Smart and Healthy Ageing through People Engaging in Supportive Systems

SHAPES

Grant agreement ID: 857159

SHAPES-OC2-Solutions Work Program

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Topic Descriptions

The list of topics of the Open Call "SHAPES-OC2-Solutions" are summarized below:

Topic IDs	Targeted Applicants	Funding
SHAPES-OC2-Solutions-1	Reminder Wearable for Elderly Adults with Mild Cognitive Impairments	Up to €50,000
SHAPES-OC2-Solutions-2	Monitoring hydration and quantity of fluid intake	Up to €50,000
SHAPES-OC2-Solutions-3	Speech-enabled Chatbots	Up to €50,000
SHAPES-OC2-Solutions-4	Social support in local community	Up to €50,000

In the follow-up sections the detailed descriptions are provided for each topic.

NOTE: refer to Appendix A for the up to date architecture of the SHAPES Technological Platform.

SHAPES-OC2-Solutions-1

Reminder Wearable for Elderly Adults with Mild Cognitive Impairments

Purpose
Wearable device offering reminders to elderly adults about important tasks

Relevant SHAPES Pilot Theme(s)
Pilot Theme 5 and specifically Use Case 2 (UC-PT5-002)

Commitment
Applicants are expected to make their solution available for a demo during the SHAPES pilot trials

Type of Applicants
We seek providers of smart devices offering reminders to their users with capability to integrate those with SHAPES Technological Platform for communication of data to SHAPES Digital Solutions

Expected project duration
The expected project duration is between six (6) and twelve (12) months.

Funding
Up to €50,000

The requested solution is planned to be used in the Pilot Theme 5 "*Caring for Older Individuals with Neurodegenerative Diseases*" in the Use Case 2 "*Monitoring Patients with Mild Cognitive Impairment*".

The UC-PT5-002 supports remote monitoring of important key health parameters of older individuals with the aim of maintaining or possibly even improving their health status thanks to preventive health and care measures.

The digital assistant technology in PT5 Use Case 2 can remind an older adult of a task or event via a smart speaker. It is unknown at this stage, how beneficial or user friendly this will be to an older adult with mild cognitive impairment. It also does not cater for the hearing impaired. The WHO stated in

2018[1] that almost third of all adults over the age of 65 are affected by disabling hearing loss.

A smart band with a 1.1 inch display, 15 days of battery life and an IPX7 water resistance rating that vibrates to alert the user to a new reminder in text format would address the shortfalls of a sound based communication medium and cater to the 33% of the population suffering from disabling hearing loss. The concept would be to keep the device as simple as possible, serving as only a text based reminder for life events with only one other function, a push button alarm for emergency help.

Developments would enrich the learnings from Use Case 2 as a comparison between sound and vision based communication mediums for older adults could be evaluated. The smart band could be worn on either wrist or as a pendant around the neck. Example concept images are provided below:

In the Use Case 2, the requested solution will be embedded in a tablet, besides other tracking sensors such as fitness tracker for recording of steps, exercises and sleeps.

The list of relevant SHAPES Digital Solutions [6] and their allocations to Pilot Theme 5 [3] can be found in . Note that the solution offered by projects funded in this topic MUST be integrated with SHAPES Technological Platform using interfaces detailed in [5].

As a continuous monitoring of the key health parameters is essential, we welcome also extra capabilities to cover other needs of the Use Case 2 in Pilot Theme 5.

From the technical point of view the provider of the technical solution at least a Level 1 Compliance Level interoperability solution with the SHAPES platform. In this sense an API is needed to transfer the data to the SHAPES Technological Platform. Then, the collected data will be aggregated and processed in the data analytics modules, and the results will be presented to the user via one of the previously mentioned SHAPES Digital Solutions. To ensure Level 1 Compliance Level for the interoperability with SHAPES Platform, either of the following connectivity options are requested:

(1)   D2S (device to server) communications over Wi-Fi, using technologies like HTTP REST, OAuth 2.0 and JSON formatted data.

(2)   D2D (device to device) communications supporting device discovery, configuration and data exchange in a local LAN, using (a) Wi-Fi communication and/or (b) Bluetooth (or Bluetooth Low Energy (BLE)).

Other formats are also possible and can be discussed separately. Additionally, technical support from the provider of technical solution will be required during the execution of the SHAPES Pilot Theme 5.

The funding amount will cover all the technical adaptation works needed from the manufacturer to connect its system to the SHAPES platform and to provide at least ten (10) units of its digital solution and the corresponding licenses to be used during the pilots at the user homes.

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[1]   https://www.who.int/pbd/deafness/estimates/en

SHAPES-OC2-Solutions-2

Monitoring hydration and quantity of fluid intake

Purpose

Many older people no longer feel thirsty or do take notice of their need much too late. As a result, older people are frequently dehydrated, which is in turn a source of many illnesses and general malaise. The frequent intake of medication also makes it necessary to drink enough fluids. To counteract forgetting to drink, a smart drinking bottle can help. We look for smart water bottles that can inform the SHAPES platform in an automatic way about water intake of the user.

Relevant SHAPES Pilot Theme(s)

Pilot Theme 2 and specifically Use Case 1 (UC-PT2-001)

Commitment

Applicants are expected to make their solution available for a demo during the SHAPES pilot trials

Type of Applicants

We look for manufacturers of smart water bottles that provide an API or similar interoperability mechanism in order to allow the automatic and secure water intake data transfer, storage and processing in the SHAPES Technology Platform.

