

Cognitive function stimulation using social robots H2020 / AAL engAGE

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AAL
PROGRAMME



Authors:

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Challenges for cognitive function stimulation



- Mild cognitive impairment (MCI) is a syndrome that affects older adults (not only) and causes changes and decline of their cognitive abilities
- Social robots, non-invasive IoT, and Artificial Intelligence are key technologies that can be innovatively and uniquely combined to stimulate cognitive decline
- Specific challenges that need to be addressed for developing innovative Ambient Assisting Living (AAL) systems for cognitive stimulation
 - Low levels of engagement of the older adults with traditional cognitive stimulation applications (mostly based on cognitive games and memory exercises)
 - Lack of coaching support and social interaction to allow the older adults to self-manage their cognitive decline in their homes delaying as much as possible their institutionalization
 - Traditional MCI screening methods (i.e. based on genetic, neuroimaging biomarkers, questioners, etc.) are either costly and rather invasive or they lack contextual information

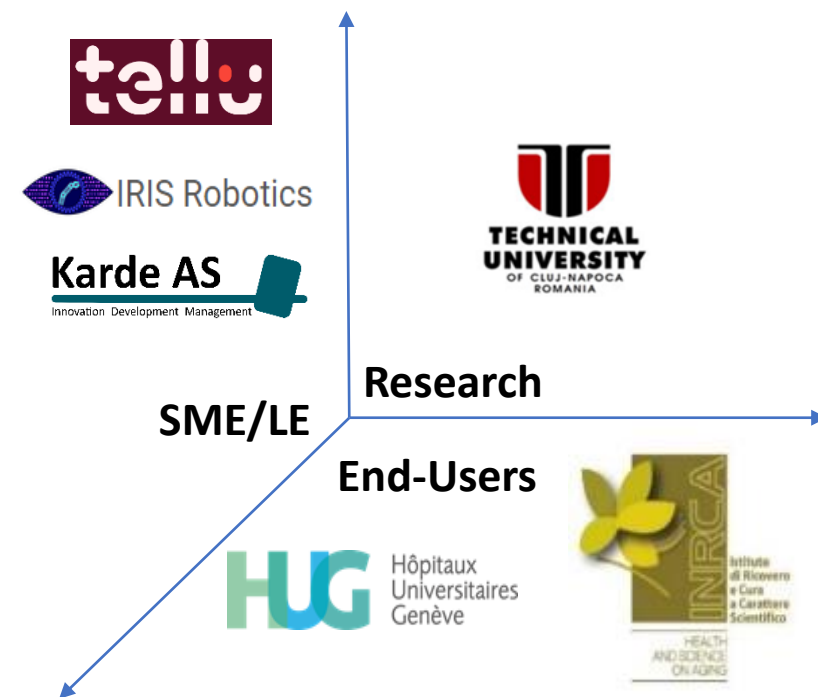
Innovative technologies for cognitive function stimulation



- Assistive services are shifting towards the use of objective monitoring using IoT sensors
 - Non-invasive monitoring of the daily life activities of the older adult with MCI
- Self-reporting for monitoring perceived health and wellbeing state
- Cognitive decline evaluation
 - Human perspective and sensors perspective data fusion
 - Machine learning to assess the cognitive decline and correlate it with activities of daily living (ADL) and wellbeing
- Social Robot coaching and cognitive stimulation
 - Coaching for older adult cognitive function self-management
 - Social interaction, engagement, and motivation
- Communication platform and intelligent personalization
 - Adaptable and personalized dashboards interfaces for non-face to face communication
 - Analytics for healthcare professionals/caregivers

