

NAGAVARUN SAMALA

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EDUCATION

Northeastern University, Boston, MA

Dec 2025

Master of Science in Robotics, Electronics and computer engineering

coursework: Algorithms, Computer Vision, Control Systems, Autonomous Field Robotics, Sensor Fusion, Legged Robotics, Advanced Computer Vision

Chaitanya Bharathi Institute of Technology, India

Bachelor of Technology in Mechanical Engineering

Jul 2023

TECHNICAL SKILLS

Languages and Tools: C/C++, Python, MATLAB, OpenCV, Eigen, GTSAM, PCL, Git, Docker, NumPy, FilterPy, Matplotlib

Software and Frameworks: ROS, ROS2, Simulink, Gazebo, MuJoCo, Isaac Sim, TensorFlow, PyTorch, ONNX, TensorRT

EXPERIENCE

Silicon Synapse Robotics Lab, Boston, MA

Nov 2023 – Dec 2025

Research Assistant (MATLAB, Simulink, State Estimation, Perception)

- Implemented end-to-end autonomous navigation system for M4 robot using ROS2, integrating elevation mapping with 2.5D costmap generation and custom Nav2 plugins for path planning, achieving robust indoor navigation with dynamic obstacle avoidance in hospital simulation
- Developed behavior tree system for autonomous waypoint navigation with custom action nodes for path planning, obstacle avoidance
- Drafted Error-State Kalman Filter for a bipedal robot, combining IMU and Mocap data to estimate robot pose for integration with ZMP controllers
- Developed Capture Point-based ZMP controller to dynamically regulate foot placement for balance recovery, achieving stable bipedal standing

MethodAI Boston, MA

Bio-Medical Engineering

Jan 2025 – Jun 2025

- Developed and automated systematic single element testing to validate transducer performance and verify tumor alignment using tumor phantom
- Built MATLAB scripts for real-time RF data capture, histogram visualization, and beamformed image plotting to support transducer evaluation
- Developed a real-time force visualization MATLAB app by integrating a Force sensor to capture and plot insertion forces during catheterization

Kitolit Ltd, Hyderabad, India

Oct 2022 – Aug 2023

Robotics Engineer | (ROS, OpenCV, CNN, Object Detection and Image Processing)

- Engineered embedded vision pipeline on Raspberry Pi processing distorted fisheye imagery through custom calibration matrix and lane detection algorithms, delivering steering commands at 30Hz for responsive vehicle control
- Implemented closed-loop control system translating detected lane boundaries into precise servo commands through custom control algorithm, demonstrating successful autonomous lane-following in various lighting conditions
- Engineered and deployed a self-driving RC car using ROS and LD19 lidar, creating a real-time 2D point cloud map with Hector SLAM for precise localization and navigation. Integrated MOVE Base for path planning, obstacle avoidance, target positioning
- Developed inverse kinematics solver for 12-DOF humanoid biped, implementing forward/inverse kinematic transformations and gait generation algorithms to achieve stable bipedal locomotion with custom walking patterns

PROJECTS

Autonomous Vehicle Path Planning with YOLO Detection and BEV Transformation

- Developed autonomous vehicle path planning system integrating YOLO object detection, BEV transformation, and A* path-finding algorithm to enable real-time obstacle avoidance and navigation
- Built computer vision pipeline processing dashcam video with perspective transformation matrices and occupancy grid mapping, achieving accurate vehicle detection and spatial positioning for autonomous navigation applications
- Implemented real-time video processing system with OpenCV and Python, generating synchronized side-by-side visualization of camera feed and top-down BEV navigation view for autonomous driving research

3D Scene Reconstruction using Neural Radiance Fields

- Developed a full PyTorch-based NeRF training pipeline, including ray sampling, positional encoding, hierarchical volume rendering, and loss optimization for high-quality novel view synthesis.
- Optimized training with stratified sampling and hierarchical importance sampling, improving convergence speed and achieving PSNR 28.29

Structure from Motion & GTSAM Optimization (GTSAM, Pattern Matching, Non-linear Optimization)

- Developed robust 3D reconstruction pipeline achieving sub-pixel accuracy through GTSAM bundle adjustment optimization, reducing reprojection error from 415,950 to 10.9 (97.4 % improvement) across 3,334 landmarks and 23 camera poses
- Designed multi-camera pose estimation system using essential matrix decomposition and PnP algorithms, integrating RANSAC outlier rejection and cheirality constraints to ensure geometrically consistent 3D scene reconstruction
- Engineered factor graph optimization framework using GTSAM library, diagnosing and resolving numerical stability issues through noise model tuning and coordinating system validation

Reinforcement Learning on a Bipedal Robot

- Crafted a simulation environment using MyoSuite, a wrapper over MuJoCo, for a bipedal model, customizing joint dynamics and control via XML configurations for precise torque application
- Implemented and fine-tuned multiple reinforcement learning policies with Stable Baselines3, optimizing Cassie's dynamic stabilization and accurate waypoint navigation through complex reward structures
- Achieved bipedal locomotion by integrating quaternion joint state extraction and applying specific torque values, guided by policy optimization in Stable Baselines3, ensuring dynamic walking performance across varied simulated terrains