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Telemedicine Standardization -- The Need for an Operational Approach

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NOTE: "Opinions, interpretations, conclusions, and recommendations are those of the author and are not necessarily endorsed by the U.S. Army."

For the expansion of multinational telemedicine operations, a sine qua non which has been well demonstrated is that of standardization. There are many agencies and organizations working in the realm of technical and communications standards, but few are working in the arena of operational standards. NATO is one exception, and its recent success in establishing a Standardisation Agreement (STANAG) on the development of Teleconsultation systems may be held up as an example for emulation. Recent NATO military operations have demonstrated both a need for and a lack of interoperability in the area of Telemedicine. Since multinational operations seem to be the wave of the future, and multinational medical support will be mandatory for provision of best care to the patients, NATO has developed an interest in the area of the provision of Teleconsultation across national boundaries. Work in this area has been carried out by the NATO Telemedicine Panel, and this presentation will discuss the approach of the Telemedicine Panel to standardize and improve multinational Telemedicine support to military operations. The Panel has chosen for practical reasons to concentrate its efforts on Teleconsultation rather than on the broader definitions of Telemedicine, which include patient education, home health care, and monitoring for patients with chronic diseases, due to the fact that these broader areas are not within the purview of NATO, being strictly national responsibilities. The emphasis of the Panel is on Business Processes, rather than technical or clinical standards, and the rationale for this decision will be discussed.

Any one of us who has worked in the Telemedicine (TMED) arena is very aware of standards, and the need for them. However, there has been demonstrated frequently a tendency to get bogged down in arguments about specific standards and to ignore others which may actually be more important. A review of the TMED literature over the past 10 years demonstrates several salient facts:

1. The equipment to successfully carry out TMED clinical practice is a reality—it works;
2. Many small demonstration projects are successful; and
3. Once we attempt to spread these pilot projects over a larger area, or into the multinational or multi-jurisdictional arena, there are many more failures than successes.

I would hold that one reason for the third point is that generally inadequate attention is paid to the right kind of standards. Innovators of systems and projects have frequently tended to concentrate only on technical or clinical standards, but have paid insufficient attention to what I would term operational standardization. The old concept of “build it and they will use it” is simply not realistic.

For the expansion of multinational telemedicine operations, a sine qua non which has been well demonstrated is that of standardization. I know of no one who would dispute that. There are many agencies and organizations working in the realm of technical and communications standards, and some working in the area of clinical standards, but few are working in the arena of operational standards. NATO is one exception, and its recent success in establishing a Standardisation Agreement (STANAG) on the development of Teleconsultation systems may be held up as an example for emulation.

Recent NATO military operations in the Balkans and Afghanistan have demonstrated both a need for and a lack of interoperability in the area of Telemedicine. Since multinational operations seem to be the wave of the future for NATO, and multinational medical support will be mandatory for provision of best care to the patients, NATO has developed an interest in the area of the provision of Teleconsultation across national boundaries. Work in this arena has been carried out by the NATO Telemedicine Expert Team, and this presentation will discuss the approach of the Team to standardise and improve multinational Telemedicine support to military operations. It appears to me that this
The Relevance of User Evaluation Research for e-Health-Applications in the Homecare Setting

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Abstract - BACKGROUND: Within the broad field of e-health specific attention is being paid to telehomecare applications. In this domain more attention has to be paid on the intertwining of technological design and the contexts of use. In order to optimize an effective and efficient implementation of telehomecare technology the user perspective needs particular attention. Lessons can especially be learned from ‘the social construction of technology’ literature focusing on the ‘technology as an artefact’ and ‘the social context’ in which the technology is embedded and from evaluation research.

OBJECTIVE: We will demonstrate the importance of User Needs assessment. Knowledge and insight has to be gained in the particularities of the healthcare sector as a critical part of the design and implementation of telehealth applications.

METHODS: Experiences in pilot telehomecare projects in Belgium, demonstrate the added value of user evaluation research. Using a constructive technology assessment (CTA) approach the follow-up, development and introduction of the telehomecare applications in the primary healthcare field is being done. The perspectives of the different stakeholders, with their own needs, expectations and values, are studied, evaluated and integrated in an evaluation framework, and taken into account when designing and implementing the technology.