engAGE project identity card

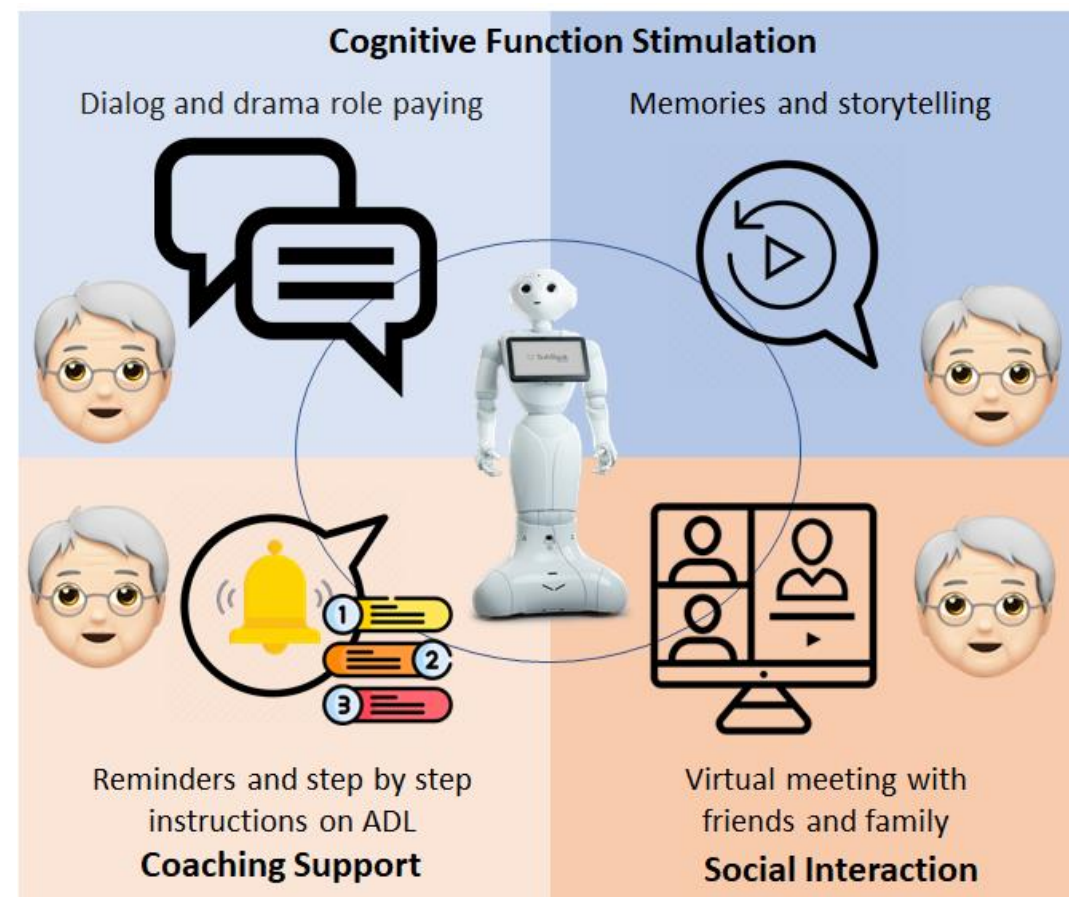
- **ID:** aal-2021-8-159-CP
- **Coordinator:** Technical University of Cluj-Napoca (DSRL)
- **Title:** Managing cognitivE decliNe throuGh theatre therapy, Artificial intelligence and social robots drivEn interventions
- **Lifetime:** 01.12.2021 – 31.05.2024
- **Program:** ACTIVE AND ASSISTED LIVING 2021 (AAL 2021) - H2020
- **Budget:**
 - 345 k Euro (UTCN-DSRL)
 - 1.3 mil Euro (Total)



