

Services for managing cognitive decline of elders

H2020 / AAL Remember-ME

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AAL
PROGRAMME



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Presentation Outline



- Context and Motivation
- Remember-Me project presentation
- Remember-Me goals and objectives
- Remember-Me Architecture Overview
- Remember-Me Components Description
- Relevant publications

Context and Motivation



- Older adults want to continue living in their own homes rather than move into residential institutions
- Assistive technologies have the potential of providing the needed support in managing various problems of their daily life
- Present older adults' assistive services are shifting towards the use of objective monitoring using IoT sensors
 - Need of objective **monitoring of older adult's health and care state**
 - Need to enable the **remote and daily monitoring** of important care aspects
- Most of today's care process assessment is still relying on self-reporting of "perceived behaviours or state"
 - Not viable in the case of elders who mostly deal with problems such as forgetfulness, confusion, changing mood, etc.
- Intervention techniques lack the personalization dimension focusing on static models

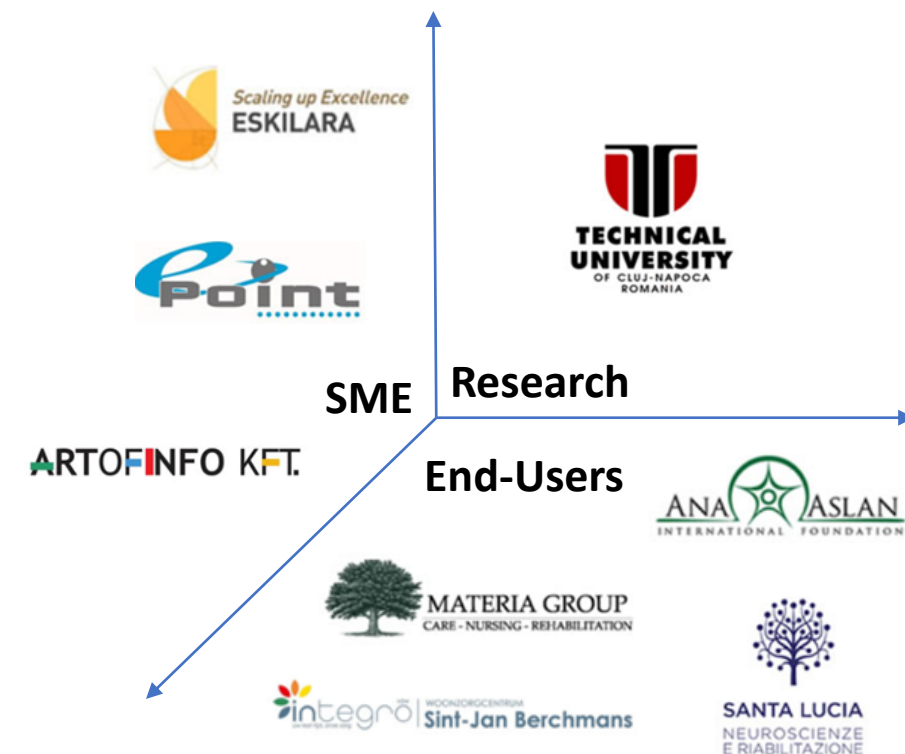
Context and Motivation

- Use of social robots for older people care can support the intervention phase and increase the end-user motivation
- Existing studies identify the care areas where the robots can be successfully used:
 - Physical assistance
 - Safety monitoring
 - Social companionship
- Older adults have provide positive feedback regarding the usefulness, utility, safety, and trust of a social robots
- Doctors and caregivers consider that the robot is a useful tool for rehabilitation

Remember-Me project presentation



- **ID:** aal-2019-6-188-CP (AAL162/2020)
- **Title:** Smart assistant to prevent and detect cognitive decline, promote cognitive function and social inclusion among older adults (Remember-Me)
- **Lifetime:** 01.04.2020 – 31.03.2023
- **Program:** ACTIVE AND ASSISTED LIVING 2019 (AAL 2019) - H2020
- **Budget:**
 - 211.348 Euro (UTCN-DSRL)
 - 1.340.268 Euro (Total)



