LOW-COST & LOW-BANDWITH INFORMATION SYSTEMS FOR EMERGENCY RESPONSE

The Case of the Bull-Running

[1] M. Belzunegui, [3] R. Ecay, [1,3] R. Huarte, [1] J. Legarrea, [2] D. Mayor, [1] A. Pina and [1] E. Unzue

[1] *Computer Science Engineering Department, Public University of Navarra, Pamplona, Spain*

[2] *Computer Science Service, Public University of Navarra,Pamplona, Spain*

[3] *Spanish Red Cross, Navarra State Branch, Pamplona, Spain*

Keywords: Emergency Situation, Knowledge management, Databases and Datawarehousing, Mobile technologies for Healthcare applications.

Abstract: This paper describes one research line carried out by the Public University of Navarra in collaboration with the Spanish Red Cross with an interdisciplinary team of volunteers, students, technicians and lecturers whose main aim is to create low cost information systems, adaptive to irregular infrastructures and dispersed locations for emergency response purposes. The features of such systems require a consolidation of the information at several levels and some times among different organizations. They require as well other features like platform independence, low bandwidth information flow and feedback from the end users in order to optimize the process to acquire and display information. The final aim is to improve the data capture and the needed interpretation of such data in order to help within one Emergency response situation. One specific application has been implemented for the management of the incidences of the bull-running and has been used and tested during the "Fiestas of San Fermin" in Pamplona from the 7th to the 14th of July 2009.

1 INTRODUCTION

Information Management in Emergency situations is a key tool in the decision-making processes. In this work we propose a new technological model for medical assistance in emergencies. The main objective is to create simple systems, usable in adverse circumstances, low cost and high performance in order to use them in developing countries for emergency response procedures. The current systems are expensive, not easy to put in place and to maintain and most of the times they require specific training and even in some cases the final end user has to adapt itself to the system and not the contrary. This and the cost of licences, computers and infrastructures make this type of solution not suitable for developing countries

The project we are presenting here has studied different technologies and has proposed one technological model of reduced cost and with a huge adaptability to different operating systems and connectivity platforms for the transmission of the information in such emergency contexts.

As a result of this study we have determined several action lines to decrease cost and at the same time choosing the best possible technology with the adequate devices.

To show the feasibility of all these ideas we have designed and implemented one specific application to handle the medical assistance during the running of the bulls in Pamplona (http://www.sanfermin.com/index.php/en/encierro).

The solution has been tested during the "Fiesta of San Fermin 2009" showing both feasibility and utility.

What we are looking for is a technology able to handle the essential information transfer in such systems, at a reasonable cost, and then to develop several applications that combined and coordinated adequately make up an effective, useful and reliable information system.

Belzunegui M., Ecay R., Huarte R., Legarrea J., Mayor D., Pina A. and Unzue E. (2010).
LOW-COST & LOW-BANDWITH INFORMATION SYSTEMS FOR EMERGENCY RESPONSE - The Case of the Bull-Running.
In *Proceedings of the Third International Conference on Health Informatics*, pages 432-435
DOI: 10.5220/0002739004320435

The rest of this paper has the following structure. The next section describes current and relevant background related with the topic. Then the next section describes with detail the proposed technology. The following section explains a complete example of a real experience of the system. In the next section we present the most relevant results. Then we discuss some conclusions and we outline several future lines to work on.

2 BACKGROUND

The main issues in designing, implementing and using this kind of Information Systems have to deal with Management of complex, dynamic and not precise information (Turoff et al, 1996), with the necessary collaboration between different types of organization located at different geographic places (Catarci et al., 2008)(Yang et al., 2009).
Open source and freeware software is more and more needed for such kind of situations. Sahana (Currion et al., 2007) is a free and open source disaster management system developed in Sri Lanka following the disaster Tsunami in 2004. The main characteristics of Sahana are: open-access approach, low cost deployment and easy adaptability, free and open source.
In any case a solution should take into account the following statement (Carver et al., 2007) "Building the computer as part of the emergency management team assures that people continue to do the things they do well, supported by the technology, not driven by it".