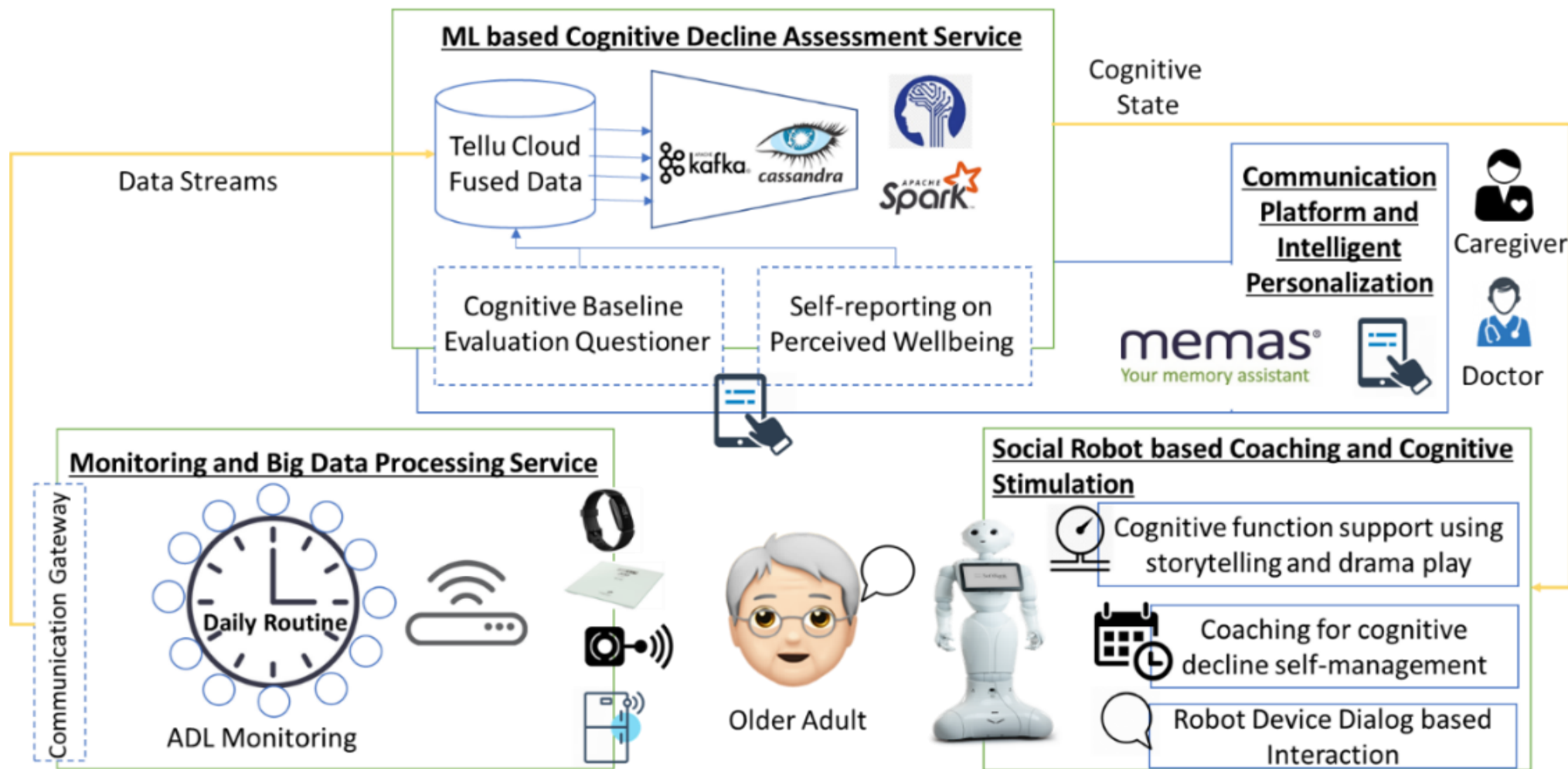
engAGE goals and objectives



- **Main objectives:**
 - Combat and slow down cognitive decline progression
 - Support the wellbeing of older persons with MCI
- Develop an ecosystem of services for:
 - Holistic monitoring of ability to conduct ADL and wellbeing
 - Machine learning-based cognitive decline evaluation
 - Coaching, cognitive stimulation and social interaction using social robots



engAGE briefly

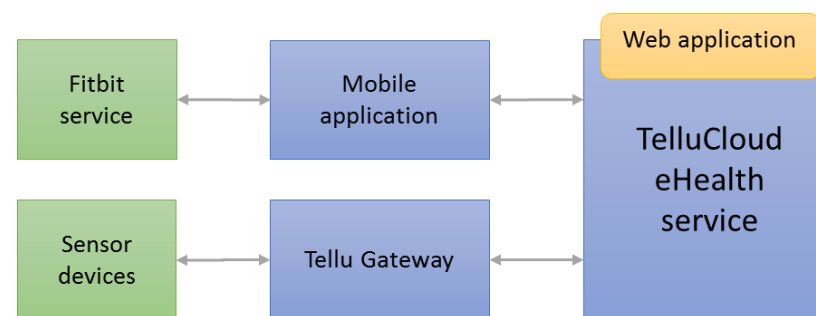
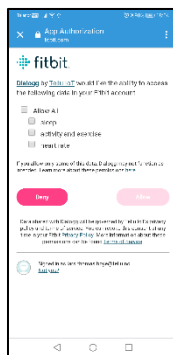


Technology overview



• Monitoring and Big Data Processing

- Use a combination of physical and virtual (self-reporting) sensors
 - **Lightweight monitoring infrastructure** based on commercial off-the-shelf sensors/devices for measuring sleeping and sleep quality, physical activity, movement habits, eating, etc.
 - Perceived health and wellbeing state will be monitored using **self-reporting** (e.g. older adult mood, feelings, impressions, etc.) or reporting from family carers and formal carers
- **TelluCloud infrastructure**
 - Intelligent gateway for collecting, and pushing data into the cloud (in a data storage)