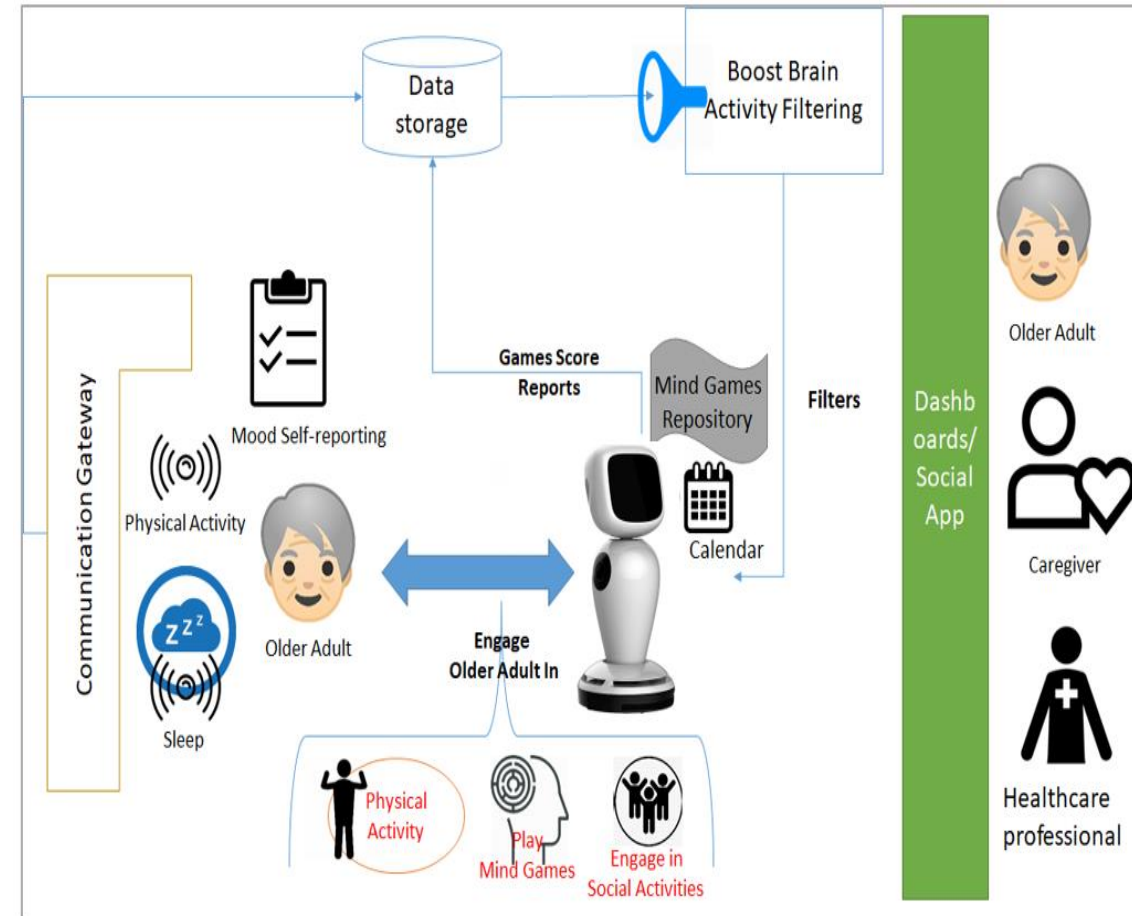
Remember-Me goals and objectives

- **Main objective:**
 - Develop a system based on a social robot, sensor-based monitoring, cognitive games and a social application which can stimulate the physical, cognitive and social conditions of older people
 - Restrain the deterioration of their cognitive state
- **Key aspects to be addressed in the project:**
 - Offers an integrative, multidomain monitoring of cognitive function and detection of cognitive decline
 - Promotes social inclusion
 - Offers personalized brain training in the user's real-life setting by employing a social robot / tablet / smartphone / smart tv