I. INTRODUCTION

Information- and Communication Technology (ICT) is becoming more and more important in the healthcare sector. While many technologies have already found their way in the intramural setting, more and more attention is being paid to telehomecare applications. In this domain more attention has to be paid on the intertwining of technological design and the contexts of use. In order to optimize an effective and efficient implementation of telehomecare technology the user perspective needs particular attention. In particular, lessons can be learned from ‘the social construction of technology’ literature focusing on the interaction between ‘technology as an artefact’ and ‘the social context’ in which the technology is embedded. Evaluation research offers some additional insights on methods.

A. The social construction of technology

Recent developments in science and technology studies, in information systems research and organization studies urge not to use a technological deterministic paradigm. Technological determinism holds the idea of an unidirectional impact of technology on society (‘black box’). In a response to this instrumental vision the social construction of technology demonstrates that users are not passive consumers of technology. Pinch and Bijker identify ‘relevant social groups’ who give meaning to the technology and thereby co-design (in collaboration with the manufacturers) the artefact [1]. Technology and its social environment are mutually interdependent [2]. Technologies are both mediating social roles, and are shaped within the context of particular roles [3]. As technology is embedded in society, values, norms, power relations and other social constraints influence the shaping of technology. On the other hand the use of new artefacts can in turn alter the existing values, norms and work routines. In other words, technology can be cause as well as effect: technology can be shaped by society, and will shape society [2].

Especially in healthcare, too little attention is currently paid to the (potential) consequences of an ICT application on work practices and roles of different potential users. Explicit debates and reflection on the impact of technologies on future roles, can help to clarify the development and use of technologies. One of the particular research issues for the future of e-health, is studying the implicit ‘scripts’ in technologies assigning tasks and duties to different persons, or interfering with institutionalized interaction patterns [4]. In order to avoid that ICT applications will affect the persons and roles in undesirable ways, a specific methodological approach can be used: constructive technology assessment.

B. Evaluation research

Healthcare evaluation research of technologies mainly uses quantitative methods [5,6,7,8]. This tradition is clearly
Telecare in Singapore Health Services

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Abstract - This paper describes and discusses Home Telecare initiatives in Singapore Health Services (SingHealth). The outpatients with chronic diseases using the system are:

- Chronic heart failure patients and heart transplant patients
- Pregnant patients with diabetes
- Pregnant patients with gestational hypertension
- Peritoneal Dialysis Patients

The Telecare system provides timely and personalised outpatient care anytime, anywhere by empowering outpatients outside of SingHealth medical facilities to use ubiquitous technologies such as low-cost health monitors and Internet Telecare portal or mobile phone text messages (SMS) to update their daily health status for SingHealth clinicians to review and intervene (if necessary) to reduce complications/emergencies. By using the system, clinicians are also able to actively fine-tune the medication of their outpatients depending on their recent health status. The system also assists clinicians to extend their reach and care to overseas patients, and traveling patients (who are not able to attend regular reviews in person). The system empowers clinicians to customise and individually set vital signs thresholds and symptom questionnaire for each of their patients. When a patient’s vital signs are abnormal, their clinicians are alerted via SMS. Clinicians can also view a patient’s health progress through interactive informative charts. The Telecare portal also provides a secure messaging module for the patient and clinician to communicate with each other. For urgent messages, clinicians can SMS the patient immediately through the portal. The system is developed in-house using Microsoft .NET with a scalable object-oriented design. Infrastructure/application security features and audit trails have also been implemented to protect patient’s privacy and data. The system can handle patients with comorbidities (more than one chronic disease). Telecare is a possible long-term solution to use information technology to provide long-term care for the rapidly aging population and the rise of chronic degenerative diseases. Singapore Health Services (SingHealth) consists of a cluster of 3 Hospitals, 5 National Specialist Centers and a network of primary healthcare clinics (polyclinics) distributed around the east side of Singapore providing public healthcare. Each year, SingHealth attends to 3 million patients.

