

Chapter 8.6

Support for Medication Safety and Compliance in Smart Home Environments

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ABSTRACT

The rapid pace of new medications introduced to the market and the trend of modern health-care towards specialization complicates doctors' prescribing process and patients' management of medications, resulting in an increase in the likelihood of unsafe prescriptions. The severity of this problem is magnified when patients require multiple medications or have cognitive impairments. The Medicine Information Support System (MISS) is designed to integrate related

information systems from doctor offices, pharmacies and patients' smart homes with a universal database of medication conflicts to enable safety checks for adverse reactions among prescribed medications. MISS enhances the quality of patients' healthcare by monitoring and promoting the compliance of patients' medication intake. It also ensures patients' medical records remain private by following the privacy guidelines and regulations such as the Health Information Portability and Accountability Act (HIPAA) law in the United States.

INTRODUCTION

A Smart Home (SH) integrates and networks different technologies to provide assistance with activities of daily living. SHs, especially those designed for the elderly and persons with special needs, have gained importance as a research subject in the last few years as the baby boomer generation reaches the retirement age and begins to experience the need for assistance (Noury et al., 2003). One of the primary needs of this population is assistance in managing medications, which can be challenging due to complicated medication names, multiple simultaneous medications, or medications with differing types of dosing instructions. Two extremely important facets of medication management are the detection of possible conflicts among medications and compliance with prescriptions.

The Medicine Information Support System (MISS) presents a smart home-based solution to integrating doctor offices, pharmacies and a patient's home to assist patients in managing their medications (Reyes Álamo et al., 2008). It supports the safety of prescriptions by checking at multiple times for conflicts between medications, health conditions and foods that a patient may consume. It forwards prescription data from doctors, pharmacies, and smart home if no conflict is found and provides the mechanism for enhancing compliance with medication intake. More details of this process will be described in the following sections.

MISS is designed to transparently wrap around existing computer systems in doctors' offices, pharmacies and smart homes using Web Services (WS) to provide interoperability via standard communication interfaces. The section on system requirements and design architecture provides a detailed view of the interactions between different subsystems, as well as the data they exchange.

Additionally, because proper medication management is critical to patients' well being, a medication management system must be error

free and capable of detecting various types of medication conflicts. The section on system model demonstrates the correctness of MISS. Additionally, since prescriptions and health conditions are personal health information, using telemedicine for the storage, use, and disclosure of this information between systems presents potential threats to patient privacy. As a result, privacy regulations such as the Office for Civil Rights (OCR) HIPAA (OCR, 2009) must be incorporated into the requirements and design of MISS to provide proper privacy protection for patients.

The rest of the paper is organized as follows: the requirements, design, and detailed architecture of MISS are presented after a discussion of related work. We then describe a system model for conflict checking and compliance monitoring and illustrate MISS's prototype implementation. The last section of the paper summarizes the contributions of MISS and states future work.

RELATED WORK

Some previous efforts have been made to help individuals manage their prescriptions. For example, the Magic Medicine Cabinet (MMC) (Wan, 1999) is an Internet-enabled medication manager equipped with facial recognition software, Radio Frequency Identification (RFID) smart labels, and vital signs monitor and voice synthesis. The MMC generates personalized reminders, detects when a wrong medication is taken, and measures vital signs. However, no details are provided on the authors' claim that their system interacts with the patient's pharmacy, doctors and health care providers, and no safety checks are made for conflicts among medications. Our work bridges this gap by using WS to connect the patient's SH with the patient's visited doctors and pharmacies and to conduct multiple checks for medication conflicts. In New Zealand the ePharmacy system ("ePharmacy," 2009), connects the doctors and the pharmacies to facilitate medicine prescribing

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