Sensor-based architecture for remote and continuous monitoring of chronic diseases in developing regions

Adelina Basholli
Information School
South-East European Research Centre, University of Sheffield, Thessaloniki, Greece
adbasholli@seerc.org

ABSTRACT

The healthcare sector has increased pressure towards improving the quality of care delivered to patients, especially considering new technological advances. The application of sensor-based networks (SBN), can help to monitor patients diagnosed with chronic diseases who need constant treatment and management. Hence, in this research is presented a design schema of a SBN architecture that is proposed based on the findings of the qualitative study conducted with healthcare professionals in a developing region, Kosovo as a case study. The proposed SBN schema considered healthcare professionals' suggestions, recommendations and tried to overcome their concerns about continuous and remote monitoring of patient's vital signs.

KEYWORDS

e-health, chronic diseases, medical information, sensor-based platforms, vital sign monitoring

1 Introduction

Sensor-based applications can provide continuous and remote monitoring of chronic conditions and sharing of the information generated between patients and their doctors. This is considered highly beneficial, taking into account the increasing number of patients diagnosed with chronic diseases, particularly those in the low-and-middle income countries [1]. Various studies such as [2, 3, 4, 5, 6] have concluded that patients can significantly benefit from the application of remote monitoring technologies for chronic diseases, as it allows them to receive continuous treatment in their homes and stay connected with their doctors.

Considering the results of the qualitative study, here is proposed a schema of a sensor-based architecture that would help developing regions to continuously and remotely monitor their chronic ill patients. Hence, the results of the interview study contributed in the formulation of the components that the proposed sensor-based architecture has.

2 The SBN architecture

The general architecture of the sensor-based applications for healthcare setting, includes the patient who provides data to the system. In this way, patient's vital signs will be the input in the form of raw data to the proposed architecture, indicated as wearable kit in figure 1. These data will be routed through several points and then will get accessed by healthcare professionals through the web-monitoring kit. Collected sensor data will be transferred using low-power energy consumption technologies to a mobile device which in this case represents a relay node between the sensor-based platform and the data storage unit. Data analyses and filtering will be performed on the transferred sensor data which then will be presented to healthcare professionals.

The interview study revealed several design considerations or functionalities that healthcare professionals suggested [7]. These included: monitoring units (mobile and web-application), provision of alarms/notifications in critical conditions, possibility to set a range of normal values of vital signs, filtering possibility (display patients with critical values first), data access only from authorized personnel, set recording interval of vital signs, provide a summary (report) of patient's vital signs and monitoring personnel (the 1:1 scenario, one doctor monitoring one patient, and also the 1:N scenario, medical personnel that will monitor several patients).

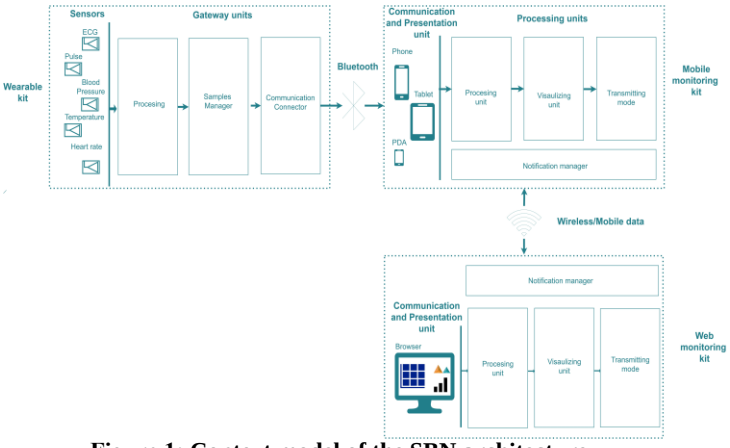

Figure 1: Context model of the SBN architecture

In this way the proposed SBN architecture suites the needs of healthcare professionals to easily provide feedback and monitor their chronic ill patients at a distance. The patients, on the other hand, will be monitored continuously and have reports of their vital signs shared with their medical personnel. Hence, the proposed SBN architecture presents a feasible solution for helping developing regions to easily manage the increasing number of patients diagnosed with chronic diseases.

REFERENCES

[1] M. Suhrcke, R. A. Nugent, D. Stuckler and L. Rocco, (2006) Chronic Disease: An Economic Perspective, London: Oxford Health Alliance, ISBN 0-9554018-1-X.

[2] G. Appelboom, E. Camacho, M.E. Abraham, S.S. Bruce, E.L. Dumont, B.E. Zacharia, R. D'Amico, J. Slomian, J.Y. Reginster, O. Bruyère, E.S. Connolly, (2014) Smart wearable body sensors for patient self-assessment and monitoring, Arch Public Health. 72(1):28, doi: 10.1186/2049-3258-72-2.

[3] L. Nissen, T. Lindhardt, (2017) A qualitative study of COPD-patients' experience of a telemedicine intervention, Int J Med Inform. 107, 11-17, http://dx.doi.org/10.1016/j.ijmedinf.2017.08.004.

[4] Ch. Li, X. Hu, L. Zhang, (2017) The IoT-based heart disease monitoring system for pervasive healthcare service. Journal of Procedia Computer Science, Volume 112, 2328-2334. https://doi.org/10.1016/j.procs.2017.08.265

[5] G. Huzooree, K.K Khedo, N. Joonas, (2017) Pervasive mobile healthcare systems for chronic disease monitoring. Health Informatics Journal, 1–25. https://doi.org/10.1177/1460458217704250.

[6] V. Kumar, U.B. Mahadevaswamy, (2018) Unilateral Vital Signs Monitoring Systems on IoT. International Journal of Engineering and Manufacturing, 8(1), 53-62. doi: 10.5815/ijem.2018.01.05.

[7] A. Basholli, Th. Lagkas, P.A. Bath, G. Eleftherakis, (2018) Healthcare professionals' attitudes towards remote patient monitoring through sensor networks. IEEE 20th International Conference on e-Health Networking, Applications and Services (Healthcom), Ostrava, Czech Republic. Doi: 10.1109/HealthCom.2018.853109