D3.1 Report on Platform Specification and Architecture

Ambient Assisted Living Joint Programme

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Version	Authors	Date	Description
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0.2	KI-I, UCY, KARDE, HARPO, FRC	15.06.2020	First full draft of contents
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0.4	KI-I, UCY, KARDE, HARPO, FRC	26.06.2020	Penultimate version based on input from all partners
1.0	KI-I	29.06.2020	Final version

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List of Abbreviations (ascending order)

Abbreviation	Full name
AAL	Ambient Assisted Living
ACS	AsTeRICS Configuration Suite
API	Application Programming Interface
AR	Augmented Reality
ARE	AsTeRICS Runtime Environment
CMS	Content Management System
DB	Database
DoW	Description of Work
DTLS	Datagram Transport Layer Security
FRC	Frederick Research Center
HARPO	Harpo Sp. z o. o.
HTTP	Hypertext Transfer Protocol
ICE	Interactive Connectivity Establishment
IdP	Identity Provider
IP	Internet Protocol
KARDE	Karde AS
KI-I	Kompetenznetzwerk Informationstechnologie zur Förderung der Integration von Menschen mit Behinderungen
LAMP	**L**inux**A**pache**M**ySQL**P**HP (Technology stack for creating web services)
NAT	Network Address Translation

PLATUS	Platus Learning Systems GmbH
RasPi	Raspberry Pi 3 Model B+
REST	Representational State Transfer
S1	Smart nutrition and health service
S2	Smart home control service
S3	Smart city navigation service
S4	Smart home safety service
S5	Smart social communication service
SDP	Session Description Protocol
SRTP	Secure Real-time Transport Protocol
STUN	Session Traversal Utilities for NAT
TCP	Transmission Control Protocol
TURN	Traversal Using Relays around NAT
UCY	University of Cyprus
UDP	User Datagram Protocol
UI	User Interface
VR	Virtual Reality
WebRTC	Web Real-Time Communication
WP	Work Package

Executive Summary

The GUIDed project addresses the challenge of keeping older adults independent and functioning in their own homes for as long as possible by facilitating important activities of daily living through IT solutions. To achieve this, GUIDed will offer a selection of smart devices and services integrated in a smart kit based on budget options, while giving heavy emphasis on training the older users on using the service and maximizing their benefit.

The service categories of the GUIDed solution are:

1. Smart nutrition and health service (S1)
2. Smart home control service (S2)
3. Smart city navigation service (S3)
4. Smart home safety service (S4)
5. Smart social communication service (S5)

During task 3.1 the partners analysed the input from the DoW and drafted an outline for the platform specification and architecture. By obtaining the input from D2.1 of WP2, which consists of the demands and requirements of potential end users, the focus on more specific aspects was provided. The selection of the functions to be implemented as well as the respective assignment of priorities were conducted which deliver the foundation for this task's results.

The main platforms for realizing the final GUIDed product include the Android application on the client side, the Raspberry Pi with the ARE, a runtime environment that serves as the platform for the software modules, which serve as a hub for controlling smart home devices (S2 and S4) and the public cloud platform that handles the data storage, the services S1, S3 and S5, as well as the authentication service. The intention is to use and extend existing solutions such as AsTeRICS[1] or OpenHAB[2] as much as possible, whereas if the use cases cannot be supported well, proprietary GUIDed-specific components will be implemented. However, the focus lies on an architecture that enables an implementation that would be extensible for adding new services in the future.

This document also includes the ideas about how to address the implementation of specific functions. As to one problem exist multiple solutions some considerations were included that were regarded as reasonable alternatives in the beginning but seem to be less convenient as a result of the conducted research.

[1] https://www.asterics.eu/

[2] https://www.openhab.org/

1 Introduction

This document describes the final system specification as the output of task 3.1 in WP3. It includes the hardware specification and the system architecture. The foundation for the system specification was defined in the DoW. Task 2.1 of WP2, End-users Involvement and Experimental Evaluation, provided further input by analysing the demand for assisted living solutions.

The report starts by summarizing the previous input from the DoW and task 2.1 before summarizing the service functions finally agreed upon for implementation. It then proceeds by presenting the high-level platform specification and architecture in section 2. In section 3, the architecture is described in more detail and considerations are elaborated. Section 4 wraps up the results of the report.

1.1 Starting Position

In the DoW the GUIDed partners defined the initial architecture as shown in Figure 1. It includes the Raspberry based smart platform/hub which was intended to host the Web APIs, the web portal, the plugins that represent the five services and the database while being connected to specific sensors and actuators. Apart from the Raspberry Pi, the initial system concept includes mobile devices that run an Android application with AR functionality to recognize for example a switch (actuator) or a pillbox and obtain information or controls for adjusting data (e.g. pill taken) or smart home devices (e.g. turn on light).

