Chapter 42

Design of a Home Automation App to Assist Elderly and Limited Mobility People

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ABSTRACT

This research focuses on a solution to assist elderly and limited-mobility people. It aims to improve the autonomy, and, consequently, the quality of life of this target audience by automating daily tasks conducted at home, such as turning on the lights and manipulating electronic devices. However, it is important to consider the costs and quality attributes (e.g., usability) related to the design of solutions to automate a specific environment, that may include hardware platforms and physical adaptations. In this context, the authors present in this chapter the software requirements discovery and elicitation of a home automation app considering the real needs of the elderly and limited-mobility people. Additionally, we conduct the requirements specification using the unified modeling language (UML) to improve completeness, along with graphical user interface (GUI) prototypes. Finally, we present a mobile app prototype using the Android and Arduino platforms to illustrate a use scenario of the solution.

INTRODUCTION

The system automation involves computerized or mechanical techniques to reduce (or remove) manual tasks conducted by human beings (Hock, 2005). It is an operational process established in an environment controlled and executed by means of a set of different devices. The automation is already a reality in many industries, including the field of manufacture, to decrease human interactions. Another example of a specific type of automation can be applied at home (known as home automation). The home automation represents the use of technologies in the domestic environment to provide more comfort, practicality, productivity, efficiency, and profitability (Manda, Kushal & Ramasubramanian, 2018). The goal is to integrate technologies with easy access to information, Internet, and security. Additionally, integrating it with the data network, voice, images, and multimedia. Therefore, the home automation is strongly related to the concept of the Internet of Things (IoT), where home devices are interconnected to achieve specific tasks (Ahlgren, Hidell & Ngai, 2016).

In the last years, the main goals of most of the world population are to make the everyday life simpler, easier, and safer. The home automation is an example of an area that can enable these goals by assisting residents to conduct tasks such as turn on the lights and manipulate electronic devices. Even these being simple tasks (for some people), the home automation may increase the autonomy and quality of life of residents, depending on the target audience. This is the case of elderly and limited mobility people. This population is growing, and consequently, the wish and need of people to be independent (impaired by age and physical limitations) (Nouy, Virone, Barralon, Ye, Rialle & Deongeot, 2003; Ramlee, Tang & Ismail, 2012). Considering a specific scenario, according to the Brazilian Institute of Geography and Statistics, 46 million of Brazilians have some kind of disability (24% of the total population) (IBGE, 2010). Therefore, it is relevant to design new solutions to enable them to be more active in the society, improving quality of life and autonomy (what may also have psychological implications).

However, it is important to consider the costs related to the design of solutions to automate a specific environment, that may include hardware platforms and physical adaptations. In this context, mobile devices and electronic prototyping platforms may be alternatives to enable low-cost automated home, considering small and medium-sized environments. Some mobile applications (apps) have been developed to assist users in their everyday life tasks at home (e.g., eWeLink[1], IFTTT[2], Smart Life[3], OpenHab[4], and Android Accessibility Suite[5] apps). Nevertheless, the apps available on the market have some limitations regarding software quality attributes such as usability, and usually, do not focus on the real needs of a specific target audience (in the case of this work, elderly and limited mobility people). Currently, mobile devices are widespread in the world population. For example, in Brazil, up to the present day, there are 280 million mobile devices with Internet connectivity (Sobrinho, Silva, Perkusich, Pinheiro & Cunha, 2018). This justifies the development of new technologies focusing on mobile platforms. Low-cost solutions have the potential to decrease barriers between financially disadvantaged people, automation technologies, and IoT's.

On the other hand, another issue that is faced by apps' designers to create solutions to assist elderly and limited mobility people is the usability (Zapata, Fernández-Alemán, Idri & Toval, 2015). The use of new technologies is not a simple task for this target audience. The "ease of use" characteristic of apps is a factor that must be exploited and studied. Usually, they have to deal with the size of the screen, graphical user interface (GUI), virtual keyboard, drag and drop features, and so on. This indicates that an app, disregarding the type of disability of the user, may provide (among other features) adaptable layouts without loss of information, customization resources, sound and vibratory alerts, and images.

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