Smart Data Integration within a Wellbeing Application Platform

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***Abstract*— Big Data is an omnipresent main challenge of 21st century. Some of the major profiteers of Big Data is the healthcare and medical sector, with its ever growing number of sensors, devices and accompanied number of data. Given the similarities and the comparable development in the field of Internet of Things (IoT), we propose the next logical step to be a combination of both. This Paper introduces our approach for the development of a Wellbeing Application Platform, as a symbiotic pairing of IoT and medical devices, as well as an associated process of multi-sensor data fusion to create Smart Data and user-optimized recommendations.**

I. Motivation

Nowadays, the increasing amount of sensors, connected medical devices and the accompanying amount of data poses a significant problem in hospitals and other medical areas. In order to utilize this quantity of data, [1] proposes a Medical Application Platform (MAP) which serves as "safety- and security-critical real-time computing platform" for integrating and managing medical devices and data. Another area with similar development of increasing data and its usage is private health monitoring, where people rely on health-apps, -sensors and increasingly Internet of Things (IoT) devices, to monitor and support their health-conscious living. However, two main problems occur. Firstly, a large part of those sensors and devices is not accurate enough regarding methods of measurement and results of sensors. Secondly, most health applications are not personalized enough. General-purpose advices, like targeted amount of steps, are not advanced enough recommendations and thus only of limited value for improving individual wellbeing - a combination of medical and general physical health and fitness. This lack of results-producing recommendations is a possible reason for the behavior of wearers of health-sensors observed by [2]: At the end of their study half the attendees were not using their health-sensors any more. One third even stopped using them after 6 months. In order to receive the needed information for results-producing recommendations, all available data has to be processed further, to create Smart Data like MAPs already do.

II. Approach and Use Cases

We address the above named issues by planning to create a Wellbeing Application Platform (WAP). A WAP provides a new possibility of combining the mentioned areas and is able to deliver customized advices whereby focusing on wellbeing and domestic health monitoring. We are using MAP's concept by transferring it into the wellbeing area, including new requirements of a non-clinical domain. WAPs meld together non-professional devices, like wearables, already used by consumers, and single sophisticated medical devices which provide highly accurate results, in any sort of combination. On the one side these combinations compensate disadvantages of non-professional devices regarding vague or false results, for instance by preventing an erroneous pedometer during ironing. On the other side it reduces the cost of professional equipment by only deploying selected ones. To involve a WAP on a daily basis, existing IoT-Platforms are used to integrate ordinary devices as new sources of wellbeing data. While smartphone apps and wearables can be used as non-professional devices, Body Sensor Networks (BSN) or Wireless Sensor Networks are already applicable as an option of including professional medical devices [3]. A WAP represents a centralized data integration platform for context-aware multi-sensor data fusion of ordinary IoT devices, consumer-grade wearables and medical-grade equipment. This big and various data collection capacitates WAP's ability to create Smart Data. By applying medical knowledge and machine learning algorithms customized recommendations are received in the next step. The main added value of a WAP represents the skill of improving the quality and usage of non-professional medical devices and their results by reducing measure errors through knowledge of professional ones.

Because of the wide range of used devices, Use Cases of WAPs can be located in diverse wellbeing application fields. Nutrition counseling and monitoring with smart-fridges using RFID combined with BSN and clinical accurate devices represent a powerful wellbeing scenario which can help with weight problems or medical conditions like diabetes. Sportsmen using WAP for optimizing their performance by getting recommendations about their needed behavior changes are also possible. Further WAPs can be used in already existing technical environments like cars. The combination of wearables and implemented medical accurate sensors can be used to monitor and advise a driver.

We will use this platform as interdisciplinary integration of medical, biological and genetic data under special consideration of relevant environmentally impacts for human health and progress or prevention of diseases.

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