Hermes
Cognitive Care & Guidance for Active Ageing

A home based system and mobile device to support the user's cognitive state and prevent cognitive decline based on intelligent auditory and visual data processing and reasoning.

HERMES

Overview

00. Overview

HERMES provides an integrated approach to cognitive care. This is achieved through an assistive technology that combines the functional skills of the user to reduce age-related decline of cognitive capabilities and assists the user when necessary.

Based on intelligent auditory and visual data processing and reasoning, the project results in a combination of home-based and mobile devices to support the user's cognitive state and prevent cognitive decline.

The system is able to remind users actively about future events and appointments. At the same time the system facilitates the episodic memory of its users by the provision of important moments.
The system recognizes the people present and can provide relevant information. This information is also used to train the user's memory in personalized cognitive games.

01. Episodic Memory

Facilitation of episodic memory is provided through the capturing of content in audio and images. This includes when, where, who, what and why of a moment, including additional contextual information, such as (primary) date and time. It additionally includes (secondary) human emotion, the amount and name of people present and derivatives, as well as (tertiary) information from other sources.

The **HERMES** core is a **semantically enriched media storage and retrieval system**, capable of storing all relevant parts of a user's daily life. Capturing is done through continuous, instantaneous analysis of the captured information and based on a number of parameters, it can be decided that the information is so important that it should be recorded. Relevant events are automatically detected (e.g. person entering a room) to trigger the respective recording devices. Both stationary and mobile cameras and microphones are used by the system.

HERMES provides a search function which will enable its users to go through past conversations and to search e.g. for emotional parts of a conversation or for certain keywords. This function facilitates the users' episodic memory and will enable them to resume past conversations. The episodic memory support also covers conversation support on the grounds of interactive reminiscence based on the recordings of important moments in everyday life, ranging from the present back into the (shared) history of the user and the communication partner.

Episodic
Memory

02. Prospective Memory

Prospective memory is implemented through advanced activity reminding, to assist the user's prospective memory in performing everyday tasks and to support independent living. Modelled after human associative memory, contextual cues remind the user automatically and non-disruptively, facilitating remembering at the right place, at the right time.

HERMES issues audio-visual reminders, i.e. by synthesized voice messages, sounds and visual display. The audio and visual modalities are used together or separately depending on the user context and reminder's content. Context acquisition, automated scene analysis, advanced context modelling, situation identification and conversation analysis lead to the recognition and identification of such an event. Reminders are generated and timed to help with **management of daily activities**. The system provides the information previously captured only if essential. The system avoids giving information that the users can remember on their own.

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'Recuerda, tienes una cita con el médico esta tarde!'

Prospective Memory

03. Cognitive Training

HERMES offers cognitive training through cognitive games that are personalized to the user, i.e. the contents of the games are personalized to data previously recorded by the user. These consist of captured moments that are related to contextual information, as well as future events that are stored in the users' calendar.

The combination of cognitive training with real life situations as recorded by the user provides the user dual advantages. Cognitive training consists of useful exercises with external validity, as they are based on information about the person's life. In these training games, different aspects of cognition will be trained. Through the game design and the interaction paradigms chosen, **cognitive exercises become friendly and fun** and overcome problems with traditional cognitive training that can be demotivating.

HERMES provides a measure of the state of the cognitive processes. The performance in these exercises is stored and compared with previous performance providing to the professionals an idea about the cognitive profile over time. The training can help to maintain cognitive abilities, or to reduce the decline in elderly users.

Cognitive Training

¿Quieres jugar a un juego para entrenar tu memoria?

User-Centered Design

04. User-Centred Design

Five user-centred design approach components are defined and maintained throughout the project to facilitate user acceptance and technology adoption, adjusting the system to the user needs uncovered in the project. Special attention is given to possible privacy concerns that might arise through the use of the system:

↗ **Support at home and on the move**
provide the user both at home and outside with cognitive support when needed. The project is based on a hybrid approach consisting of a mobile device and a home unit that complement each other in terms of functionality.

↗ **User-centred interface design**
is achieved by the aid of participatory design methods to reach an integrated, easy-to-use, interface that is specifically targeted at the user and customizable to the individual strengths and weaknesses of the person.

↗ **Persuasive technology design**
enhances the compliance with medical advice and increases long-term safety of the user. The persuasive technology also addresses training to support the rehabilitation and nurture of cognitive abilities to avoid decline.

↗ **Activity centred personal information management**
effectively reduces cognitive load of the user and removes a possible "technology burden" that might accompany the introduction of the new technology in the user's home.

↗ **Holistic privacy management**
integrates system security and user privacy by addressing the recipient, context, usage and sensitivity of data. Privacy management addresses both the privacy of the user and the privacy of conversation partners.

05. Technical Approach

HERMES' research challenges require profound research and development in areas such as audio and video processing, including visual pattern recognition, automatic speech recognition, speech analysis, speech data retrieval, emotion detection, text-to-speech synthesis and noise cancellation.

The HERMES architecture consists of the following components:

1. The **sensing environment** of auditory and visual sensors placed within the surrounding environment.

2. A tier of **perceptual components** comprising visual analysis, audio processing, as well as other sensor processing components.

3. **Middleware libraries** enabling perceptual components to provide metadata to the data repositories.

4. **Data repositories** storing application data and metadata as well as storing raw sensor data.

5. A **data access layer** implementing distributed data access services over the various data repositories.

6. A **service controller** middleware which orchestrates the underlying data access, sensor processing and "playback" and rule execution components in accordance to application requirements.

7. **Memory aid and cognitive support applications** that build on top of this data infrastructure.

All the technical work is driven through user-centred design, ensuring that the user is always at the heart of all design decisions. A detailed user analysis provides the geriatric, user-based underpinning of the project.

'Do you want to record this conversation?'

That's me!

Technical Approach

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cure   TXT e-solutions   ingema

IBM   UNIVERSITY OF BRADFORD   MAKING KNOWLEDGE WORK™

Consortium Members:

↗ **CURE**, Austria (Coordinator)

↗ **INGEMA Foundation**, Spain

↗ **IBM Haifa Research Lab**, Israel

↗ **University of Bradford**, UK

↗ **Athens Information Technology**, Greece

↗ **TXT e-solutions**, Italy

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Project Coordinator:

Prof. Dr. Manfred Tscheligi
E: tscheligi@cure.at
T: +43 (0)1 743 54 51 10

Contact:

Arjan Geven
E: geven@cure.at
T: +43 (0)1 743 54 51 14