Safe Sequential Path Planning of Multi-Vehicle Systems Under Presence of Disturbances and Measurement Noise

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***Abstract*—**

I. Introduction

II. Problem Formulation

Consider N vehicles whose joint dynamics described by

$$\begin{aligned} \dot{x}_i &= f_i(t, x_i, u_i, d_i) \\ |u_i| &\in \mathcal{U} \\ |d_i| &\in \mathcal{D} \\ i &= 1, \dots, N \end{aligned} \tag{1}$$

where blah blah and [STANDARD ASSUMPTIONS HERE].

Under the worst case disturbance, each vehicle aims to get to some target state, denoted $\mathcal{T}_i$ at some scheduled time of arrival t_{STA}. On its way to the target state, each vehicle i must avoid the danger zones $\mathcal{A}_i(t)$ of all other vehicles $j \neq i$ for all time, defined as

$$\mathcal{A}_i(t) = \bigcup_j \{x_i : \|x_i - x_j(t)\| \leq R_c\} \tag{2}$$

III. Solution via double-obstacle HJI VI and SPP

A. Double-Obstacle Hamilton-Jacobi Variational Inequality

- Reachability general theory (backwards, then forwards)

B. Sequential Path Planning

- Priorities - Treat higher priority vehicles as obstacles

C. Obstacle Generation

- Forward reachable set

1) Centralized Planning:

2) Distributed Planning:

D. State Measurement Updates

IV. Numerical Implementation

V. Conclusions and Future Work

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