Venkata Harshavardhan Bontalakoti

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Education

Johns Hopkins University, U.S.A | Masters in Robotics Engineering   Aug'25 - Present
Indian Institute of Technology, Hyderabad, India | B.Tech in Mechanical Engineering(Exchange) Aug'24 - May'25
National Institute of Technology, Silchar, India | B.Tech in Mechanical Engineering   Dec'21 - May'24

Work Experience

Indian Institute of Technology Madras, India   May'24 - Jul'24
Robotics Research Intern | Research and Development

- Won the prestigious **Summer Fellowship (SFP-2024)** at the Department of Aerospace Engineering, standing out among **1000 plus applicants** for excellence in robotics research.
- Designed and developed a modular **simulation environment** using **Unity** and **ROS2** to support maritime **perception and control** research. Integrated realistic ocean and wind **physics models** to simulate environmental disturbances, resulting in **12.5%** reduction in deployment time for marine drones.
- Created an **open-source robotics platform** intended for advancing **autonomous navigation**, **multi-agent interaction**, **sensor fusion**, and **control strategies** in unstructured marine domains.

Instruments Research and Development Establishment, DRDO, India   May'23 - Jul'23
Robotics Engineer Intern | Military and Defence Applications

- Contributed to the **design and analysis** of **sensor-mounting systems** for **autonomous aerial, ground, and naval platforms**, with a focus on optimizing robustness, vibration isolation, and measurement accuracy.
- Assisted in developing a **scalable hardware-software integration pipeline** for deploying **multi-sensor payloads** (**EO/IR cameras, LiDAR**) on mobile defense platforms.
- Prototyped an **autonomous coastal surveillance** system using distributed **sensor-equipped** ocean buoys, **reducing operational costs** by **30%** while significantly enhancing perimeter awareness and **real-time detection** capabilities.

Projects

Vision-Based Quadruped Robot with Real-Time Sensor Fusion and Object Interaction   [GitHub]
ROS2, Python, YOLO, MoveNet, C, MuJoCo, IMU Fusion, Object Detection, Pose Estimation, Embedded AI

- Developed a fully open-source **quadruped robot (12-DOF)** with a 2-DOF gripper and onboard **vision-based pose estimation** using **MoveNet** and **fused IMU-camera data** for **real-time perception-guided locomotion**.
- Formulated a modular **ROS2-based perception and control pipeline**, incorporating **sensor fusion(EKF)**, PID-based stabilization, and **closed-loop actuation** in unpredictable and cluttered environments.
- Enabled **environment-aware navigation and manipulation** for applications in **search and rescue**, **agriculture**, and **autonomous field robotics**.

Multimodal Embedded Perception Assistant using On-Device LLM   [GitHub]
Python, OpenCV, Quantized LLM, Audio-Visual Perception, C, Embodied AI, Edge Computing

- Engineered a lightweight, fully local **perception pipeline** integrating vision, speech, and ambient sensing to enable real-time **human-aware interaction** and autonomy on **edge devices**, improving the inference time by **22.5%**.
- Deployed on-device modules for **emotion analysis**, **drowsiness detection**, and **user presence**, facilitating **context-aware decision-making** without cloud dependence.

Human-Guided SLAM using TurtleBot3 and Pose Estimation   [GitHub]
ROS2, Gazebo, TensorFlow Lite, PID Control, RViz, SLAM, Computer Vision, Pose Estimation

- Enabled **autonomous SLAM mapping** by integrating **human pose estimation** (TFLite) with **TurtleBot3**, allowing the robot to follow and map based on real-time human motion cues.
- Implemented a **PD-controlled visual servoing pipeline** in **ROS2**, visualized via RViz Cartographer, showcasing a **perception-driven** alternative, **faster by 32%** compared to traditional manual mapping.

Achievements

- **Academic Exchange Scholar, Indian Institute of Technology Hyderabad** : Selected for a prestigious academic exchange awarded to the **top 10%** students post-junior year based on **academic excellence and research interest**.
- **Smart India Hackathon 2024 Winner (Hardware Edition)**: Engineered a **drone-based automation** system addressing a real-world smart automation challenge; selected among the **top 7 teams** out of 30 nationally.

Technical Skills

Programming: C/C++, Python, Matlab, C#, Linux, Cmake, Git/GitHub, Docker
Robotics: ROS2, Gazebo, Mujoco, Unity, SLAM, Nav2, Moveit, UART, Raspberry Pi, Optimization, Sensor Fusion
AI & ML: Pytorch, OpenCV, Tensorflow, Stable Baselines3, Scipy, Pandas, Matplotlib, YOLO, Reinforcement Learning

Publications

1. **Improvement in Multi-resident Activity Recognition System in a Smart Home Using Activity Clustering**, *Topics: Machine Learning, Deep Learning, Multi-Modal Learning*   [Paper]