Expected project duration

The expected project duration is between six (6) and twelve (12) months.

Funding:

Up to €50,000

The requested component is planned to be used in the pilot theme 2 "*Improving In-Home and Community-based Care*" in the Use Case 1 "*Remote monitoring of key health parameters*". This use case concerns remote monitoring of important key health parameters of older individuals with aim of maintaining or even improving their health status thanks to preventive health and care measures.

The monitoring of steps, exercises, sleep, and intake of fluids, nutrition and wellbeing are defined as important key health parameters of older individuals in UC-PT2-001. During the SHAPES project, it was identified that the tracking of steps, exercises and sleep can be covered by fitness trackers. The status of wellbeing can be accessed via the eCare platform within the SHAPES set of digital solutions.

Tracking the intake of fluids of older individuals is a challenge and no already available SHAPES component can deliver this information. Thus, an innovative digital solution that supports the monitoring of continuous fluid intake and provides information about drinking patterns is of key relevance for the collection of essential information to the use case.

In the UC-PT2-001, the listed subsystems will be embedded in a tablet. Besides that, the older individual will be equipped with a fitness tracker for recording of steps, exercises and sleeps. The requested placement and interfacing with other SHAPES subsystems and components in UC-PT2-001 is detailed in the table below.

Technical partner	SHAPES Digital Solution	Task
EDGE	eCare	A smart ambient intelligence, health and wellness platform delivering remote monitoring of key health parameters of older individuals, incl. those with health problems requiring periodic or permanent monitoring.
CH	Chatbot ROSA	Chatbots are digital nurses that monitor users at home, communicating in natural language and chat ("how do you feel").

VICOM	Safe digital assistant	Friendly interaction mechanisms based on Automatic Speech Recognition & Natural Language Processing. Support the older people to remain independent and carry out with their daily activities at home.
TREE	DAPHNE	Uses information about anthropometrics, health markers, mental well-being, physical activity and nutritional data of the user and, using data processing and AI, creates personalised nutritional, activity and behavioural models, giving risks and recommendations for users and carers.
TREE VICOM	Data analytics and predictive algorithms	Analysis of anomalies and alert generation based on the data gathered from the different sensors.

As a continuous monitoring of the key health parameters is essential, we are looking for further additional options to cover all aspects of UC-PT2-001.

Data on the intake of fluids informs on key health parameters: first and foremost, and at a very basic level, data measuring fluid intake is essential to prevent life-threatening implications such as dehydration. The frequent intake of medication also makes it necessary to drink enough fluids. The German Society for Nutrition gives a reference value of 1.5L/day, which is increased to 2L/day in summer. To encourage the regular intake of fluid, the use case is looking for an innovative digital solution. The device should measure how much liquid has been drunk from e.g. a bottle and report this to the SHAPES system. In addition, the SHAPES system will support manual entries (e.g., if the older person has been increasing his/her intake of fluid outside his/her home or alternating between water and tea for instance). According to documented daily intake of fluid intake, reminders are given if the person does not drink enough according to the following guidelines:

- a glass of water immediately after waking up (stimulates digestion and circulation)
- 3 hours into the day: drink at least 0.5L
- 6 hours into the day: min. 0.75L
- 9 hours into the day: min. 1 L
- 12 hours into the day: min. 1.3 L
- 15 hours into the day: min. 1.5L
- Cap drinking 2 hours before bedtime in order not to interrupt the night's sleep

In this sense, we are looking for solutions which could tackle the challenge described before.

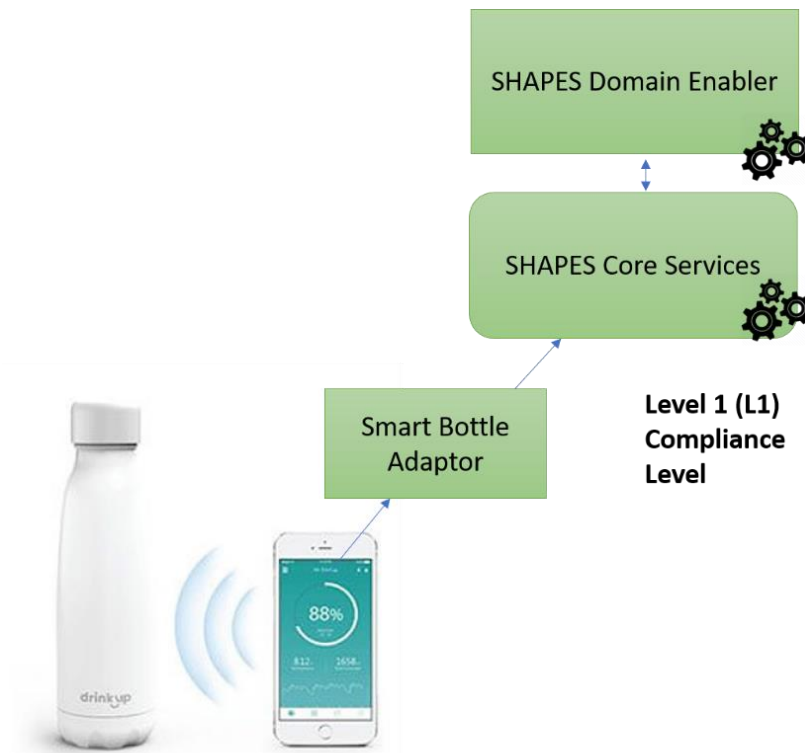| Technical partner	SHAPES Digital Solution	Task
External third party	Smart monitoring hydration solution measuring fluid intake. Alternative configurations can be provided too.	Smart solution monitoring the person's hydration providing the fluid intake measurements with the corresponding timestamps to the SHAPES platform through a dedicated secure API. Alternatively, in the case the provider of such a smart monitoring hydration solution currently uses a dedicated cloud to store the data, a platform federation approach can be established with the SHAPES platform.