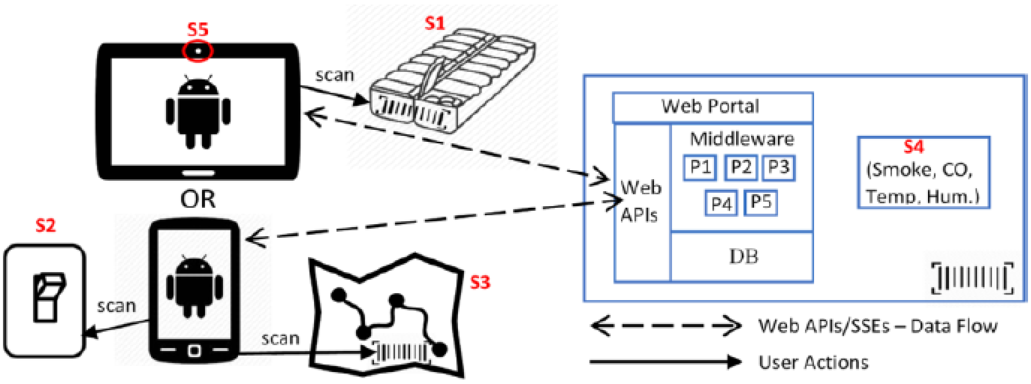

Figure 1: Initial High-Level Architecture

1.2 Considerations of the Outcomes of the User Demand Analysis

In the following tables (1-5) the consortium partners summarize the functions per service category that were seen as beneficial by potential end users. Furthermore, two columns representing the implementation perspective were added. The columns' entries which define if one function is in scope and if so what priority is assigned are based on discussions within the technical team in agreement with the business partners. These evaluations are based on given platform possibilities or constraints, end user needs, given hardware and the project timeline. The priority for a function is assessed by a scale of one to five (1-5) with one (1) being the most important and five (5) the least important function.

Service	Function	Remark	Priority
S1	Reminder-function for pills	In scope	1

	Order function for pills	Out of scope	
	Information of medication	Out of Scope	
	Blood pressure measurement	Out of Scope	
	Sugar measurement	Out of Scope	
	Cooking recipes	In Scope	3
	Nutritional facts of food	In Scope	5
	Information about medication in layman language	In Scope	2
	Point at plate or glass and get calorie count	Out of Scope	
	Scientific information about all new “miracle medicines” and “health vitamins”	Out of Scope	
	Growing tips for herbs and vegetables	In Scope	4

Table 1: Smart Nutrition and Health Service (S1)

Service	Function	Remark	Priority
S2	Light switch (button instead of slider preferred)	In scope	1
	Control the television	Out of scope	
	Control the front door (with intercom)	Out of Scope	
	Wake up alarms	Out of Scope	
	Remote control of house appliances	Out of Scope	
	Stove watch	Out of Scope	
	Web camera for remote monitoring	Out of Scope	
	Energy conservation	Out of Scope	

Table 2: Smart Home Control Service (S2)

Service	Function	Remark	Priority
S3	Point of interest (POI)	Out of Scope	
	Information about new places of interest in neighbourhood, e.g. new restaurants	Out of Scope	
	Virtual tours	In Scope	4
	Close ups of POI	Out of Scope	
	Help to find the right direction to walk	In Scope	1

Table 3: Smart City Navigation Service (S3)

Service	Function	Remark	Priority
S4	Call help service	In Scope	2
	Smoke detector	In scope	1
	Gas detector	In scope	1
	Door alarm if door opens during night	In Scope	3
	Burglary camera for cottage	Out of Scope	

Table 4: Smart Home Safety Service (S4)

Service	Function	Remark	Priority
S5	Picture of person to call	In Scope	1
	Exchange recipes and chat	Out of Scope	
	Automatic answering	Out of Scope	

Table 5: Smart Social Communication Service (S5)

1.3 Final Set of Service Functions

Table 6 represents the final set of service functions that will be implemented in the course of WP3. The data is taken from the previous section as well as from the DoW for functions that were not mentioned by the user interviews in WP2. Functions with priority 1-2 are definite candidates for implementation in the GUIDed project, whereas functions with a lower priority will be implemented based on the remaining resources in the project.

Service	Function	Priority
S1	Reminder-function for pills	1
	Cooking recipes	3
	Nutritional facts of food	5
	Information about medication in layman language	2
	Growing tips for herbs and vegetables	4
S2	Light switch	1
	Smart Switch	3
	Interface to a variation of systems provided through AsTeRICS and OpenHAB → vast possibilities to include additional devices into GUIDed product in future	2
S3	Virtual tours	4
	Help to find the right direction to walk	1
S4	Call help service	2
	Smoke detector	1
	Gas detector	1
	Door alarm if door opens during night	3
	Notify secondary users if sensors signal alarming values	1
S5	Picture of person to call	1
	Video calls with augmented experience	1
	Possibility to speak to a random person (matching the language) via the communication service (if the other person has agreed in advance)	3

Table 6: Final GUIDed Functions per Service Category

2 High Level Platform Specification and Architecture

2.1 Platform and Architecture Goals

Goals for the platform specification and architecture can be divided into functional and non-functional goals. Functional goals represent the service functions the final system is expected to provide, as summarized in section 1.3. The non-functional goals, that include the quality of service, development objectives or architectural constraints, are as follows:

Quality of service:

- Safety: no harm may occur to the user when properly using the system
- Security: minimized vulnerabilities for malicious attacks
- Usability & accessibility: easy to use and inclusive (elderly people)
- Interoperability: include different smart home vendors; usable on different Android versions.

Development goals:

- Extension/reuse of existing open-source technologies
    - AsTeRICS
    - Property4All[3]
    - OpenHAB
- Maintainability: adaptable to specific end user needs
- Extensibility: create a system that can be extended in the future.

Architectural constraints:

- Distribution of human agents: primary-, secondary- and tertiary users, administrators
- Distribution of physical devices: Raspberry Pi and smart home devices in the residence of the primary user, client software application on the mobile device
- Distribution of data: mainly on the cloud; configuration data on the Raspberry Pi and Android client application.

The taxonomy for the platform and architecture goals was provided by Laamswerde A. (2003)[4].

2.2 Hardware Specification

One of the main goals of the GUIDed project is to assemble the smart platform. The platform is composed of the smart hub and a set of sensors and actuators that may be adapted to the individual user needs. The smart hub is the central component of the smart platform. It is based on a Raspberry Pi 3 Model B+ (RasPi) with the Raspbian operating system. The main application running on the hub is AsTeRICS Runtime Environment (ARE). ARE offers connections to the modern home automation standards such as KNX, Zigbee, Zwave and Easywave. Therefore, the hub can play a role in the home automation center in the primary users' homes. The smart platform will be a hardware component for the Smart Home Control Service (S2) and the Smart Home Safety Service (S4). Figure 2 shows an example of the Raspberry Pi 3 Model B+. Table 7 summarizes the key specifications for the RasPi and Table 8 describes the smart platform hardware components.

