Evolution-based Dynamic Path Planning for Autonomous Vehicles

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Planning is an essential element of autonomous systems. This work presents a dynamic path planning algorithm for an unmanned autonomous vehicle to execute a set of assigned tasks in a changing environment. This problem comprises path planning and task sequencing. The approach adopted here is to solve these subproblems simultaneously using an evolutionary planning algorithm and a stochastic model of the environment. During the mission, the planner replans and adapts the path in response to changes in the environment. Simulation results demonstrate that the path planning algorithm can compute feasible effective solutions to path planning problems. These include planning with timing constraints and dynamic planning with moving targets and obstacles. The vehicle is able to autonomously travel from the initial location to the goal location while avoiding obstacles and performing the assigned tasks.

1 Introduction

The path planning algorithm presented here was developed as a part of the Evolution-based Cooperative Planning System (ECoPS) [19]. The ECoPS is a distributed system for real-time task and path planning for a team of autonomous vehicles. The planning algorithms are based on the combination of a market-based planning architecture and optimization techniques called Evolutionary Computation (EC). The planning system was successfully demonstrated for the Defense Advanced Research Projects Agency under the Mixed Initiative Control of Automa-teams program. In related work, it is scheduled for flight testing on Seascan Unmanned Aerial Vehicles (UAVs) manufactured by The Insitu Group in combination with autonomous Unmanned Surfaces Vehicles (USVs), see Figure 1.

The overall goal of this work is to increase autonomy of unmanned vechicles. A vehicle is called autonomous if it has the ability to plan its own actions using the acquired information about its environment to accomplish its tasks.

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