Telematic system with cooperative mobile intervention units applied in emergency and catastrophe medicine
CoopUrg

[Developed under CEEX 2005R/D Programme]

FIELD OF APPLICATION

Emergency and catastrophe medicine represents the first communication interface of medical services with the critical patient. In emergency medicine the international standards stipulate the introduction of modern circuit, which includes 3 links:

- Pre-hospital polyvalent and multidisciplinary system strongly medicalised
- Emergency department
- Medical unit disposing of medical imaging department, laboratory with high performance in diagnostic and several departments which can overtake immediately patients stabilized in emergency receiving unit for specialty treatments

CoopUrg project constitutes, in the first, an attempt to implement this circuit contributing to the improvement of "saving chain" and compliance with the concept of "golden hour".

GENERAL OVERVIEW

The projects general objective consists of developing a telematic system, based on medical intervention units equipped with computation and communication devices, which allow cooperative behavior, and on acquisition and transmission medical data and echo-graphic images to specialized emergency receiving centers. The system allows diagnostic triage optimization in case of trauma and shortening the "accident-definitive therapy" duration, increasing the competition and quality of Romanian medical emergency system.

The technical- scientific objectives considered in CoopUrg project are:

- Development of an integrated regional system able to provide telemedicine and transfer services of medical data to distance, using communication networks and cooperative units, to ensure high performance diagnostic in case of trauma
- Increase in performance of emergency services by connecting specialists physicians in various fields for assuring tele-diagnosis, tele-consultancy, tele-assistance, having the purpose of diagnostic triage
- Optimization of non-invasive maneuvers guided by ultrasound FAST protocol
- Optimization of system's functionality in alternate conditions by dynamic resource allocation and implementation of cooperative techniques
- Design of the entire system as an infrastructure for: data processing, development of complex multimodal database, data processing and transmission in normal or degraded conditions
- Development of an efficient tele-ultrasonographic system for the evaluation and quantification of parenchymal organs to traumatized patients, as potential transplant source
- Creation of a network and support database for research in the field of tele-assistance emergency
- Carrying on collaborative activities and interdisciplinary participations

SYSTEM FUNCTIONS

- Medical examination results acquisition, including echo-graphic images prevailed accordingly to FAST protocol, and results transmission to medical imaging units and emergency receiving units (UPU), data storage on ambulances local level in conditions in which the results cannot be communicated to specialty medical centers.
- Specialist authentification on different levels: mobile unit, UPU, transplant centre and authentification data recovering (user name and password) in case they are lost.
- Minimal emergency file generation (data subset, consisting of patient identification data and accident anamnesis - including echo-graphic images) which includes necessary and sufficient information for the revelation of free liquids collections by the imagist specialist and establishing the most directs ways of definitive therapy.
- Pre-hospital file generation, respecting the standard pre-hospital format, starting from the minimal file and adding the objective primary examination data, therapy and final data.
- Generation of the imagistic specialist response in a synthetic form, named in documentation as structured response, and its visualization, at request, in all involved medical compartments.
- UPU file generation, respecting standard UPU format, starting from minimal file and adding objective primary examination, objective secondary examination, therapy, FAST UPU (examination of parenchymal organs) and final data.

- Data examination of type minimal pre-hospital file transmitted by mobile units located in the area by all involved specialists in the patients treatment process.
- Data examination of prehospital files and UPU transmitted by mobile area units, emergency receiving units, respectively, but only by the specialist who generated the respective entity.
- Operative alert of diverse specialist categories in the moments they have to intervene: imagist specialist when receiving a new minimal file, pre-hospital specialist when receiving a structured response, transplant centre specialist at the apparition of a new potential organ donor, respectively.

