HISS - Hospital Information System for Students

Michele Crudele[1] and Giulio Iannello[1,2]
{m.crudele, g.iannello}@unicampus.it

[1] Università Campus Bio-Medico di Roma
[2] Università di Napoli Federico II

This position paper describes the HISS (Hospital Information System for Students) Project which is being developed at the "Università Campus Bio-Medico di Roma", and whose goal is to set up a simulation of a Hospital Information System in our University Clinic, and to make it accessible by the students through wireless devices for educational and training purposes.

The project, which will start in September 2003 and will last about one year, has been funded by Hewlett-Packard, under the Applied Mobile Technology Solutions in Learning Environments – 2003 Grant Initiative and involves the Faculties of Medicine (students of Medicine, Nurse and Dietetics) and Engineering (students of Biomedical Engineering). The Project Proposal can be found at http://research.unicampus.it/hiss/.

In the following we will summarize the background that motivated the project proposal and present an overview of the project and of its goals.

1. BACKGROUND

Technology vision. We are aware that mobile technology in our campus can improve dramatically the University Hospital activities. The strong need of a pervasive Hospital Information System encounters some difficulties in the diffusion of PC's in the wards or in other places. Computers are still too big to be installed in the place where the nurse or the physician works. The most common tool for a medical operator is still the exercise book and the pen. By giving ubiquitous access to digital medical resources, all the personnel could be able to cure better and faster the patients.

Mobile technology plans. Wireless LAN technology has been used for experimental purposes for one year. Eventually, in March 2003, one ward of our University Hospital has been fully equipped with a WLAN system to allow nurses to access and modify clinical data of the patients. The most important application, so far, is the drugs administration recording which has a strong economic impact in the institution. A better management can lead to global savings while avoiding mistakes and waste. We have implemented a WLAN solution based on Symbol technology because it makes available rugged palm computers (droppable, waterproof, robust) with built-in bar-code reader and strong cryptography.

Mobile technology implementation. The main step for the future is to install all over the Hospital a suitable support for accessing the Hospital Information System using any wireless computer. One main point is security (cryptography and authentication). After

examining different technologies (very often not interoperable) we concluded that we have to wait some more time to have a standard, non-proprietary, strong and stable system. That's why we have decided to concentrate our task on the software production, having experienced how different is to design an interface for a 15" monitor opposed to a small palm display with no keyboard. The recent challenge of Tablet PC's opens another interesting field of researching. In the mean while we plan to implement wireless access in all the wards and some classrooms for teaching purposes.

2.   PROPOSAL OVERVIEW

Executive summary. Students of Medicine and Nursing, as well as Dietetics and Biomedical Engineering will find at the end of their University course a different environment in hospitals: more informatics, more telecommunication and more wireless technology. There is a urgent need of training in this field, in order to discover the new capabilities of the "connected hospital". The project's goal is to set up a simulation of a Hospital Information System in our University Clinic, mainly used by the students through wireless devices (mainly palm and tablet computers). The coexistence of a Faculty of Medicine and Bioengineering in the same institution and building, gives a good chance of enhancing cooperation among the students using mobile technologies. Each group of students will have a specific role. Bioengineering students will be in charge of setting up software and hardware, evaluate performance, monitor activity and study interoperability issues. Medicine students will focus on the clinical information required at the bedside. Nursing students will work on the nursing record. Dietetics students will address the communication between wards and catering department. The project will be coordinated by the Computer Science research group, with the help of the Information Technology departments of the University and Hospital.

Project details. Hospitals are enhancing their level of technology. The complexity of modern care requires an integration of hardware and software. One of the weakest points in distributing the access to electronic medical records is the difficulty of having computers in the wards or in the patients' rooms. Researchers have studied the failure of using PC's or notebooks placed in the trolley of the nurse: it seems that the time and the attention to typewrite data is taken from the direct care of the patient and therefore acceptance by the nurses is low. Better and simpler interfaces are required, but also a less invasive instrument. Moreover, the need of plugging the notebook to the Hospital network to work on-line and access the latest data, makes it more uncomfortable. The advent of wireless computing and small devices can change dramatically this scenario.

   The introduction of these new modes requires careful study and tests. We think that the best way is starting with a simulated Hospital Information System, developed by the students of Biomedical Engineering and used by the students of Medicine, Nursing and Dietetics.