Figure 2: Raspberry Pi 3 Model B+

[3] http://www.prosperity4all.eu/

[4] https://link.springer.com/chapter/10.1007/978-3-540-39800-4_2

Component	Specification
Processor	Broadcom BCM2837B0, Cortex-A53 (ARMv8) 64-bit SoC @ 1.4GHz
RAM	1GB LPDDR2 SDRAM
Wireless Connectivity	2.4GHz and 5GHz IEEE 802.11.b/g/n/ac wireless LAN, Bluetooth 4.2, BLE
Ethernet	Gigabit Ethernet over USB 2.0 (maximum throughput 300 Mbps)
Ports	4 × USB 2.0 ports, full size HDMI, MIPI DSI display port, MIPI CSI camera port. 4-pole stereo output and composite video port, Extended 40-pin GPIO header, Micro SD

Table 7: The Raspberry Pi 3 Model B+ Specification

ID	Hardware	Components
H1	Smart Hub	(1) Raspberry Pi 3 Model B+ Hardware Board; (2) MICRO USB 5V 3000mAh Transformer; (3) Raspberry Pi 3 Official case; (4) SD card 8GB class 10 with Raspbian; (5) HDMI High quality 1m 1.4V Full HD 1080P; Ethernet Cable 1m; Coolers for Raspberry Pi 3 Model B+; (6) Wireless LOGITECH Keyboard/ Mouse MK220
H2	Air Quality Sensors	E.g.: MQ2 (Methane, Butane, LPG, smoke), MQ7 (Carbon Monoxide) sensors
H3	Ambient Environment Sensors	E.g.: Adafruit Sensiron SHT31-D (Temperature & Humidity Sensor Breakout), Sense HAT (Orientation, Pressure, H Temperature)
H4	Smart Home Actuators	E.g: TP-Link LB130 Smart LED Wi-Fi Light Hue White A19 E27
H5	Wide Angle Lens	CYGNETT GoCapture 140 Degree Universal Wide Angle Glass Lens for Smartphones and Tablets, Mpow Fisheye Lens,3 in 1 Clip-On Lens Kits 180 Degree Fisheye Lens
H6	Easywave Transceiver	RX11 ELDAT Universal Transceiver Modules

Table 8: Smart Platform Hardware Components

2.3 Systems Architecture

The GUIDed system is composed of the backend platform and the Android mobile application. The backend platform provides the implementation of the key modules that deliver the main functionality of the system services, as these are illustrated in the following diagram. The modules are explained on the following figure and are analysed in detail in the following sections of the deliverable. The backend platform will be developed using the Linux, Apache, MySQL, and PHP (LAMP) stack and will be delivered as a Drupal-based hybrid CMS (Content Management System), which will be deployed on the public cloud (i.e., DigitalOcean). The hybrid CMS will provide the administrator web system, the Drupal-based Web APIs and the push notifications. A push notification in this case refers to a remote notification "pushed" from the server to the user even when the application is not running. Primarily, the administrator web system offers the capability to administrators and secondary users to enter and manage the information via the CMS, which will be stored in a MySQL database. The Web APIs and the push notifications provide the capability to interact with the Android AR/VR mobile application using HTTP requests and event-driven push notifications that are initiated from the server.