Keywords: Telecare, chronic disease, remote monitoring, personalized care

I. BACKGROUND AND INTRODUCTION

The Singapore public healthcare delivery system is organized into two vertically integrated delivery networks, Singapore Health Services (SingHealth) and National Healthcare Group (NHG) [1]. The public healthcare system provides 80% and 20% of hospital care and primary care respectively. The remaining portion is provided by private hospitals and private practitioners. Each year, Singapore also attends to more than 200,000 overseas patients [2].

SingHealth consists of a cluster of 3 Hospitals, 5 National Specialist Centers and a network of primary healthcare clinics (polyclinics) distributed around the east side of the country. Each year, SingHealth attends to 3 million patients [3].

Singapore has a rapidly aging population, with the proportion of those 65 years and above estimated to increase to 19% of the population by 2030 [4]. This growth will spur a quantum increase in the demand for healthcare services and chronic disease management. Hence, there is a need to improve the health of the elderly and strengthen the management of the main chronic diseases. Within the population, with the rising affluence and the proliferation of healthcare information, there is also the rise of the “expert patient” - patients who are health and tech savvy.
Home Based Integrated Care in Patients with Chronic Respiratory Failure with the Use of e-Health Services

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INTRODUCTION

COPD (chronic obstructive pulmonary disease) is a chronic progressive lung disease, characterized by frequent exacerbations, resulting in patients’ poor quality of life and repeated hospital admissions. The aim of the study was the evaluation of clinical usefulness of an advanced e-health system in home-based rehabilitation and follow up and home hospitalization of patients with advanced stages of COPD.

METHODOLOGY

Eighteen subjects (mean FEV1 0.73 L) with at least four admissions for COPD exacerbations in the previous 2 years, including admissions in Intensive Care Unit, were followed up for 12 months, after an initial outpatient evaluation and rehabilitation phase.

The telemedicine system we employed, consisted of a specially designed electronic health record (EHR), a compilation of integrated medical peripherals (spirometer, oximeter, ECG etc.), for patients’ monitoring and a digital camera for real time video communication (by using one ISDN line of 128kbps). Through the system, a large variety of preventive and therapeutic tasks became possible for the members of the rehabilitation team from hospital to patients’ homes. These tele-visits were performed at a frequency of about once a month, either on a regular or an emergency basis.

RESULTS

During the first year of the program, the number of hospital days fell to 4 from 17.5 per patient, within the year before the intervention. The hospital admissions declined to 0.4 from 2.1 for the same time period. The emergency and scheduled hospital visits fell to 4.7 from 8.6 and accordingly the cost savings from the reduction of both, hospital admissions and
Telehealth Model between University and Primary Care

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Abstract- A Telehealth model has been developed by the Federal University of Minas Gerais (UFMG) and the Municipal Administration of Belo Horizonte since 2004. A telehealth network was implanted first in Belo Horizonte, and currently extends to other cities in Minas Gerais state, linking the university to inland health centers to support the family health teams in their daily work. The main telehealth activities are permanent education and second opinion in clinical cases, focused on primary care professionals from medicine, nursing and odontology. The assisting support is based on spontaneous demand, using online technology for complex cases and offline for simple ones. The educational support is provided through teleconferences according to professional necessities. A simple model of technology is used, based on computers with webcams, management and communication software packages, allowing simultaneous online access of multiple basic health units with image, voice and text interaction. During the first 2 years of implementation there have been performed 151 telehealth events, with the participation of approximately 2,025 health professionals. The Ministry of Health in 2006 integrates in a pilot national project the biggest Brazilian public experiences in telehealth in order to support the family health teams. This projet will benefit around 10,000,000 inhabitants.

I. INTRODUCTION

Brazil is a country with big territorial dimensions and huge social, economical, cultural, geographical and infra-structural contrasts. All these facts generate big differentiation in terms of professional qualification, which justify the large range of services qualities found in the health care to the population. Within this context, it is proved the necessity to deeply use information and communication technologies in health, to support the professional that are settled in distant and poor regions in the country.