Figure 2. Smart bottle as an example of an innovative smart and digital solution to monitor dehydration and quantify of fluid intake, app and L1 interoperability schema with SHAPES platform.

From the technical point of view the manufacturer of technical solutions or hydration service providers must present at least a Level 1 Compliance Level interoperability solution with the SHAPES platform. In this sense an API is needed to transfer the collected fluid intake data to the SHAPES Platform. Then, the collected data will be aggregated and processed in the data analytics modules, and the results will be presented to the user via eCare system / personal chatbot / safe digital assistant or other SHAPES components. To ensure Level 1 Compliance Level for the interoperability with SHAPES Platform, either of the following connectivity options are requested:

(3)   D2S (device to server) communications over Wi-Fi, using technologies like HTTP REST, OAuth 2.0 and JSON formatted data.

(4)   D2D (device to device) communications supporting device discovery, configuration and data exchange in a local LAN, using (a) Wi-Fi communication and/or (b) Bluetooth (or Bluetooth Low Energy (BLE)).

Other formats are also possible and can be also considered.

Furthermore, technical support from the manufacturer of technical solutions or hydration service provider may be required during the execution of the SHAPES pilots.

Finally, the funding amount will cover all the technical adaptation works needed from the manufacturer to connect its system to the SHAPES platform and to provide at least ten (10) units of digital solutions and the corresponding licenses to be used during the pilots at the user homes.

SHAPES-OC2-Solutions-3
Speech-enabled Chatbots

Purpose

To provide a multilingual natural speech enabled chatbot service with vocabulary geared to Medical and Wellbeing applications with language translations options for the range of languages required for running SHAPES pilot trials.

Relevant SHAPES Pilot Theme(s)

This service is expected to be used in all Pilot Themes

Commitment

Applicants are expected to make their solution available for a demo during the SHAPES pilot trials

Type of Applicants

Legal entities established in EU Member States.
For details refer to the "Eligibility Criteria" document.

Expected project duration

The expected project duration is between six (6) and twelve (12) months.

Funding

Up to €50,000

Chatbots have emerged as one of the key aspects of this AI-driven customer service. The strong and growing interest in Chatbots is driven by the promise of intelligent digital assistants always available to resolve customer requests cheaply, quickly and consistently. Chatbots are not intended to replace humans, but act as co-pilots. They have the potential to bridge the gap between brands and consumers in ways that no other tool has been able to do before - increasing automation and availability so humans can focus on multiple customers at once, leading to greater efficiency.

Due to the increasing popularity of the Virtual Assistants and due to their interesting applications within the medical domain, several members of the SHAPES consortium are interested in implementing these solutions in their own pilots and use cases, thus to relief human participants from common interactions with users, related to informing older persons about their health status and specify symptoms, reminding older persons to go to appointments or to stick to a medication plan, to motivate the user to engage in games and cognitive tasks or engage in social activities or to guide patients through a rehabilitation exercise. Such services need to be also geared to dealing with Medical Vocabularies and so Artificial Intelligence approaches prove to offer added advantage in such communications. Certainly, natural human and machines interfaces (HMI) mean inherent capability of voice-based communication.

The goal is to add a novel service to the SHAPES platform that would ease interactions between users and SHAPES services/applications using natural speech user interface. Multilingual interaction is an essential requirement for such a solution, such that to offer capabilities for SHAPES to operate across borders. As an added advantage voice transcription and speech synthesis options are expected to ease also multilingual interaction among human actors as well.

These services should be consumed via HTTP REST API using a cloud-based service. Applicants should make their platforms and their resources available during the SHAPES Pilot Theme trials.

The list of SHAPES Digital Solutions expected to integrate results of such projects include:

Technical partner	SHAPES Digital Solution	Task
CH	Chatbot ROSA	Chatbots are digital nurses that monitor users at home, communicating in natural language and chat ("how do you feel").

VICOM	Safe digital assistant	Friendly interaction mechanisms based on Automatic Speech Recognition & Natural Language Processing. Support the older people to remain independent and carry out with their daily activities at home.
FINT	FINoT	A smart IoT-based living platform that leverages on the smart neighbourhood, smart community, and smart city paradigms to deliver relevant information on weather, air quality, pollution, local public works, local transportation, and local activities.
AELTD	Access Earth	Access Earth is a global platform that uses smart and crowd sourced data gathering methods to provide the world with details on the levels of accessibility local bars, restaurants, shops and other businesses have.
PAL	ARI TIAGo robots	ARI and TIAGo social robots will make use of natural language interaction in order to guide users through cognitive games, provide feedback, reminders, and suggestions and to understand the different requests from the end-users.

