

## Chapter 52

# Integrated Smart TV–Based Personal E–Health System

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### ABSTRACT

*This paper discusses the design and experimental implementation of an integrated system for the delivery of health related services, based on different technologies and devices. The idea is to create a unique point of access for the user, towards both a cloud-based remote service for the consultation of medical reports, and a personal local service that allows to collect and display data from biomedical sensors, to manage user's reminders for medicines, and to monitor the patient's dietary habits. The proposed system employs suitable technologies to simplify the user interaction, such as Near Field Communications enabled devices, and a smart TV equipment. By this way, it is possible to effectively deliver telehealth services also to users who may be less familiar with technological equipments, such as older adults, or people living in rural communities. The experimental implementation proves the feasibility of the proposed service, and the possibility to gain users' adherence and compliance, through proper design criteria.*

### INTRODUCTION

Developed countries around the world are facing the need to apply dramatic changes to traditional healthcare paradigms, pushing for a rapid shift from in-hospital care, to more advanced home healthcare solutions, according to new, de-centralized models. These changes are driven by several and differentiated factors, either economical, social, and technological ones. In the economic perspective, the global economic crisis puts a big pressure on the welfare and healthcare-related national systems, causing a strong reduction of the available financial resources, against a growing demand of healthcare services and

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facilities. The demand increases because of an increased incidence of elderly population, and changed life styles, leading to a longer life duration but also a stronger impact of chronic diseases. In the social perspective, most of the developed countries are experiencing a demographic shift (United Nations, 2013); as an example, the life expectancy for males and females in Europe has increased from 45.7 and 49.6 to 75.0 and 79.9 years, respectively, in less than a century. Demographic changes affect a wide range of economic and social fields, as well as policies concerned with health, social welfare, housing, and many other issues. Further, overall problems regarding healthcare services are emerging in many developed countries, such as: the demand for increased availability of care services outside hospitals and medical institutions, and into patients' own premises; the need for improved efficiency of the services, to maintain acceptable quality despite reduced financial resources; the difficulties and costs in recruiting personnel specialized in elderly care, especially to deliver assistance at home (Klersy, De Silvestri, Gabutti, Raisaro, Curti, Regoli & al., 2011).

Telehealth (also known as telemedicine, or remote health) in general refers to a number of technologies, systems, and applications that may be adopted to provide remote support of health care at home. Such a support requires the availability of a set of basic functionalities, like remote consultation and diagnosis, as well as the possibility of collecting data for the monitoring of health parameters and vital signs (e.g. blood pressure, heart rate, and seizure risk). Suitably designed (i.e. compliant, user-friendly, safe) devices for remote patient monitoring have been shown to increase the patients' role in the management of their own health, improve chronic disease management, and reduce the incidence of acute episodes (Spinsante, Antonicelli, Mazzanti & Gambi, 2012). By using a variety of integrated or standalone devices, up-to-date information on patients' chronic disease and/or post-acute care status (including vital signs, heart rate, blood glucose levels, medication management, mental health, physical and cognitive fitness), and even other data (such as patient's location, or ambient parameters that may condition their health status) can be transmitted to family caregivers, providers, or third parties in charge of patients monitoring. Clinicians, or properly trained individuals, can then intervene with coaching actions, or by adjusting the course of treatment.

To ensure patients' adherence and compliance, it is of basic importance to adopt technologies and devices that improve the user experience and make it as easier as possible. The project presented in this paper fulfils these requirements, by providing the experimental implementation of an integrated system to offer a set of health-related services, both remote and local, accessible through a unique interface represented by a smart TV platform. A Cloud-based service enables the remote consultation of personal medical records by the citizens, while the local service supports the self-monitoring of some health-related parameters collected from NFC (Near Field Communication) enabled medical devices, the management of user's reminders for drugs and medicines, and the monitoring of diet habits.

The development of the proposed work is an extension of a previous project by the same authors (Raffaelli, Gambi & Spinsante, 2014), motivated by the idea of implementing a more complete e-health system, including both a remote service for online consultation of medical reports and a service for local self-monitoring and storage of some health-related parameters. The purpose of the study herein presented is to show, by experimental implementation, the feasibility of an innovative way to access health-related services, by means of new devices, such as smart TVs. The experimental outcomes show that the smart TV is a suitable tool of user interaction, both for accessing remotely generated information (managed by a cloud infrastructure) and for the local (i.e. at home) collection and processing of data gathered by the user, by means of classic biomedical devices or new wearable sensors.

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