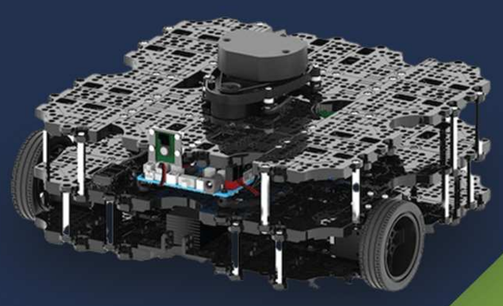

Machine Learning-Enhanced Adaptive Navigation for Dynamic Environments With ROS

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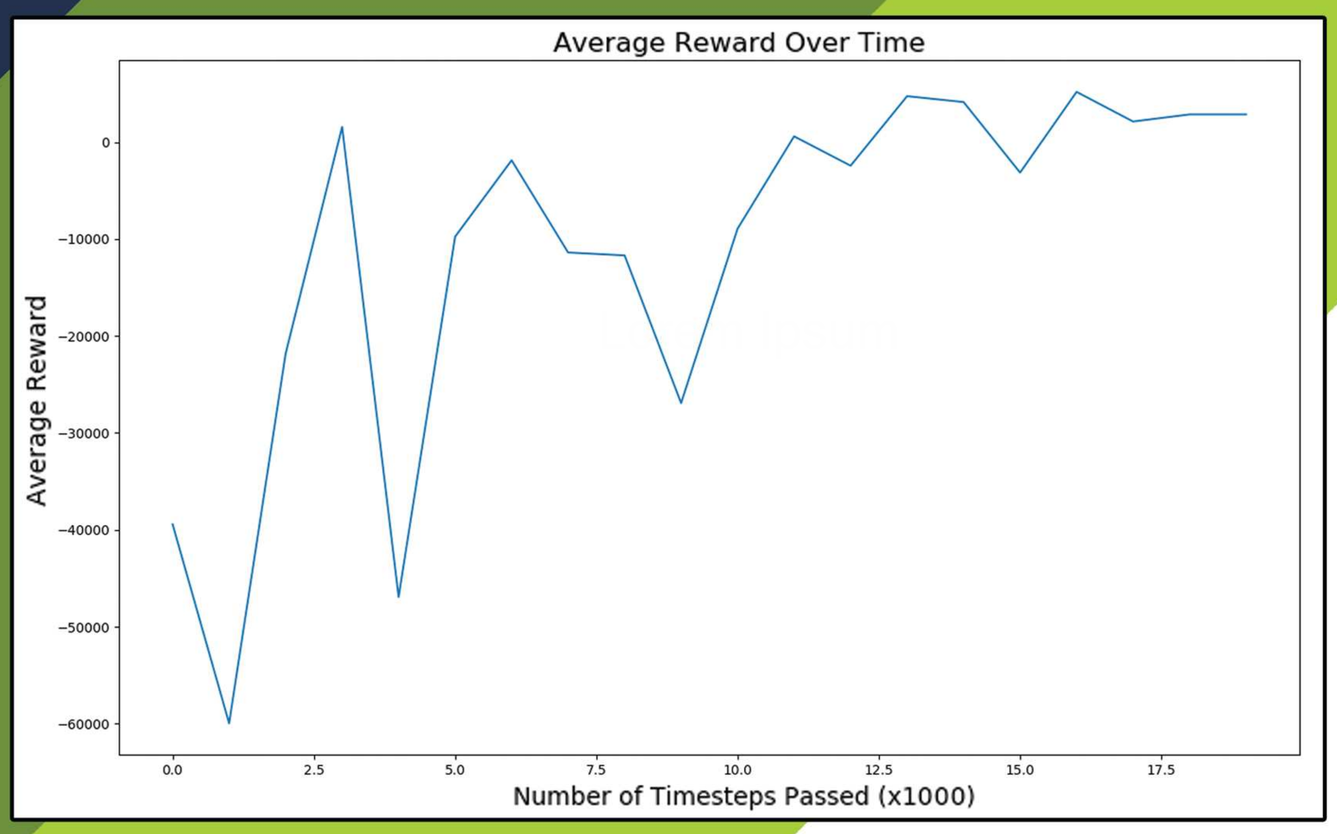
Overview:

This project focuses on the synergy between the ROS aspects of robotics, the combination of machine learning algorithms, and self-learning neural networks that power these packages capable of continual adaptation to evolving environments.