The following requirements need to be met for technical validation:

Criteria	Description
Languages	The following list of languages is expected to be supported: German, Greek, Italian, Portuguese, Greek, Italian, and Czech
Delay - STT	The delay of the transcriptions' decoding should enable real-time communication with Voice Assistants in chat-style fashion.
HTTP REST API	The model functionalities can be accessed via an HTTP REST API
STT - Handle up to 50 concurrent petitions	The max peak usage of the STT service is estimated to be around 50 concurrent users, although usually will be lesser, the service needs to handle these number of petitions.
Supports socio sanitary domain terminology	As STT model will be used in the socio sanitary domain, it is expected to handle the associated terminology. If this is not the case, the provided solution needs to handle Language Model adaptation so it can be fine-tuned to the required domain.
Language Model Adaptation	The Language Model of the STT module can be adjusted using the provided API to obtain better results with the terminology of the socio sanitary domain.
Dialogue Adaptation	The resulting Virtual Assistants/Chatbots need to be geared to deal with Medical Vocabularies and interactions scenarios of the SHAPES use cases.
Audio Format	The audio format that is needed to send to the model needs to be an open and well-known format which can be easily captured/encoded in the SHAPES front-ends (preferably .wav).
Delay - TTS	As the system will be used for Voice Assistants, it needs to synthesise text fast enough when it comes to short utterances (<=10 words).

Allows to cache content	The licensing needs to allow to store the output of the TTS module in the SHAPES servers and/or front-end devices to allow real-time consumption of long answers from the Digital Assistant. The stored audios will be only used within the scope of the SHAPES project.
Voice type	A female voice is preferred. Having both Male and Female voices is considered a plus.
Parameter Adaptation	If the voice can be adjusted via parametrization (speed, pitch, etc.) is considered a plus

Deliverables

Name	Description	Type
API documentation	Documentation on how to use the API of the STT and TTS services	Report
Language Model Adaptation guide	Documentation on how to adapt the Language Model of the STT module	Report

During the use and exploitation of the STT module, the following technical support will be required:

- Support at performing the communications using the provided API
- Support at adapting the Language Model of the STT service.
- Support at adjusting the parameters of the TTS service.
- Troubleshooting

Technical support may be required at any time over service period defined in a Commitment section.

Conditions of formal acceptance

Req.	Name	Description
1	**Technical Viability**	The solution can be integrated in the Shapes platform and meets the technical requirements abovementioned.
2	**Usability**	The Word Error Rate of the STT module is low enough to allow an interactive communication with a Virtual Assistant
3	**Naturalness**	The synthesized voices should be natural enough not to break the immersion of the end-users.
4	**Delay**	The delay associated to the services is low enough to allow an interactive communication with a Virtual Assistant

To ensure the usability requirements a quality-testing will be performed using native speakers of the language to transcribe. If the achieved results are not satisfactory due to domain-specific terminology, another test round will be performed after adapting the LM according to the providers' instructions previous to decision.

SHAPES-OC2-Solutions-4
Social support in local community

Purpose

Many older adults have the wish to be actively involved in social activities in their local community. They wish to know what social events, happenings, sport activities are going to happen in the next period close to their place of living and if interested to express the interest to participate. These events can be organized by public organizations or private institutions and companies targeting the involvement of older adults who stay at home to fight loneliness. For these individuals, it needs to be ensured that they have easy access to suitable opportunities according to their interests as well as to get into contact and exchange with others.

We look for solutions which counteract loneliness of older individuals living at home by gathering and providing the required information that can be easily assessed and understood by them. This information may come from related databased, social media and local websites that publish these events and are maintained by organizations, institutions and companies. The information received by the older individual should referred to events that are close to his/her place of living and accessible by foot or short drive/usage of public transport.

Relevant SHAPES Pilot Theme(s)

Pilot Theme 2 and specifically Use Case 2 (UC-PT2-002)

Commitment

Applicants are expected to make their solution available for a demo during the SHAPES pilot trials

Type of Applicants

We are looking for service provider who can offer the end user an easy opportunity to interact with the local community. We expect that the solution will be provided in a form of mobile application that can work on phones and tables and various operational systems (e.g. IOS, Android) and is built on state-of-the-art technologies. Moreover, an API or similar interoperability mechanism has to be provided in order to allow the automatic secure data transfer, storage and processing of related information in the SHAPES Technology Platform.

Expected project duration

The expected project duration is between six (6) and twelve (12) months.

Funding

Up to €50,000

The expected component is planned to be used in the Pilot Theme 2 "*Improving In-Home and Community-based Care*" in the Use Case 2 "S*upporting the interaction of the individual with the community*". The UC-PT2-002 approaches older individuals who suffer from loneliness and wish to be actively involved in social activities in community.

The causes leading to loneliness can be very different and they change with age. Unfortunately, however, all people who suffer from loneliness for longer periods of time have one thing in common: their health, both physical and mental, suffers.

This use case aims to support the interaction of the older individual with the community. If older individuals are already somewhat distanced from their community and they don't take part in day-to-day activities within the community, they also don't necessarily hear about new developments or opportunities for engagement, sports, educational or cultural events.

It needs to be ensured that they have easy access to suitable opportunities and developments in the community, such as specialized transport services, and are actively informed about e.g. weather conditions that allow for exercise outdoors but also activities such as readings, bingo, exhibitions and

other opportunities to engage in activities taking place in local communities.

Based on an initial survey, only activities that align with the hobbies and interests of the older individual are suggested. The (machine) learning system notices which kinds of information and events are clicked on / not read or listened to entirely. Also, relevant news items should be included in the platform - a balanced mix of articles and news must be provided that does not focus too much on negative developments.