According to the Brazilian Institute of Geography and Statistics (IBGE), in 2000 the country had 169,590,693 inhabitants, living in 5,507 cities [1]. About 88% of these cities had the population ranging from 2,000 to 50,000 citizens.

Still according to 2000 census, Minas Gerais has a population of 18,030,458 inhabitants and 853 cities. About 88% of these cities have a population of less than 30,000 inhabitants and 60% less than 10,000 [1].

The Unique Health System of Brazil (SUS) was created by the Federal Constitution in 1988 to reorganize the services and actions in health. It was created to decentralize the former health system.

SUS presents the principles of universality of access, integrity and equality in assistance, participation of the community and equity. It is a complex system, with huge numbers. For instance, it realizes, according to the Health Ministry, 72,000 heart surgeries and 132 million high complexities procedures each year [2]. However, 80% of its attendance is concentrated in the primary level, which is the main entrance form to the system.

In 1994, the Family Health Program (FHP) was created by the Federal Government to reorganize the health attention practices and amplify the access of all citizens to integral and continued treatments. It was formed family health teams, composed by a doctor, a nurse, auxiliary nurses, people from...
Rural Telemedicine: Lessons from Alaska for Developing Regions

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"Telehealth is about people and processes, not just about the technology”1

Abstract: Alaska shares many characteristics with many other rural and remote regions of the developing world, including a small population spread over a large area, lack of roads linking villages to hospitals, a significant indigenous population, and a shortage of doctors in rural areas. Satellites brought reliable voice communication with village health aides in the 1970s. Alaska has now introduced the first permanent upgrade to the voice satellite system, known as the Alaska Federal Health Care Access Network (AFHCAN). This satellite-based system is now the world’s most extensive telemedicine network, linking 248 sites, including 158 village health centers. This paper examines the approach used to design the network, and includes preliminary findings on utilization of the network and associated cost-savings. It also discusses the U.S. Universal Service Fund subsidy for rural health care facilities. It concludes with lessons learned that could be applicable for other remote and isolated areas and developing regions.

I. TELEMEDICINE AND TELEHEALTH

In the programs described here, applications of telecommunications in support of health care are referred to as "telemedicine," although some researchers and practitioners prefer to use that term for consultative uses, and the term "telehealth" to refer to applications for continuing medical education and administration. Information and communication technologies (ICTs) can be used to support health services including the following:

- Emergencies: to summon immediate medical assistance; to communicate with emergency vehicles and staff;
- Consultation: typically between primary health care providers and district level physicians, or between district physicians and specialists;
- Remote diagnosis: e.g. transmission of medical data and images, interpretation of data by distant specialists;
- Patient monitoring: e.g. transmission of patient data from home or rural clinic, often coupled with follow-up through local medical staff;
- Training and continuing education: of health care workers, paraprofessionals, physicians, etc.;
- Public health education: of target populations including expectant mothers, mothers of young children, groups susceptible to contagious diseases, etc.;
- Administration: ordering and delivery of medications and supplies; coordination of logistics such as field visits of medical staff; accessing and updating of patient medical records; transmission of billing data, etc.;
- Data collection: collection of public health information such as epidemiological data on outbreaks of diseases; and
- Research and information sharing: such as access to medical data bases and libraries and consultation with distant experts and peers.

II. THE CONTEXT

A. The Rural Context

The health sector in developing countries confronts major administrative, quality control, and logistical problems. In general, health care in developing countries must be dispensed by individuals with less training and less backup than their counterparts in industrialized countries. Developing regions typically face severe shortages of physicians, particularly in rural areas. Specialists may be available only in the major cities. Health workers may have only minimal training, or have few opportunities to upgrade their knowledge and skills. Facilities for treating patients may be inadequate in terms of staffing, equipment, and medications.

