AUTONOMOUS DRIVING WITH ROS 2

Integrating a LiDAR and Stereo Camera for Automated Driving in MIniaturized Traffic scenarios 1:14

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INTRODUCTION

Testing autonomous driving functions in full-size vehicles is expensive and potentially unsafe. This project focuses on a 1:14 scale model equipped with a Jetson controller running ROS 2 to simulate and validate key functionalities such as real-time sensor integration, data fusion, and autonomous navigation.

OBJECTIVES

- Install ROS 2 environment on Jetson Orin
- Read and publish stereo camera and LiDAR data
- Enable CAN-Bus communication
- Visualize sensor data in Python or MATLAB

IMPLEMENTATION

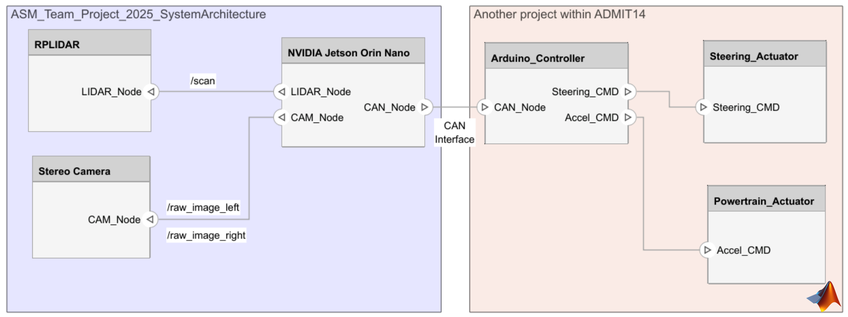
The system was developed using ROS 2 Humble running on a Jetson Orin board. Python-based ROS 2 nodes were created to publish sensor data from the stereo camera and LIDAR. Image data was processed both in Python and MATLAB, using MATLAB's ROS Toolbox for easy subscription and visualization. Object detection was implemented using YOLOv8 on camera streams. Additionally, LiDAR data was processed in real time to trigger proximity alerts and was visualized using RViz 2 for environment mapping.

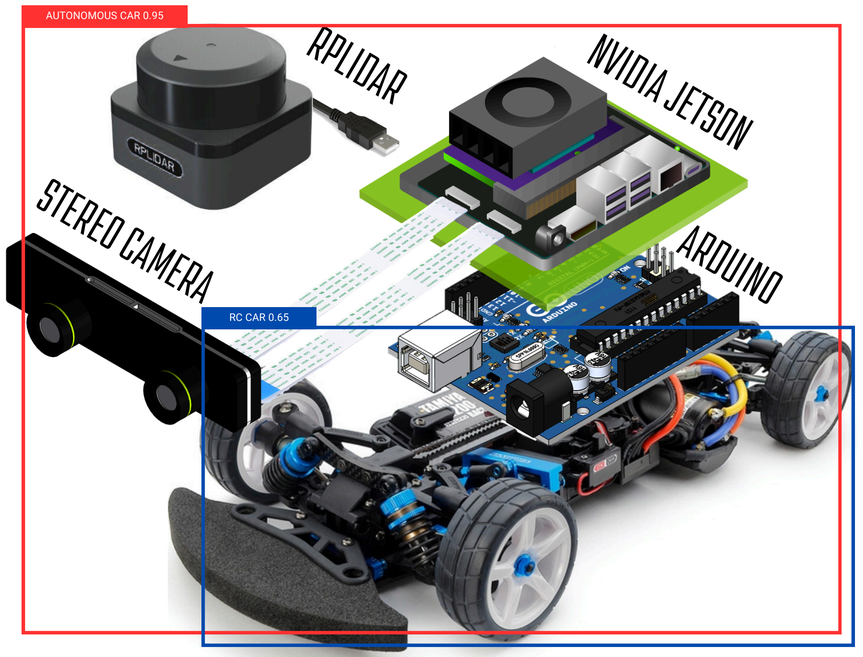
EXPLORE THE FULL PROJECT ON GITHUB

ROS 2 NODES, MATLAB & PYTHON SCRIPTS,
LIDAR AND CAMERA INTEGRATION,
STEP-BY-STEP TUTORIALS TO REPLICATE THE SYSTEM.

SYSTEM ARCHITECTURE

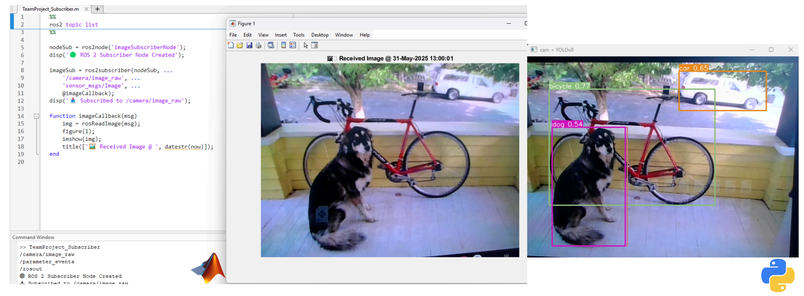
The system integrates multiple sensors with a NVIDIA Jetson Orin running ROS 2 nodes. Stereo camera and LiDAR data are published from Python nodes and received via another Python node or MATLAB ROS 2 subscribers.



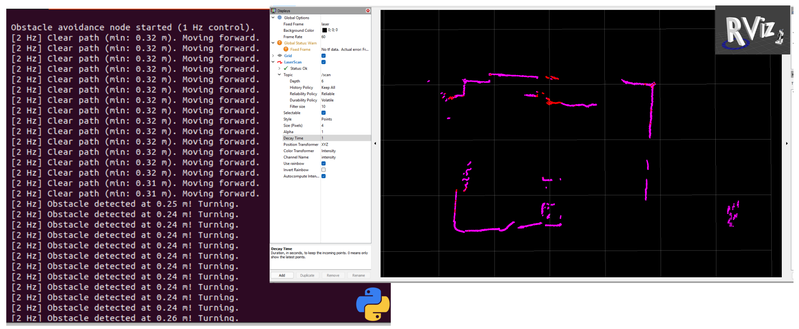


RESULTS

STEREO CAMERA IMAGE RECEPTION



LIDAR PROXIMITY DETECTION & MAPPING



CONCLUSION & FUTURE WORK

ROS 2 enables modular and scalable integration of sensors for mobile robotic applications. MATLAB provides a convenient interface for visualizing and processing data. Future work includes implementing SLAM, autonomous navigation, and real-time decision making based on sensor data.