

# GAUTHAM RAMKUMAR

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## EDUCATION

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### Northeastern University, Boston, MA

*Master of Science in Robotics (Concentration: ECE)*

May 2026

GPA: 3.52/4.0

**Relevant Courses:** Advanced Perception, Robot Sensing and Navigation, Autonomous Field Robotics, Mobile Robotics, Robot Mechanics and Controls, Control Systems Engineering

### Vellore Institute of Technology, India

*Bachelor of Technology in Electronics and Communications*

May 2024

GPA: 3.48/4.0

**Relevant Courses:** Digital Signal Processing, Digital Image Processing, Fundamentals of Machine Learning

## TECHNICAL SKILLS

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**Calibration & State Estimation:** Multi-Sensor Calibration (Camera-LiDAR-IMU), Intrinsic/Extrinsic Calibration, Temporal Synchronization, Extended Kalman Filter (EKF), Sensor Fusion, Factor Graph Optimization (GTSAM), Bundle Adjustment, Pose Estimation, Noise Modeling

**Perception & SLAM:** Visual SLAM (RTAB-Map), Loop Closure Detection, Pose Graph Optimization, Stereo Vision, Depth Estimation, 3D Reconstruction (SfM), Feature Matching (SIFT/ORB), Object Detection (YOLO), Camera Calibration (OpenCV)

**Machine Learning:** CNNs, U-Net, Transfer Learning, Fine-Tuning, Data Augmentation, Loss Function Design, Model Evaluation, Edge Deployment

**Programming & Tools:** Python, C++, MATLAB, OpenCV, NumPy, Open3D, GTSAM, PyTorch, ROS2, Linux, CMake, Git

**Hardware & Sensors:** ZED Mini Stereo Camera, LiDAR, VectorNav IMU, GNSS/GPS, NVIDIA Jetson Nano, Intel RealSense RGB-D

## PROJECTS

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### Camera-LiDAR Temporal Calibration | *Python, C++, Open3D, OpenCV*

Oct 2025 – Dec 2025

- Designed a targetless temporal calibration pipeline estimating real-world camera-LiDAR time offset on unsynchronized ROS data using cross-modal edge alignment optimization
- Built edge-based scoring using Canny detection and distance transforms; validated estimated 70ms offset via independent Powell optimization and dense grid search cross-validation
- Integrated IMU preintegration for motion-compensated LiDAR densification, merging 3 consecutive scans to improve point cloud density for calibration robustness

### 3D Reconstruction using Structure from Motion | *Python, OpenCV, GTSAM, Open3D*

Oct 2025 – Nov 2025

- Constructed a full 3D reconstruction pipeline using SIFT features and RANSAC on 24 monocular images, recovering camera poses and sparse scene geometry from scratch in Python
- Improved reconstruction accuracy by 26% using non-linear bundle adjustment over 1,477 landmarks via factor graph optimization
- Enabled camera localization in GPS-denied environments using essential matrix decomposition and PnP pose estimation

### GPS-IMU Fusion using Extended Kalman Filter | *Python, NumPy*

Sep 2025 – Oct 2025

- Built a real-time state estimation pipeline fusing 200 Hz IMU with GNSS using an Extended Kalman Filter, implementing prediction and measurement update steps for continuous vehicle localization
- Modeled IMU noise characteristics and GPS measurement uncertainty to tune process and observation covariance matrices for robust sensor fusion across varying signal quality
- Maintained localization continuity in GPS-denied zones using IMU-only dead reckoning, with adaptive covariance weighting to handle degraded GNSS measurements in tunnels

## PROFESSIONAL EXPERIENCE

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### SmartInternz

*IoT Intern*

Chennai, India

May 2023 – Jul 2023

- Built a real-time sensing pipeline achieving 1 cm measurement accuracy using ultrasonic sensors with signal processing for noise filtering and reliable actuation control
- Implemented cloud-based data logging at 1 Hz using Firebase Realtime Database for remote sensor monitoring and system diagnostics
- Developed a secure multi-user control interface supporting 10 concurrent connections with device-level authentication via IBM Watson IoT