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A telemedicine Framework for Collaborative Pacemaker Follow-up

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Abstract—According to international guidelines implanted pacemakers need to be checked periodically to ensure that they are working correctly. To spare a significant number of patients the burden of having to travel to specialized hospitals as well as to increase efficiency in pacemaker therapy a telemedicine framework has been developed prototypically. The purpose of this study has been to use a routine ECG recording to verify whether the pacemaker works correctly or if further examination is indicated. The telemedicine framework enables an active collaboration between the caregiver in the vicinity of the patient and the specialist at the hospital. The concept has been evaluated in a clinical pilot trial on 24 consecutive patients with a total of 17 different pacemaker models from 6 different manufacturers. The promising results indicate that the presented, manufactured independent follow-up concept, which can be handled by general practitioners, has the potential to work as an efficient screening method to identify possible problems as early as possible.

I. INTRODUCTION

Pacemaker (PM) implantation is only the first step in the therapy of patients suffering from several heart rhythm diseases like bradycardya, sick sinus syndrome, and AV-node dysfunction. It has been estimated that in Austria about 50,000 patients have permanent pacing systems and that there are about 3,000 implantations of new pacemakers per year. Since the patient’s life may depend on the pacemaker, both patient and device need to be examined in periodic intervals according to the international guidelines [1]. Thus, PMs are to be inspected up to four times a year, depending on the duration of PM implantation, the patient’s general condition and the results of previous follow-ups.

In the course of most of these follow-ups – so-called “basic follow-ups” – mainly the depletion level of the PM’s battery, the basic function of the PM as well as patients’ general conditions are assessed.

Only in a minor number – mostly during the first year after the implantation – more comprehensive procedures are necessary in order to adjust PM settings to the individual needs of the patient as well as to optimize the pacing system concerning power source utilization. These procedures – so-called “extended follow-ups” – are performed in specialized PM clinics. Therefore company specific, cost intensive PM programming systems are required, which allow communicating with the implanted PM telemetrically.

Since there is no method to check the basic function of the pacemaker in an easy and uncomplicated way, currently only “extended PM follow ups” are performed in Austria. This implies a huge personal effort for the departments and long travel burdens for the usually elderly persons to undergo this routinely performed examination. A screening examination would be helpful that is able to identify possible problems with the PM as early as possible without the need for the patients of travelling to the PM clinic for extended PM follow-up.

The general idea of the project is to shift a significant number of “basic PM follow-ups” from follow-up centres to caregivers located in the patient’s vicinity. This is based on the fact, that “basic follow-ups” can be performed without the necessity of manufacturer specific PM programming devices.

Due to international standards each device reacts to the application of a magnet by changing the pacing rate in a predefined way – depending on the depletion level of the

![Figure 1. Example of an ECG sequence recorded during magnet placement from a patient with a Medtronic Kappa pacemaker; A: magnet takes effect (PR=100 min⁻¹); B: after the 3rd stimulus the PR lowers to 85 min⁻¹ indicating BOL.](image-url)
Computer Skills and Digital Divide for HIV/AIDS Doctors in Low Resource Settings

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Abstract—The purpose of this paper is to point out basic informatics knowledge, ability in using computers and access to internet for some of the physicians following courses at the Institute of Tropical Medicine in Antwerp, while working in low resource settings.

I. INTRODUCTION

Lack of access to information remains one of the major barriers to evidence based medicine in low resource settings. Limited access to computer facilities, to literature databases and to continuing medical education (CME) programs are just some examples out of the full range causing disparities in universal access to health care information.

Worldwide just 14 percent of the population is online [1] and besides the lack of resources, several other factors as users’ skills, time availability, and return of investment are contributing to the information and communications technologies (ICT) gap [2].

In order to decrease the barrier to evidence based medical information the Institute of Tropical Medicine, Antwerp (ITMA) supports physicians working in low resource settings on HIV/AIDS care with a telemedicine service (http://telemedicine.itg.be) [3].

The physicians can send difficult clinical cases and questions to a web-based discussion forum (Fig.1). A network of HIV/AIDS specialists is responsible for their discussion and the formulation of a final advice. Clinical images and bibliographic material are used to accompany questions and answers. Interesting cases and recurring questions are elaborated as case rounds and frequently asked questions (FAQs), consultable through the search function for CME on the website. User-friendly guidelines, links, digested conferences coverage and news always targeting low resource settings are also available for consultation.

