

EMPATHIC

THE EXPRESSIVE & EMPATHIC VIRTUAL COACH DESIGNED TO IMPROVE THE INDEPENDENT YEARS OF THE ELDERLY

Horizon 2020 SC1-PM-15-2017

Research and Innovation

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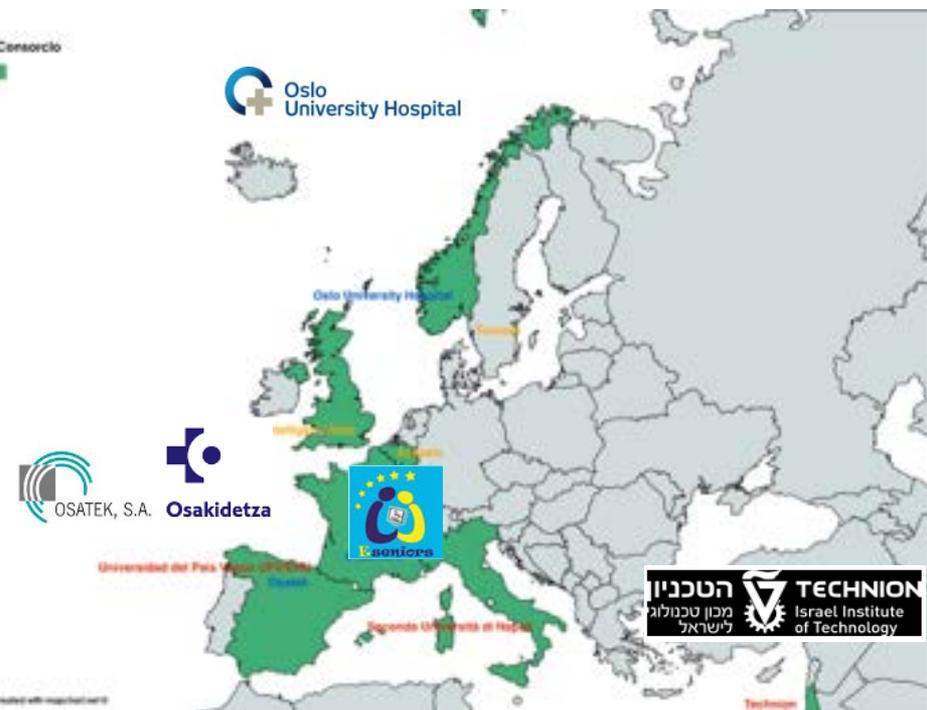
- **Pillar:** Societal Challenges
- **Work Programme Part:** Health, demographic change and well-being
- **TOPIC :** Personalised coaching for well-being and care of people as they age
- **Specific Challenge:** The activity aims at developing and validating radically new ICT based concepts and approaches for empowering and motivating people in need of guidance and care due to age related conditions, in cooperation with their carers where relevant, and **to help them improve and maintain their independence, functional capacity, health status as well as preserving their physical, cognitive, mental and social well-being.**
- **Scope:** Proposals should develop a proof of concept of radically new solutions for a **personalised "virtual coach"**, building upon intelligent ICT environments, access to relevant physiological and behavioural data, **new forms of accessible interaction based on tangible user interaction concepts**, open platforms[1] and **emotional computing. Usability and ease of user interaction should be essential design elements of the "coach".....**

- **OBJ1:** Design a virtual coach, to engage the healthy-senior user and reach pre-set benefits, measured through project-defined metrics, to enhance well-being through awareness of personal physical status, by improving diet and nutritional habits, by developing more physical exercise and by social activity
- **OBJ2:** Involve end-users and to reach a degree of fit to their personalised needs and requirements, derived by the coach, which will enhance their well-being
- **OBJ3:** Supply the coach with Incorporate non-intrusive, privacy-preserving, empathic, expressive interaction technologies
- **OBJ4:** Validate the coach efficiency and effectiveness across 3 distinct European societies (Norway, Spain, and France), with 200 to 250 subjects – who will be involved from the start
- **OBJ5:** Evaluate/validate the effectiveness of EMPATHIC designs against relevant user's personalised acceptance and affordance criteria (such as the ability to adapt to users' underlying mood) assessed through the Key Performance Indicators (KPI) to be defined in the project
- **OBJ6:** Drive the developed methodology and tools to industry acceptance and open-source access identifying appropriate evaluation criteria to improve the “specification-capture-design-implementation” software engineering process of implementing socially-centred ICT products.