The Problem:

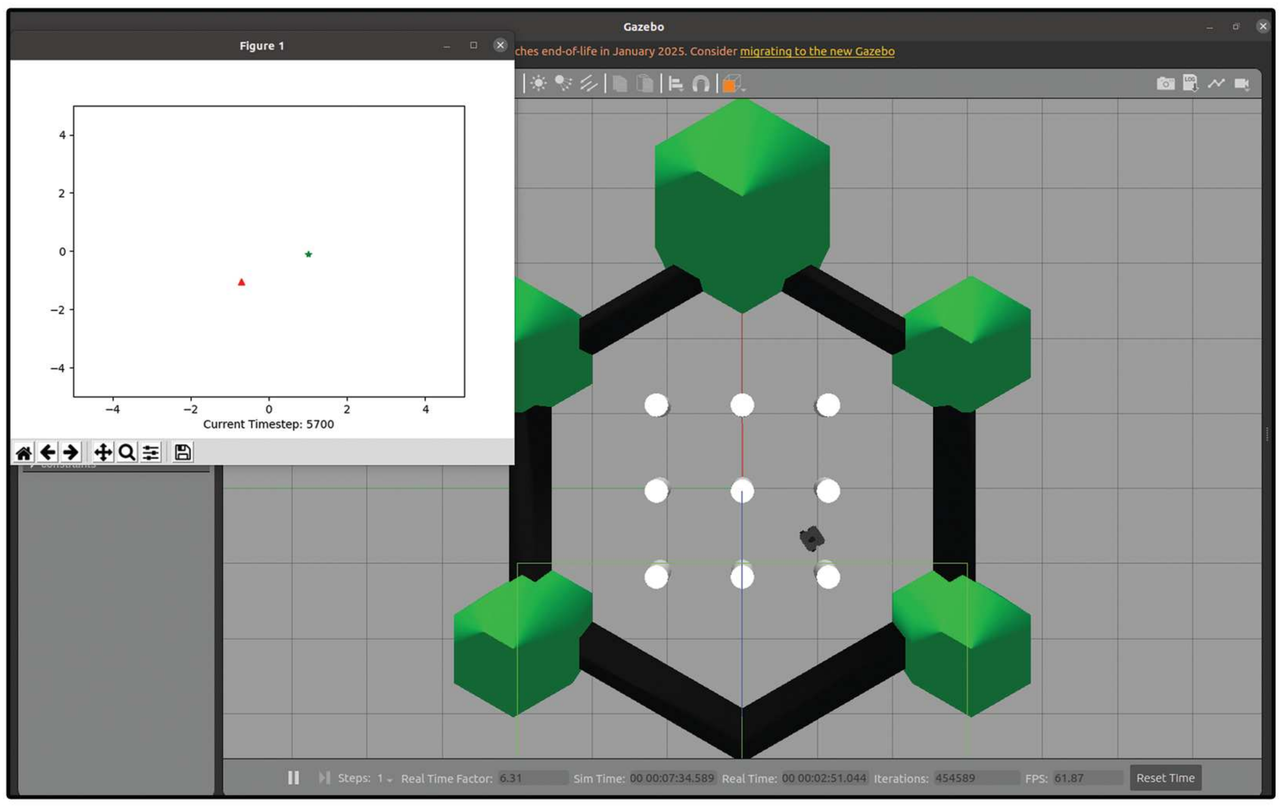
Traditional SLAM and pathfinding algorithms are limited to known, static environments.

They struggle in dynamic, partially known spaces common in real-world environments.

Machine learning offers a solutionm but integrating with ROS is complex.

This project proposes a simplified framework to bridge ROS inputs with ML-powered decision making for adaptive navigation

Positive preliminary results when run In Gazebo.



The Solution:

This project aims to develop a general-purpose navigation framework where ROS inputs from various sensors can be seamlessly interpreted by neural networks to generate real-time navigation decisions, even in unpredictable environments.

This is a massively under-represented area of research that we hope to contribute to, as well as to aid other researchers in achieving their robotics goals.

Primary Aims:

+ **Adaptability**: Maintain performance despite environment changes.

+ **Innovation**: Creates a modular, training-from-scratch pipeline.

+ **Scalability**: Supports a variety of robots and sensor inputs.

+ **Reliability**: Operate robustly in unseen environments.

References:

[1] Taheri, H., Hosseini, S.R. and Nekoui, M.A., 2024. Deep reinforcement learning with enhanced ppo for safe mobile robot navigation. arXiv preprint arXiv:2405.16266.
[2] PPO Implementation Inspiration: https://github.com/ericyangyu/PPO-for-Beginners
[3] PPO Algorithm Source: https://www.datacamp.com/tutorial/proximal-policy-optimization

GitHub Link: