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E-health

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E-health is a collective term aiming to reflect all modes of electronic healthcare delivery via the electronic communication means. E-health applications bring technology to patient care, ranging from prevention and diagnosis to follow-up, allowing the utilization of modern communication equipment and services capacity to link distant healthcare stations and individuals for the provision of healthcare services in real-time to remote groups of populations. More than that, e-health practices minimize the paperwork involved in the healthcare delivery, optimize the provided services, and ensure seamless communication and access to information independently of geographical limitations.

According to the eEurope2005 action plan “*e-health refers to the use of modern information and communication technologies to meet needs of citizens, patients, healthcare professionals, healthcare providers, as well as policy makers*” [3].

The following factors favor the adoption of e-health programs:

- growing concern regarding medical error;
- advance of patient-centric healthcare systems;
- need to improve cost benefit ratios and to rationalize healthcare;
- citizen mobility across Europe.

Having realized the impact of the information technology era to the healthcare industry, this e-health special issue focuses on the e-health tools and practices, recent R&D efforts and outcome and investigates the current and future trends in the e-health field along with the relevant policy and standardization processes within the EU and worldwide.

Papers have been organized in six key areas.

1. Regional healthcare systems – interoperability issues

Health information networks typically involve the linking of healthcare institutions, via telemedicine and web-based services, to professionals and patients disseminated over a broader geographic area, than could be serviced by the institution without the technology. There is no standard “regional” health information network.

The importance lies on the interoperability of different healthcare networks. An autonomous, self-functioning regional system, may entail a range of automated processes having a positive effect on the organization in local level, but in the event it cannot communicate and exchange data with external systems constitutes a mere office automation application instead of an advanced e-health application. Ad hoc industrial standards, like HL7 and DICOM, have prevailed today, nevertheless interoperability is a hot open issue.

Over the last two decades, European standardization has increasingly and substantially contributed to the implementation of various European policies. In the light of the changing conditions under which European standardization in the enlarged EU needs to operate and taking account of the challenges due to digitalization and globalization, it has become necessary to review the objectives, scope and needs of European standardization policy.

The CEN/ISSS has on the request of the European Commission started a new investigation of standards requirements in the area of “e-health”, in connection with the eEurope 2005 action line. The investigation is performed by a focus group comprising all major stakeholders with a mandate to overview the existing achievements and proposed e-health related and relevant standardization activities, in formal standardization and industry consortia and prepare a report, containing proposals and priorities for future standardization work.

A recent initiative of the German government is the e-health interoperability workshop – *The Government and Expert View* – an informal meeting of government representatives together with key standardization experts dealing with interoperability problems with the target to agree upon a draft action plan for collaboration on interoperability aspects.

Papers tackling the interoperability in this issue:

1. M. Mauher *et al.*, “National, regional and international interoperability of Croatian healthcare information system” presents the general architecture of the Croatian healthcare information system and the respective pilot projects and results of pilot implementations as well as national ICT environmental accelerators for health ICT implementations.
2. A. Berler *et al.*, “The use of HL7 as an interoperability framework in a regional healthcare system in Greece” discusses the impact of health level 7 (HL7) message-based communication systems in achieving

interoperability in a regional healthcare information system.

3. M. Tsiknakis *et al.*, “An architecture for regional health information networks addressing issues of modularity and interoperability” describes the regional health information network of Crete in Greece, HYGEIAnet, and introduces its framework for the reuse of standardized common components and public interfaces, thus enabling integrated and personalized delivery of healthcare.

2. M-health: independent living exploiting mobile technologies

Telemonitoring systems for the mobile citizen allow for healthcare provision away from the traditional nursing areas (i.e., at the home environment, work setting, while traveling, etc.). They address the mobile citizen wishing to undertake an active role in monitoring his/her health status. M-health applications enable ambiguous healthcare monitoring, seamless to the patient and contribute to the elevation of the quality of life, enhance independence, while tackling social exclusion, as the patient is now able to participate in social activities. Bringing smart handheld devices to the fore would strive healthcare to intensive remote diagnosis, prevention, and monitoring. The envisaging of interacting devices combined with smart cards, the latter serving as a key for the holder, would be the next step in utility and convenience for healthcare, serving both the provider and the service recipient. Interacting handheld devices and mobile phones are merging to monitoring devices of the (near) future.

The papers discussing m-health are:

1. A. Kropp, “Wireless communication for medical applications: the HEARTS experience” discusses the HEARTS wireless network, in the frame of which biometric and environmental data measured from patients during both hospitalization and in their normal lifetime activities, is gathered.
2. S. Pavlopoulos *et al.*, “A web-based system for personalized patient education and compliance monitoring” presents an integrated health telematics platform to enhance chronic patient compliance to therapy and interactive communication with their attending physicians, developed by the C-Monitor project.
3. A. Prentza *et al.*, “Cost-effective health services for interactive lifestyle management: the PANACEIA-iTV and the e-Vital concepts” presents two different technical and business concepts in the provision of telemonitoring services, PANACEIA-iTV and e-Vital.