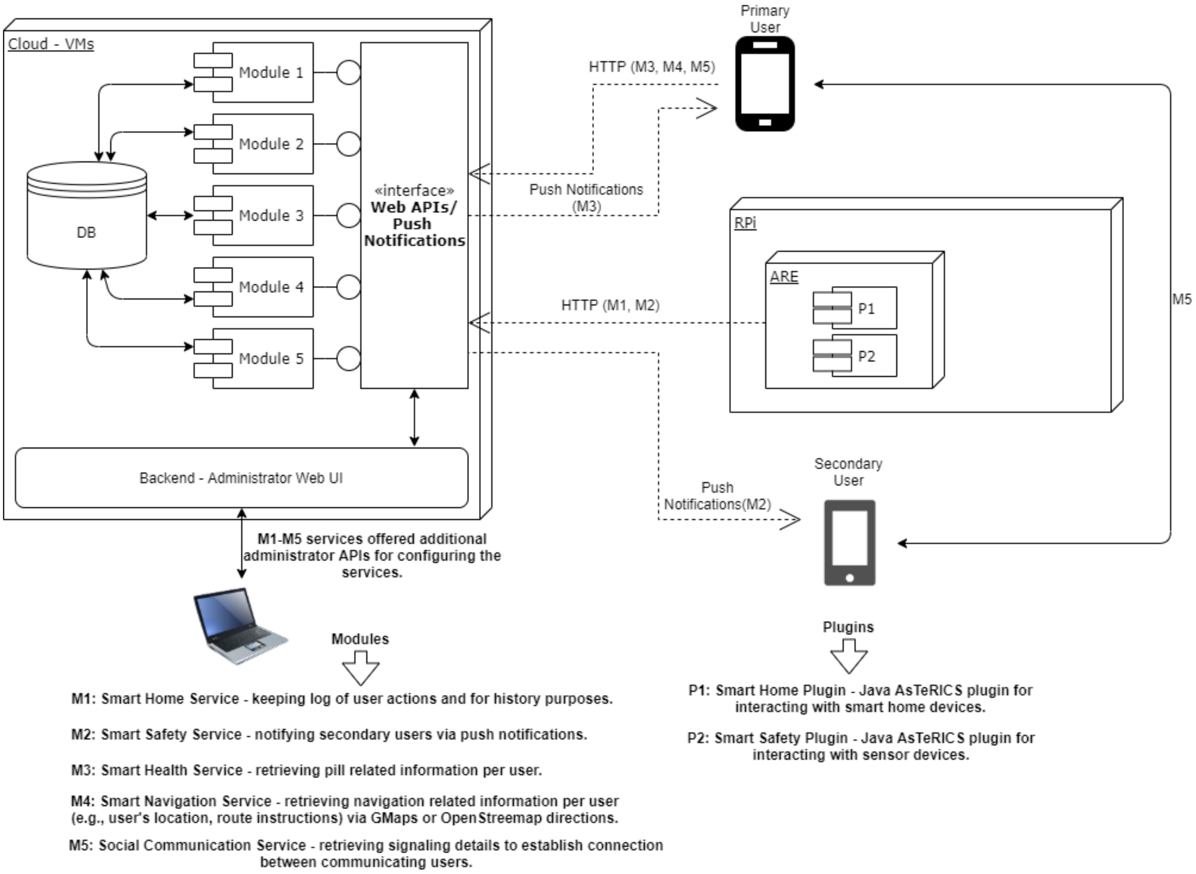

Figure 3: GUIDed high-level architecture

Furthermore, two of the system services (M1, M2) are supported at the home through the re-use of the AsTeRICS framework and the implementation of the necessary plugins that allow controlling and interacting with smart home devices. The communication with these devices is provided via the smart hub that will be configured in this project based on the Raspberry Pi 3 micro-controller board. Finally, both the Drupal backend platform and the AsTeRICS framework (deployed at the home on the smart hub) are based on an extensible and plug-in based plug-n-play architecture. Therefore, although in this project the five services and the necessary plugins will be implemented, the GUIDed system architecture is defined and designed in such a way, so as to allow the extension and evolution of the system beyond the project lifetime. This will allow the GUIDed product to adapt and evolve in the future to offer additional AR/VR based services and support additional smart home devices.

3 Systems Design

3.1 Raspberry Pi Hub: Smart Home Control and Safety Modules

This section describes the imagined user perspectives and the related software architecture when using the GUIDed services 2 and 4. This includes receiving and processing requests for controlling the home environment as well as sending requests to the cloud server to notify all registered users per Raspberry Pi Hub (RasPi Hub) if any sensor-indicated hazard occurs.

The UIs are represented by prototypes depicting realistic scenarios from a mobile camera view. The architecture is represented as a semi-formal implementation model that adheres to the principles of object-oriented design.

3.1.1 User Interface Prototypes

Figure 4 shows the user interfaces that would communicate with the RasPi Hub. When the camera is pointed towards a light the controls are loaded and the user may turn the light off or on. For the safety module the client application would show the status of the sensors and notify the user and related secondary users if for example smoke is detected.

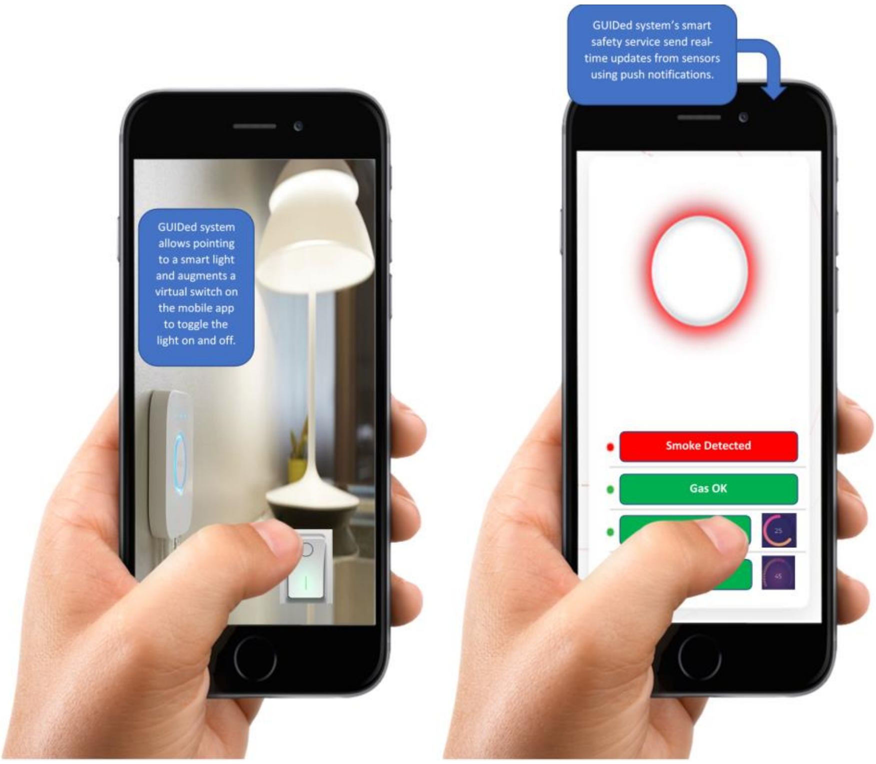

Figure 4: Smart Home Control (left) and Smart Safety (right) - Concept Prototype UI

3.1.2 Implementation Models

For the RasPi Hub system design following assumptions are defined, whereas specific details may be subject to change during the project:

- The RasPi Hub receives requests (for smart home commands) either within the local network or over the GUIDed cloud from an Android client application.
- It checks for authentication/authorization (remote call to public cloud endpoint).
- It saves the login state of the client to allow interactions with less overhead.

- It proceeds the commands to the specific transceiver adapters (e.g. EldatPlugin, HuePlugin) that communicate with the smart home environment.
- The mapping between client commands on the frontend and specific backend smart home commands needs to be configured. It is assumed that this data is maintained on the public cloud.