- **Sc1:** Provide automatic personalised advice guidance (through the coach) having a direct impact in empowering elder users into a wide of advanced ICT keeping improving their quality of life and level their independent independency living status of the people as the age. *EMPATHIC will research a) the identification and assessment of main cues related to physical, cognitive, mental and social well-being b) defining personalised, psychologically motivated and acceptable coach plans and strategies c) translating professional coach behaviour into actions of the Intelligent EMPATHIC-VC*
- **Sc2:** Identifying non-intrusive technologies to detect the individual's emotional and health status. of the person through non-intrusive technologies. *EMPATHIC will use emotional information from eyes, face, speech and language to deliver a hypothesis of the user emotional status to assist decisions of the EMPATHIC-VC. In this framework, the research will focus on the detection of sudden shifts in the user emotional status or emotional changes during a certain period of time: a) extraction of emotional features b) data-driven approaches for multimodal modelling combining emotional cues provided by each source c) identification of significant changes in individual behaviour*

- **Sc3:** Implement health-coach goals and actions through an intelligent computational system, intelligent coach and spoken dialogue system adapted to users' intentions, emotions and context. *EMPATHIC will **research** a) Data-driven modelling of user and tasks; b) Machine learning for understanding the user; c) Learning policies and questionnaires to deal with coach goals; d) Statistical approaches for dialogue management driven by both user and Coach goals; e) Online learning for adaptation.*
- **Sc4:** Provide the virtual coach with a natural, empathic, personalised and expressive communication model in a supportive manner to allow emotional bonds that result in engaged and effective relationships. *EMPATHIC will **research and develop**, through early and continuous interaction with the end-users, the technologies to consider individual user profile, including cultural facts and interaction history, the current emotional status of the user and the coach strategies at each decision of the dialogue manager, at each text generated by the Natural Language Generator, at each inflexion of the TTS and at each movement of the personalised visual agent*

- **Tg1:** Develop a simulated virtual coach and acquire an initial corpus of dialogues. *A set of annotated dialogues will be designed and obtained through a Wizard-of-Oz (WoZ) technology to fulfil the initial end-users and data requirements of Scientific Goals*
- **Tg2:** Integrate and provide a proof-of-concept of the technology running on different devices.
- **Tg3:** Validation through Field trials. *EMPATHIC will test representative realistic use cases for different user profiles in three different countries*



Participant organisation name
Universidad del País Vasco
OSATEK
Oslo University Hospital
e-Seniors Association
Tunstall Healthcare (UK) Ltd. 
Technion – Israel Institute of Technology
Intelligent Voice Ltd.  Intelligent Voice
Acapela Group S.A. 
Institut Mines-Télécom
Seconda Università degli Studi di Napoli

