

T4I Final Submission

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Short Article Title	Challenges in using sensors to track users' health and wellbeing on a daily basis			
Key words	Health and wellbeing sensors, wearable technology, continuous monitoring, personal feedback, user health self-management, challenges			
Ethical statement	"Ethical approval was unnecessary because the communication present a theoretical framework of research"			
Category of article	Research/Evaluations not requiring ethical approval			
Article overview	Despite the many technological advances in sensor devices, there are still many challenges that hinder their end to end deployment and use in health and wellbeing monitoring and self-management systems. This talk provides an overview of the different pieces in such a system and identifies some of the major challenges that have to be addressed before their mass adoption by the national health services.			
Background/Context	Based on the expertise in the applied machine learning for health and wellbeing research group at Carlos III University of Madrid and past and current research projects, this communication identifies some of the major challenges that are faced today by those that want to deploy systems to continuously monitor the user's health and wellbeing based on user and environmental sensors.			
Methods	Summary of conclusions based on previous research studies.			
Results and Conclusions	<p>According to the state of the art in terms of available technologies, and not taking into account that every intervention (based or not in the use of ICT technologies) should be based on supporting evidence in terms of its impact in the user's health and wellbeing, the major identified technological challenges in order to pave the way for the successful deployment of sensor based user health and wellbeing tracking systems are:</p> <ul style="list-style-type: none"> • The elements to be deployed should tend to a zero configuration and maintenance scenario. • Energy efficiency: batteries should last for months and should be very easy to recharge. User friendly and non-intrusive energy harvesting mechanisms could be used in order to achieve years of battery life. • Non-intrusive, easy to wear technology. The devices should be nearly invisible for the user and not affect the daily activities. 			

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	<ul style="list-style-type: none"> • Security. Information should be protected and only made available to authorized personnel. The user has to maintain some rights on his or her personal data. • Standards from information to systems, from software to hardware are mandatory. • Personal, adaptive user interfaces. Each user has a particular condition and the systems have to be tailored for each user. • Persuasive feedback that is able to promote behavioral change. • Foster collaborations among all the involved stakeholders. Technology experts are only a piece in the final puzzle and collaborations among the different stakeholders is of the uppermost importance. The requirements from patients, carers, health professional, authorities, technology providers and researchers should be all considered in the final solution. • Minimizing the costs for the mass adoption in the different national health services. • Machine Learning algorithms have to be improved in order to automatically extract knowledge out of the sensed data
<p>Discussion</p>	<p>Every intervention should be validated in terms of its impact on the user. Gains in physical, mental and social health should be properly assessed and validated. ICT technologies are a means (and not the objective) to support such interventions, but very much influence their success and their challenges should be taken into account from the early stages of the design of each new experiment. Moreover, each health-related condition has particular implications and poses particular pre-requisites to the supporting technologies. This talk summarizes some of the major common challenges in current technologies which will apply to many underlying scenarios.</p> <p>Moving forward from pilot experiments to real life systems is not an easy task and some major challenges should be first addressed. The technological challenges involved all the different elements in the end to end solution, from the sensor technology to the central information processing systems, from the user interfaces to the doctor's control panel to visualize the data, from information to security, from communication networks to low latency and information reliability. The scenario is complex and requires all the involved stakeholders to work together. The solutions should be adapted to the specific needs of each user, according to his or her medical conditions and preferences.</p>
<p>References in MLA format</p>	<p>Das, R., Tuna, A., Demirel, S., NETAS AS, K., & Yurdakul, M. K. (2017). A Survey on the Internet of Things Solutions for the Elderly and Disabled: Applications, Prospects, and Challenges. <i>International Journal of Computer Networks and Applications (IJCNA)</i>.</p> <p>Cornacchia, M., Ozcan, K., Zheng, Y., & Velipasalar, S. (2017). A survey on activity detection and classification using wearable sensors. <i>IEEE Sensors Journal</i>, 17(2), 386-403.</p> <p>Al-Janabi, S., Al-Shourbaji, I., Shojafar, M., & Shamshirband, S. (2016). Survey of main challenges (security and privacy) in wireless body area networks for healthcare applications. <i>Egyptian Informatics Journal</i>.</p> <p>Kumar, P., & Lee, H. J. (2011). Security issues in healthcare applications using wireless medical sensor networks: A survey. <i>Sensors</i>, 12(1), 55-91.</p>



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	<p>Alemdar, H., & Ersoy, C. (2010). Wireless sensor networks for healthcare: A survey. <i>Computer Networks</i>, 54(15), 2688-2710.</p> <p>Rault, T., Bouabdallah, A., Challal, Y., & Marin, F. (2017). A survey of energy-efficient context recognition systems using wearable sensors for healthcare applications. <i>Pervasive and Mobile Computing</i>, 37, 23-44.</p>
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