PervasIve Nursing And docToral Assistant (PINATA) [1]

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Abstract. Providing patient-centric health care services is the goal of health-care institutions. However, due to human-related aspects, this goal is frequently undermined. PINATA offers an automated patient-centric system based upon Pervasive Ambience Intelligence techniques and enriched with Semantic Web technologies. The system makes use of RFID sensors to track the movements of patients and medical staff in order to direct staff effectively. An automated camera system monitors the patients and alerts hospital staff in case of emergencies. Through handheld devices hospital staff is automatically provided with relevant patient information gathered from various sources. PINATA is based on a Service Oriented Architecture and makes use of domain specific ontologies.

Keywords: Ambient Assisted Living, Semantic Web, RFID, Vision Processing, SOA

1 Introduction

Healthcare institutions need new ways to maximize the available time that doctors and nurses spend with patients and to decrease mundane tasks such as form filling, which though important, inhibits the health worker's efficiency and effectiveness. Ambient Assisted Living (AAL) systems which make use of Ambient Intelligence (AmI) technologies can help to solve these problems and to provide personalized solutions such as in [1] and [2]. In fact, these systems can be used to monitor the patient's permanence in a hospital, trace down medical records, monitor diet, track movement and detect incidents (such as falls).

2 Methodology

PINATA is based upon a Service Oriented Architecture (SOA) and is composed of two main components; a Knowledge Brokering module (KBr) and a Device Manager (DM). The role of the KBr is to integrate the patients' information. This module makes use of a number of domain specific ontologies which have been crafted in consultation with various medical entities. The Patient Ontology is an electronic representation of the patients' records and describes patients' profiles in terms of various health-related information. The Medical Ontology, is based on [3] and [4] and represents conceptual knowledge about clinical situations from three aspects; clinical problems, investigations and recommendations. A set of rules are used to represent

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decision-making logic. The SOA approach was adopted to facilitate the integration of patient related data which typically reside in different hospitals or clinics. This approach allows the system to query the different organizations, get the data and collate it together thus providing a unified view of the information for the KBr.

The DM handles the various devices connected to the system. In the present hospital scenario, the patient has an RFID tag embedded inside the wrist band. The various RFID readers around the hospital detect the movement of the patient and send the information to the DM and eventually to KBr. This ensures that the patient's whereabouts are continuously known by the medical staff. Handheld devices are used to provide the staff with various types of information including alerts (related to patients' medication schedule). These alerts are described in the Medical Ontology and the web service responsible of keeping track of the patient's medications makes use of this knowledge when sending out the alert to the nurse's device. When a nurse is in the proximity of a patient, the handheld device reads the RFID tag and can automatically display the patient's information, again via the appropriate set of web services.

PINATA makes use of a camera system which tracks the movement of patients, through image processing, and in case of an emergency alerts the nurse. A typical situation is that in which a patient faints and falls in his room. The camera system detects this situation and through the RFID system alerts the nurse in the nearest vicinity about this emergency. The system automatically uploads on the handheld device all the information required by the nurse. PINATA's reasoning and inferencing capabilities provide for situations such as anaphylactic shock due to allergic reaction and suggest to the nurse the best course of action. If the situation is deemed critical by the system (based upon various cues extracted from the environment and past situations) this will automatically escalate the problem and request for reinforcements.

Conclusion

PINATA is still a prototypical system and more work needs to be done. The initial results obtained from the system are encouraging. Patients quickly got used to it and the medical staff understood its potential and are now exploring new possibilities with our help. Fusing the Semantic Web with the real world is creating a niche of innovative approaches to further enhance existing solutions to real life situations.

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