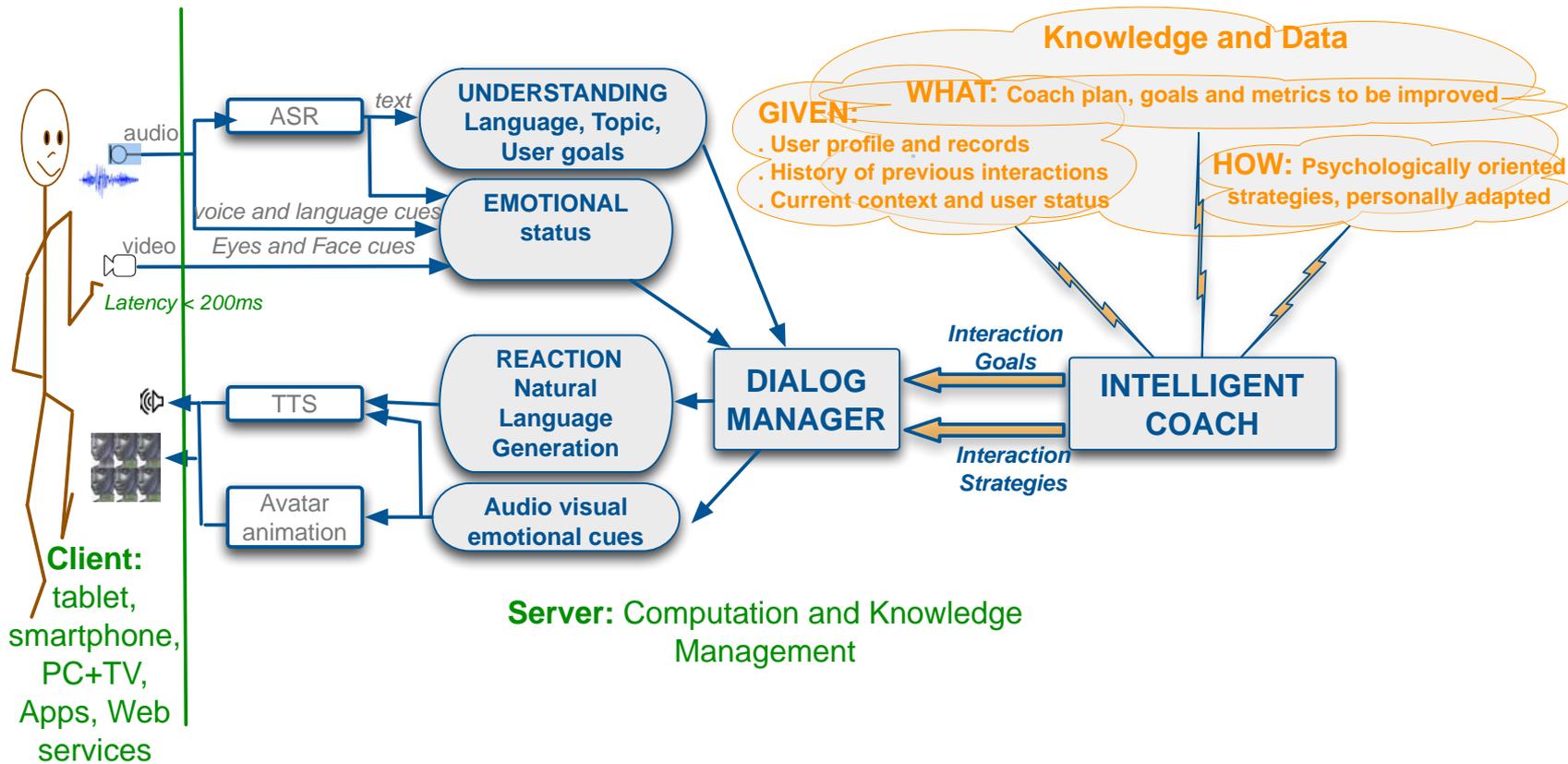
A SPOKEN DIALOG SYSTEM FOR EMPATHIC VIRTUAL COACH

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Javier Mikel Olaso, Asier López, Joffre Tenorio, Begoña
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- Will deal with **user estimation** and also with the **main decisional systems** needed to develop the virtual coach. To this end, we first **identify cues and goals for well-being as well as personalised and detailed coaching plans and actions to be implemented**. Then these coaches developed by health professionals will be implemented by an Intelligent Computational Coach, along with the Dialogue Manager and modules devoted to user state identification and understanding.
- Develop DM strategies that consider not only the user but also the high-level coaching goals to be achieved by a joint optimisation approach for dealing with shared user-coaching goals.
- Develop the technologies to understand the user through the interaction in terms of emotional status, interaction goals and conversational topics
- Develop a DM capable of personalisation and adaptation to the user-specific profile and current status through novel online learning algorithms
- Develop the Intelligent Coach's ability to translate the well-being personalised action plan into dialogue goals and strategies.



- Short-term system decision.
- Several models on interactions:
 - **System-driven** dialogues will be **conducted by policies aiming at improving project defined well-being metrics** learn by the Intelligent Coach. **Strategies defined by Psychologists** will be considered and learned through interactions for **user personalisation purposes**. Thus, the **DM** will implement **the dialogue goal and dialogue strategy** proposed by the Intelligent Coach.
 - **User-driven dialogues** that we foresee to be **open-domain**, to some extent. In such a case the DM will also be assisted by a User goal tracker and a Topic detection module.
 - **User-driven dialogues to get context and supply assistance**: get weather information, time table of local events, search of relatives,..
- In all the cases the DM will be able to integrate not only the classical semantic inputs but also additional parameters representing the emotional status of the user.

