Personalized Medical Services using Smart Cities’ Infrastructures

Constantinos Patsakis†, Riccardo Venanzi‡, Paolo Bellavista†, Agustí Solanas‡, Mélanie Bouroche†

†School of Computer Science and Statistics, Trinity College Dublin, Ireland.
‡Dipartimento di Informatica, Elettronica e Sistemistica, Università di Bologna, Italy.
†Smart Health Research Group, Dept. of Computer Engineering & Mathematics
Univerrsitat Rovira i Virgili, Catalonia, Spain.

Abstract—The unprecedented urbanization of the past decades has not only led to the introduction of the concept of smart cities, but has simultaneously made them a necessity. By converting our cities into smart ones, we enable future generations to live in a friendly and sustainable environment. Within smart cities, the wide deployment of sensors allows the interaction of citizens with city infrastructures.

While smart cities are aiming towards more efficient resource management via smart grids, smart vehicles etc, another approach can also be made. The wide deployment of sensors in smart cities can be used to provide citizens with better medical services. In this work, we illustrate how this can be achieved by allowing patients to interact with city sensors. Patients with respiration problems use their smart phones to find the route to their destination with the minimal effect on their health.

Index Terms—Smart Cities, Mobile Health, Smart Health, sensors

I. INTRODUCTION

The vast majority of the major cities were established several centuries or at least many decades ago. While this continuity provides a different culture to each city, infrastructure maintenance becomes a major issue as they cannot be redesigned from scratch. The problem becomes even bigger with the vast urbanization that is being expanding worldwide. Therefore, smart cities are becoming more and more important. They provide the only viable solution for efficient resource management in an urban environment, while not compromising the citizens quality of life and minimizing the pollution footprint.

These goals are achieved through the installation of a wide network of interconnected sensors, which allow almost real-time measurement of specific sectors of urban life. Thus, fine-grained queries can be made providing insight to local problems, or aggregation results can show the real size of urban problems.

Concurrently to this cities transformation, there is a major transformation in healthcare. The wide use of ICT, through the use of computers, sensors and databases has gradually formed what we now call e-health. The introduction of e-health has drastically reduced the costs and provided patients doctors and carers with new communication methods that allows them to exchange medical records and test results both instantly and remotely. Moreover, diagnostic tests can be performed with more accuracy and symptoms can be traced in very early stages, providing better health services to the citizens. The wide adoption of mobile services such as smartphones and tablets, has extended e-health to mobile health (m-health), allowing not only remote, but mobile and personalized medical services.

From one perspective, the above areas do not have much in common, nevertheless, no one could argue that the smart cities infrastructure could provide even more fine-grained services to patients. This idea leads to the concept of Smart Health proposed by Solanas et al. in [1], which can be understood as the provision of health services by using the context-aware network and sensing infrastructure of smart cities.

A. Scope of this work

This work demonstrates how smart city sensors can be exploited to provide personalized medical services. Apart from illustrating the general concept, we showcase a system that has been deployed for this specific purpose. The system, composed by an application server and a mobile application, allows patients with respiratory problems such as asthma, allergies etc to select the best route for their commuting between two regions. The selection criterion is the least possible impact to their medical problem. Thus, the mobile application contacts the application server to get the real-time measurements of pollution, pollen etc from the city sensors which are close to this route. Then, for each possible route the impact to the patient’s health is calculated and the one with the least impact is proposed by the application. This way, a new interaction between citizens and smart cities is created. Smart cities can offer personalized medical services with their existing infrastructure.

B. Structure of this work

The next section provides an overview of the related work regarding smart cities and m-health and smart health. Then, section three describes some real world application scenarios to illustrate the gap that this application is filling. Section four, analyzes the architecture of the system and discusses several implementation issues. Finally we conclude with some remarks and ideas for future work.

II. RELATED WORK

The wide diffusion of cheap, small, and portable sensors integrated in an unprecedented large variety of devices -