4. F. Ortu and S. Andreassi, "Psychological implications of the application of health state continuous monitoring systems in cardiovascular pathologies" provides an insight of the constant monitoring psychological impact by analyzing the interactions between situational attributes and personality dispositions (for instance, trait anxiety).

3. Medical education

Medical education concerns the diffusion of scientific information with the aim to educate and train healthcare professionals as well as citizens. On-line learning enables physicians to access timely and flexibly accurate and aggregated information and benefit from continuing education and teleconsultation. ICT advances in the medical field create new opportunities for life-long learning and provide the necessary tools for bridging the gap between the available medical resources and the needs of the healthcare professionals. Not only that, it also offers the opportunity of a more self-reliant informed citizen.

It should be noted that one target of eEurope 2005 is that member states and the commission should ensure that citizens can access online health services (information on healthy living and illness prevention, electronic health records, teleconsultation and e-reimbursement, etc.) by the end of 2005.

The papers dealing with the medical education issues include:

1. S. Pavlopoulos *et al.*, "Remote medical education via Internet enhanced services – the REMEDIES platform for distant training" presents the remedies medical education system for healthcare professionals.
2. G. Stalidis *et al.*, "Information and e-learning services for the efficient management of allergy and asthma, employing an integrated environment monitoring network" presents a distributed telematic platform, which is implemented to support health information management and innovative services to people suffering from allergies, asthma and rhinitis: the citizen approach.

4. Health grid

Grid technology is promising, both for computing intensive applications and knowledge discovery. The goal of health grid is to meet the growing computing needs of health actors. The first challenge is to integrate grid technology into health practice, by the deployment of pilot biomedical applications for example, the second challenge is to integrate specific health requirements into grid technology, such as standards, interfaces, protocols and data heterogeneity and the third challenge is to address the dispersion of the biomedical community.

In regards to health grid the paper from F.-S. Salloum, "Health applications and grid technologies" presents

the current status of standardization activities and working groups, which are currently involved with the specification of health applications and the standardization of needed components such as security, functionality, etc., which are being introduced by the use of grid technologies.

5. Wearable devices, personal health management systems and services based on biosensors

Innovative computer and software technologies are deployed to provide vital patient data monitoring and connect clinicians with mobile patients via workstations, wireless devices and the Internet. Technology progresses to produce virtually invisible biosensors, implantable or integrated in the patients clothing or to small, portable devices, which enable continuous vital data transmission and allow the development of personalized treatment plans for the patient.

The following papers concern issues relating to wearable devices and biosensors:

1. P. Celka *et al.*, "Wearable biosensing: signal processing and communication architectures issues" focuses on issues in wearable biosignal processing and communication architecture currently running at the Swiss Center for Electronics and Microtechnology (CSEM) in the framework of several European projects.
2. R. Paradiso *et al.*, "WEALTHY, a wearable healthcare system: new frontier on e-textile" presents the wealthy health monitoring system, which is based on a wearable interface implemented by integrating fabric sensors, advanced signal processing techniques and modern telecommunication systems, on a textile platform.

6. Tools for health professionals

Physicians, healthcare organizations managerial force, medical auxiliary personnel and administrative personnel, as well as a range of other professionals (e.g., pharmacists, etc.) may benefit from the ICT tools designed to enhance the communication capabilities of the healthcare professionals, to facilitate the completion of every day tasks, to reduce paperwork and eliminate errors, as well as to assist medical practice. The tools for healthcare professionals include (among others):

- computer-aided diagnosis;
- electronic prescription;
- electronic records;
- digital libraries;
- on-line registries;
- hospital information systems;
- electronic ordering (e-procurement, e-lab ordering, etc.).

Tools for health professionals are presented via the following papers:

1. B. Blobel and P. Pharow, "Tools for health professionals within the German health telematics platform" describes the German health telematics platform, based on an architectural framework and a security infrastructure, as well as its tools based on smart cards.
2. A. M. Demiris and N. Ioannidis, "Context awareness and nomadic devices featuring advanced information visualization in clinical routine" presents an IT platform, which emerged from applications in the cultural heritage domain, that can be used to deliver context-aware services and advanced visualization of information to medical personnel in a clinical environment. Along with the description of the platform and its components, two application examples/medical use cases are presented.
3. H. F. Kwok *et al.*, "Improving interpretability: combined use of LVQ and ARTMAP in decision support" discusses the use of LVQ in ST analysis and describes the overall architecture of the rule-based disease-specific approach of automatic detection of ischaemia from ECG signals.

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