Tour Guide Multi-Robot Task Coordination in Dynamic Indoor Environment

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I. MOTIVATION

Tour guide mobile robots are deployed in environments such as museums and exhibitions. For long-term autonomy, human-aware task coordination is a major challenge. This research aims to develop a novel navigation framework for multiple social robots working as tour guides in an indoor environment. The global path planner used is a modified RRT*. This optimizes the radius of curvature of the planned path. A local planner avoids human collision through a predict-plan cycle as shown in figure 2. The task coordination is performed with minimal explicit communication. The control architecture allows the robots to optimally guide human groups. The preliminary experiments based on the proposed framework provides satisfactory results.

A risk-based coordination method with a social cost for multi-robot task allocation (MRTA) is implemented in [1]. In [3] a LSTM model is proposed which predicts future human trajectories. Our research uses a similar concept human trajectory prediction for social robot navigation.

II. PROBLEM STATEMENT

This research is targeted for an indoor scenario as shown in figure 1. Each robot guides a group of people to different landmarks. The robots avoid dynamic obstacles. The landmarks act as communication nodes for effective multi-robot coordination.

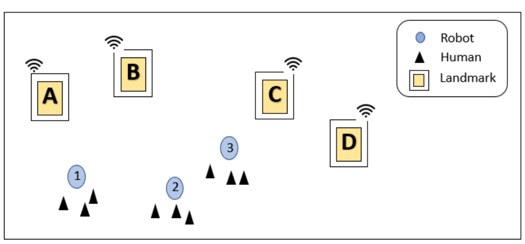

Fig. 1. Model of proposed indoor environment

III. RESULTS

The control system architecture is shown in figure 2. X and $\dot{X}$ are the position and velocity vectors respectively. The distance D is obtained from fusing RGB image with ultrasonic sensor. It is used to maintain optimum distance between the robot and the human group. figure 4 shows variation of robot velocity with respect to D.

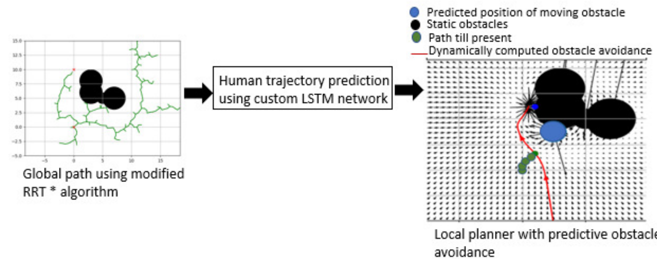

Fig. 2. Proposed motion planning strategy

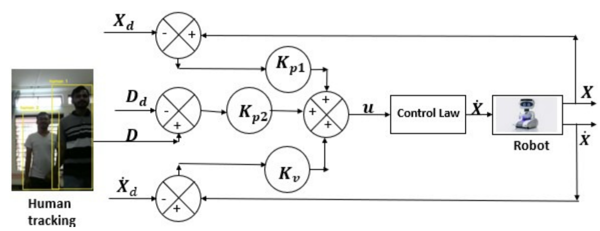

Fig. 3. Control architecture for trajectory tracking and optimal guidance of humans

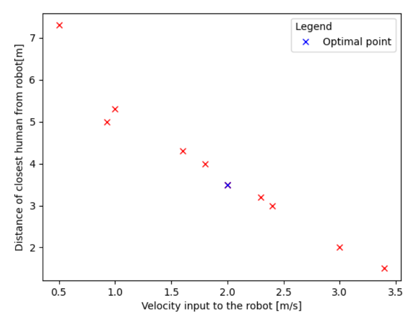

Fig. 4. Graph depicting the change in velocity based on distance of the robot from human group.

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