NIBARKAVI (Niba) NARESH BABU AMUTHA

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Roboticist with experience in developing production-grade software for deploying Autonomous Mobile Robots in industries and expertise in planning, optimization, and machine learning for robot perception, seeking to elevate real-world robotic solutions.

EDUCATION
Masters in Robotics, University of Michigan, Ann Arbor | CGPA: 3.64/4.0   Aug 2022 - Apr 2024
Course Highlights: Algorithmic Robotics, Mobile Robotics, Deep Learning for Robot Perception, Machine Learning, Programming for Robotics
Bachelors in Robotics and Automation, PSG College of Technology, Coimbatore | CGPA: 8.61/10.0   Jun 2018 - May 2021

TECHNICAL SKILLS
Languages: Embedded C, C++, Python, MATLAB
Frameworks: Linux, ROS, OpenCV, Docker, Git, PyTorch, TensorFlow, PyBullet, NumPy, SciPy

PROFESSIONAL EXPERIENCE
Research Student - University of Michigan Field Robotics Group, Ann Arbor (advised by Katherine A. Skinner) [Reports]
Underwater 3D Reconstruction using Imaging Sonar and Monocular Camera via NeRFs   Jun 2023 – Apr 2024
- Developed a driver and a visualizer for an imaging sonar for real-world data acquisition employing ROS in Python and C++.
- Calibrated sonar and camera, deducing their transformation matrix and depth-scaling factor through optimization formulation.
- Investigated Neural Implicit Representations, designed and conducted underwater experiments for benchmarking state-of-the-art 3D reconstruction models and extended Neusis by formulating a distance function that reduces noise and outliers.

Shipwreck Localization and Ranking using Side-Scan-Sonar   Jan 2023 – May 2023
- Developed an algorithm to compute the GPS coordinates with 30m resolution and 10m accuracy for detected shipwrecks.
- Formulated a confidence score via pixel-wise segmentation of regions of interest to rank the shipwreck sites for archaeological significance, incorporated into the underwater exploration pipeline of Thunder Baby National Marine Sanctuary.

Robotics R&D Engineer - Hachidori Robotics, Bengaluru   Jul 2021 – Jun 2022
Software development for Autonomous Mobile Robots (AMR) and Mobile Guided Vehicles (MGV) for warehouse automation
- Integrated Kalman Filter with IMU, limiting AMR positional drift to 1°, despite signal dropout in the Local Positioning System.
- Engineered Python and embedded C algorithms for omnidirectional mobility in a mecanum-wheeled tele-operated MGV. Enabled variable speed control, joystick-guided linear motion and versatile curved trajectories for windmill blade cutting.

Intern - Indira Gandhi Centre for Atomic Research, Kalpakkam [Publication]   Dec 2020 – Jun 2021
Real-time subassembly identification for nuclear reactor core inspection system by sensor fusion of IMU and camera
- Resolved spatial awareness challenges in nuclear reactor core inspections, arising from subassemblies hexagonal structure.
- Devised a spatial coordinates-based numbering system for subassemblies. Developed a C++ algorithm leveraging it, determined the inspection system orientation with 1° accuracy in real-time, and published this work after rigorous prototype testing.

KEY COURSE PROJECTS
Robotics Systems Laboratory [Reports]   Sep 2023 – Dec 2023
ArmLab – Automated block sorting and stacking via vision-guided manipulation
- Implemented and tested features for a robotic system with a 5DoF manipulator and camera: camera calibration, forward and inverse kinematics and a vision system for block detection with detection accuracy of 1mm and positioning accuracy of 7mm.

BotLab – Real-time frontier-based exploration SLAM for a differential drive robot via sensor fusion of LIDAR and camera
- Built the robot, implemented PD motor control, odometry with IMU error correction, visual servoing for obstacle avoidance, A* planner, and particle filter, innovating particles weight update with LIDAR rays using depth-constrained breadth-first search.
- Achieved real-time explorational SLAM with RMSE of 0.07, 0.14 and 0.12 of position (x, y) and orientation error respectively.

Algorithmic Robotics [GitHub, Report]   Sep 2023 – Dec 2023
- Implemented ANA*, quickly finding sub-optimal paths, converging to the optimal. Evaluated Manhattan, Euclidean, Chebyshev and Octile heuristics for A* and ANA* across simulated environments with varying obstacle configurations using PyBullet.
- Implemented Rapidly Exploring Random Trees and Safe Interval Path Planning for dynamic obstacles, Linear and Quadratic Programming for trajectory optimization, Iterative Closest Point and Principal Component Analysis for point-cloud registration, Random Sample Consensus for fitting planes in point clouds and several gradient-based optimization methods.

Mobile Robotics [Publication, GitHub]   Jan 2023 – Apr 2023
Volume-DROID: Real-Time Volumetric Mapping with DROID-SLAM using camera
- Generated real-time 3D semantic volumetric map from camera input by integrating Volumetric Mapping, Deep Visual SLAM and Convolutional Bayesian Kernel with 0.018 trajectory error and 0.003 transformation error between neighboring poses.

PUBLICATIONS
- Peter S, Sandilya SG, Ashwin S, **Nibarkavi NA**, Emaad G. Volume-DROID: A Real-Time Implementation of Volumetric Mapping with DROID-SLAM. Advances in Artificial Intelligence and Machine Learning. 2023; 3 (3): 73.
- Thirumalaesh A, **Nibarkavi NA**, Winston SJ, Jose J, Rathika PD. Real-time sub-assembly identification through IMU data fusion with vision sensor for an inspection system. International Journal of Nuclear Energy Science and Technology ,16(2), pp.80-96, 2023
- Shalikha R, **Nibarkavi NA**, Puhazhmathi M, Suresh M. Automation of Vehicle Door. International Research Journal of Automotive Technology, 3. 1-5. 10.34256/irjat2011, 2020.