

Emergency Management System

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Abstract: The Emergency Management System supports rescue units in cases of major incidents. In nowadays rescue operations only very little IT is involved although great improvements during an incident could be achieved. In major incidents medics need to be coordinated efficiently to rescue as much casualties as possible. Our prototype is the first system which helps the officers in charge to maintain an overview over all casualties and medics on the scene. Every medic and every casualty gets equipped with units that build an ad-hoc mesh network. Sensors of different kinds integrate themselves into the system. The system was built to show the capabilities of DAiSI, especially the possibilities of the runtime-testing mechanism which ensure the correctness of the integrated system.

1. Problem

A major incident is any emergency that requires the implementation of special arrangements by one or more of the emergency services and will generally include the involvement, either directly or indirectly, of large numbers of people. (London Emergency Services Liason Panel, 2007)

As this prototype was planned and implemented in Germany, we consider the German standard procedures for major incidents. A local command centre and several rescue units arrive at the scene after the initial alarm. Medics classify the casualties in different categories (so called triage-classes) with regard to their grade of injury. The medics are coordinated by the local command centre. The main problem in a major incident is the lack of information about positions and activities of different rescue units and furthermore the lack of information about positions and conditions of the casualties.

2. Solution

It is difficult for the officers in charge in a major incident to make good decisions because of this lack of information. The flow of information between medics / casualties and the Command Centre has to be improved to solve this problem. Voice radio suites well for coordination of rescue workers or placing of orders, but information bandwidth is not very high, capacity is low, and misunderstandings are frequent. It was our aim to increase the information bandwidth by using digital data radio while decreasing voice radio communication.

The prototype consists of four components: the local Command Centre, Medic Units, Casualty Units and Peripheral Units. In the following we will introduce each of these components.

Command Centre

The Command Centre collects all available information, processes it and delivers it to the officers in charge so that they have an overview over all resources and casualties and can coordinate the rescue actions. An automatically selected subset of the available information is transmitted to the affected medics and processed and displayed by their Medic Unit.



The Command Centre was implemented on a touch sensitive display using infrared measurements. Good usability, even with gloves, was one of the requirements before the development started. That is why a touch screen was chosen and huge effort was put into the development of the graphical user interface.

Medic Unit

The position of a medic is acquired using a standard GPS sensor that is attached to his helmet. The Medic can monitor vital data like heartbeat rate or blood pressure using his Medic Unit. Furthermore he can enter or edit personal data of a casualty like the gender or age group. The Command Centre can assign a medic to one special casualty or give extra information about casualty clearing points, helipads and other special places.



The Medic Unit in its displayed state was realized for a Sony Vaio Mini PC. The Vaio has a pressure-sensitive touch display which was used to make the application fast and easy to operate.

Casualty Unit

The Casualty Unit stores all personal data like age (or age group) or gender but also a history of assigned triage-classes or the current positions. The position is either acquired by GPS or by known positions of nearby medics. If a medic is near a Casualty Unit, casualty's data is displayed on his Medic Unit. The Casualty Unit has eight tricolour LEDs which visualize the current triage class. Colour codes are equivalent to casualty tag colours of the German Red Cross associated with triage classes.



A Sun SPOT is the hardware platform of the Casualty Unit. It communicates via its ZigBee interface with the Command Centre and the medics.

Peripheral Unit

Sensors can collect vital data of casualties much easier and more accurate than humans can. Hence the Peripheral Unit was developed to collect vital data of casualties. It consists of a Sun SPOT, a pulse oximeter and a sphygmomanometer (blood pressure meter). The Unit can be powered by an internal accumulator or by an external power supply.



The sensors are connected to the Sun SPOT via analogue inputs (pulse oximeter) and UART (sphygmomanometer). After pre-processing on the Sun SPOT the data is transmitted to the Command Centre and Medic Units.

To address the problem of the continually changing environment (changing with respect to the components present in the environment) DAISI (Dependable Dynamic Adaptive System Infrastructure) is used. This infrastructure can integrate (and disintegrate) components into a system at runtime. Runtime testing during component integration is used to increase dependability of the resulting integrated system. (Rausch & Niebuhr, 2009)

For further information see: <http://www2.in.tu-clausthal.de/~Rettungsassistenzsystem/en/>

Bibliography

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