Remember-Me Architecture Overview



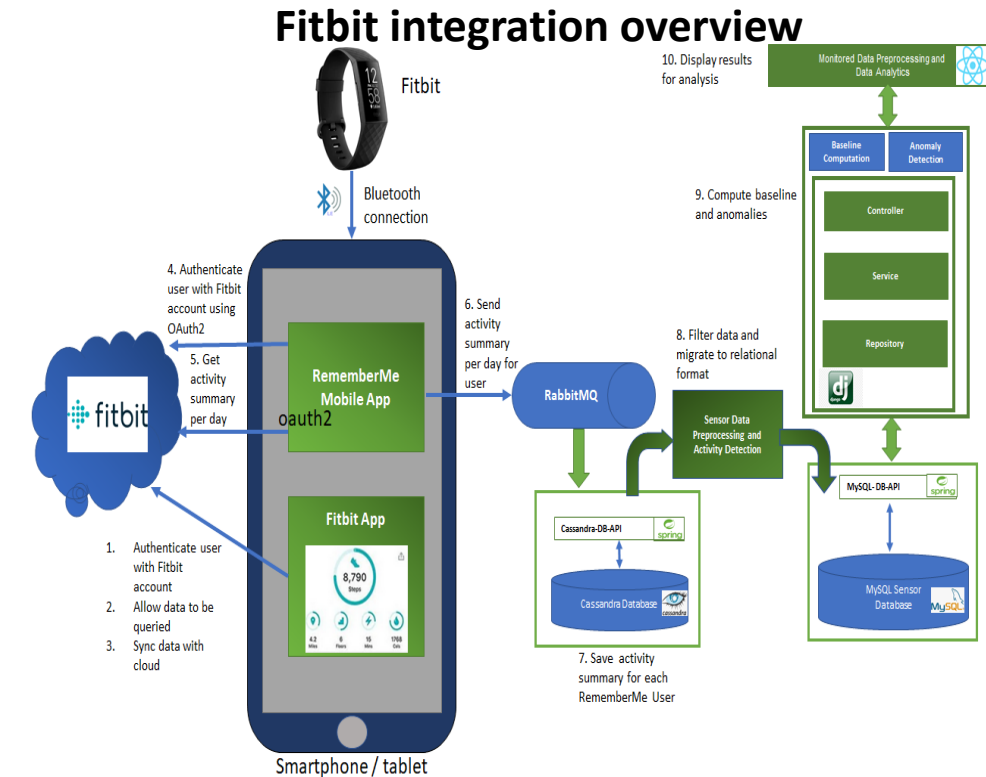
- Older adults are monitored with a monitoring infrastructure that:
 - Combines physical sensors with virtual sensing devices (self-reporting)
 - Collects data about activity levels, sleeping patterns/quality and mood
- Collected data are processed and analyzed for detecting:
 - Short/long-term decline in cognitive, social and physical activities
- Based on the analysis results, the activities on the robot are personalized with the goal of:
 - Stimulate the elders' physical/mental activities
 - Limit the deterioration of their cognitive state