The older individual should be reminded about activities that are taking place and informed on how to get there and what to bring. If interested in participating in an event requiring the purchase of a ticket, an official registration or any other type of formal or financial transaction, the user should have the possibility to express his/her interest and this will be forwarded to the informal caregiver or a predefined person in charge of the older individual's financial/ administrative tasks. This person can then book a ticket and enter the information in the system.

Subsystems listed in the UC-PT2-001 will be embedded in a tablet (or smartphone). Desired location and interfacing with other SHAPES subsystems and components in UC-PT2-002 is provided below:

Technical partner	Subsystem component	Task
FINT	FINoT	A smart IoT-based living platform that leverages on the smart neighbourhood, smart community, and smart city paradigms to deliver relevant information on weather, air quality, pollution, local public works, local transportation, and local activities.
OMN	DigiRoom	A web-based, no-install communication tool for e.g. the communication with their informal caregivers or family members/friends who are not close by/able to meet physically
VICOM	Safe digital assistant	Friendly interaction mechanisms based on Automatic Speech Recognition & Natural Language Processing. Support the older people to remain independent and carry out with their daily activities at home.
SciFy	Newsum	News summarization mobile app that automatically summarizes information from many sources and combines them in a single text. It gives you the main points of all the different information that you would get if you read all the articles from the sources you visit. With the use of artificial intelligence technology, news are summarized and all repeated information is not duplicated.
TREE	Data analytics	Analysis of data and result generation of most relevant information to a care receiver, based on data gathered from different sources.
AELTD	Access Earth	Access Earth is a global platform that uses smart and crowd sourced data gathering methods to provide the world with details on the levels of accessibility local bars, restaurants, shops and other businesses have.

The above listed subsystems of SHAPES give the end user the opportunity to inform oneself about the news and condition of the days (e.g. weather, transport options, events) and provide an easy access to have a chat with their loved ones and people in charge of care.

Besides that, we are looking for a subsystem that provides an easy access to get to know people in the local community. Although there are well-known social networks on the market (i.e. Facebook, Instagram), we would to emphasize the attempt to find people near you who are interested in same topics like football or discussing book as well as fellow human beings who might be on the same page as you. Whether diagnosing illness, loneliness, the desire for a good conversation or a cup of coffee is a simple but fundamental need of many elderly people. In times of Covid-19, possibilities to get in

contact with others significantly dropped, while work load for informal caregiver raises accordingly.

During the pandemic, the needs of older individuals became more visible. Volunteer who could do grocery shopping or picking some medicines are more and more important and are big relief for people in care and the care givers.

The aim of the UC-PT2-002 is to create more community, more connectedness, and a stronger exchange among people with physical and mental stress. In this sense, we are looking for solutions which are able to provide an easy access to interact with people in the local community.

Technical partner	Form of solution	Functionalities
External third party	Mobile/Web Application	Third party should provide some of these options: • search for people in near location • selection of topics/ interests • matchmaking to find like-minded people in local community • possibility to get in touch with people that user like to get to know • newsfeed that informs about like-minded users close to end user • newsfeed that informs about volunteers • newsfeed of local events based on the profile and interests of the older individual

UC-PT2-002 Architecture
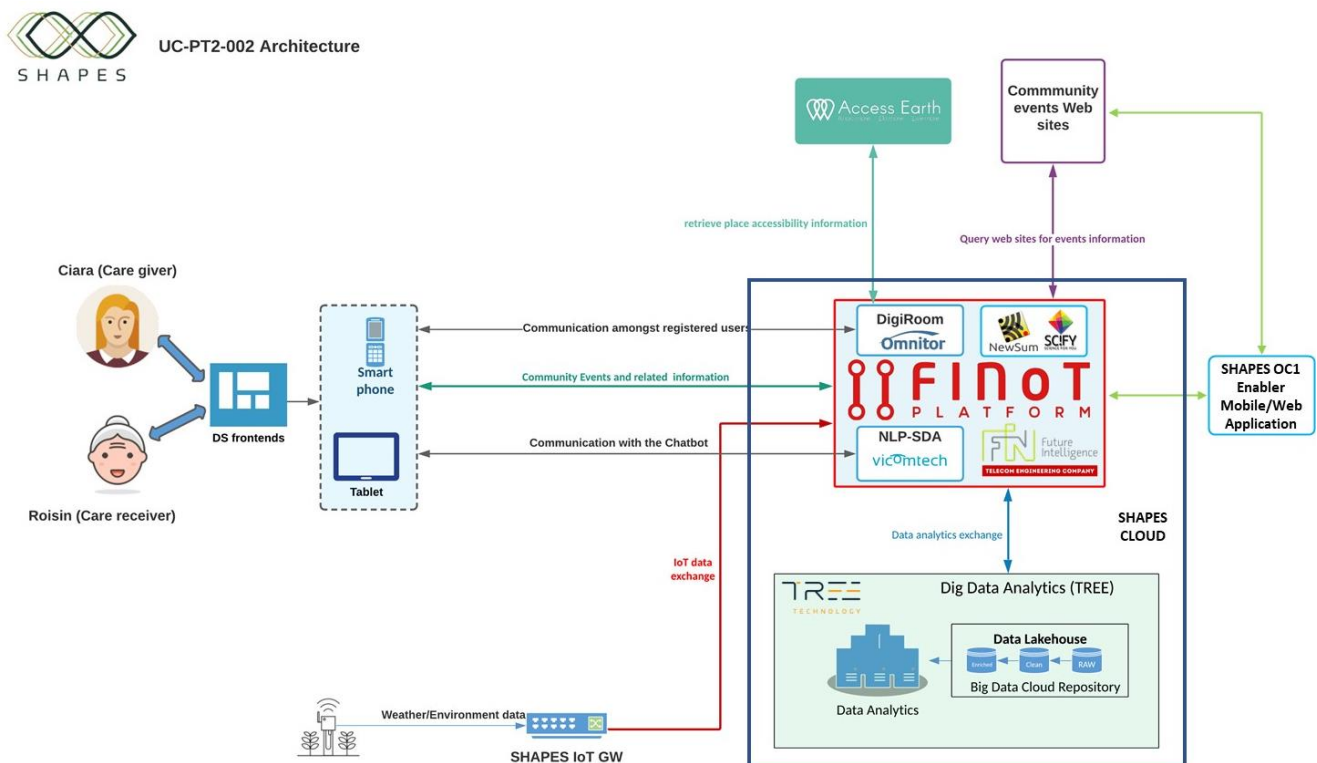
The diagram illustrates the positioning of the third-party mobile application with the applicable SHAPES solutions for enabling social support in local communities. The data uploaded to the SHAPES Technology Platform will be processed in the data analytics modules in order to understand which information is most related to a particular older individual and the results will be presented to the care receiver via a user friendly mobile application interface that will integrate the various information.

