REA: A HEALTHCARE-ORIENTED VIRTUAL AGENT WITH DIALOGUE CAPABILITIES

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Introduction

Assisted living technologies have become increasingly popular in healthcare with the aim to improve patients' quality of life. REA is a work in progress research project whose main innovation lies in the combination of smart monitoring solutions, such as activity recognition and physiological/lifestyle tracking, with an intelligent, socially competent virtual agent that aims to empower and motivate people in need through personalized feedback and responses, as well as to assist caregivers and clinicians to easily collect information about the patients.

Methodology

The proposed system researches and develops state-of-the-art technologies in the following domains:

Language understanding: User-machine interaction is managed by converting the user's voice to text using the Google Cloud Speech-to-Text API. The text is then processed by state-of-the-art Named Entity Recognition and Relation Extraction techniques [3] to assist in retrieving the important information of a user's request. The results are disambiguated, linking terms to lexical databases and semantic networks (e.g. WordNet, BabelNet, ConceptNet).

Sensor data collection and analytics: The sensor management system handles data aggregated from wearable and ambient sensors (blood pressure, blood sugar, body temperature /heart rate/blood oxygen, conventional camera). The data is analysed using data- and knowledge-driven approaches [2], supporting activity recognition (e.g. fall), sleep disorders, etc., while respective notifications are sent in cases of missed medication dosage and high blood pressure.

Ontology-based reasoning: Reasoning aggregates the available information to achieve context awareness. OWL 2 ontologies are used to capture user profiles, sensor measurements and conversational topics, while rules (SPARQL graph patterns) and Description Logic [1] reasoning are combined to derive implicit relations and understand the context of the interaction.

Dialogue management: The system supports natural interactions with users through complex dialogues. Ontology-based dialogue management techniques are implemented [4] that take into account: a) the user profile and health situation, b) the dialogue history, c) the current conversational context. Based on these data, the dialogue management decides on a set of available actions to perform in the next system move, such as motivational and interventional actions (notifications, alerts, reminders, etc.), clarification, etc. The results are transformed to speech through the Nuance Vocalizer.

Deployment and evaluation

The system's integration and evaluation will be conducted in three time phases and will materialise progressively module-wise in both home and clinical environments (rehabilitation units).

Conclusions

The presented work revolves around a smart virtual agent that provides innovative solutions and support services in the healthcare sector, focusing on clinical and non-clinical rehabilitation and care environments for caregivers and people with mobility problems.

References
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