ReMember-Me Components Description



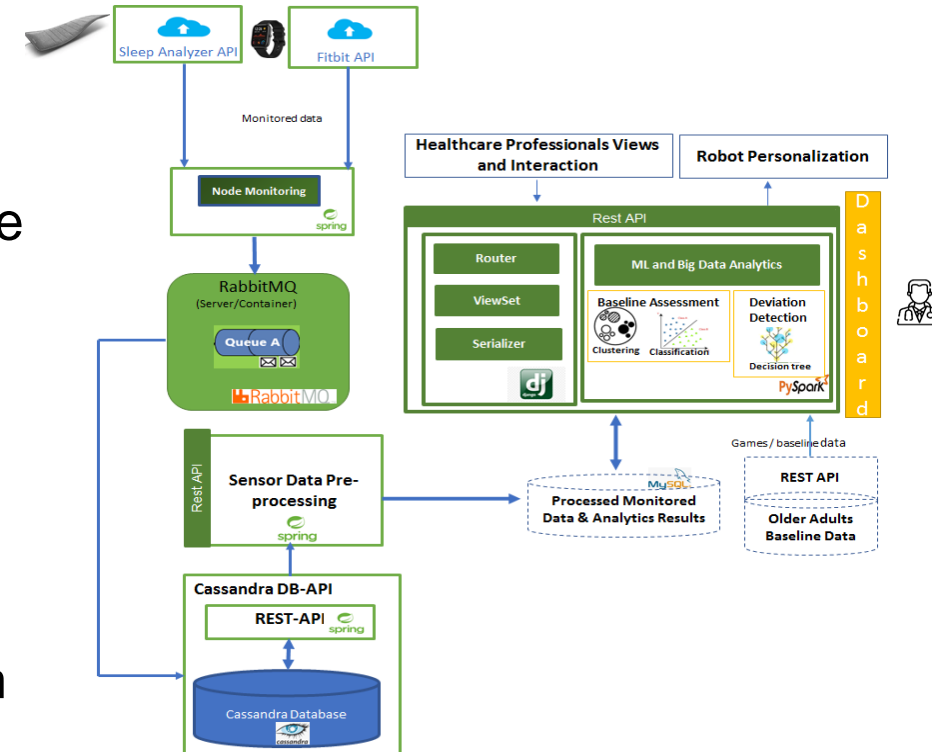
- **Monitoring infrastructure** (developed by TUC)
 - Physical activity monitoring
 - Open access API – data needs to be synched through BT and then pushed in the cloud
 - Monitors heart rate, activities, efforts, sleep, etc.
 - **Status:** Custom API for gathering data from Fitbit cloud API is under development by TUC
 - Sleep levels tracking
 - Open access API – data is pushed directly in the cloud
 - Monitors sleep quality and offers various insights
 - **Status:** API for gathering data from Withings cloud API is under development by TUC
- **Android app**
 - Additional data sources
 - Baseline assessment questioners data
 - API developed to push data in the analytics data model
 - Short exercises and rehabilitation games data
 - API developed to push data in the analytics data model



ReMember-Me Components Description



- **Web app**
 - Used to get data for the Robot Personalization component
- **Monitored Data Preprocessing and Data Analytics (developed by TUC)**
 - Detecting older adults either sudden or long-term decline in physical, social or cognitive activities
 - Daily physical activity levels, sleeping patterns and mood change
 - Machine learning techniques and big data analytics
 - Baseline representation
 - Anomaly detection
 - The component's functionalities are exposed through an API for any interested component (REST)

