- Designed an MPC-based trajectory planner, reducing trajectory tracking error by 28% compared to baseline PID controllers.
- Trained RL agents for decision-making (lane changes, overtaking, intersection handling), achieving a ~90% task success rate across multiple CARLA towns.
- Validated system performance with end-to-end driving tests, demonstrating ~85% route completion in dense traffic scenarios.

UR5 Interceptor MPC + LQR

Python, CasADi, PyBullet — *Individual Project*

July 2025 – Sept 2025

- Designed a hybrid control architecture for a UR5 robotic arm to intercept moving targets in real time.
- Implemented Model Predictive Control (MPC) for predictive trajectory planning under dynamic constraints.
- Integrated a Linear Quadratic Regulator (LQR) for stable low-level joint control, ensuring smooth execution.

- Built and tested the system in a PyBullet simulation, demonstrating successful interception of dynamic targets.

TerraPredict – Landslide Prediction & Analysis *Computer Vision, LLM, PyTorch — Team Project Aug 2024 – Sept 2024*

- Developed a semantic segmentation model on satellite imagery (Landslide4Sense) to predict landslide regions
- Fine-tuned and tested the model with Satellite-acquired images and live UAV video feeds to analyze landslide progression
- Validated model performance across varied data sources (satellite setups + UAV) for generalization under real-world conditions
- Built end-to-end workflow: data collection / preprocessing → model training → real-time inference on video inputs

UR5 – Vision-Based Model Predictive Control *Python, CasADi, ROS2 — Individual Project July 2024 – Aug 2024*

- Designed a nonlinear MPC controller for visual servoing with real-time optimization using CasADi.
- Implemented image-based visual servoing with feature tracking and velocity command generation.
- Validated controller performance under varying lighting conditions and dynamic obstacles.

Brain Tumor Classification using Deep Learning *Pytorch, Keras, Python — Individual Project May 2024 – June 2024*

- Developed a CNN architecture for multi-class brain tumor classification from MRI scans (4 classes).
- Achieved 94.5% validation accuracy using data augmentation, dropout regularization, and transfer learning.
- Implemented grad-CAM visualization for model interpretability and clinical validation.

Technical Skills

- **Robotics:** Motion Planning | Control Systems | SLAM | Dynamics | State Estimation
 - **AI/ML:** Reinforcement Learning | Computer Vision | Deep Learning | Imitation Learning | Foundational Models
 - **Programming:** Python | C++ | MATLAB | PyTorch | TensorFlow | NumPy | OpenCV | JAX
 - **Tools:** ROS1/ROS2 | Isaac Gym/Sim | Gazebo | MuJoCo | PyBullet | SolidWorks | CARLA | Git
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Intellectual Property

- **Patent:** Bipedal robot with the coaxial-orthogonal hip mechanism and ankle actuator with the torque enhancement mechanism. *Filed in 2025*
 - **SMC 2025** (*IEEE International Conference on Systems, Man, and Cybernetics*): Encoding Symmetries of Humanoid Robots using Equivariant Neural Networks in Reinforcement Learning for Locomotion. [ref]
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Leadership & Achievements

- **Team INFINIX – CAD Head**, VIT Vellore *Jul 2023 – Jul 2024*
 - Led a 12-member design team for the NASA Human Exploration Rover Challenge, coordinating end-to-end CAD workflow and subsystem integration
 - Implemented topology optimization and advanced material selection strategies, achieving an 18% reduction in rover weight while maintaining structural integrity
 - Managed cross-functional collaboration with manufacturing and testing teams, ensuring design feasibility under strict NASA competition requirements
 - Enhanced team efficiency by standardizing CAD practices and mentoring junior designers in simulation and optimization tools
- **RoboVITics – Core Committee Member**, VIT Vellore *Feb 2021 – Jul 2024*
 - Secured 2nd place in a inhouse robotics hackathon among 50+ teams by developing a novel AI-driven solution
 - Organized and conducted technical workshops on robotics, AI, and embedded systems, training over 500 students across multiple cohorts
 - Coordinated the MLH-sponsored hackathon , managing logistics, safety, and technical reviews for 1000+ participants
 - Coordinated and mentored peers in Robowars Combat robotics competition, fostering interdisciplinary collaboration between mechanical, electronics, and CS students