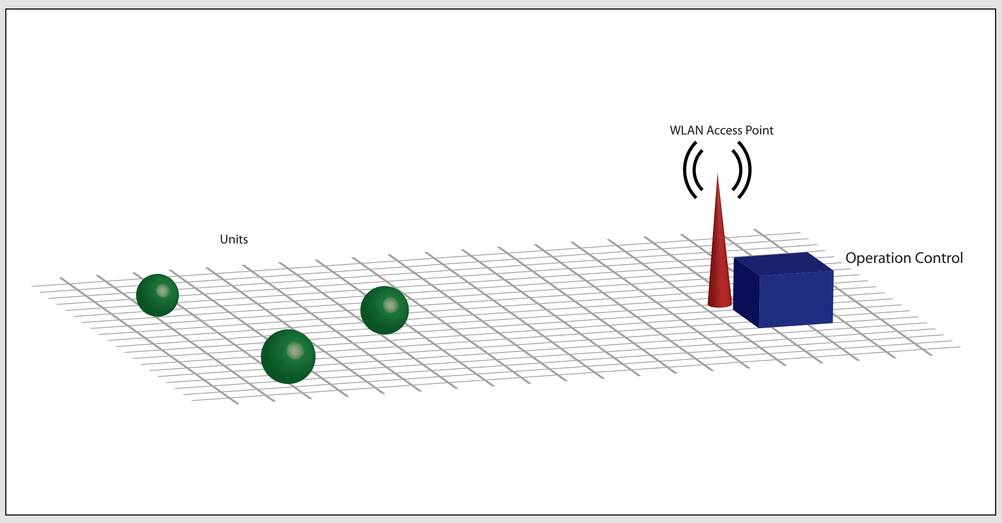
ZoneTrak: Design and Implementation of an Emergency Management Assistance System

Scenario



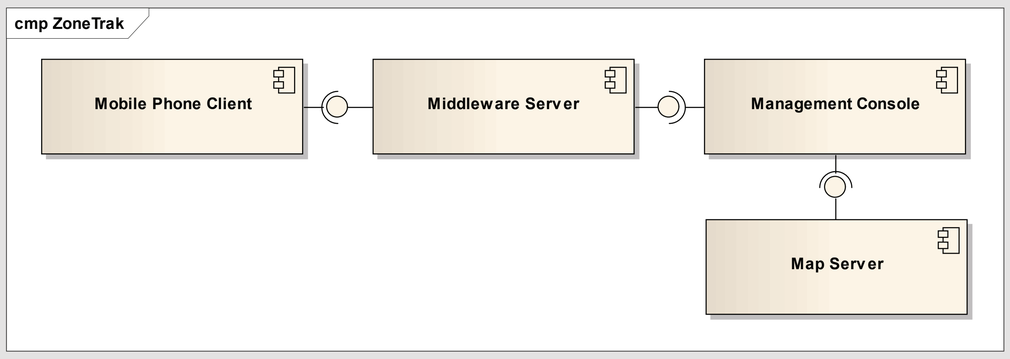
One of the most difficult tasks in emergency situations is to keep track of ongoing activities.

The base of operation is the place, every information passes. The ZoneTrak system's management tool which is able to visualize, analyze and log activities occuring on the field of operation. In contrast to traditional systems, information is tracked in real-time.

The infrastructure used to keep track of units on the field is powered by a wireless network. Instead of using 3rd party networks, ZoneTrak is meant to be used within a self-controlled environment, increasing reliability and safety.

Each tactical unit is equipped with a WLAN-capable mobile phone which transfers position data to the stationary base of operation. Data on critical and dangerous areas is supplied by the system and fetched by mobile devices.

System Architecture



Mobile Phone Client

The mobile phone client which has been implemented for a large variety of mobile phone operating systems including Symbian, Android and Windows Mobile, transfers collected data directly over the established network connection to the middleware server via a RESTful web service.

Middleware Server

The middleware server is the system's heart: It serves as a persistency layer between other system components and exports an RESTful interface used by both, the mobile phone client and the server, to exchange and persist data. This component allows multiple management consoles to run simultaneously.

Management Console

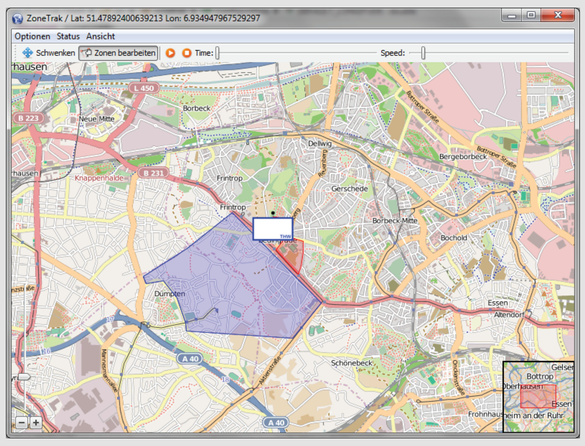
The management console allows real-time visualization and ex post analysis of situations. It is designed for expandibility, i.e. 3rd party plug-ins are supported.

Map Server

This optional component is designed as a virtual machine hosting a web server providing map tile graphics. These graphics are generated on-demand and are cached for future use. The map server can be exchanged by public WMS and other map services.

Real-Time Tracking of Units

Keeping track of ongoing situations always includes the knowledge about the position of forces, their movement and their current work. ZoneTrak's mobile phone client sends information like these to the middle-ware server.



The main role of the management application is to aggregate all kinds of data from available units in the areas and broadcast / share them among all teams based on responsibilities. We implemented the following extensions:

(1) A major requirement in emergency management is to keep track of previous operations. It is particularly important to be able to analyze a non-static situation a-posteriori, so we implemented a method to replay the ongoing development of situations.

(2) We developed several visual plug-ins, improving usual tasks such as route visualization, different visibility levels, and specialized view layers.

Being aware of the fact that emergency management organizations use traditional solutions for many years, we tried to make the system as adaptive and intuitive as possible for future developments.

Reliability

One very important aspect considering the deployment of an assistance system for emergency management especially for urban search and rescue organizations is reliability. Our system uses a wireless network infrastructure instead of an existing mobile phone network in order to be independent from infrastructure systems which might fail.

Initial Findings & Future Work

During a practice session of the cross-border pilot project on civil protection called EU USAR (Urban Search and Rescue) in Germany, we demonstrated the system and interviewed members of disaster relief organizations from different countries. We gathered valuable feedback which helped us to further improve the application. In oder to discover further application areas, we plan to use reality mining and field observations to get a more detailed insight into behavior patterns during emergency situations. Moreover, it will be possible to detect problems within disaster relief organizations such as a lack of communication between units.

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