During technical discussions and the examination of given systems and technologies the technical partners discussed two conceptual implementation models. The initial approach is shown in Figure 5. It mainly relies on AsTeRICS plugins for receiving client requests, calling the remote authentication and authorization service, processing the requests in order to send commands to the smart home environment and sending back responses to the clients. The maintenance of the AsTeRICS model would be conducted over the WebACS which can be done in the local network by indicating the RasPi Hub IP-address. Over the WebACS one user can retrieve the AsTeRICS model deployed in the ARE environment, if any is deployed, and reconfigure it or create a new one and deploy (upload) it to the ARE. However, one problem with this model is that the ARE WebService that represents a REST API for the ARE system is only used by the WebACS and not the gateway component "InternetGateway". Consequently, the functionality would need to be reinvented in the "InternetGateway" plugin. One advantage with the approach in Figure 5 is that it would exclusively rely on the ARE as the functions would be implemented within AsTeRICS plugins.

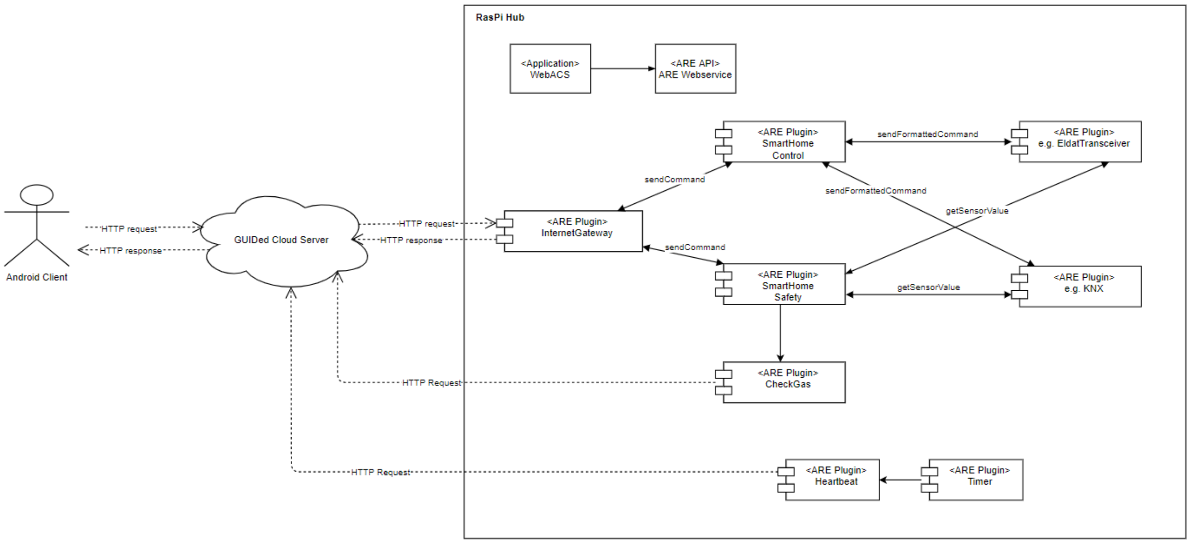

Figure 5: Implementation Model Approach 1

The second implementation model in Figure 6 represents a different approach. It defines a proprietary gateway application outside the ARE named "RasPi GUIDed WebService". It receives requests and sends responses, checks for authentication/authorization (remote call to public cloud) and proceeds commands to the AsTeRICS plugins via the existing ARE WebService (REST API). Furthermore, it would include a heartbeat function instead of having a specific plugin for doing so. It would also save the states of the smart home devices provided through an ARE plugin "DeviceStateLogger" which enables the tracking of device states and sensor values and the eventual notification of secondary users if some hazard is sensed. The ARE WebService is both utilized for configuring the model and sending the commands extracted from the client requests to the respective ARE smart home plugins. This approach has the advantage that there are fewer plugins and interrelations between them to consider as it would be the case with the initial approach in Figure 5.

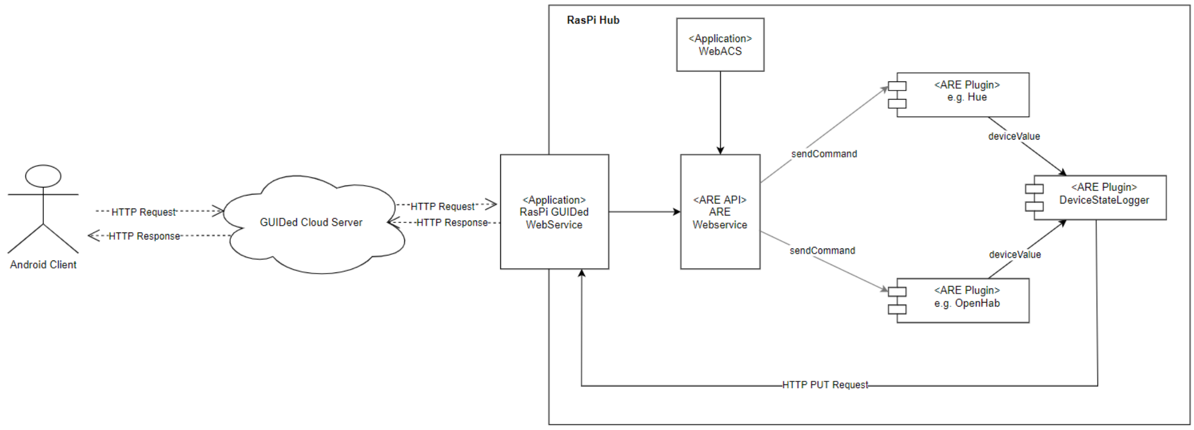

Figure 6: Implementation Model Approach 2

3.2 Cloud Server

3.2.1 Smart Health Module

The smart health service aims to provide an augmented experience in order to support the older adult and assist him/her in the process of taking the medication at the right time (see Figure 7). It offers the capability to the user to retrieve information in simple terms (i.e., plain language) on the pills he/she should take and at what day and time each should be taken. Moreover, the service provides reminders in the form of push notifications to the user when it is time to take the medication.

