

# SUJAI RAJAN

Robotics Engineer

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## SUMMARY

**Robotics Engineer** with 3+ years of experience designing and deploying intelligent robotic systems that integrate computer vision, motion planning, sensor fusion, and algorithm development. Skilled in ROS2, Python, and OpenCV for autonomous navigation, perception, and optimization. Proven ability to accelerate development cycles through simulation, cross-functional collaboration, and innovative problem-solving.

## SKILLS

**Programming & Tools:** Python, C++, C, MATLAB, Git, SolidWorks, Autodesk Inventor, AutoCAD, Linux, Gazebo, MoveIt2, RViz

**Libraries & Frameworks:** OpenCV, Robot Operating System (ROS, ROS2), PyTorch, TensorFlow, Scikit-Learn, Tkinter, Open3D, GTSAM

**Core Robotics:** Perception, Sensor Fusion, SLAM, Path and Motion Planning, Kinematics, Mapping, Robot Control(MPC, PID), Robotic Algorithms

**Machine Learning:** Supervised, Unsupervised & Reinforcement Learning, Deep Learning, Neural Network, Convolutional Neural Networks (CNNs)

**Computer Vision:** Object Detection, Image Processing, Feature Extraction, Stereo Vision & 3D Vision, YOLO

**Hardware & Integration:** Sensors (Cameras, LiDAR, IMUs, GPS), Embedded Systems (Arduino, Raspberry Pi, RTOS, Jetson Nano)

**Soft Skills:** Creativity, Problem Solving, Cross-Functional Collaboration, Strong Communication, Leadership, Adaptability

## EDUCATION

**Master of Science in Robotics | Northeastern University, Boston, MA**

Key Coursework: Autonomous Field Robotics, Pattern Recognition & Computer Vision, Machine Learning, Control Systems, Neural Networks & Deep Learning, Robot Mechanics & Control, Robotic Science & Systems Robot Sensing & Navigation,

**Bachelor of Technology in Mechanical Engineering | Vellore Institute of Technology, Vellore, India**

## PROFESSIONAL EXPERIENCE

**Robotics and Automation Engineer | Futaba Corporation of America, Huntsville**

**March 2025 - current**

- Designed and deployed two **machine-vision inspection systems for multi-stage PCB validation**—positional alignment, feature recognition, and data-matrix verification—before conformal coating, **reducing downstream rejects by 98 %** and **increasing inspection throughput by 65 %**.
- Engineered the perception and motion-control architecture using a **BTT Octopus 3D-printer controller with customized Marlin firmware**, coordinating seven synchronized stepper axes with sensorless homing, which ensured precise alignment and repeatable conveyor positioning.
- Developed the complete mechanical and software framework in **Python and C++**, designing and fabricating modular, ESD-safe assemblies in **CAD** and **3D-printing** key components; implemented an **OpenCV-based inspection pipeline** integrated with **SMEMA handshaking**, internal **MES API validation**, and LabVIEW GUI monitoring, achieving **100 % traceability** and long-term maintainability across the coating line.
- Delivered two industrial **6-DOF robotic vision systems** using **MyCobot 320 Pi** arms with **8 K cameras** and a **Python–ROS2–OpenCV stack** to automate PCB barcode linking; achieved **100 % traceability** across downstream inspection stages and **eliminated manual scan errors**.
- Architected the integrated vision and motion-control framework, combining a **barcode-decoding SDK**, **Tkinter HMI**, and **SMB-mounted image storage** for operator interface and result logs; optimized camera parameters for consistent, glare-free imaging under variable factory lighting.
- Directed electromechanical, safety, and vision integration, implementing Keyence **light curtains**, **photo sensors**, tower lights, COB illumination, and polarizing filters on a **Raspberry Pi 4 / ESP32 platform**; incorporated autonomous fault handling and automated CSV + image logging, delivering a **3x throughput increase**, **zero rework incidents**, and a **scalable architecture** for future robotic-vision systems.

**Robotics Software Engineer | Tekflaire, Texas**

**Aug 2024 - March 2025**

- Developed and validated an **autonomous navigation pipeline** in **ROS2** and **Gazebo**, integrating **LiDAR**, **IMU**, and **GPS** data for localization and obstacle avoidance; applied **EKF-based sensor fusion** to improve trajectory accuracy and stability on **simulated robotic platforms**.
- Designed and **tuned motion-planning algorithms** in **ROS2** using **cost maps**, **DWA**, and **A\*** for adaptive route generation and collision recovery; optimized planner performance in **RViz** and **Gazebo**, improving path smoothness and reducing trajectory drift across simulation environments.
- Built **computer-vision and perception modules** in **Python** and **OpenCV** for terrain segmentation, feature detection, and visual mapping; enhanced autonomous path optimization and decision-making accuracy in **simulated robotic systems**.

**Robotics Engineer | Citus Infotech, India**

**Aug 2020 - July 2022**

- Developed **robotic motion-control systems** for industrial automation, implementing **PID-based velocity controllers** in **C++** for conveyor-driven sorting arms; optimized control-loop tuning to improve response time and minimize oscillations during real-world tests.
- Implemented **LiDAR-based SLAM systems** using the **ROS2 Navigation Stack**, refining **Gmapping** and **Cartographer** for warehouse-mapping applications; optimized point-cloud processing through **Voxel-Grid filtering**, improving localization accuracy and computational efficiency.
- Prototyped a **vision-based gesture-recognition interface** using **OpenCV** and **TensorFlow**, enabling basic robot control through **hand-motion detection** and **CNN-based classification**; demonstrated the feasibility of integrating **AI-driven perception** into automation workflows.

## PROJECTS

**3D Point Cloud Reconstruction using SfM (Python, OpenCV, GTSAM, Open3D, SIFT, RANSAC):** Developed a Structure-from-Motion pipeline to reconstruct 3D point clouds from sequential images. Implemented SIFT-based feature extraction, fundamental matrix estimation, and triangulation; RANSAC for outlier rejection and GTSAM for bundle adjustment, reducing reprojection error by 93% and improving 3D reconstruction fidelity.

**Autonomous Car Simulation on Udacity Self-Driving Car Simulator (Python, Keras, TensorFlow, OpenCV, imgaug):** Trained and deployed an end-to-end CNN steering model on 10k+ augmented frames using YUV normalization, dropout, and behavior cloning to improve generalization; deployed real-time inference with PID feedback in Udacity's simulator, achieving stable lane-following and <0.1 rad error across multi-track tests.

**Underwater Image Stitching and Alignment Optimization (Python, OpenCV, GTSAM, SIFT, RANSAC):** Engineered an image-mosaicking pipeline for underwater mapping, preprocessing low-contrast imagery using CLAHE and SIFT/RANSAC feature alignment; optimized homography transformations via GTSAM graph optimization, reducing alignment error by ~78 % and enabling large-scale visual map reconstruction under low-visibility conditions.