Chapter 18
Overview of the ISO/IEEE11073 Family of Standards and their Applications to Health Monitoring

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ABSTRACT

Traditional fields in health delivery such as chronic diseases or independent aging are evolving to novel healthcare applications like intra-hospital ecosystems and Neonatal Intensive Care Units (NICUs). Furthermore, emerging trends in Information and Communication Technologies (ICTs) and evolution of the Medical Devices (MDs) to Personal Health Devices (PHDs) led towards the interoperability of new health services. In this patient-centered context, the international ISO/IEEE11073 (X73) family of standards is proposed to provide device usability enhancements. In this chapter, the X73 technical features and the new transport technology profiles specifically designed for X73 are introduced to provide an updated framework for developing highly efficient portable and wearable MDs and PHDs. Moreover, these protocol guidelines and technology features are applied to vital signs monitoring, pointing out some potential advantages for adopting new use cases such as NICUs where design requirements like ergonomics, reliability, size, power consumption and signal transmission become strict implementation constraints.

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1. INTRODUCTION: INTEROPERABILITY AND STANDARDIZATION ON E-HEALTH

Throughout the last decade, healthcare applications have gradually experienced a substantial progress, mainly due to advances in Information and Communication Technology (ICT) resources, hardware and the new short-range wireless transmission protocols towards the electronic processes and communication applied to health environments, or so-called e-Health. The technology designed for patient monitoring or vital sign acquisition has been until recent years meant to be located inside the hospital, due to several factors such as security constraints, price of the equipment, difficulty of set-up and maintenance and the classic healthcare delivery paradigm accepted by the society and governments centered in physician. The rapid growth of the electronics market made possible that Medical Devices (MDs) could be purchased by individual users and institutions other than just hospitals, allowing the emerging of a new kind of healthcare making the patient the owner of his own health (Anderson & Funnell, 2005). Information Technology (IT) has provided the resources to develop innovative applications where the patient is at home, taking measurements by his/her own and reporting them remotely (by phone or e-mail) to the specialist or the healthcare service. Consequently life quality of patient is improved and healthcare system efficiency is increased. Thus, patients have taken a major position about managing their health and adopting a proactive behavior through telemedicine services and e-Health solutions. This new approach based in the empowerment of the patient has implied that the application environment has been extended from hospital-located healthcare services to the patient/user context. The use of the Personal Area Network (PAN) technology which manages MDs featuring short range and low-power wireless communication in proximity to an individual's body becomes fundamental for supporting these new healthcare scenarios. Technologically, this new user-centered paradigm led to the evolution of the traditional MDs into the new Personal Health Devices (PHDs): a portable, even wearable and more efficient version of the MDs in terms of computational load and battery performance. New versions of MDs and PHDs make use of batteries, low-range wireless technologies and Low Voltage-Low Power (LV-LP) hardware to make them portable, wearable and allow the user himself/herself or the professional healthcare service providers to manage the measurement process in order to report signals and events for remote supervision (Korhonen & Parkka, 2003; Wooton & Craig, 2006; Simons, 2008).

Nevertheless, traditionally MDs and PHDs manufacturers usually provide single devices with a proprietary protocol, very limited connection features and just a few of them are able to communicate data via several technologies (serial (RS-232), Infrared (IrDA), Radio Frequency (RF) or Ethernet) although the receiver was a system from the same company. That is, communications, if implemented, were not oriented to develop inter-device applications, as security or safety breaches could be fatal in some use cases. That was the main reason, apart from economical, for the companies to keep systems closed and continue to develop proprietary solutions (Clemmer, 2004). But it has not been until Internet and the World Wide Web (WWW) were widely deployed when the new e-Health paradigm emerged. Inside the hospitals, systems started to be connected to networks to provide data access in real-time, as well as speed up processes. Electronic Health Records (EHRs) begun to migrate from a paper format to electronic databases, with the obvious advantages related to availability, security and the overall information integration in clinical decision. MDs and PHDs manufacturers, aware of this new framework, started to provide systems that could be connected to the hospital network, increasing the products enabled to communicate to an external data logger. Unfortunately, those