Figure 7: Smart Health Service - Concept Prototype UI

The primary user needs to perform the following steps:

- Step 1: It uses the Android smartphone or tablet device to click and start the GUIDed mobile application and initiate the smart health service.
- Step 2: The user points the camera to the pillbox.

- Step 3: The user receives relevant information. In specific, the user can see information such as when to take each pill. The user may also be able to select which pill he/she has taken.

Finally, as aforementioned, reminders will be also available in the case it is time to take a pill and the user has neglected to do so.

3.2.2 Smart Navigation Module

The smart navigation service aims to offer an augmented experience by providing directions in a more “natural” way, complementing the “traditional” Google maps like directions.

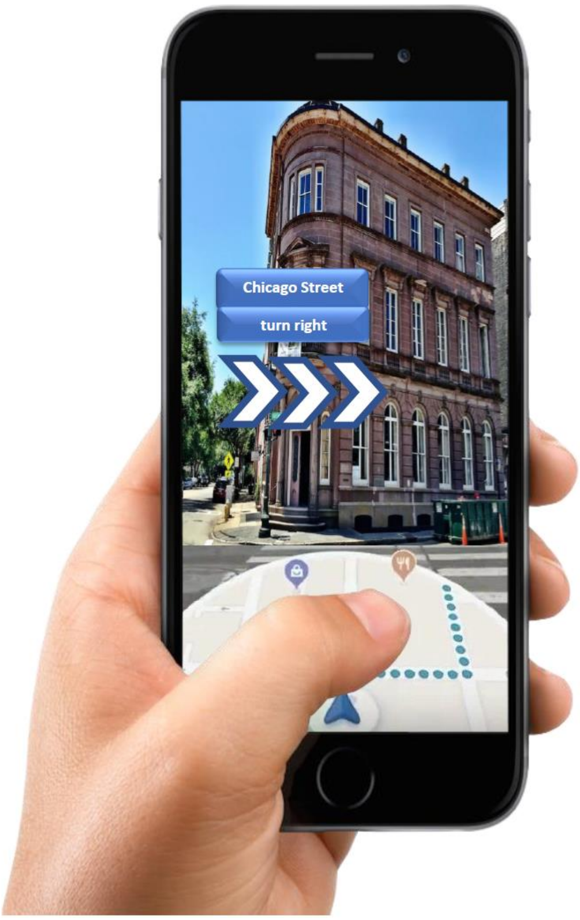

Figure 8: Smart Navigation Service - Concept Prototype UI

In specific, the primary user needs to perform the following steps to use the service:

- Step 1: The user opens the GUIDed Android application and searches by address for directions from point A to point B.
- Step 2: The resulting route is generated, the route is selected by the user and the camera navigation view is loaded.
- Step 3: The app loads directions to the destination where the Google Maps or OpenStreetMap directions view is shown at the bottom of the screen and the AR/VR directions are shown on the same screen at the upper part (see Figure 8).

3.2.3 Social Communication Module

The social communication service aims to offer a sense of real-life physical presence between the older adult and the communicating family member, healthcare provider or friend, avoiding thus social isolation and loneliness. Using the service, older adults can keep in contact with family and friends while engaging in everyday activities such as eating together, drawing with the grandchildren and knitting.

To achieve the above, a video calling application will be designed and developed with a simple to use and user-friendly User Interface (UI) for older adults, not only those that are technology competent and have experience with modern technology, but also those who do not. In addition, state-of-the-art video call technologies will be utilized to offer a unique experience to primary users: the envisioned approach is described as follows:

- Step 1: The primary user opens up the GUIDed application on his/her smartphone/tablet.
- Step 2: The primary user selects the picture of the person to conduct a video call. This picture will be made available from the application to the primary user.
- Step 3: Based on the picture selected by the user, the connected person is called via an internet-based video call. Secondary users have access to the social communication service through their smartphones/tablets as well.
- Step 4: At any given time, any of the communicating users may terminate the video call. Then, the social communication service exits and the GUIDed application home screen appears to the user.

The main functionality of the social communication service includes video calls between primary users, as well as between primary and secondary users. A user may participate in such a video call only through his/her GUIDed account: the service is able to connect exclusively GUIDed accounts.

3.2.3.1 "Connect with strangers!"

A secondary functionality called *"Connect with strangers!"* to be designed and developed is the following: the GUIDed social communication service will enable primary users to conduct video calls to a random GUIDed primary user, provided that the remote user agrees to this communication and that the preferred languages of the two users match. The steps of this functionality are the following:

- Step 1: The primary user (user1) opens the GUIDed application on his/her smartphone/tablet and initiates the social communication service.
- Step 2: user1 initiates the "*Connect with strangers!*" functionality by pressing the respective software button. The service randomly selects a primary user (user2) from the pool of GUIDed users with the same language preferences as user1 and prompts him/her if he/she would like to conduct a video call with user1.
- Step 3: If user2 accepts, user1 and user2 connect and conduct a video call between them.
- Step 4: The two users are enabled to permanently connect their GUIDed accounts by becoming friends. In case both accept to be friends, with the press of a "become friend" software button each user is entered in the other user's contacts list and are no longer

considered by the service as strangers. In future use of the *"Connect with strangers!"* service by user1, user2 will be excluded from the random user selection process, and vice versa.

