Flexible Autonomy for Multi-UAV Coordination

Yuki Ikuno, Jack Flann, Feng Wu and Sarvapali Ramchurn
Agents, Interaction, and Complexity Research Group
Electronics and Computer Science
University of Southampton

User Interface based on Gold-Silver-Bronze Command Structure

- UI design is based on Gold-Silver-Bronze Command structure, which is used by emergency services of the United Kingdom.
- Tactical commanders assign tasks to UAVs (Monitor View)
- Controller view is used by Operation commander to control the agents (Controller view)
- Messages flow between function and variable nodes of the factor graph.
- Utility function is substituted for tasks and an agent works as a variable.

Flexible Autonomy Using the Max-Sum Algorithm

- Decentralised algorithm.
- The allocation is computed by the Max-Sum algorithm.
- Flexible Autonomy is introduced by the interaction of the commanders with the factor graph.

Multi-UAV Controller for Human-UAV Interaction

Monitor View - Silver Command

- The screens of all agents can be viewed on the multiple screen mode.
- Targets are shown in the view.
- Sending a notification to the bronze commanders.
- Creating situational awareness map in Crowd Scanner.
- The Monitor view renders the Heat map created by smart Crowd sourcing.
- The Monitor view shows the selected agent of camera view and its status.
- Task list shows the list of allocation and task priorities.
- Agent schedule displays current and one step ahead task plan and completed time.
- Summary of Operation indicates the ending time of the operations, and the maximum/minimum flight distances of agents.

Controller View - Bronze Command

- The Operational commanders (First Responders) observe the agent views to find the targets.
- The UI allows them to choose either Teleoperation and Auto control mode.
- An Agent can be controlled by a joystick on the screen.
- The targets are annotated by the operator (Infrastructure damage, medical care, crime unrest and water source).
- Annotated information is posted to Atomic Orchid.
- The Status tab shows other first responders and agents status.