Technology overview



- **ML-based Cognitive Decline Assessment**

- Analyze the older adult monitored data intending to assess the ability to carry out activities of daily living
 - Correlations between the carried-out activities and the cognitive state will be inferred enabling to early detect the cognitive decline
- Consider two types of features in the learning process
 - features extracted from the monitored data on daily life activities
 - contextual features related to the baseline cognitive function, and subjective reports on health state and well-being (self-reporting)
- ML to classify and cluster the older adult monitored ADL data concerning the cognitive function baseline allowing to detect deviations which may signal or predict the cognitive decline
- Start from DSRL ML and big data analytics platform

- **Communication Platform and Intelligent Personalization**

- Built upon the functionalities of the MEMAS communication tool developed by KARDE

Technology overview

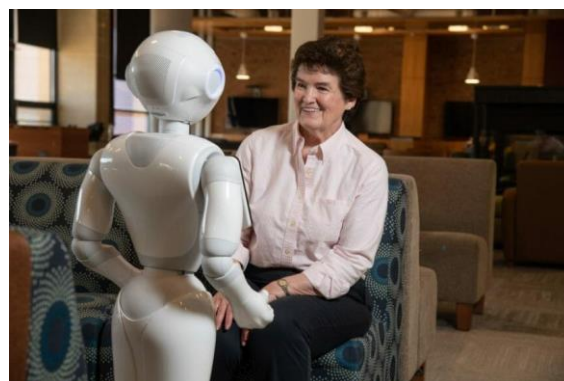
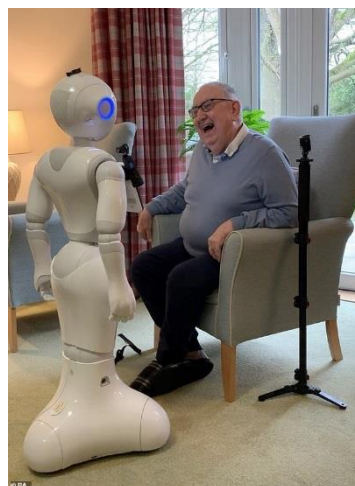
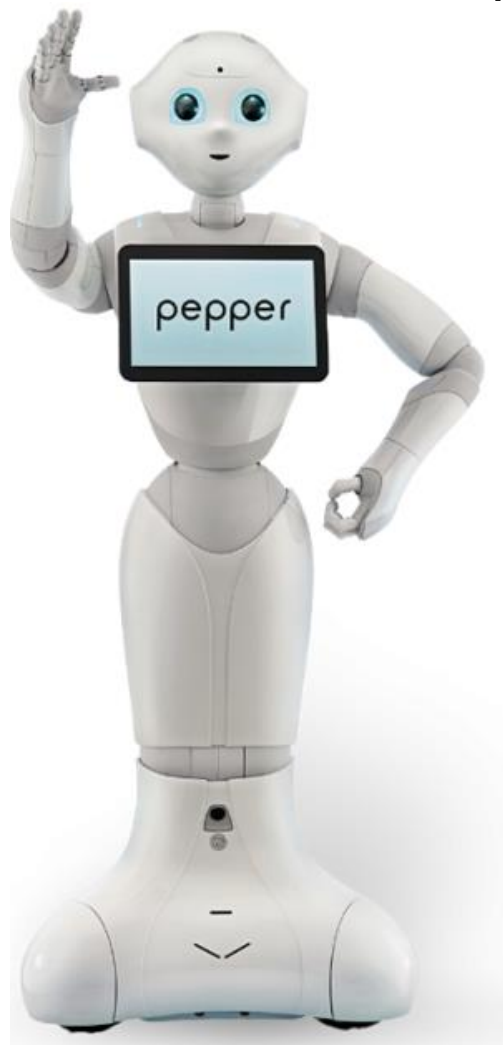


- **Social Robot Coaching and Cognitive Stimulation**
 - Provide personalized brain training in the older adults' real-life setting by employing the social robot as an intervention tool
 - The robot will act as a companion and will provide a wide spectrum of assistive functions
 - cognitive stimulation (i.e. drama storytelling)
 - reminding or step by step instruction on conducting ADL (e. washing, preparing meals, taking medication, drinking water, etc.)
 - facilitation of social interaction by creating a support network through collaborative caregivers or family members
 - The family caregiver will have the option of personalizing the robot content to the preferences and wishes of the older adult
 - correlated with the output of the ML cognitive assessment targeting to maintain or improve the older adult cognitive state

Social robots: Pepper or Temi



- We will use **IRIS Robotics** experience in commercializing and personalizing robot-based solutions in Europe (official reseller of Pepper and Temi)



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