APPLYING STANDARDIZED COMMUNICATION ON PERSONAL HEALTH AND SPORTS DEVICES

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Abstract

Standards in eHealth are a core requirement for integrating the mass of different technologies in personal health care. Especially communication between different devices needs to be addressed in order to simplify the development and versatile integration of medical and sports equipment in various applications. In this paper we present our practical experience in applying one of the IEEE 11073 communication standards which is currently under development.

1. Introduction

Personal health care and sports applications often require the integration of different devices and communication channels. A core problem in these areas is the variety of existing data transfer formats resulting in a complex development process which often does not facilitate the adaptability and integration of additional devices.

One step towards addressing this problem is one standard of the IEEE 11073 standard family which is currently under development to standardize communication between devices and computer systems. This important step in a complex communication line has the aim to insure data transfer between different types of medical and sports devices due to a standardized data structure, data presentations capabilities and functionality needed for data transfer.

Recently, various different work groups are trying to prove the necessity for the IEEE 11073 standard family. Galarraga et al. [1] opine that these standards are a good approach for an easier management of health problems. Nevertheless, more platforms supporting these standards are needed to ratify the high level of interoperability. Stollmann [3], in cooperation with the Fraunhofer Institute for integrated circuits [2], works on the integration of Bluetooth communication according to the IEEE 11073 standards. Yao and Warren [4] applied embedded sensors to clothing in order to transfer vital signals via Bluetooth, based on the IEEE 11073, with minor modifications.

An increase in interoperability of medical and sport devices will have advantages for the patient, the health professionals as well as for developers. It will be possible to set up and enlarge point-of-

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care health networks easily and avoid overburden of the patient or the trainee when exchanging parameters from different devices.

To implement the standardized data exchange described within the IEEE 11073 standard family we used a test setup which is able to count the number of knee bends of a trainee. This test setup consists of a measurement belt which is connected to a notebook running a graphical user interface.

The experience we acquired during this project will be used in further development processes.

2. Methods

To measure the movement of the patient or trainee, an inertial navigation system, developed by Fidesser F., Mosinzer N. and Schönwälder A. for their Master Thesis at the University of Applied Sciences Technikum Wien, had been used. The navigation system consists of three orthogonally aligned linear acceleration sensors. Due to acceleration, the voltages, measured at the sensors, changes. These changes get amplified, then digitised with a high-resolution A/D converter and stored within a µControllers memory. Out of the time behaviour of the three vectors, the number of knee bends can be calculated. This result is transmitted over a serial interface to a notebook running a graphical user interface to display the performance of a workout.

The developed software verifies if the two communication partners know their configuration from a former connection. In this case the two partners switch to an associated mode where data can be exchanged. If the association fails, the personal health device communicates its configuration to the notebook which will save the configuration for future transactions and both devices switch to the associated mode. In this mode the µController will transmit the number of knee bends which are stored in an object for metric data according to the IEEE 11073 standard. Equally important are objects that are used to store device information (e.g. identification number) and store objects to retain information temporarily.

3. Results

We succeeded in establishing the needed software components, according the new IEEE 11073 standard, for a PC/PC connection for our use case. The implementation of this software solution on the µController and the integration of an algorithm to derive the actual number of knee bends out of the acceleration values are near completion.

4. Discussion

The expertise reached during the development of the test setup based on the standardized data exchange protocol shows that it is feasible to implement the standard. To prove the full plug-and-play compatibility of personal health devices it is necessary to combine devices from different work groups. Due to the fact that this standard is still in development, the challenge remains to ratify interoperability of systems from different developers.

The benefits that may be achieved have an influence on the patient or trainee, the developers of devices as well as on the health professionals. Patients will have the possibility to include additional devices easily. This will increase the time consumption for the installation process. Developers can distribute devices which are compatible with devices from other developers. When the whole communication line (beginning with a medical or sports device ending at a health server) is

established, health professional have the benefit of access needed patient data at any time. A resident doctor will have access to the blood pressure values of a patient and can react to changes by communicating an updated medication to the patient. Due to the standardization of the transfer of medical data it is possible to enrich the point-of-care setup with a glucose meter and forward the blood sugar value by the same technology the blood pressure device uses. This will result in a more personal and effective treatment or observation of patients.

To meet the requirements for the mentioned example the prospective necessary task is the standardization and implementation of a long-distance connection from the patient's home to a health server. In the context of electronic health care record those servers can provide health professionals with patient's data irrespective of their location.

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