- WoZ data acquisitions.
- Interaction with prototypes
- Health professional knowledge
- Coaching plans

- Data acquisition
- End-Users feedback
- Testing features

The number and timings of studies is listed below. Note that the same participant cohort will be involved on each of the three studies.

Study 1: WOZ study (M5-M10).

Goal: Data acquisition and first user feedback

Study 2: Mid-period prototype (M15-M18). **Goal:** Second data acquisition and partial user acceptability of the solution

Study 3: Final prototype (M22-M35).

Goal: Evaluation of the technology and user

acceptability of the solution

Number of participants to be considered on each of the development studies:

Partners	Healthy	Depression
OSA/ UPV	60	30
OUS	30	30
ESE/ TUN	30	-

This study respond to the need to provide scientific evidences regarding the benefits of the solution. In other words, to show that the use of the Empathic-VC improves the well-being and the quality of life.

Study 4: Validation study (M22-M35). **Goal:** Validation of the approach.

Number of participants to be considered. This cohort has to be different than the one defined on the previous studies:

Partners	Healthy	Depression
OSA/ UPV	15	15
OUS	15	15
ESE/ TUN	30	-

- Promote main axes for well being:
 - Take care of nutrition
 - Physical Activity
 - Social Activity and Engagement: entertainment and relatives
- Share goals with the user, assist in the process and track success.
- My current achievements $\xrightarrow{\text{EMPATHIC}}$ My desired achievements.
- The coach typically make questions aimed at discovering the users's capacities as well as promote the use of their own resources.

- **G**: final and intermediate **Goals**: walk two days a week during ten minutes.
- **R**: **Reality** and **Resources**: explores current situation.
- **O**: **Options**: explores options to get goals.
- **W**: **Will**, action that also includes the action plan: **where, when, who, what**,...
- General (exploration) questions:
 - **What?** Goals, attitudes,....
 - **Where** and **when?**
 - **How?** experiences, capacities, skills and conduct to action
 - **Why?**
 - **For what?** Motivation

- **Main Goal:** improve the fruit diet in terms of number and variety.
- These first examples look like this:
 - **System:** *So, Pablo, ¿Have you ever eaten consistently 2 or 3 pieces of fruit?*
 - **User:** *When my wife was healthier, she used to take care of buying the fruit. Thus it was easier for me to eat it.*
 - **System:** *And in any other time of your life?*
 - **User:** *Long time ago, when I lived alone, I used to take care of buying the fruit myself, and I ate it more frequently.*
 - **System:** *What does this information suggest to you about your objective of eating 2 or 3 pieces of fruit a day?*
 - **User:** *Well... That it's something that basically depends on me.*
 - **System:** *So, can you see anything you could do to get closer to your objective?*
 - **User:** *Uhhh... I should start thinking how I am going to organise when I am going to buy the fruit.*
 - ...

- We consider two main alternative to build this kind of Dialogue Systems:
 - **Planned based agents.** These will be used at least as first prototypes which will be built as soon as the first WoZ experiments are carried out.
 - **Advantages:** Full control on the system, easy to change the behaviour of the agent.
 - **Drawbacks:** Not very scalable, require a lot of hand design.
 - **Statistical systems.** Stochastic Finite State Transducers and Deep Learning based methodologies to generate the output of the Dialogue Manager. Since they need a lot of data, they might not work in the earlier phases.
 - **Advantages:** Promising technology, do not need to design the dialogue by hand.
 - **Drawbacks:** Experimental, not very reliable.

- Iterative procedure.
 - Writing scenarios for the WoZ acquisitions
 - Defining Dialog Act labels
 - First approach for System-driven dialogs: planned DM, such as Ravenclaw or FLoReS
 - Getting more dialogs from the professional coach.
- Introducing external Knowledge in Neural Networks based Dialog management.
- Acquiring data in Spain:
 - two sessions with the professional coach
 - Woz beginning end of May
- Annotating dialogs
- Getting more GROW-based dialogs related to Physical Activity, Entertainment and Family engagement.