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Mobile Communications in Emergency Situations

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“The objectives of emergency medicine are to rescue lives and to limit the extent of injuries to accident victims. Emergency physicians analyse the accident situation, decide the best first aid procedures to implement on-the-spot and select a hospital for immediate follow-up care. Legal emergency accident protocols are usually completed by hand. This delays, or otherwise makes it virtually impossible, to, establish an optimal chain of therapeutic steps.”

These were the conclusions of an Austrian emergency physician (EP) who established contact with us in November 2004. As a university of applied sciences in the field of medical IT, we decided to respond to the challenge. In a matter of about three weeks, we drew up the key project specifications, estimated a budget of approximately 500,000 Euros, located an industrial partner, ilogs GmbH, and secured the participation of Dr. Christian Wutti, the Medical Director of the Department for Emergency and Rescue Services of the Carinthian Chamber of Physicians. After two years of development and field testing, along with a significant amount of related efforts, our research project - known formally as CANIS, for Carinthian Notarzt (emergency physician) Information System - was finalised in July 2007. It is now already in use at several Austrian cities, with marketing undertaken byilogs.

This article recapitulates some of the key steps in our journey. We believe they may have considerable significance for other such initiatives elsewhere.

Development Targets

The following objectives were established to streamline and buttress the communication process between the partners:

î Development of a unique, Austrian-wide mobile medical information system to support emergency rescue operations in order to effectively increase the quality of patients’ medical treatment.

î Reducing the latency time to the necessary treatment while at the same time increasing the quality of treatment.

î Creation and optimisation of a bi-directional digitally secured information flow between the emergency physician at the accident site and the corresponding hospital utilising the fire-and-forget principle.

î Portable system architecture for the interconnectivity of different mobile data collection devices (‘off-the-shelf’ components) and communication architectures.

î Contactless identification of the emergency physician (RFID / Health Professional Card).

î Connection of the E-card (Electronic Health Card) to support the identification of the patient .

î Data collection/entry simultaneous to the first aid measures via speech recognition protocols and data entry.

Identification of System Components

At first, we identified and evaluated principal components of the system: the Central Office for Emergency Response and Notification, the regional hospital information systems (HIS) and key medical equipment (defibrillators, respiration machines) – all of which are equipped with communication interfaces and utilised by emergency physicians. These components communicate over the standard Health-Level 7 (HL7) interface or proprietary formats.

The E-Card: Still Transitional

In Austria, the E-Card plays a special (but momentarily limited) role; it is not yet permissible to integrate or read an ECard for patient identification, because it is not recognised in law as a valid identification card. Thus, a request for the patient's basic data (medications, allergies, etc.) from the HIS based upon the identification of the patient via the E-Card is not yet possible.

Regulatory changes in the pipeline, principally in the shape of amendments to the Health Telematics Law, should bring System environment of the mobile emergency system more transparency and clarity to this issue. In the future, a digital signature on the E-Card could be used among other things, for example, to identify an emergency physician and provide the foundations for data integrity during transmission.

Benchmarking Against the Rest of Europe

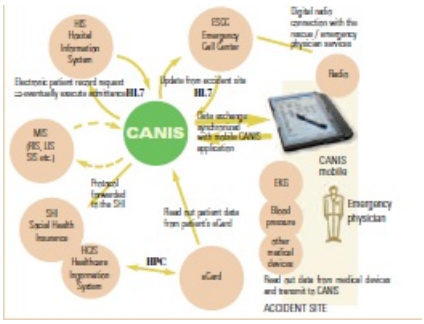
The integration of new systems in what remains a heterogeneous IT landscape is unavoidable. In addition to their recognized benefits, there are also possible risks, for example, false patient identification due to lack of machine-readable patient identification.

Given that documentation for medical emergency events in Austria largely involves paper-based emergency patient care report forms (EPCRF), we decided at the outset to research the situation across Europe. After collecting over 70 EPCRFs from 23 European countries, we found that conditions were almost similar everwhere. Yet another interesting result was that EPCRFs not only frequently vary from one country to another, but sometimes there were up to 10 different kinds of EPCRFs in a single country.

Dynamic System

Nevertheless, further investigation revealed that the information entities within EPCRFs were pretty well structured. This, in turn, led us to seek development of a completely dynamic system, where the GUI (graphical user interface) is created by the underlying database structure.

Given the well-known problems of mobile devices in real working environments, we focused right from the start on designating system usability as a key success factor.



System environment of the mobile emergency system

The Emergency Physician – A Beast of Burden ?

To overcome the commonplace image (and reality) of an over-burdened EP (emergency physician), we performed a range of hardware evaluations to draw up guidelines for mobile hardware platforms. After choosing appropriate platforms, we designed the software user interface – once again entailing different GUIs for different hardware platforms.

This was only made possible due to the dynamic layout of the system. In brief, separating the user interface layout from the software application was, we believe, an important success factor.

Depending on the range of capabilities and cost structures, EPs can determine the ideal IT support combination for their real-life work settings.

SMeUtuLpT 1IPLE Hardware Setups

supports the EP with either a Tablet PC, which is mounted in the emergency rescue vehicle (ERV) or via the EP's own PDA. Setup 2 contains only a Tablet PC. This is either a rugged device carried by the EP to an accident site or mounted inside the ERV. In both instances, EPs can enter data via voice.

Setup 3 focuses on the PDA as a carry-on device, including speech recognition.

Setup 4 is an extension of Setup 1. It provides a choice of Tablet PC or PDA, plus electronic data acquisition through a digital pen or speech

recognition. [The application of a digital pen is recommended, with speech recognition seen as an option].

Setup 5 entails a hands-free approach, with the PDA bodymounted or sewed into the EP's suit. This, however, prevents a user from receiving visual feedback directly from the display. To solve this, a wearable VGA computer monitor (Head Mounted Display [HMD]) is being introduced, on which the content of the standard display is projected. Setup 6 additionally equips the EP with two card readers (RFID, Smartcard) in order to be able to identify the EP or the patient, as well a tiny wireless camera. This camera is mounted on the EPs helmet and enables the taking of photographs of both the accident scene as well as the patient, which increases the value and quality of documentation.

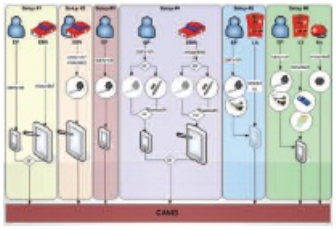
Finetuning to Real-Life in the Real World

The final choice of equipment specifies displays which are easily read in different real-world lighting conditions and equipped with all necessary communication components (GPRS/UMTS, GSM, Bluetooth). Also mandatory is a battery duration for over 8 hours, warm battery swap features and a high (military-grade) protection MIL-STD 810F.

The system is now live, and crucially, avoids the need for dedicated training of EPs.

This, in turn, is a direct result of the usability tests and research efforts undertaken from the outset. An increasing number of supplemental systems and devices are now online and we have completed the first field tests with speech recognition capabilities.

Though paper-based EPCRFs are widely used all over Europe, the next years will lead to a change as more countries move to an electronic solution to increase the efficiency of the process and enhance the quality of emergency medical treatment.



Six different hardware setups for emergency scenarios

Canis: Projects Partners

î Carinthia University of Applied Sciences, School of Medical Information Technology (Dipl.-Ing. Simon Grasser)

î ilogs GmbH (Managing Director Dr. Walter Liebhart)

î Carinthian Chamber of Physicians (Medical Director Dr. Christian Wutti, Department for Emergency and Rescue Services)

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www.fh-kaernten.at/canis

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