This telemedicine service is directly linked with a Short Course on Antiretroviral Treatment (SCART), see Tab. 1.

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<tr>
<th>TABLE 1</th>
<th>Short Course on Antiretroviral Therapy (SCART) content</th>
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<tr>
<td>At the end of this training physicians should be able to:</td>
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<tr>
<td>- Choose, and explain to the HIV positive patient, the appropriate antiretroviral drugs taking into account the goal of the therapy, the optimal timing for initiation of treatment, and the general characteristics of the patient and the availability of resources in a specific setting.</td>
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<td>- Plan a monitoring strategy for a patient on ART including clinical follow-up, adherence monitoring, laboratory follow up, identification and management of immune reconstitution inflammatory syndrome and side effects.</td>
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<td>- Identify and predict ART failure, to be able to assure the management of it, including the prescription of the appropriate alternative ART taking into account the available resources</td>
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<td>- Evaluate the quality of care for patients with chronic health problems like AIDS patients and relate quality aspects to the organization of a clinic taking into account the different resources needed for AIDS care.</td>
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<tr>
<td>- Explain the possible impact ART can have on mortality and the role of clinical care within the whole spectrum of interventions addressing the health and social care challenges related to the HIV epidemic.</td>
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Seamlessly and Securely Sharing Health Care Data with Triple Space Communication

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Abstract - The eHealth is an eBusiness scenario in which the integration problems is amplified by the intensive use of knowledge, by the need of accurately handling citizens’ privacy and by live or death implications. eHealth has been seeking for semantic interoperability for more then a decade, but securely sharing health data among healthcare organizations remains an open challenge. Many standardization activities (such as HL7 CDA, openEHR, CEN ENV 13606 / EHRcom, DICOM, IHE) are addressing this problem but none of them as achieve the desirable level of flexibility.

In this paper we describe how sharing of health care data respecting parties’ autonomy and citizens’ privacy is addressed in TripCom, which is a EC funded project starting in April 2006) aiming at developing an highly scalable, semantically enhanced communication infrastructure. Such infrastructure is the result of the integration of Tuple Space, Semantic Web (triple), and Web service technologies. Tuple Space and Web services provides platform for application integration based on persistent publication. Semantic Web provide machine processable semantics in order to allow mechanized integration of services (data and processes). Decoupling communications TripCom will reduce (if not eliminate) the need for a priori knowledge of the partner and communication channel thus enabling multi-party interaction for free.

I. INTRODUCTION

The healthcare organizational structure in all countries is naturally distributed, being a geographical spread of centers at different levels of complexity: from the general hospitals down to individual physicians. The ultimate objective of such a structure is to build a network of complementary centers (hospitals, laboratories, ambulatories, coordination centers, etc.) spread over the territory, to meet effectively the social needs in the area.

This necessary distribution makes it very difficult for clinicians to capture a complete clinical history of a patient, because a patient's health information may be spread out over a number of different institutes or different departments within the same healthcare institute. As a matter of fact, the medical and economic impact of not knowing a patient’s complete medical history is profound. Medical practice today still entails sorting through a stack of lab reports, trying to find information on a specific patient. But tens of thousands of people die each year due to lack of information. As reported in many studies, poor information is the “leading killer” in the Western World.

An open challenge in eHealth is (see strategic objective 2.4.11 of 2005-06 Work Programme of IST) to allow health professionals’ timely interaction with heterogeneous and distributed medical databases. So, the key problem to address is exchanging patient records among healthcare organizations or among different units within the same organization: radiology, cardiology, neurology, etc.

The main purpose of such a mechanism is to provide healthcare organisations with a complete array of patient information. It should firstly identify a patient and then it should locate the patient’s information, including clinical results and labs. The access to and the availability of this information have to be authorised, according to rules determined by the data owner through a data access security policy engine.

II. STATE-OF-THE-ART

A powerful integration technology, which allows for immediate access to distributed information, is needed in order to provide healthcare organisations with a complete array of patient information.

A number of standardization initiative are progressing to address this interoperability problem such as:

- HL7 (Health Level Seven) [1], a non-profit, ANSI accredited Standards Developing Organization, founded in 1987, that provides standards for the exchange, management and integration of data to support patient clinical care and the management, delivery and evaluation of health care services;
- GEHR/openEHR [2], an initiative that foster EHR interoperability started in 1992 as the “Good European
Development of Portable Telemedicine Station: A design aproach

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Abstract- Portable telemedicine devices developed last years focus their functionality in offering solution to a specific problem. The approach of our development is centered in offering a device that allows the user to select its configuration in function of the demands, single changing a device of the type pen drive. The results obtained in our design validate the concept of portability and wished functionality, allowing us now to focus in the development of specific applications

I. INTRODUCTION

In our works of field in the area of the telemedicine, we have found that the developments available focus in offering connectivity by different communication channels to conventional diagnostics medical equipment.

Equipment for the measurement of ECG, EEG, pulse oximeter’s, patients monitoring, etc. are available integrated in a card to connect a computer or could be commercial devices with interface of connection for remote access.

Our concept supposes that a portable unit based on computer motherboard could be developed, with physiological programmable data acquisition devices of way so that with few peripheral, a device of flexible configuration can be obtained. In order to begin the work, we decided to try the implementation of 3 functionalities with the common hardware:

1. Mobile Intensive Care Unit
2. Clinical Lab Station
3. Central Management Telemedicine Station

In this paper, we try to discuss our goals and disadvantages, in order to do an evaluation of the functionalities obtained.

II. GENERAL PROJECT

The station characteristics will be:

- One hardware platform for the requirements of the three suggested applications
- Booting configurable device
- Patient interface hardware remotely configurable
- “Real” portability: less possible weight and maximum energy support.

In order to do a prototype, we use an Intel chipset motherboard with a 1 GB pen-drive booting device, 512 MB RAM, TFT 17” monitor and USB Bluetooth communication system. The energy necessary for the station was provided for a PC power supply modified to support a 24 volt battery input. All the components placed in an aluminum case.

The Bluetooth enable the system to connect to patient interface in the ICU mode of operation, and to maintain wireless communications in another two settings.

The station will be provided with the following hardware in each configuration:

Mobile Intensive Care Unit:
- Booting device
- Bluetooth communication
- Patient modules (developed with a DSP chip and a Bluetooth interface)

Clinical Lab Station
- Booting device
- USB analytical modules
- Necessary chemical stuff
- Calibration procedures

Central Management Telemedicine Station
- Booting device
- USB communication system
- VoIP communication system (micro and speakers)
- Radio interface
- GPS
- Videoconference system

Space Technology as a Tool for Delivery e-Health 305
Application of VoIP Technology with Mobile Health Information System in a Wireless Hospital

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Abstract—National Taiwan University Hospital (NTUH) launched a pilot Voice Over Internet Protocol (VoIP) project which exploits existing wireless environment covering medical campus, main hospital and branch hospitals. IP phones with communication applications are provided to doctors, nurses, and staff in NTUH including direct calls, broadcasting, and conferencing. In this project VoIP technology integrates with a wireless hospital information system, enabling seamless and spaceless collaboration among medical professionals and administration staff to provide a continuous and comprehensive healthcare for patients in the hospital. Preliminary user survey was performed to investigate knowledge, attitude to VoIP applications, as well as their expectation for hospital information system in the future. The result shows users in this project generally understand and support VoIP technology.

I. INTRODUCTION

NTU hospital has launched a pilot project to integrate VOIP technology with existing phone lines. There are 100 users, including doctors, nurses, technicians, and administrative personnel. They are distributed with three kinds of equipments: USB phones, WiFi phones, and PDA phones (Fig. 1). Communication functions provided include direct calls, broadcasting, and conferencing. Moreover, those IP phones can call people outside the hospital through hospital telephone servers, and users can be called from outside in the same way. The integration of VOIP and traditional phone lines marks the commencement of mobile health information system in a wireless hospital.

