Texas A&M Summer Research

Local Path Planning

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General Autonomous Robot Framework

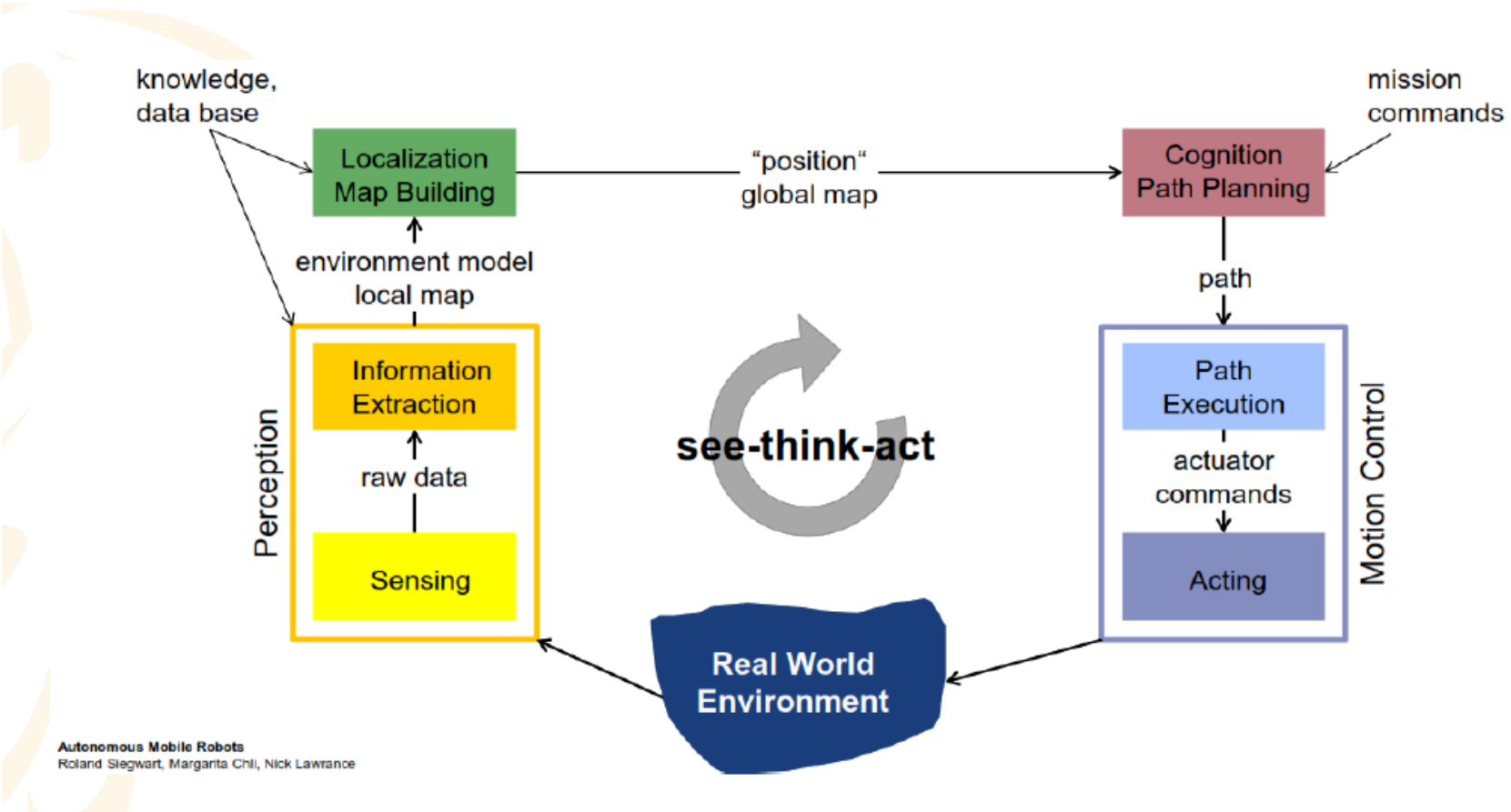


Figure: General Autonomous Robot Framework

Introduction

Path Planning

- Given a robot and a description of the environment, plan a conflict-free path between the specified start and goal locations.

