Human agent coordination in disaster response

Wenchao Jiang[1], Joel Fischer[1], Tom Rodden[1], Nadia Pantidi[1], Stuart Moran[1], Khaled Bachour[1], Chris Greenhalgh[1]
Sarvapali Ramchurn[2], Feng Wu[2], Sebastian Stein[2], James McAuley[2], David Zilli[2], T Dong Huynh[2]
Steve Reece[3], Mark Ebden[3], Steve Roberts[3]

[1]Mixed Reality Laboratory
School of Computer Science
University of Nottingham

[2]Agents, Interaction, and Complexity Group
School of Electronics and Computer Science
University of Southampton

[3]Pattern analysis and machine learning group
Department of Engineering Science
University of Oxford

Background

In large-scale multi-incident disasters, there are limited resource and personnel for disaster response. Effective coordination is required to allocate resources and tasks optimally.
(e.g. earthquake,tsunami ,flood, chemical attack)

- Sophisticated agent coordination algorithms already exist [Ramchurn et al, 2010]
- Intelligent planning agents can be built to support coordination in this setting



Aims

Understand how can intelligent agents cooperate with human operators effectively in disaster response.

Before we integrate intelligent agents into the disaster response organisation, we need to address a set of issues regarding human agent interaction.

1. Will human trust and use follow instruction from intelligent agent?
There are evidences showing human is reluctant to use intelligent systems because they do not understand and trust agents.

2. Will human over-rely on intelligent agents?
When some processes are automated by intelligent agents, problems such as complacency and automation bias will emerge, which may outweigh benefits of automation.

3. How emotional issues such as stress, fear, frustration may affect the way they interact with intelligent agents.

System overview - AtomicOrchid

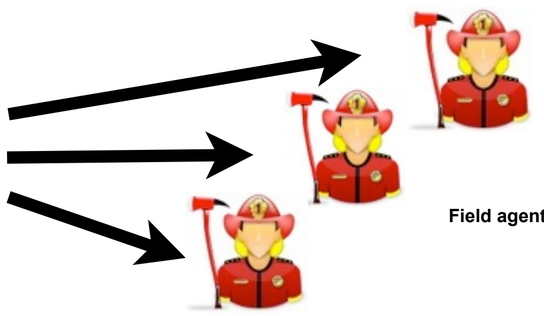
A mixed reality game to simulate disaster response scenario

- Provide realistic disaster response experience, which otherwise can only be gained in real-life disaster
- Allow data collection from human participants
- Can be easily extended (more heterogeneous agents, more disaster scenarios)

Game scenario

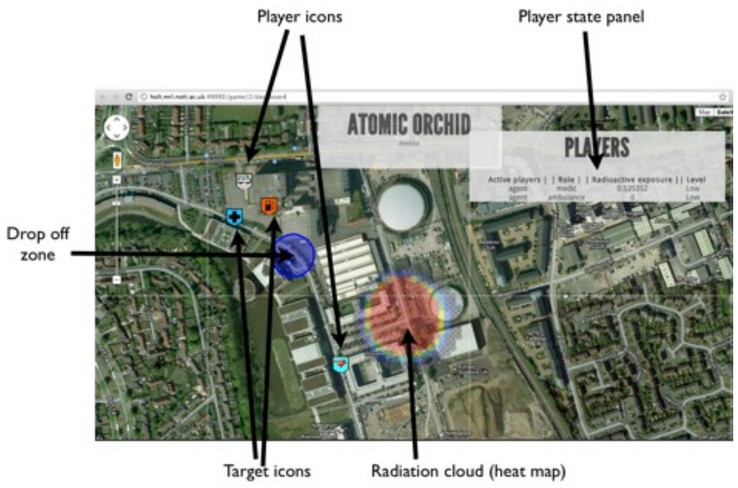
Organisational setting: a coordination centre with multiple field agents

Coordination centre



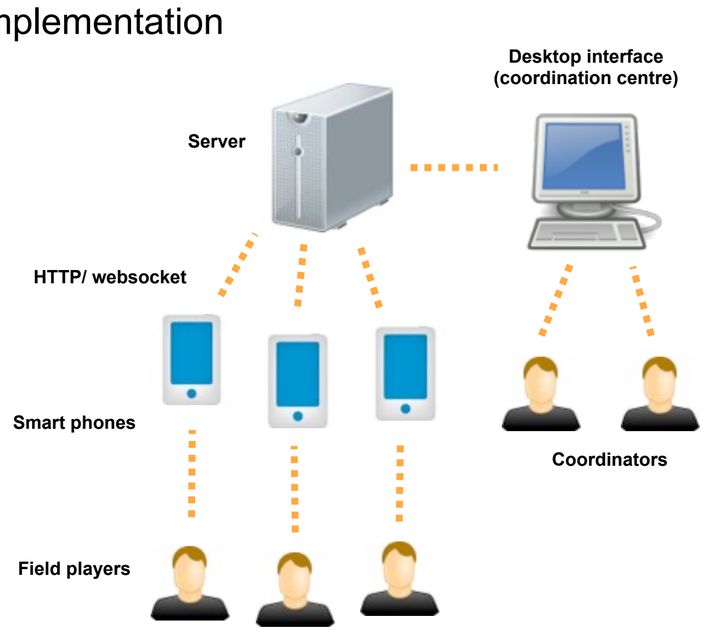
Field agents

Disaster setting:
large-scale multi-incident chemical attack



Implementation

- Server - Ruby Sinatra, Node.js
  - maintain virtual environment, generate virtual events
  - push events to smart phones and desktop interface
- Smart phone - Android app
  - Visualise virtual events from server
  - allow text based communication
- Desktop interface - Web based
  - Visualise virtual events from server
  - Allow text based communication with field players
- JSON schema
  - Remote communication in the system is based on a JSON schema specifically designed for the game,
  - The JSON schema allows easy extension to incorporate heterogeneous intelligent agents.



System Architecture

System testing

Game sessions

- Four game sessions have been run so far
- 4-6 game players for each game session
- Each game session lasts for 15-29 mins

Data collected

- Videos of game play
- System logs of player locations shows players movement
- System logs of remote messages
- Interviews

Videos and system logs

{"location":{"player_id":"139","longitude":-1.397788217291236,"latitude":50.93455696944147,"skill":"firefighter","initials":"NJ"},"ackid":29691,"time_stamp":1341056339182}
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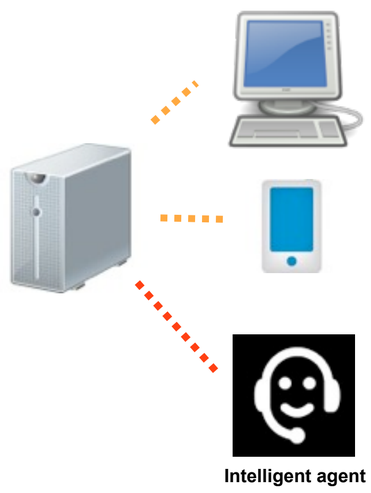
Future direction



1. Connecting a intelligent planning agent into AtomicOrchid to support coordination

2. Enable the agent to provide different degree of automation (DOA)

3. Experiments with agents providing different DOA.