A. VoIP Background

As the Internet becomes prevalent, many applications which leverage the free energy appear, including VoIP applications. VoIP, Voice over Internet Protocol, transfers voice data over the Internet, and it saves tremendous communication cost in comparison with the traditional circuit-switched telephone network. Skype [1] is a well-known and successful application of VoIP.

B. Toward a Mobiles Healthcare

The same revolution can occur in a hospital setting. Traditional ways of communication among medical and paramedical personnel include wired phone lines and even shouting out loud in the hallway, which is inefficient and cost-high. Moreover, many health care scenarios have evolved to a mobile setting that both healthcare providers and healthcare receivers are moving in most of the caring process. For example, when a patient needs a CT scan, the communication between the technician in the scanning room and the nurse in the vicinity of the ward is a mobile communication scenario. To achieve an in-time, cost-effective, and ubiquitous communication, we have to combine VoIP and wireless network technology to develop a mobile telecommunication application.

C. Wireless Environment in NTU Hospital

In National Taiwan University Hospital, as well as the medical campus, wireless access points are deployed throughout the buildings. Web portal of the Intranet let doctors check their patient list and PACS data wherever they are. Another group of access points allows guests to the hospital to surf the Internet and receive emails. The wireless environment makes NTU hospital a place ready to develop mobile health information system.

D. Goal of the VoIP Pilot Project

In adapting to an increasing flow of patient information and communication around medical personnel, tradition phone lines have to be changed by incorporating state-of-the-art VoIP technology. VoIP brings the following benefits:
The Luxembourg Heart Failure Project: A New Concept of Tele-Home Monitoring For Patients Suffering From Congestive Heart Failure (CHF)

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Epidemiological background
Congestive heart failure (CHF) has become a health problem of epidemic proportion in the western world. CHF affects 5,000 – 10,000 people in the Grand Duchy of Luxembourg and is the leading cause of hospital admission for patients over 65. Better methods of secondary prevention are urgently needed to reduce life threatening situations and health care costs. In most cases a conventional pharmaceutical therapy has only modest effects on morbidity, mortality and quality of life [2].

According to results of SHAPE (Study on Heart failure Awareness and Perception in Europe) 3.6 million new heart failure cases are reported each year in Europe. About 14 million people in Europe are affected today and this number will probably increase to 30 million by the year 2020. CHF related hospitalisations have more than doubled in the last 20 years. Heart failure patients experience a lower quality of life than patients suffering from any other chronic disease [1]. In France the costs of treating heart failure are estimated between 109-208 M€ every year [6]. The German heart foundation reports, that Germany spends approximately 286 M€ per year on the treatment of about 1.5 million heart failure patients [7, 8]. Recent studies have shown that re-admission, length of stay and hospital charges are significantly decreased when tele-home monitoring systems will be applied to CHF patients [1]. It is assumed that reduced re-admission rates will also have a positive effect on the quality of life.

Expected Results
The Luxembourg Heart Failure Project (LuHF) aims to develop a home monitoring system, able to improve the quality of life of CHF patients as well as reducing their hospital stay. One important requirement is that elderly and disabled patients may use this system easily. Another necessity is, that the system can be used as Information Technology (IT) platform in CHF managed care programs.

Objectives
Our multidisciplinary research project will improve the currently available methods of home tele-monitoring for CHF and assesses its health economic impact in five different steps:
1. Determination of practical physiologic parameters (e.g. blood pressure, ECG, weight) to be measured non-invasively by the patient himself.
2. Set up of a tailor-made home monitoring system adapted to the needs of patients with CHF.
3. Development of a data transfer and evaluation system to analyze the patient’s health status at a distance.
4. Conducting of a randomized clinical trial to compare a group of home-monitored patients to a group of conventional treated patients.
5. Analyze the effects of home monitoring in CHF on Quality of Life (QoL) and Health Care Costs.

Figure 1: MoniCard supports CHF-specific Managed Care Systems.