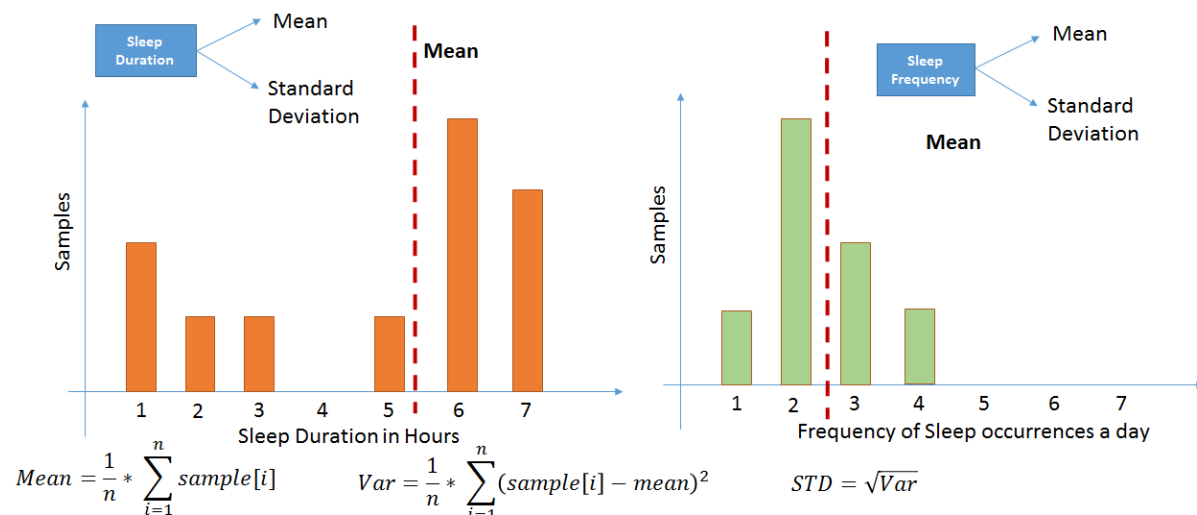


ReMember-Me Components Description



• Monitored Data Preprocessing and Data Analytics

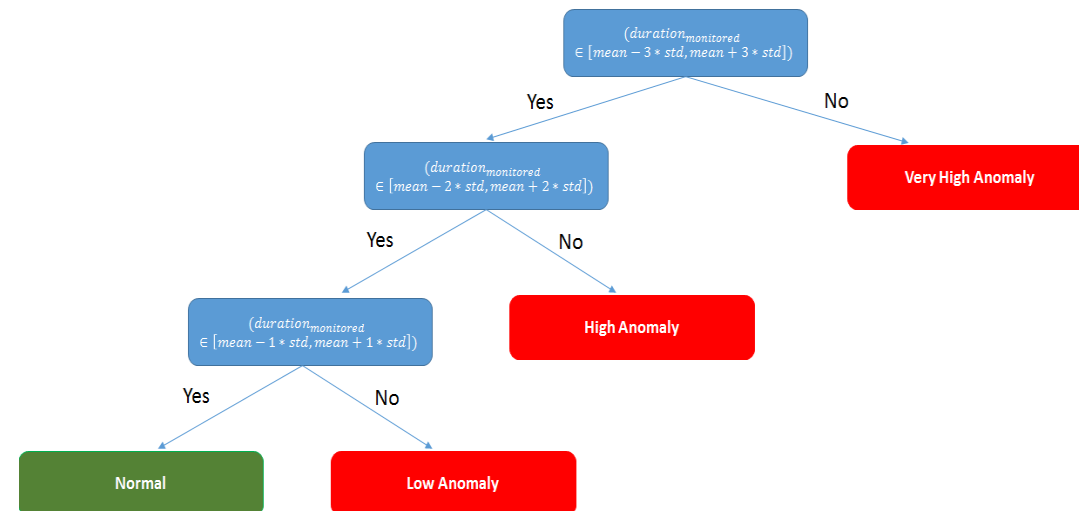
Baseline Representation (Sleep)