3.2.3.2 Social Communication Service Architecture Schema

Figure 9 shows the Social Communication Service Architecture Schema. Using the AR/VR functionality, the remote client is automatically selected by the service and connected to the primary user.

Regarding the technology to be used for the development of the Social Communication Service, the WebRTC (Web Real-Time Communication) is perceived as the most appropriate technology to use. WebRTC enables web applications to exchange video and audio streams, as well as other data, in a peer-to-peer fashion. The technology is available on all modern browsers and native clients for all major platforms. The WebRTC technologies are implemented as an open web standard and are available as JavaScript APIs in all major browsers. For Android applications a WebRTC library is available.

WebRTC was selected as it is widely used, open-source, and supported by major actors in the field such as Apple, Google, Microsoft and Mozilla.

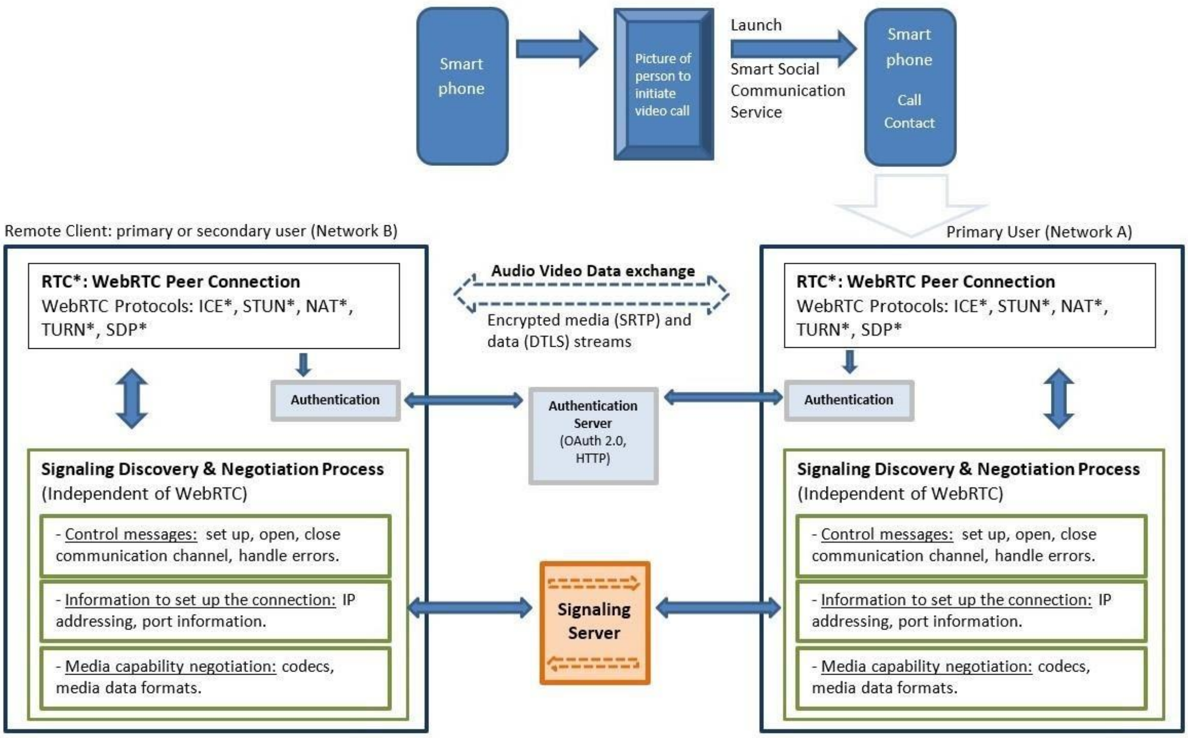

Figure 9: Social Communication Service Architecture Schema

Interactive Connectivity Establishment (ICE) is the framework responsible for allowing web browsers to connect to other web browsers (peer to peer connection). A direct connection from browser 1 to browser 2 would not work for reasons such as firewalls, that clients usually do not have a unique public IP address, and that routers do not allow clients to directly connect with peers. Thus, data need to relay through intermediate servers. ICE uses STUN and/or TURN servers.

Session Traversal Utilities for NAT (STUN): a protocol that discovers a client's public address and determine any restrictions in the client's router that would prevent a direct connection with a peer.

Network Address Translation (NAT): assigns clients with a public IP address. Requests are translated from the client's private IP to the router's public IP. The client can now be discovered on the Internet.

Traversal Using Relays around NAT (TURN): bypasses the Symmetric NAT restriction of routers by opening a connection with a TURN server and relaying all information through that server. The Symmetric NAT restriction imposes that the router will only accept connections from peers the client has previously connected to.

Session Description Protocol (SDP): describes the multimedia content of the connection (resolution, formats, codecs, encryption, etc.) using metadata. The aim is both peers to understand each other once the data begin to be transferred.

3.2.3.3 WebRTC APIs

Three important WebRTC APIs are used for communication.

getUserMedia: the API used for accessing the needed hardware for the video call, i.e. the camera and the microphone on the user's device (PC or smartphone).

RTCPeerConnection: represents the WebRTC connection between the local client (user) and the remote client (another remote user). Its methods include initiating, maintaining and monitoring the connection, and close the connection after the call has been completed. RTCPeerConnection uses UDP/IP, meaning that there is no guarantee of packet arrival as is the case when using TCP/IP, but with the advantage of the reduced overhead that offers better real-time communication.

RTCDataChannel: it is the network channel used for peer-to-peer data exchange between the two connected users.

