Abstract Submission to attend the competition of Young Investigator Best Paper Award

Standard-based Design: The Implementation Way of New Ubiquitous and Personal Health Solutions

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INTRODUCTION. Technological innovations are bringing new opportunities to healthcare applications. Although these improvements apply to most of its different fields, outstanding results are being achieved in Medical Device (MD) interoperability, oriented to ubiquitous solutions including wearable devices and focused on the new paradigm of Personal Health (p-Health). These evolutions can improve the quality of the patient's care, increase the user's interaction and furthermore, lead to new medical use cases based on Ambient Assisted Living (AAL) or health and wellness. Furthermore, in order to assure p-Health applications to be fully compatible with larger global e-Health systems in terms of terminology homogenization or Plug-and-Play operation, proposed solutions have to be based on open and interoperable architectures.

METHODS. ISO/IEEE11073 (X73) is an international family of standards, promoted by a grouping of manufacturers, institutions (IEEE among others), and developed into the European Standardization Committee (CEN) through its Technical Committee 251 (TC251). Although X73 first version was focused on MD interoperability at the Point-Of-Care (X73-PoC), the emerging of a leveraged new version of this protocol (X73-Personal Health Devices, X73-PHD) has brought into scene features like ubiquitous environments, improved high quality and wearable sensors, wireless technologies support (e.g. Bluetooth or Zigbee), as a result providing a faster and more reliable p-Health solutions to be used over PHD [1]. X73-PHD appears the best-positioned international norm to reach the challenge of standard-based design of p-Health solutions. Most relevant healthcare organizations, like Integrating the Healthcare Enterprise (IHE) or Continua Health Alliance, are actively working within both X73-PHD Working Group and CEN/TC251 (to which our research groups belong) towards the development of new MD communication protocols, while incorporating the newest transmission technologies to improve the possibilities of the patient monitoring. While these new features are achieved, it is also necessary to make an important effort to transfer its advantages to the real case scenario by incorporating health professionals and institutions to the developing and evaluation stages.

RESULTS. Recent innovative advances within use cases and application environments for standard-based telemedicine solutions are detailed in this paper. Standardization challenges and an analysis of X73 as a middleware interoperability solution are described as well as emerging tradeoffs during the implementation of a proof of concept end-to-end healthcare system [2]. The key factors in the standard-based designs X73-compliant are shown through p-Health implementation examples: wellness & fitness, heart failure patients' follow-up, AAL or elderly patient care, and emergencies.

DISCUSSION AND CONCLUSION. Standard-based design will be shown as an essential feature in the implementation process of ubiquitous p-Health solutions based on wearable MD. Future trends and open points to discuss are: Electronic Health Record (EHR) harmonization, real-time signals integration, and computationally optimized implementation on microcontrollers.

[1] ISO/IEEE11073.CEN/TC251-Health Informatics.*www.cenorm.be - www.centc251.org*. Point-of-Care MD Communication standard (X73-PoC). Personal Health Devices standard (X73-PHD). *www.standards.ieee.org/ - www.ieee1073.org*. Last access: 02/09.

[2] I.Martínez, J.Fernández, M.Galarraga, L.Serrano, P.de Toledo, S.Jiménez, S.Led, M.Martínez-Espronceda and J.García, "Implementation of an end-to-end standard-based patient monitoring solution," *IET Commun* 2(2):181-191, 2008.