VISHNU ROHIT ANNADANAM

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EDUCATION

Master of Science, Robotics | Northeastern University, Boston, MA | GPA – 3.7/4 **Expected Dec 2024**

Coursework: Autonomous Field Robotics, Mobile Robotics, Computer Vision, Control Systems, Robotics Sensing & Navigation.

Bachelor of Engineering, Electronics & Telecommunication | University of Mumbai, India | GPA – 8.4/10 **Jun 2022**

Coursework: Neural Networks & Fuzzy Logic, Image Processing & Machine Vision, Discrete Time Signal Processing.

EXPERIENCE

UAS Research Assistant | Field Robotics Lab, Northeastern University, Boston, MA **Dec 2023 – May 2024**

- Led the system design and development of a multi-UAV swarm system, each equipped with a dual FLIR camera setup to enable stereo vision and ensuring accurate time synchronization across cameras on all drones.
- Developed a Python and ROS2 based control architecture to achieve coordinated formation flight and target tracking using the ArduPilot systems running on the Pixhawk 6X flight controllers.
- Designed 3D models of components such as camera mounts, GPS antenna mounts and other joints for the UAV using Fusion 360 and 3D printed them on printers like Prusa i3 Mk3s+ and Ultimaker S5.
- Implemented a real-time camera feedback system to the ground control station and conducted extensive field tests and missions to collect precisely time-synced datasets from all drones.

Graduate Teaching Assistant – Robotics Sensing and Navigation | Northeastern University, Boston, MA **Sep 2023 – Present**

- Guided students on data acquisition using ROS/ROS2 and analysis techniques for IMU, GNSS, RTK GPS, Camera & LiDAR sensors.
- Led discussions on core robotics concepts such as localization, mapping, path planning, computer vision, optimization, etc. and their state-of-the-art algorithms.

Computer Vision & IoT Intern | EdVerb Learning Pvt. Ltd, Mumbai, India **Feb 2022 - Mar 2022**

- Built multiple Computer Vision and TinyML projects leveraging the ESP-32 Cam to create practical applications such as Face Detector, Eye Detector & Tracker, Flower Classifier, etc.
- Programmed the ESP-32 board to interface these projects with multiple sensors to devise several cost efficient IoT-based solutions for automation.
- Designed and programmed movement of a miniature car to automatically detect and avoid obstacles using Arduino Nano and ultrasonic sensors; developed components such as, LDR-enabled Smart Headlights, IR Remote Control.

TECHNICAL SKILLS

Operating Systems & Software: ROS/ROS2, Linux, Windows, Git, Gazebo, Raspberry Pi, Fusion 360.
Programming Languages & Libraries: Python, C++, MATLAB, OpenCV, PyTorch, GTSAM, NumPy, Matplotlib, SciPy.
Proficiencies: Robotics, Computer Vision, Deep Learning, System Design, Motion Planning, Machine Learning, CAD, 3D Printing.

PROJECTS

3D PointCloud Reconstruction from 2D Images through Structure from Motion

- Developed a 3D reconstruction algorithm that performs Structure from Motion to create a sparse point cloud from 2D images captured with a phone camera, using OpenCV for processing and GTSAM for optimization.
- Matched features between images using SIFT and RANSAC to estimate camera poses using essential matrix and Perspective-n-Point (PnP) pose computation, and triangulate their inlier feature points into 3D space.
- Optimized the point cloud by performing global Bundle Adjustment using GTSAM's factor graphs with Levenberg-Marquardt algorithm to improve camera poses and landmarks from the initial triangulation.

GPS & IMU Sensor Fusion for Automotive Dead Reckoning

- Built and deployed custom Python based ROS drivers for real-time sensor data acquisition from GPS and IMU mounted on a vehicle for localization and navigation tasks.
- Analyzed IMU's noise characteristics through Allan Variance and calibrated magnetometer by correcting hard and soft iron distortions along with error compensation in IMU and GPS data.
- Compensated for accelerometer bias to estimate vehicle's forward velocity, and fused yaw angle computed from gyroscope and magnetometer data to estimate heading for Dead Reckoning with IMU.
- Performed sensor fusion by implementing Extended Kalman Filtering (EKF) to get an improved estimate of vehicle's overall trajectory including GPS-lacking environments.

Autonomous Disaster Response Reconnaissance Bot

- Applied techniques of mobile robotic kinematics and sensing, motion planning and SLAM, to conduct autonomous reconnaissance in an initially unknown simulated disaster environment using a TurtleBot3.
- Utilized a 360° LiDAR with custom ROS nodes and existing packages to achieve robust and efficient exploration, integrating sensor data for comprehensive environment mapping.
- Calibrated the camera and wrote custom nodes enabling precise detection, localization and visualization of 11 AprilTags used as simulated victims during official demo session, generating a complete occupancy grid of the environment in *rviz*.