   To improve the accessibility of the simulated Hospital Information System through wireless and portable devices a number of advanced technical issues will also being considered. Some work has already been carried out about support for transparent horizontal (WLAN-WLAN) and vertical roaming (Bluetooth vs. WLAN and UMTS/GPRS vs. WLAN), and content adaptation using user profile information.

The impact of this simulated HIS is strong on all the actors. The project of the database structure falls under the Clinical Information Systems course of the Biomedical Engineering Laurea. Biomedical Engineering students of the Telematics course will deal with performance evaluation, monitoring, security issues and interoperability specifications. The compatibility for future incorporation of the wireless devices in the Hospital Information System will be studied by the Information Technology Department of the Hospital, addressing especially the security issues (finger print authentication, VPN, etc.). The construction of an order entry system for diets is a topic dealt by the students of the Dietetics curriculum. Nursing and Medicine students will work mainly with the electronic clinical records.

In order to achieve a valuable result in a short time (one year) the HIS will be restricted to the clinical information, leaving aside all the administrative modules (admission, billing, etc.) and some specialized areas (radiology, laboratory, etc.). In fact, the clinical information is mostly used while visiting a patient in a room and seems suitable for presentation on a small display. We plan to test also tablet computers in order to understand whether the absence of a keyboard and the more natural way of taking notes using a pen can be more acceptable for a nurse at the bedside. The use of digital cameras for clinical illustration of patients (e.g. dermatology problems, state of a wound, etc.) with immediate delivery to the HIS will also be addressed.

In all the wards and rooms there will be a wireless connection to a specific LAN (different form the actual hospital information system LAN, for security reasons). Each student participating in the project will be equipped with a wireless enabled device with a biometrics device for authentication. Some of them, especially the teachers (nurses and physicians) will use tablet PCs. We estimate the involvement of one hundred students, on a shared basis for the use of around 40 wireless devices.

An important point is feedback. A system for collecting comments, bug notices, proposals and other information from the users, will be set up.

We plan to set up the whole network with multicast mode enabled. This will give us the possibility of transmitting to many students at the same time video based content (e.g. live from the operating theatre or from a lecture hall). A video server will therefore be set up, choosing the appropriate standard compatible with the wireless portable devices (MPEG-4, Window Media, Real Video).

Impact on Teaching and Learning. The HISS project requires a tight collaboration of all the departments involved in order to grow in a parallel way.

Both the Faculty of Medicine (courses on Medicine, Nursing and Dietetics) and Engineering (course on Bioengineering) will be involved in the HISS project.

Learning on the job has been considered as a fundamental methodology for medical related professions. A great part of the teaching is done in the wards, while visiting patients. The typical way of memorizing what is said or done by the teachers, nurses or physicians is to take a written note on an exercise book. This leads to unstructured data and does not give any possibility of accessing specific information beside the small one contained in the book itself. A notebook computer could be carried by the students but it is cumbersome and difficult to write into.

The scenario we imagine with the introduction of wireless small devices in the wards is this:

> the teacher asks the students to access the clinical information of the patient to be visited each students reads on his/her palm computer the relevant data about the pathology and the anamnesis the teacher visits the patient and gives new information on his/her situation while the nurse updates the clinical record the students listen and take personal notes on their palm computers adding value to the updated clinical records.

Obviously the impact is different on students from Medicine, Nursing and Dietetics courses. In any case, the familiarity achieved by using these new devices will give them more ability for their work in future and more advanced hospitals. They will also learn the limitations, regulations and dangers arising from this new way of accessing clinical data.
Students of Biomedical Engineering (Clinical Information System course) will work with a researcher and with the programmers in order to set up the database and the interface of the different modules. Students of the Telematics course will deal with performance evaluation, monitoring, security issues and interoperability specifications. The final result should be a deeper understanding of the clinical records by the medical students and a greater awareness on the problems of programming in a high demanding environment by the engineering students.

Measurement. The role of the Medical education department is to verify the students' progress while advancing in the project, by comparing the test group with other students not accessing the same facilities. Three tutors (one each for Medicine, Nursing and Dietetics courses) will monitor and gather the feedback from the students.
The Campus Intranet will be constantly reporting the advancements and accepting proposals by the students using the system and all the other ones.