- Baseline is computed on historic data as a mean of the sample values

Anomaly Detection

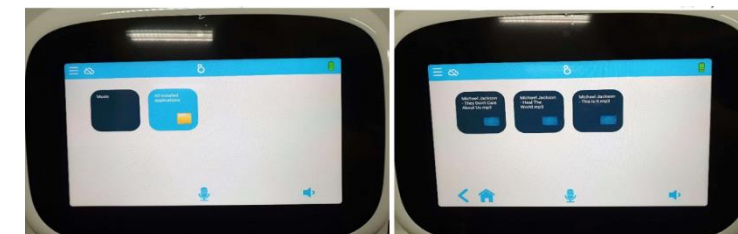
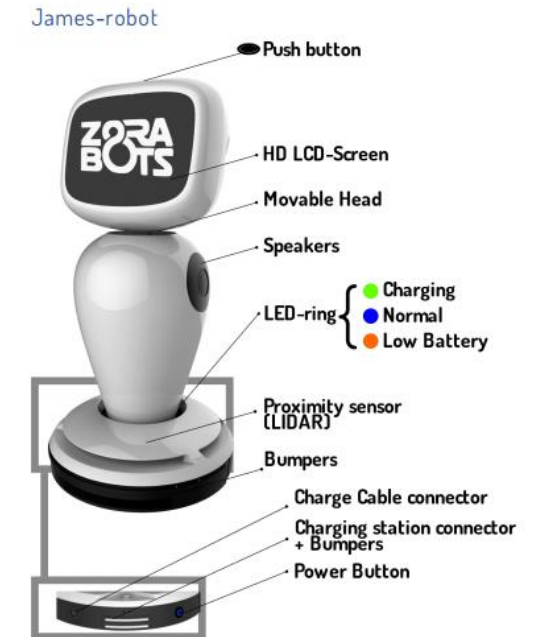
- Statistical Models for deviation based on mean and standard deviation
- Decision Tree for evaluating each feature of the statistical models
- The following features are used for sleep: sleep duration, sleep frequency, sleep quality .



ReMember-Me Components Description



- James Root
 - Available modules
 - Kiosk
 - Main interaction interface with the robot (Starting and stopping apps, Browsing the web, Starting and stopping multimedia, Video calls)
 - Modules
 - ZBOS multimedia player, Browser, Default games, Third party apps can be installed (e.g. for video calls, games, etc.)
 - Compositions
 - Sequence of apps specific/personalized for an action (e.g. play a specific song then show a video and finally start a game)
 - The robot can be accessed and controlled from:
 - Web application: <https://accounts.zorabots.be/login>
 - Phone application (Android/IOS) named “Zora Bots”



ReMember-Me Components Description



- James Root
 - **Robot Personalization API developed by TUC**
 - It allows to create on the James robot:
 - Personalized kiosks
 - Personalized scheduled activities/compositions
 - Communicates with the robot by means of the web sockets and ZBOS MQTT API
 - Android application implemented that calls the local broker available on the robot to enforce the personalized kiosks/activities/compositions

Published materials

- Papers

- Anghel, I.; Cioara, T.; Moldovan, D.; Antal, M.; Pop, C.D.; Salomie, I.; Pop, C.B.; Chifu, V.R. Smart Environments and Social Robots for Age-Friendly Integrated Care Services. Int. J. Environ. Res. Public Health 2020, 17, 3801. **IF: 2.849 Q1** <https://www.mdpi.com/1660-4601/17/11/3801>
- T. Sărătean, M. Antal, C. Pop, T. Cioara, I. Anghel and I. Salomie, A Physiotherapy Coaching System based on Kinect Sensor, IEEE International Conference on Computer Communication and Processing (ICCP 2020), 3 – 5 September 2020, Cluj-Napoca, Romania, **WoS indexed**, www.iccp.ro
- V. R. Chifu, C. B. Pop, A. Ciurianu, E. Șt. Chifu, M. Antal, Machine Learning-based Approach for Predicting Health Information Using Smartwatch Data, IEEE International Conference on Computer Communication and Processing (ICCP 2021), 28 – 30 October 2021, Cluj-Napoca, Romania, **WoS indexed**, www.iccp.ro
- I. A. Bozdog, D. N. Todea, M. Antal, C. Antal, T. Cioara, I. Anghel, I. Salomie, Human Behavior and Anomaly Detection using Machine Learning and Wearable Sensors, IEEE International Conference on Computer Communication and Processing (ICCP 2021), 28 – 30 October 2021, Cluj-Napoca, Romania, **WoS indexed**, www.iccp.ro
- More info: <https://www.rememberme-aal.eu/>