3 TECHNOLOGY FOR EMERGENCY RESPONSE

This Project has analysed the current available technologies and has defined a low cost technological model, flexible, able to work with different operating systems and with different connectivity platforms for information data exchange in emergency environments.
To meet these needs we have decided:

- To implement several cross-platform clients with a common thread for data transmission based in the use of Web URL queries both for sending and receiving information
- To use the least possible bandwidth, sending only the essential information
- To use open and free software so far as possible to avoid licence costs at the deployment time
- To design simple and efficient user interfaces for capturing and visualizing information, answering to the needs of the specialised technicians in emergencies.
- Every client has to catch (and/or visualize) the information in the best way possible in order to be helpful in taking decisions.
- The information may need to be consolidated at different levels (terminal, base, coordination centre, etc) and among different organizations.

4 ONE EXAMPLE: THE CASE OF THE RUNNING BULLS

We have chosen one real example (in information management for emergencies), to implement and test one soft solution based on our previous ideas: the management of the sanitary transport during the running bulls of Pamplona. This management implies 8 primary care points, more than 15 ambulances, 2 coordination centres and (at least) 2 hospitals.
To catch all the needed information we use a graphic and intuitive system that does not require typing any information to be transmitted; through a simple interface the final user (sanitary staff at the primary care points) can express quickly (by clicking) the local needs for ambulances indicating symptomatology, age range and sex. These demands will be solved between the 2 coordination centres simultaneously and will inform to the local operators at the run of the results of the demands.
One of the principal requirements the system has to meet is to be able to work in real time and to allow every device to be on-line using the different connections available in every area. It is similar to an emergency situation because it is a small area crowded (both with people and with mobile devices, mostly phones), where several medical incidences happen (some of them need sanitary transportation to hospitals) in a short time interval (between 5-10 minutes). The scenario is therefore a valid one to test the system.

Using the PDA, through a tactile and easy to use interface, the transfer is requested and at the same time this information is sent to the Red Cross centre indicating as stated before sex, age range, symptomatology and part of the body concerned and cause (see figure 1).

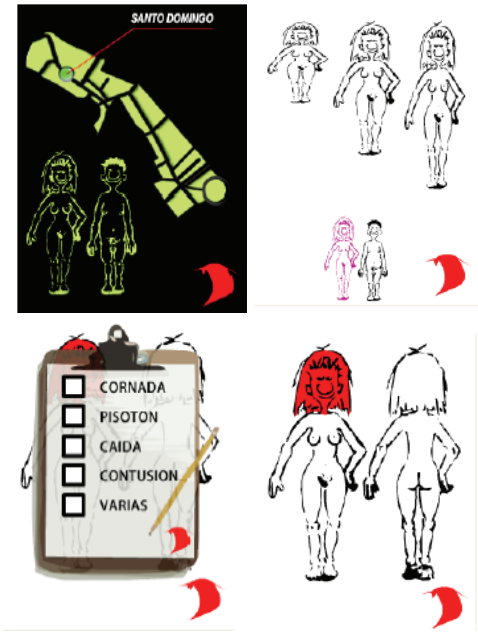

Figure 1: User interface in the Mobile devices.

Figure 2: This is the User Interface for the control centre, where they need accurate and real time information to take decisions about the transfers.

With a warning (using sound and vibration mode) the assistant at the care point at the run receives the answer to the request (ambulance and hospital as said before) for all the requests he has made. It is also possible to cancel one request if necessary.

At any moment it is also possible to consult the current status of any request. We use several colours and status to visualise the evolution of each incidence as it is seen in figure 2.

All the information is displayed and shared through a web system and one unique screen which allow a regular updating of all the information, every second for the most critical and every 5 seconds for the rest.

5 RESULTS

5.1 From a Sanitary Point of View

After the "Fiestas of San Fermin" and the 8 running-bulls where the new system has been tested, the result is very positive and satisfactory. The system has been implanted progressively starting the 7th of July at only 2 primary attention points at the run. Figure 6 shows all the primary care points.

Both the start-up of the 2 points and the communications with the coordination centre (both directions) were fine but we could not test any other thing as there was not any need of ambulances at these 2 points.