From the technical point of view the application provider must provide a solution fully interoperable with the SHAPES platform. In this sense an API is needed to transfer the collected information. The expected technologies include HTTP REST, OAuth 2.0 and JSON formatted data. Other ways of communication and exchange of data are also possible and can be discussed separately. Additionally,

technical support from the manufacturer may be required during the execution of the SHAPES pilots. Finally, the funding amount will cover all the technical adaptation works needed from the developer to connect its system to the SHAPES platform.

The following requirements need to be met for technical validation:

Criteria	Description
Community Events supported Languages	The Application must be able to discover and get community events from sites using various languages. The following list of languages is expected to be supported, in order of importance, for discovering the community events: German, Portuguese, Greek, Italian, and Czech
Authentication/Authoris ation (AA)	The application must be compatible with the SHAPES AA scheme.
HTTP REST API	The Application's services functionalities can be accessed via an HTTP REST API
Deployment	The application shall be in containerised (Docker) form and accompanied with a Kubernetes deployment yaml file
Event Recommendation service	The application shall provide an event recommendation service based on the user's preferences and history.

Deliverables

Name	Description	Type
API documentation	Documentation on how to use the Applications services	Report
Dockerised Application	The dockerised application image	Binary package
Deployment file	The Kubernetes deployment yaml file	Yaml file
Event Recommendation model	The trained event recommendation model	Text or binary file

Application module, the following technical support will be required:

- Support at performing the communications using the provided API
- Support at adapting Recommendation Model (RM) of Applications event recommendation service.
- Troubleshooting

Technical support may be required at any time over service period defined in a Commitment section.

Conditions of formal acceptance

Req.	Name	Description
1	Technical Viability	The solution can be integrated in the Shapes platform and meets the technical requirements abovementioned.
2	Delay	The delay associated to the consumption of the Application's services from the users' front-end application is low enough (does not degrade the overall user experience)

To ensure usability requirements a quality-testing will be performed using community members. If the recommended events are not satisfactory due to being no relevant with the user's preferences and or history, another test round will be performed after adapting the RM according to providers' instructions prior to any decision.

References

[1]   SHAPES project WEB portal: https://shapes2020.eu/

[2]   SHAPES Pilot Themes and Use Cases: https://shapes2020.eu/about-shapes/pilots/

[3]   Deliverable D2.6 "*SHAPES Personas and Use Cases V2*"

[4]   Deliverable D3.9 "*Final User Requirements for the SHAPES Platform*"

[5]   Deliverable D4.1 "*SHAPES Technological Platform (TP)*"

[6]   Deliverable D5.2 "*SHAPES Digital Solutions V.1*"

[7]   Deliverable D6.1 "*SHAPES Pan-European Pilot Campaign Plan*"

[8]   Deliverable D8.14 "SHAPES Ethical Framework Final version"

[9]   Deliverable D9.4 "*Open Calls for Innovation and Collaboration – Rules of Participation*"

[10]   symbIoTe project WEB portal: https://www.symbiote-h2020.eu/

[11]   symbIoTe GitHub repository: https://github.com/symbiote-h2020

Appendix A
Overview of SHAPES Platform Architecture

The SHAPES Technological Platform (TP) brings a combination of devices, software, and accessible modes of interacting within the living environment that can adapt to the needs and priorities of older individuals, including those facing permanent or temporary reduced functionality and capabilities.