Global and Local Planning

- **Global Planning** is the process of determining a path from a starting point to a destination in a global or overall sense, considering the entire environment.
- **Local Planning** focuses on determining the immediate or short-term path adjustments necessary for a robot or vehicle to navigate through its immediate surroundings and avoid obstacles.

Plans and Objective

Need Statement

- A way to implement a lane-changing algorithm so that the autonomous vehicle can avoid obstacles on its path, i.e. the road.

Plans

Path planning particularly dynamic path planning is an ongoing and complex research problem.

1. Identify and compare existing methods for dynamic path planning.
2. Conclude what method performs the best.
3. Analyze room for improvement, if any.

Objectives

Basic Objectives

1. Implement a lane-changing algorithm for an autonomous vehicle.
2. Model the autonomous vehicle as a non-holonomic vehicle.
3. Use a reliable path planning algorithm, i.e. if solutions exist, then the planner outputs at least one feasible solution.
4. Simulate the planning scenario in CARLA simulator [3].

Advance Objectives

1. Have a limited field of view where obstacles can be detected.
2. Implement a local planner that deals with dynamic obstacles.

CARLA Simulator

CARLA

- CARLA simulator is a powerful open-source platform for autonomous driving research and development. It provides a realistic and customizable virtual environment to test and evaluate algorithms and systems for autonomous vehicles.

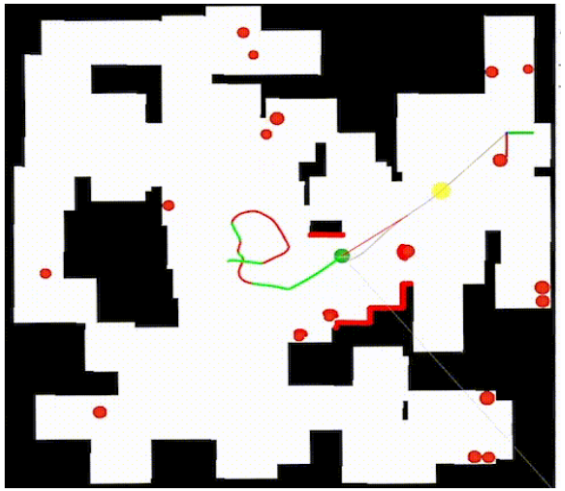
Findings from literature

Methods

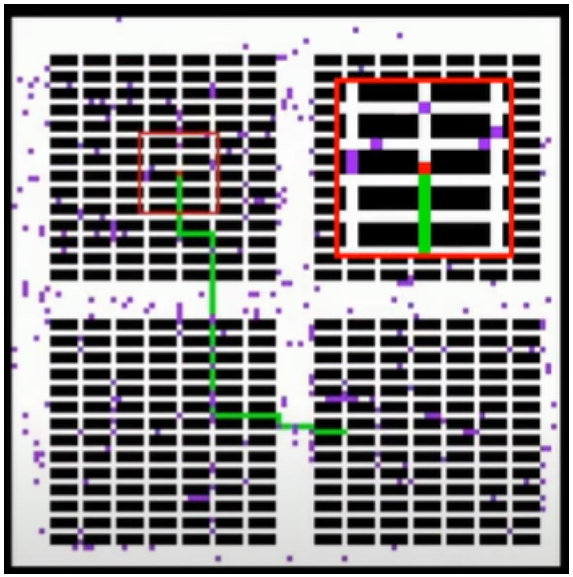
The identified approaches used in the literature are:

1. Globally Guided reinforcement learning from [3].
2. All for one controller from [4].
3. Real-time RRT algorithm from [1].
4. Dynamic-Window approach from [2].