3.2.3.4 WebRTC Encryption and Communication Security

Real-time communication between users imposes security risks, most important and most common being the interception of the video call by unwanted persons (eavesdropping). This security risk can happen in communications where the data transferred from one peer to the other are not encrypted. By applying however encryption techniques, the communication becomes secure, as it is impossible for third parties to determine the contents of the communication. The two communicating users utilize a secret encryption key to successfully decode the communication streams.

WebRTC uses encryption throughout the communication process and for all media streams. The encryption protocols include Datagram Transport Layer Security (DTLS) for encrypting data streams, and Secure Real-time Transport Protocol (SRTP) to encrypt media streams.

3.2.3.5 WebRTC User Authentication

WebRTC does not define any specific requirements on the authentication services an application should use, leaving thus the decision on the developer of the application. As there exist a number of web-based identity providers (IdP) that use social media accounts (Facebook's Facebook Connect, Twitter's OAuth), it would be possible to utilize the end-users' social accounts for authentication. However, this will heavily depend on whether the end-users indeed use/maintain social accounts. Otherwise, alternative authentication techniques will be utilized.

WebRTC Session Controller Security Schemes

User authentication takes place before the WebRTC Session Controller starts to process any signalling traffic. The WebRTC Session Controller supports the following authentication schemes:

- Guest authentication: allows anonymous guest access to WebRTC Session Controller.
- HTTP authentication: sends a HTTP GET request to a remote HTTP endpoint (e.g. a REST endpoint) using HTTP BASIC authentication headers. A return code of 200 indications that authentication was successful.
- OAuth 2.0 authentication: uses OAuth 2.0 authentication support provided by companies such as Facebook or Google and lets WebRTC Session Controller retrieve user information such as an email address, with the consent of that user.

3.2.3.6 Proprietary APIs

There are also a number of proprietary APIs that can be used to develop Video Calling applications. We are mentioning them for completeness of our research: Pubnub https://www.pubnub.com/, cometchat https://www.cometchat.com/, Twilio https://ahoy.twilio.com/, quickblox https://docs.quickblox.com/, sinch https://www.sinch.com/, tokbox https://tokbox.com/developer/.

3.2.3.7 An Alternative Solution

UCY has examined an alternative approach to developing the Social Communication Service, as depicted in Figure 10. This approach proposes using several the well-known, widely used video calling apps that have already been established for usage with Android smartphones. Such applications constitute Facebook Messenger, WhatsApp, Viber and Skype.

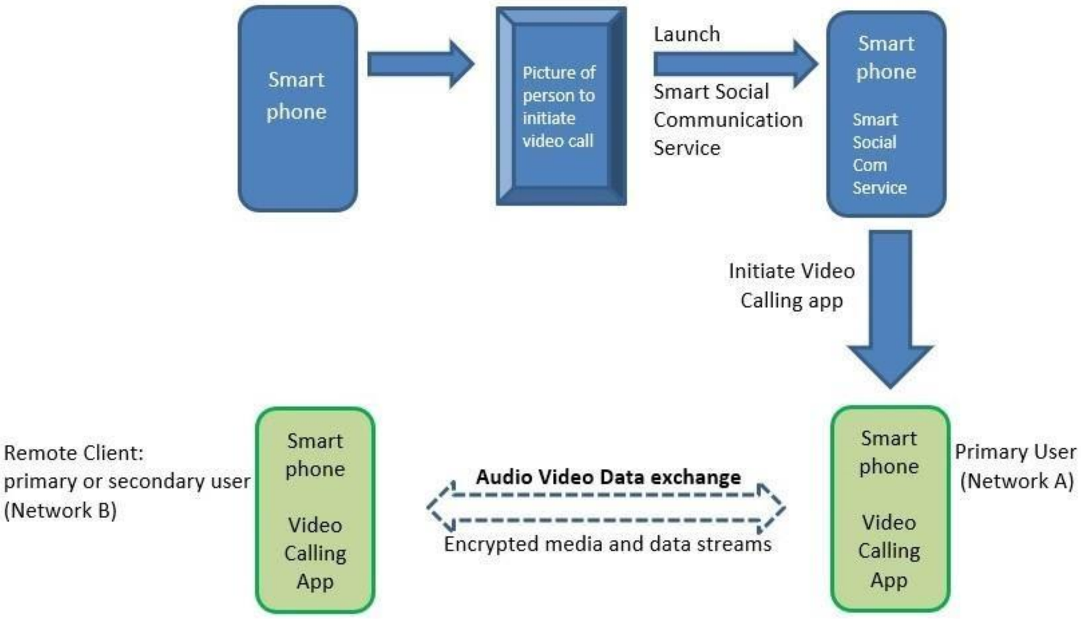

Figure 10: An Alternative Architecture Schema

The advantages of such an approach are:

- Most end-users are already familiar with at least one video calling app.
- Easy to be developed: may provide an interconnection with many video calling apps to cover wider user preferences.
- No need to worry about security, privacy, authentication.

A risk to this approach is that the video calling apps could at any point change/update their APIs, making the service to not work properly.

The consortium decided that the alternative approach would fail to satisfy the user requirements that dictate a user-friendly, accessible and very easy to use UI, where older adults' particular needs and wants would be reflected. Therefore, the consortium decided to develop the Social Communication Service from scratch, using WebRTC as the most appropriate technology. The selected approach also enables us to contribute to addressing the aspect of isolation, loneliness and promoting sociability in an additional manner that the alternative approach does not; through the "Connect with strangers!" functionality.

4 Conclusion

This report presents the main ideas of work conducted by the project partners in WP3 for task 3.1. It defines the platform specification and architecture for the goal system based on the user requirement analysis from WP2, the outline of functions from the DoW and the subsequent discussion of functions that are set to be implemented during the project. Furthermore, it summarizes some technologies and alternatives that were discussed. With the findings summarized in this report the project team will be able to follow a systematic outline for realizing the GUIDed services.