Jay Prajapati

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- Robotics Engineer with experience in Perception Systems, Machine Learning, and Multi-Object Tracking.
- Specializes in sensor fusion, camera, LiDAR, and developing software for robotic systems using C++ and Python.
- Passionate about advancing autonomous driving technology through data-driven solutions and predictive modeling.

EDUCATION

**University of Maryland, College Park, USA	Master of Engineering in Robotics (GPA: 3.7/4)**	Aug 2022 – May 2024
**Gujarat Technological University, India	B.Tech. in Mechanical Engineering (GPA: 7.88/10)**	Aug 2018 – May 2022

Related Coursework: Machine Learning, Deep Learning, Reinforcement Learning, Computer Vision, Robot Design, Control Theory, Motion Planning

EXPERIENCE

Robotics Intern | Robotics, IoT, 3D Printing, Rapid Manufacturing and Prototyping, Autonomous Navigation ⸻ Jan 2020 – Jan 2022
Robotics Lab, BVM Engineering College ⸻ Anand, Gujarat, India

- 3D scanned an 11ft statue, achieved a 98% accurate CAD model, and cut production costs by 50% for 3D printed miniatures using FDM technique.
- Worked in a Linux-based environment, optimizing data pipelines for performance and reliability in various robotic applications.

Quadruped Robot (Demo)

- Pioneered the design and development of a Quadruped Robot, mimicking walking, turning, trotting, and slope climbing abilities of canines.
- Fabricated the robot using 3D printing, reducing weight by 40% compared to acrylic or aluminum, while ensuring robust integrity and mobility
- Conducted detailed motion analysis using SolidWorks, optimizing gait patterns to achieve 90% accuracy when compared to simulation models.
- Optimized multithreaded control for 12 servo motors using an ATmega 2560 microcontroller and PCA9685 servo control board via I2C.

Comparison of 2D Mapping Algorithms (GitHub)

- Engineered a wheeled robot using Raspberry Pi, LiDAR, and camera, mapping environments up to 20,000 sqft with autonomous GPS navigation.
- Evaluated HectorSLAM, Cartographer, and Gmapping algorithms, identifying Cartographer as the most accurate with 30% fewer artifacts.

PROJECTS

Software module for a Multi-Robot System (GitHub)

- Orchestrated a swarm robotics simulation for 25 TurtleBot3 robots in Gazebo using ROS2, achieving geometric formations with 99% accuracy.
- Devised a **Master-Slave Algorithm** in a multi-robot system, enabling coordinated movements and pattern formation in a simulated environment.
- Established and integrated **CI/CD pipelines** with 89% code coverage, ensuring robust and reliable software deployment for multi-robot system.

Dynamic Path Planning and Replanning Using RRT* for Autonomous Robots (GitHub)

- Implemented C++ and Python-based **A***, **Dijkstra's**, **D***, **RRT**, and **RRT*** algorithms for optimal robot navigation using Turtlebot3 and Gazebo.
- Executed the RRT* algorithm in Python, achieving efficient dynamic obstacle avoidance and optimal path planning in complex environments.
- Designed and implemented **probabilistic inference systems** for predicting the future behavior of dynamic obstacles in autonomous navigation.
- Utilized **Bayesian inference** to model uncertainty in agent intentions and future behavior, improving prediction robustness by 20%.

AI-Driven Real-Time Image Captioning for Enhanced Accessibility (GitHub, Demo)

- Developed a deep learning model using Inception V3 CNN encoders, achieving 92% accuracy in real-time captioning for visually impaired users.
- Enhanced model accuracy and reliability with Block Static Expansion and multi-headed attention, optimizing real-time descriptive captioning.
- Created Python scripts for seamless phone camera integration, enabling real-time video feed processing and immediate voice captioning.

Semantic Segmentation for Real-Time Food Item Recognition

- Achieved 80% accuracy in food item segmentation using RNN-based ResNet50 and PointRend architectures, optimizing real-time video analysis.
- Employed transfer learning, reaching 67% test accuracy on a limited dataset (4935 training, 2135 test images), surpassing a custom model's 43%.
- Fine-tuned pre-trained architectures for accurate food identification, enhancing segmentation performance in real-world scenarios.

SKILLS

Programming:	Python, C/C++, MATLAB/Simulink, SQL, Multi-Threading, Data Structures, Algorithms, Unit Testing, PLC Ladder Logic
Software Tools:	ROS/ROS2, Rviz, Gazebo, MoveIt, NAV2, Solidworks, PTC Creo, Fusion 360, MS Office, Docker, Git (Version Control)
Library and Tools:	Git, PyTorch, TensorFlow, Keras, Cuda, SKLearn, OpenCV, Eigen, NumPy, Pandas, Doxygen, LaTeX, Linux, Lucid
Soft Skills:	Problem-Solving, Collaboration, Critical Thinking, Communication

PATENTS AND PUBLICATIONS

- **IoT based wastewater spillage detection system**, IOP Conference Series: Journal of Physics (Link)
- **QUADRUPED CANINE ROBOT**, Application No.202221001158, The Patent Office Journal No. 11-2022 (March 2022)

ADDITIONAL RELEVANT EXPERIENCE

Graduate Teaching Assistant | University of Maryland ⸻ Aug 2023 – May 2024

- Mentored 95+ graduate students in Computer Vision concepts, including homography, calibration, stereo vision, optical flow, and perception concepts, including **Kalman Filters**, **Particle Filter**, **sensor fusion**, and **SLAM**.
- Instructed on C++ and Python-based algorithms for sensor data synchronization and real-time data handling.