A framework for comparing mobile robot navigation

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Abstract*— Exploration and navigation are one of the fundamental problems in mobile robotics. Efforts to address these range from reactive, map-based to learning-based approaches. With each method being developed and tested in an isolated environments, the precise improvements of these methods are unknown. This paper presents a framework to simulate, evaluate and compare these different algorithms. *************** Our results demonstrate how methods compare over a range of attributes and environments. We anticipate that this framework and findings allow for development of more advanced approaches, but also serve as a good step towards navigating dynamic environments.**

I. Introduction

Introduction to what exploration and navigation is.

Where is it used. Why is it of importance.

Introduce the key issue in the dynamic environments.

Introduce main contribution of this paper to aid in solving the problem above

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This will contain a graphic showing all the different algorithm in a single environment. Each approach has it's own color. This serves to demonstrate in a simple way how the different algorithms behave in a simple and attracting way. Lorem ipsum dolor sit amet, consectetur adipiscing elit.Lorem ipsum dolor sit amet, consectetur adipiscing elit.Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Fig. 1. Different navigational algorithms path towards a goal

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II. Related work and background

Present the main navigational algorithmic advancements justifying your choices too Present the comparison papers and how they have previously approached these comparisons

III. Methodology

A. Experimental setup

B. Evaluation methods

IV. Navigational algorithms

A. random walk

B. wall follower

C. pheromone potential field

D. A* algorithm

E. Q learning

V. Results

For each trial (Robot, Goal, Map) we have the following measurements;

- d_g distance to goal
- ϵ success
- d_s distance to starting point
- σ area explored
- c path cost
- μ computational overhead
- m_s map size
- m_d map density

- How do we determine map complexity (needs a factor cross maps so that bigger maps are considered more complex)

$$map_{complexity} = \frac{d_{eu}}{d_{worst}} * \frac{map_{den}}{map_{size}} \quad (*)$$

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- How does an algorithm perform on average

$$algorithm_{score} = (1 - \frac{d_g}{d_{eu}}) * \frac{d_b * c}{d_{eu}^2} \quad (*)$$

algorithm \ complexity	0-25%	25-50%	50-75%	75-100%
random walk	0	0	0	0
wall follower	0	0	0	0
pheromone potential field	0	0	0	0
A* algorithm	0	0	0	0
Q learning	0	0	0	0

- How does an algorithm's performance translate to hybrid maps.

algorithm \ type	O	D	H	OAD	OAH	DAH	ODH
random walk	0	0	0	0	0	0	0
wall follower	0	0	0	0	0	0	0
pheromone potential field	0	0	0	0	0	0	0
A* algorithm	0	0	0	0	0	0	0
Q learning	0	0	0	0	0	0	0

VI. Discussion and conclusion