A number of established Digital Solutions (DS) that comprise the SHAPES ecosystem are expected to interconnect and integrate with the SHAPES core Technological Platform (TP), which is depicted in the lilac-hued area of the Figure 1 below.
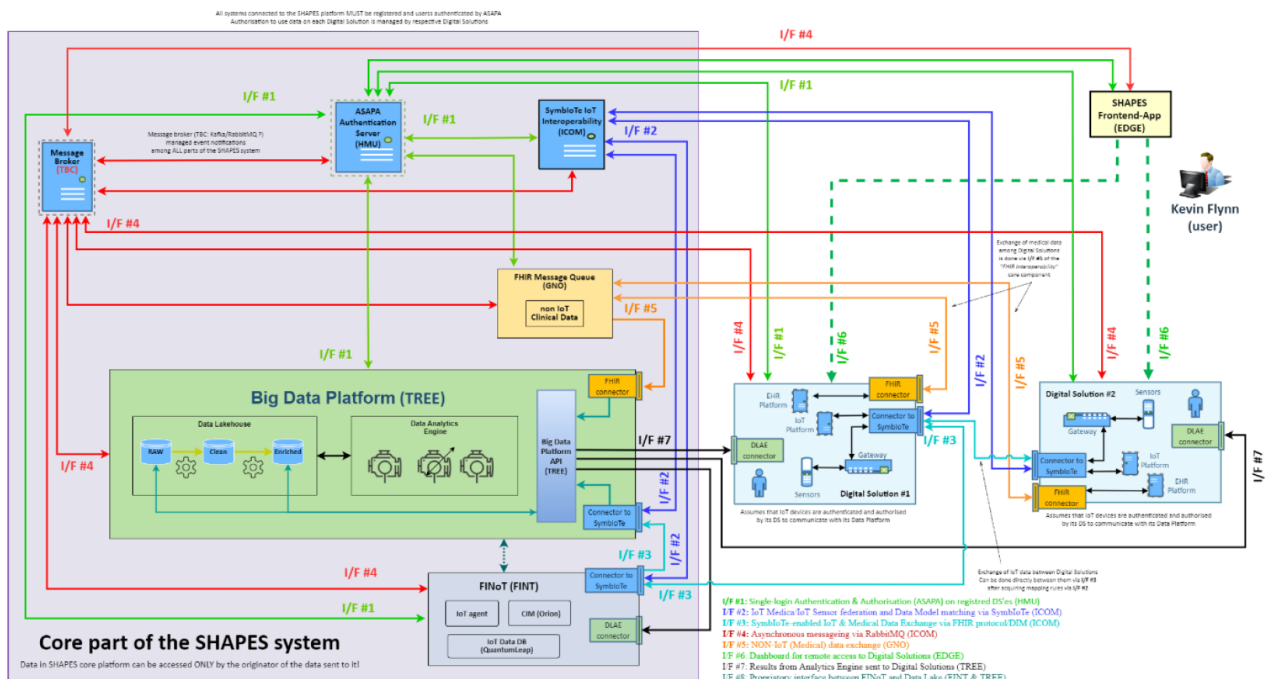

Figure 1. Shapes Core TP architecture.

A brief description of the main functionality of each core component within the realms of the SHAPES Technological Platform is given below:

- *SymbIoTe* IoT Interoperability Platform from ICOM is a mediation framework that facilitates the exchange of IoT Data between Digital Solutions and Platforms.

- *FINoT* IoT Data Management Platform from FINT is a FIWARE-based IoT framework, used to interconnect sensors, actuators and loggers. It acts as a central point for gathering IoT data, before these are fed to the Big Data Lake.

- *ASaPA* Single Sign-on Authentication engine from HMU offers authentication and authorization framework. Every user, digital solution, platform etc. is required to first register to the ASAPA component to get an authorization token in order to be able to interact within the SHAPES ecosystem.

- *Gateway* from FINT facilitates the interconnection of the edge IoT devices with the SHAPES Core cloud platform enabling as such the accommodation of the IoT collected data to the FINoT IoT platform (part of the SHAPES core).

- *FHIR* Medical Data Interoperability from GNO. The FHIR medical interoperability component facilitates the interoperability and communication among digital solutions that exchange medical-related information with each other and/or other SHAPES core components. Its main component

is the Message Queue (MQ), which allows the flow of medical-related resources among Digital Solutions or from Digital Solutions to the Datalake.

- *Big Data Platform* combining Data Lakehouse with Analytics Engine from TREE. The Data Lakehouse along with the Analytics Engine form the so-called Big data Platform that allows Digital Solutions to send their data to the Data Lakehouse for advance processing using AI-based Analytics Engine. Results from the Data Analytics Engine (DAE) are sent back to relevant Digital Solutions.

- *SHAPES Front-end Application* from EDGE, brings a simple user interface providing a centralized access to the SHAPES Digital Solutions installed in the participant's mobile phone or tablet. It also provides a mechanism for the single authentication of the user in the device

- *Message Broker* from ICOM, enables the asynchronous notification mechanisms for all core components and interconnected Digital Solutions to be able to schedule exchange of information among them, without a need for periodic checks.

A short description of the available interfaces between the SHAPES core components and the DS is given below. For a complete overview of the SHAPES TP and its interfaces employed to achieve seamless integration can be found in the D4.1.

Briefly, there are 8 interfaces within the SHAPES TP architecture. Briefly:

- I/F #1: **Interface between the various SHAPES Digital Solutions, the Front-end App and the ASAPA**. It is used to authenticate a user in the SHAPES Platform and SHAPES Digital Solutions. ASAPA upon an authentication request returns an authentication *token to be used to perform further actions within the SHAPES ecosystem.* (For more details, check D4.1, section 6.2.6.4 Authentication).

- I/F #2: **Interface between the SHAPES Digital Solutions and the SHAPES symbIoTe connector.** Upon successful authentication via the ASAPA component, Digital Solutions that wish to exchange IoT data between each other and the SHAPES Big Data Platform would need to become symbIoTe-enabled and deploy relevant symbIoTe mechanisms.