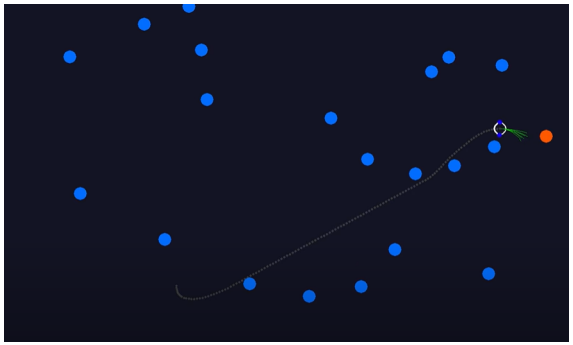
Identified Methods



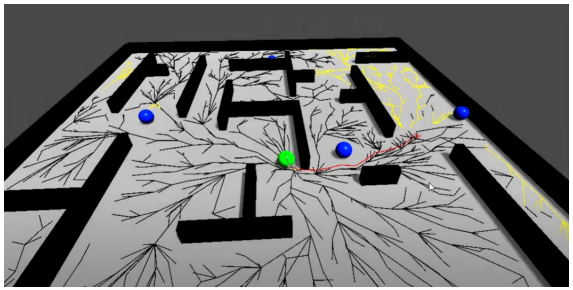
(a) All in one switch control



(b) Globally Guided Reinforcement learning



(c) Dynamic Window Approach



(d) Real Time RRT

Design Specification

The system design is given in figure 3. The figure shows the high-level modules and how they would interact with one another The high-level modules are:

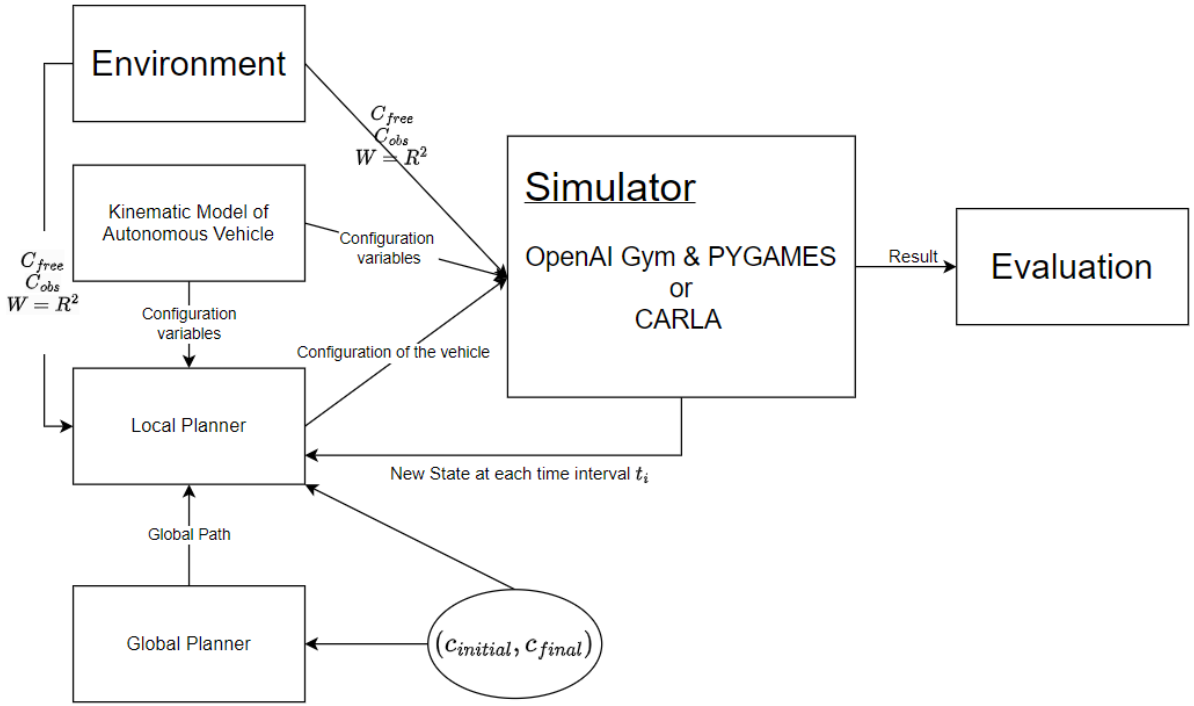


Figure: Proposed System Diagram

Conclusion

Conclusion

1. The project is on local path planning.
2. A way to implement a lane-changing algorithm so that the autonomous vehicle can avoid obstacles on its path, i.e. the road.
3. The main objective of this project is to compare existing dynamic planning methods on the CARLA simulation platform, in the context of lane-changing algorithm.

References

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