Smart Health: A Context-Aware Health Paradigm within Smart Cities


Abstract

The new era of mobile health ushered in by the wide adoption of ubiquitous computing and mobile communications has brought opportunities for governments and companies to rethink their concept of healthcare. Simultaneously, the worldwide urbanization process represents a formidable challenge and attracts attention toward cities that are expected to gather higher populations and provide citizens with services in an efficient and humane manner. These two trends have led to the appearance of mobile health and smart cities. In this article we introduce the new concept of smart health, which is the context-aware complement of mobile health within smart cities. We provide an overview of the main fields of knowledge that are involved in the process of building this new concept. Additionally, we discuss the main challenges and opportunities that s-health would imply and provide a common ground for further research.

Introduction

The adoption of information and communication technologies (ICT) within the healthcare sector led to the concept of electronic health (e-health), which is contributing to reduced costs and increased efficiency. Following the consolidation of e-health, the generalized use of mobile devices with positioning capabilities (e.g., smartphones) opened the door to the idea of mobile health (m-health), which could be understood as the delivery of healthcare services via mobile communication devices. m-Health has extraordinary potential since it adds to the advantages of e-health all the benefits related to the ubiquity of mobile devices (i.e., global monitoring capabilities, wide availability, and immediacy). Although significant advances have been made, m-health is still in its early stages and is evolving in parallel to another very promising concept: smart cities, which are also founded on ICT and aim to tackle local problems, from local economy and transportation to quality of life and e-governance.

Local governments are investing in ICT to equip their cities with technological infrastructures able to support ambient intelligence, and foster social responsibility and respect for the environment. In this sense, the opportunities for smart cities are boundless, and companies such as IBM and Intel are taking action to consolidate their leadership in this sector. They have identified several important areas in which smart cities will play a key role: public safety, energy and utilities, economic development, education, social services, and healthcare, among others.

Smart cities are strongly based on sensors that provide updated information about diverse variables, including temperature, humidity, allergens concentration, pollution, traffic conditions, and so on. According to Chen and Kotz [2], the context could be defined as "the environmental states and settings that either determine an application’s behavior or in which an application event occurs and is interesting to the user." We understand these variables, provided by the smart city infrastructure, as the context that helps us to understand the living environment of a citizen at any time. Thus, by properly using this information, we can provide citizens and patients with healthcare applications and services with active context awareness (i.e., applications and services that automatically adapt to discovered context) by changing the application’s and services’ behavior [2].

The main objective of this article is to coin the concept of Smart Health (s-Health) as the result of the natural synergy between m-health and smart cities, from the ICT perspective as well as that of individuals and society. We identify the main challenges and benefits implied by the new concept of health within smart cities, and discuss its feasibility in practice.

The rest of the article is organized as follows. The next section summarizes the main research fields that would play a key role in the development of s-health. Next, we describe our notion of s-health and emphasize its relevance, timeliness, impact, and feasibility. In the following section we elaborate on the main challenges and opportunities that s-health implies. Finally, we conclude the article by providing a summary of our contribution and some final thoughts.
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