Intelligent GIS for Distributed Cooperation of Earthquake Emergency Response Operations

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Abstract

Relief and rescue (R&R) teams are the key operational teams in earthquake emergency response. The R&R organization consists of various operational teams who have to work together and make tactical decisions in order to achieve a high performance for their organization. In disaster affected area they need to perform interdependent and independent tasks sufficiently and efficiently. Therefore they have to decide what team has to do what task, with whom, where, how, and when. As a result main challenge is the cooperation problem. The cooperation problem consists of some key sub-problems such as task allocation problem, action coordination, team coalition, resource management, spatial knowledge management.

A sufficient approach for cooperation problem is to provide human operational teams with an intelligent software personal assistant which we call distributed intelligent geographic information system (DIGIS). DIGISs run on a tablet supporting GPS, wireless communication, intelligent software agent, and GIS. Commanders of operational teams can use it to cooperate with other operational teams and coordinate their activities. They can update data (spatial data and knowledge) and insert their requests in their own DIGIS, and then the DIGIS communicates with other DIGISs to make tactical decision such as: assignment of some tasks to a certain team, allocation of some tasks between teams, join to new big team, collaboration with a certain team to do a shared task. Because DIGIS supports GIS functions and GPS, it provides team commanders with sufficient tools for spatial-data mapping, visualization of real time location of other DIGISs on the its monitor, visualization of location-based knowledge (location and state of distributed tasks, R&R teams, treatment sites, damaged persons).

In this article we will discuss the phase of analysis and design of DIGIS, as the first phase to achieve our goal. So we will describe the main problem which is the earthquake emergency response operations, defined for Tehran City. We will discuss the organizational structure of relief and rescue operations, operational human teams, their activities, tasks, and so on. Then the cooperation problem will be discussed. Finally we will explain the design of DIGIS. Figure 1 shows the phases and sub-ideas considered in DIGIS.

Keywords

Earthquake emergency response, operational teams, cooperation, design and analysis, GIS, multi-agent systems, coordination



Figure 1: key phases of DIGIS