Team-It: Location-Based Mobile Games for Multi-Agent Coordination and Negotiation (Demonstration)

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1. INTRODUCTION

The multi-agent systems community has made great strides investigating issues such as coordination and negotiation. When addressing human or human-agent behavior, very few approaches have addressed a feature that people are embodied in the real-world and act in geospatial environments. In the past, it has been difficult to perform experiments and collect data for such domains. However, with the spread of mobile technology that can run sophisticated applications and return location-based data, we are now in a position to investigate such questions.

Team-It allows researchers to run mobile-games for a variety of location-based experiments for multi-agent coordination and negotiation with real-world movement as well as competitive experiments such as pursuit-evasion games. We will provide a brief description of Team-It , its capabilities, its applications and our plan for the demonstration.

2. TEAM-IT

Team-It allows for multiple teams each which can be composed of one or more players. Players can be human or software agents. Human players interact with the game through an iOS interface shown in Figures below. All players have a location which is tracked and shared through the interface. If players move, their locations are tracked and updated. Human players are currently being tracked via

GPS location updates. Figure 1 shows various human and software agents on the game interface.
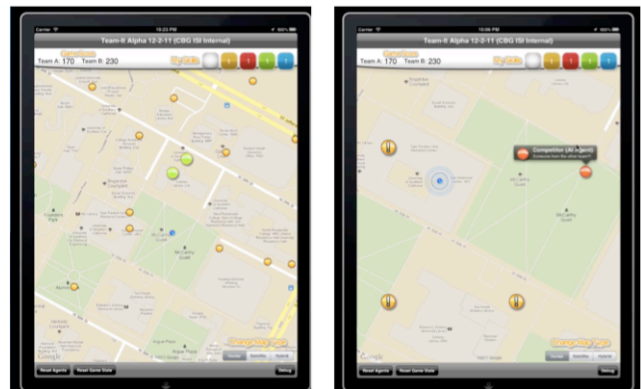
Figure 1: Human agents (larger green circles in the left figure) and software agents (red circles in the right figure) are shown in a map-based interface.

Each player is give a a collection of *cards* with various colors. These cards are abstractions that can represent skills or resources at their disposal. Players can have multiple cards of the same color to indicate greater skill or more resources. Cards can be persistent indicating that they are skill that can be applied repeatedly or consumable indicating they are a resource that gets used up when applied.

The game also has multiple *task collections*, each of which are situated in a specific geospatial location. These collections are only discovered if players are within a certain discovery radius of the task collection location. When discovered, a collection reveals a set of *tasks*. Each task requires a certain set of cards to be applied simultaneously for a stated duration in order to be completed successfully. The cards can be applied to a task only when an agent is within a particular application radius from the collection location. This application radius can be smaller than the discovery radius. Multiple players can apply cards to the same task.

Once all the required cards are applied for the required skills for the required duration, the task is completed. If a player leaves the application radius or cancels the application of a card, the task is incomplete and must be started again in order to be completed, i.e., tasks cannot be suspended. When a task is completed, each team receives

Figure 2: Players can see tasks as yellow circles that show an exclamation point when the player is within the discovery radius (left figure). At the top right, players can see their card sets. By pressing the task collection icon, players go to the card application interface (right figure) where the can apply cards to a chosen task.

points which can differ by team. The points received are known when the task collection is discovered. Figure 2 shows tasks in the map interface as well as the card application interface.

Human players may not even as a team have the cards required to complete tasks. TEAM-IT also has software agent which are parts of other teams with whom players can negotiate to obtain cards. The negotiation only involves consumable cards, i.e., resources, that can change ownership. Software agents can be endowed with arbitrary negotiation algorithms and policies can be as heterogeneous. The policies are generated by hidden valuations over various cards. The interface for negotiation is shown in Figure 3.
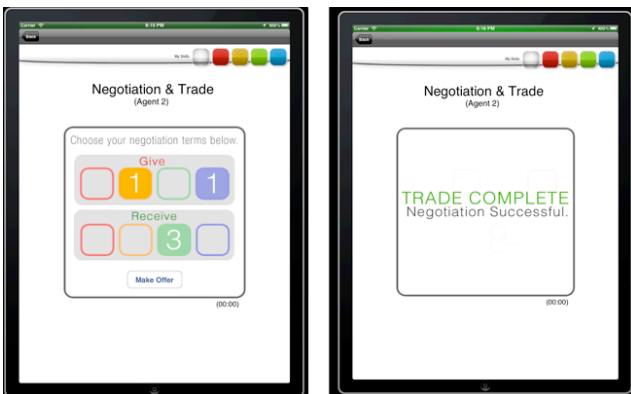
Figure 3: The human players can see what card types the software agent is willing to offer and accept as well as options for negotiation (left figure). A successful trade is also shown (right figure).

3. APPLICATIONS OF TEAM-IT

TEAM-IT gives researchers the ability to run real-world human-agent geospatial experiments in a variety of multi-agent contexts. We can investigate multi-agent coordination

by focusing on games with single team and only persistent cards where the team must decide how to best combine, path plan and schedule discovery and application of diverse skills to optimize their performance within a given time interval. We can add competition or motivational diversity with multiple teams where players must negotiate to get skills from other teams to accomplish their goals. We can introduce negotiation and trading with resources in a mixed-initiative environment. TEAM-IT also enables experiments in pursuit-evasion games with the location identification, discovery and card application features.

4. DEMONSTRATION

Figure 4: A Team-It game on the USC campus showing players coordinating to complete tasks.

We will bring several iPads on which participants will be able to use TEAM-IT . We will adapt the location-based services to work indoors by using one of two features: step-based tracking using the accelerometer where participants can physically move or acceleromater-controlled motion where participants move by manipulating the iPad. We will choose the best option based on the location and structure of the demo facility. The TEAM-IT demo will involve participants joining teams and working with their team, other teams and software agents to complete tasks and gain points. We will display a live scoreboard of the best performing teams. Participants will be able to join and leave the game at any time. A movie of TEAM-IT can be found at: *http://youtube.com/*.

5. REFERENCES