- I/F #3: **symbIoTe-enabled and IoT and Medical Data Exchange Protocol.**

- I/F #4 **Interface between the various SHAPES core components and Digital Solutions** to accommodate the need for asynchronous notification through a Messaging Queue service (the RabbitMQ here).

- I/F #5 **Interface between Digital Solutions** that need to integrate with the FHIR Queue to exchange non-IoT, medical data. **This FHIR Connector** enables the setup of a service to ingest non-IoT, medical data into Big Data Platform API in a scalable, secure, and compliant manner.

- I/F #6 **Interface between the Front-End App and Digital Solutions** to accommodate remote access to Digital Solutions in various use cases.

- I/F #7 **Interface between the Big Data Platform, the FINoT platform and the Digital Solution.** It transfers analysis results to either the FINoT platform and/or to appropriate DS.

- I/F #8 Interface between **the Big Data Platform and the FINoT platform. This is only a temporary solution** is to connect FINoT and Big Data Platform directly to exchange IoT data.

In SHAPES, there is a main distinction with regards to the data that DS handle and communicate either to each other or one/more SHAPES TP core components. These are categorized to i) IoT-related data and ii) medical related data. It has been agreed that medical-related data will go through the FHIR API (therefore IF #5), developed by GNOMON and this is presented in the following section. As far as the IoT data, these will go through the symbIoTe interoperability mechanism (IF), which has been extended in order to include and encapsulate new devices (and thus new record features) that are present in the SHAPES ecosystem.

Interoperability Aspects

SHAPES aims to deliver a scalable, standardized and interoperable technological platform (TP), which will enable the integration of various digital solutions in the healthcare domain. As described in D5.2, digital solutions in SHAPES range from assistive robots to eHealth wearables and IoT devices. In order for these solutions to interoperate, they need to ensure a common level of understanding among each other.

Therefore, semantic interoperability is needed to ensure seamless communication between DS across the SHAPES ecosystem. In SHAPES, we make the division between data regarded as Internet of Things (IoT), such as measurements, IoT metrics etc. and healthcare (medical) data, such as data questionnaires, medical records, etc.

To ensure interoperability in the IoT domain, SHAPES exploits the symbIoTe mediation framework, which in turn is based on several IoT standards that ensure seamless interoperation across diverse IoT devices and/or platforms. More information on the ontologies and standardization prototypes on which symbIoTe framework was built upon can be found in D4.1 (Section 2 5.2 and 5.5).

To ensure semantic interoperability between the e-health/medical Digital Solutions in SHAPES, the HL7 FHIR (Fast Healthcare Interoperability Resources) and the open MHealth standards were considered. More information on the FHIR component can be found in D4.1 (Section 6.2.4).

Appendix B
Scheduling of Pilot Themes

The table below shows up to date scheduling of Pilot Themes as of the end of December 2021.

For more details about Pilot Themes and their use cases refer to [7].

Pilot Theme	Use case leader	Mock-up tests	Prototype testing	Phase 4	Phase 5
PT1-001	CCS	Finalized	Jan-22	Feb-2022	Sep-22
PT1-002	CCS	Finalized	Waiting for voice assistant in German		Sep-22
PT1-003	CCS	Finalized	Jan-22	Feb-2022	Sep-22
PT1-004	CH	Finalized	Hands-on training finalized	Feb-May 2022	Jul-Nov 2022
PT2-001	GEWI	Finalized	Waiting for open call DS integration		
PT2-002	GEWI	Finalized	Jan/Feb 2022	Community interaction depends on pandemic situation	
PT2-003	AUTH	Finalized	Finalized	Ongoing (Integration of Open call DS)	Apr-2022
PT2-004	GEWI	Finalized	Ongoing		
PT3-gen	NHSCT	Finalized	Finalized	Dec 2021	
PT3-001	CH	Finalized	Finalized	Jan-Mar 2022	Apr-Jun 2022
PT3-001c	FNOL	Finalized	Finalized	Jan 2022	Apr-2022
PT3-COPD	FNOL	Finalized	Finalized	Jan 2022	Apr-2022
PT4-001	UVAR	Finalized	Ongoing	Feb-Nov 2022	Feb-Nov 2022
PT4-002	CH	Finalized	Ongoing	Feb-Aug 2022	Apr-Nov 2022
PT5-001	UPORTO	Finalized	Finalized	Finalized	Ongoing (replica sites)
PT5-002	UPORTO	Ongoing			
PT5-003	UPORTO	Ongoing			
PT5-004	AUTH	Finalized	Ongoing	Feb 2022	Jun-2022
PT6-001	UCLM/SAL	Finalized	Ongoing	Apr-Aug 2022	Sep-2022 Apr-2023
PT6-002	CH	Finalized	Feb 2022	Apr-Jun 2022	Oct-2022 Mar-2023
PT6-003	UCLM/SAL	Finalized	Ongoing	Apr-Aug 2022	Sep-2022 Apr-2023
PT6-004	UCLM/SAL	Finalized	Ongoing	Apr-Aug 2022	Sep 2022 Apr 2023
PT7-001	5thYPE	Finalized	Jan-Apr 2022	Jul-22	Dec 2022
PT7-002	5thYPE	Finalized	Jan-Apr 2022	Jul-22	Dec 2022
PT7-003	5thYPE	Finalized	Jan-Apr 2022	Jul-22	Dec 2022