Towards an Evidence-Based and Context-Aware Elderly Caring System Using Persuasive Engagement

Yu Chun Yen¹, Ching Hu Lu¹,², Yi Chung Cheng¹
Jing Siang Chen¹, and Li Chen Fu¹,³

¹ Department of Computer Science, National Taiwan University, Taiwan
² INSIGHT Center, National Taiwan University, Taiwan
³ Department of Electrical Engineering, National Taiwan University, Taipei, Taiwan
gracetfg2@hotmail.com, jhluh@ieee.org, brady31027@gmail.com,
one_leo@msn.com, lichen@ntu.edu.tw

Abstract. Due to the rapid growth of the aging population, numerous countries have been attaching importance to establishing the well-being of the elderly. However, long-term healthcare is labor intensive. To alleviate the possible social costs associated with manpower and physical resources, we propose an evidence-based caring system which can inconspicuously and automatically monitor the health status of the elderly by continuously analyzing their real-life long-term living patterns deduced from activity recognition. In this way, caregivers can get hold of the behavior changes even the elderly is not under caregivers’ supervision. Moreover, we adopt a persuasive policy to provide timely reminders and encourage the elderly to achieve a healthier life. In the primary stage, we do preliminary experiments in a nursing room. Based on the experiment, we conduct several interviews aiming to improve our system in the next phase.

Keywords: Context-aware, persuasive technology, elderly healthcare.

1 Introduction

Aging population is a critical global issue. Evidence [9] shows that approximately 10 percent of the world’s population is over the age of 60, and the proportion will have doubled by 2050. By 2010 United Nations for Human Rights claimed that aging population has become a national issue rather than merely local problems. An increasing number of countries have been attaching importance to establishing the well-being of the elderly. To alleviate the possible social costs associated with manpower and physical resources, it is necessary to develop assistive technology to help elderly people live independently.

Knowing the activities of daily living (ADLs) plays an important role in elderly healthcare. Traditionally, daily living reports are obtained from periodical interviews and manually recorded reports/data obtained by caregivers or self-reported by elderly patients. Without objective evidence from other sources, medics have to completely trust the reports. Such a problem obstructs the medics from knowing the real situation about the elderly. This motivates us to design an evidence-based report system to automatically collect and analyze daily living data of the elderly. In addition, with
limitations in manpower and available resources, it is hard to ask caregivers to attend the elderly all the time. To resolve this difficulty, we design a virtual caregiver which can timely remind and encourage elderly people. The actions and reminders of the virtual caregiver are one metaphor of the caring behavior of a human caregiver.

Since our system is now in the primary stage, the setting of our evaluation focuses primarily on a bedroom-scale environment. We perform preliminary experiments in National Taiwan University Hospital and set our target activities of the elderly at *Sleeping, Sitting, Leaving Bed, Interactions with caregivers, and Using Walking Cane*. Instead of purely focusing on technology, we attempt to acquire the true feelings of the elderly when they interact with our system. Hence, we conduct several interviews aiming to acquire directions and suggestions for the improvement in the next stage.

## 2 Methodology

The framework of the entire evidence-based and context-aware healthcare system is shown in Figure 1. An inhabitant interacting with the ambient intelligence (AmI) enhanced environment is not only a sensing data producer but also a service consumer.

![Fig. 1. The proposed evidence-based and continuous health improving framework](image)

One’s ability to perform activities of daily living (ADL) can be used to document some health-related statuses. For instance, an abnormal living pattern may reveal some physical or mental problems. In our framework, *Evidence collector* truthfully collects each daily living clue of the inhabitant; this can be achieved by various ways such as automatic recording technology from the sensed environment or in-time observation from a caregiver. After acquiring evidence of daily living information, *Context-aware analyzer* outputs meaningful features based on the information from *Evidence collector*. Some living problem may appear after further analyzing those features. The *Persuasive engagement* gives prompt assistance or encouragement whenever the *Context-aware analyzer* brings out interested situations. Ascribing to the appropriate intervention of *Persuasive engagement*, we expect the improvement in health condition. If the inhabitant follows the suggestions and services supported by *Persuasive engagement*, the changing living pattern will be perceived by *Context-aware analyzer* since it continually analyzes evidence coming from *Evidence collector*. In the end, the *Persuasive engagement* will appropriately interact with the inhabitant according to his/her ameliorating health condition.