"CoopUrg" SYSTEM ARHITECTURE

Through CoopUrg application is meant translating into reality an integrated tele-diagnostic and tele-assistance system incase of trauma. This transpose was possible due to the developement of informatic supports and of communication (especially wireless communication) needed in tele-medicine, emergency assistance and high degree performance echo-graphy (based on portable echo-graphy). This system allows performing medical data acquisition, storage, processing and transmission and echo-graphic image operations in different conditions. Through these operations is realized an emergency protocol improvement, due, mainly, to on-line tele-assistance, to a specialist located in the mobile unit, to an imagist specialist because the patients involved in different emergency situations to benefit of the most immediate and efficient medical services. Figure 1 presents the pilot system architecture in which at local level are used two categories of echo-graphs: Sonosite equipment, which is an independent, portable ultrasound machine annd Numeris Echoblaster 128 equipment which is a stationary echograph which uses as display the monitor of a laptop/PC.
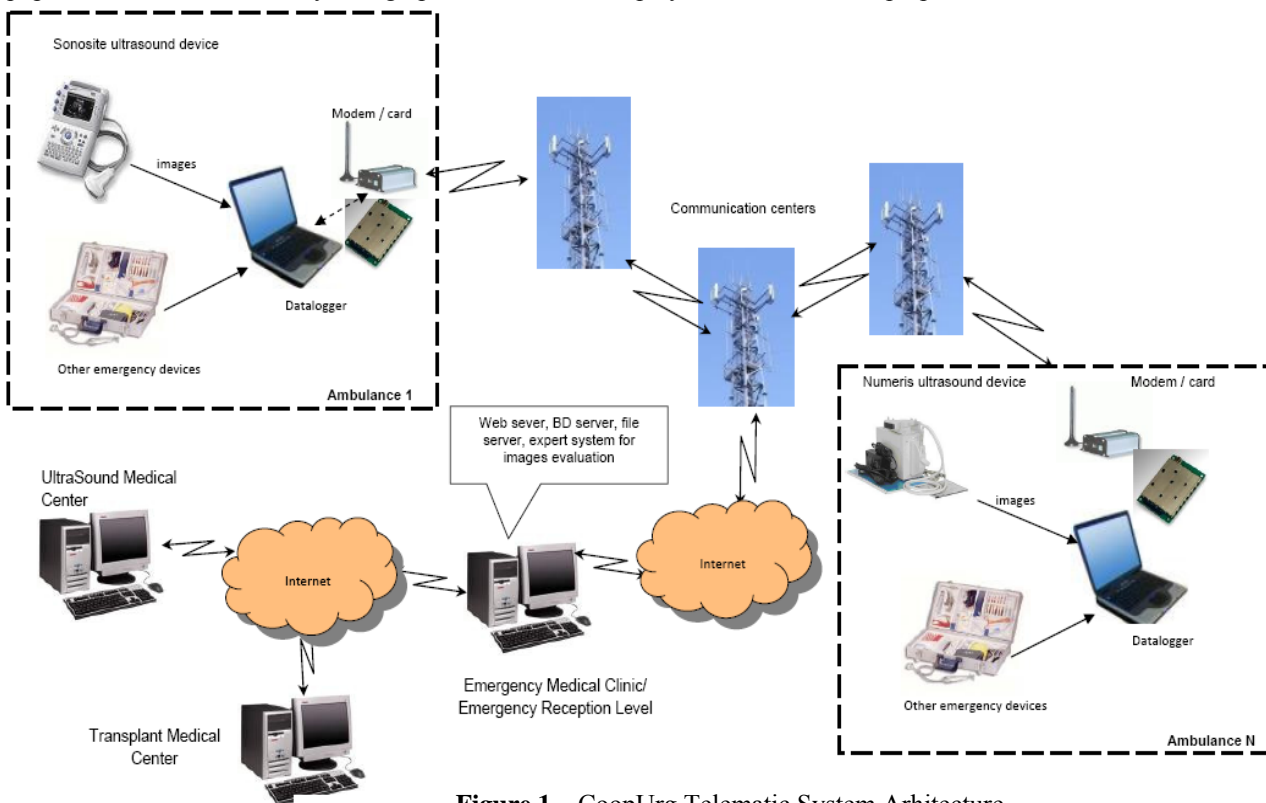