The 8th of July we extended the test to 2 more locations (Santo Domingo and Mercaderes) and the performance was fine. From the 9th to the 14th the system was tested in all the points and the result was satisfactory in all the cases. The 9th of July all the sanitary transfers were made through the new system, leaving the radio channel for refinements and other type of queries.

The 10th of July, specially difficult due to a high number of transfers and to the fatal gore of the only dead runner of the 2009 year, the system was very helpful; it allowed to liberate completely the radio channel for attending the fatal gore and the rest of the incidents were managed through the PDA's, helping notably with the tasks of the coordination centres. The rest of the days no new details were reported.

From the user point of view, either at the run (at the street) or at the coordination centres, the take-up has been very good. They see this new program and methodology as an important support tool for them.

The main conclusion is very positive about the new tool, and it is seen as an extra tool that complements the already existing means.

5.2 From a Computer Science Point of View

Computationally the result is very fine too; the application has been totally deployed with agility

and has worked in the right way at any moment.
We have tested the capacity of integration of several information systems with several operating systems (Windows, Linux, Android Windows Mobile, …) on different hardware platforms (PC, Laptops, Netbooks, Smartphones and PDA).

6 CONCLUSIONS & FUTURE LINES

The existing system until now was based on voice messages (through radio VHF) between 2 operators; these messages were registered/stored using paper and pencil.
Even this system is valid it presents possible risks of bad transcription and/or misunderstanding as well as the fact that only one incidence can be processed at the same time by the same operator.
The PDA system with this client-server architecture allows simultaneous requests and assures that once the symptomatology has been described it remains visible for all the involved agents at the web interface display, reducing time management and improving reliability.
At the same time as the Web Interface is unique for all the parts, the technicians have a common and global vision of the situations, and this helps in taking decisions.
The system prevents also from double assignment of the same resource; this means that when one resource (ambulance) is assigned, it is not possible to assign it to another incidence (before the resource is liberated).
From the conversations held with the medical doctors involved in the coordination tasks they outline that is a helpful tool for taking ambulance assigning decisions. It is a very important tool also to help in deciding to which sanitary centre an injured is sent, and this is a critical point, responsible for a high percentage of the delay before a transfer begins effectively.
The complete development of the system and an adequate deployment of it may reduce the global times a patient has to wait since the first aid and the transfer to the hospital.
The work within this project has tried to minimise the information exchange (low bandwith), and opens gates to work on a real time basis using several standard communications systems like PSTN, GSM/UMTS or satelital Iridum, thuraya or Inmarsat with sustainable low costs.

ACKNOWLEDGEMENTS

We acknowledge for the collaboration of the Red Cross and of all the volunteers that have participated in the design and implementation of the application as well as the volunteers that have piloted the experience carried out between the 7th and the 14th of July of 2009.

REFERENCES

Turoff, M., Chumer, M., Van de Walle, B., Yao, X., 2004. The Design of a Dynamic Emergency Response Management Information System (DERMIS). In *journal of Information Technology Theory and Application (JITTA), Volume 5, Number 4 Summer 2004, pp. 1-36*.

Carver L., Turoff M., 2007. Human-computer interaction: the human and computer as a team in emergency management information systems. In *Communications of the ACM, Volume 50 , Issue 3 (March 2007), pp. 33-38*.

Catarci T., de Leoni M., Marrella A., Mecella M., Salvatore B., Vetere G., Dustdar S., Juszczyk L., Manzoor A., Truong H., 2008. Pervasive Software Environments for Supporting Disaster Responses. In *IEEE Internet Computing, Volume 12 , Issue 1 (January 2008), pp. 26-37*.

Currion P., De Silva C., Van de Walle B. 2007. Open source software for disaster management. In *Communications of the ACM, Volume 50 , Issue 3 (March 2007), pp. 61-65*.

Yang L., Prasanna R., King M.., 2009. On-Site Information Systems Design for Emergency First Responders. In *journal of Information Technology Theory and Application (JITTA), Volume 10, Issue 1 2007, pp. 5-27*.