Figure 1 – CoopUrg Telematic System Arhitecture

To perform the ultrasound image acquisition, it was designed and developed an independent compact energetic ensemble, named *"Fast acquisition module of echo-graphic images",* composed of:
- Numeris ECHO Blaster 128 echograph,
- A laptop which reunites the display echograph function and of local computation equipment having the role of acquisition and transmission
- Echograph supply batteries
- 3G modem which allows connecting of the results ensemble to VPN network, or Internet, for data transfer to the Web server, from emergency receiving unit, where it resides the CoopUrg web application.
- The rectifier for echograph buffer reload and/or of laptop accumulator when the equipment is connected to 220 Vca network

The image of the ensamble is presented in Figure 2.

Figure 2. Independent portable echograph ensamble CoopUrg

The communication devices are 3G wireless modems. Two types of modems were chosen: PCMCIA (E620 Huawei) for the laptops placed on the ambulances and USB external modem (E220 Huawei) for the server and desktop stations. The

wireless communication devices allow implementation of a VPN network (Virtual Private Network), that allows secure connections and data transfer.

SOFTWARE APPLICATION

CoopUrg software application is a web application, developed under Windows operating system which manages a SQL type database. The application has a modular structure including a module for each specialist module: from mobile unit, from imaging centre, from emergency receiving centre and from transplant centre. Furthermore, exists a login module to assure the security of the system. To system security assurance it contributes also the configured functions of Windows 2003 Server and of Internet Information Services (IIS) Manager. The application assures each user category with web interfaces through which they can handle medical data and ultrasound images prevailed from patients depending on the access type and level corresponding to each user.
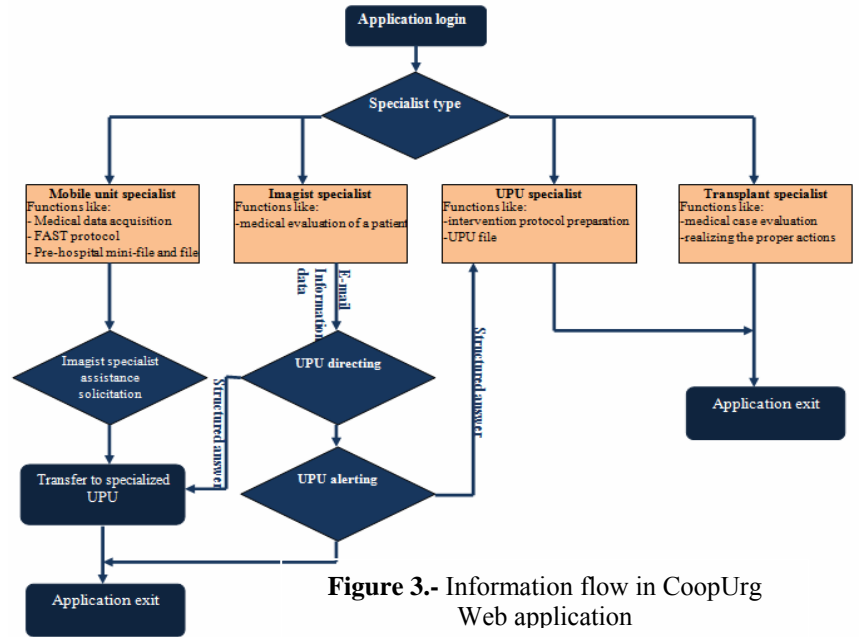
Figure 3.- Information flow in CoopUrg Web application

In the project were applied the facilities assured by cooperative information system behavior (robots and telecommunication networks) for communication channels reconfiguration in the case in which it would dispose of communication channels.

Figure 4.- Main page of CoopUrg application

Figure 5.- Structured answer generation of the imagist specialist

ECONOMIC AND SOCIAL IMPACT

The economic and social impact is quantified by the increase of the patients life chance monitored due to direct connexion with specialist in various medical fields, the reducing of hospitalization duration and increase of quality and professional valences of medical personnel in emergency through trainings which make use of real data registered in the systems database and then structured as training material.

PROJECT DEVELOPERS CONTACTS

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