SMARTBEAR

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Trusted digital solutions and Cybersecurity in Health and Care
TOPIC DT-TDS-01-2019
Smart and healthy living at home

SMART BEAR

"Smart Big Data Platform to Offer Evidence-based Personalised Support for Healthy and Independent Living at Home"

D3.5 – SMART BEAR @ Home Enabling Components v3

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D3.5 – SMART BEAR @ Home Enabling Components v3

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Executive Summary

This document serves as a comprehensive overview of the advancements made in the context of integrating devices and sensors harmonised through the central hub of the Smart Bear solution, the Mobile Application. The process of device integration and mobile application development is meticulously documented in this demonstrator, replete with the latest proof-of-concept data and operational software executables. The present document thus functions as a showcase, unveiling aspects of the updates of the actual deployment, harmonisation, and functioning of these devices in real-world scenarios. These scenarios encompass laboratory environments, where the convenience and utility of the Smart Bear solution have been rigorously tested and validated. For a more exhaustive understanding of the project's journey, encompassing the minutiae of the endeavours and outcomes, one should be directed towards the companion deliverable, D3.6, which offers a comprehensive repository of all the pertinent specifics and findings.

The introduction provides a thorough view of the current implementation, aligning it with the initial expectations outlined in the Grant Agreement, while also listing the currently implemented devices. **Chapter 1** pertains to the demonstration of HomeHub and Home Automation, which can be replicated in the pilots of the Smart Bear project, transforming users' homes into smart ecosystems through the integration of sensing and actuation devices. This ecosystem encompasses the measurement of crucial aspects of daily life, such as temperature and humidity, among others, with the potential to enhance healthy and independent living. The updates within this project phase encompass software installation, validation of the developed services, and deployment of the solution within a Kubernetes cluster.

Chapter 2 is dedicated to the demonstration of the Smart Bear Mobile Application, serving as the primary interface within the Smart Bear project, aiding the elderly participants in monitoring their physiological and health-related metrics. The present operational iteration of the mobile application was employed to showcase advancements pertaining to user interface enhancements. Updates concerning the mobile application also include the integration of measurements from newly incorporated medical devices, support for hearing aid devices and their associated mobile application screens, refined mobile interface design, the creation of cognitive games, and the handling of GDPR requests, among various other notable developments.

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Introduction

The objective of this deliverable is to underscore the implementation efforts carried out during the third phase of the Home Enabling Components within the framework of the Smart Bear project. These efforts were directed at achieving the established objectives within WP3. Specifically, the update and completion of the HomeHub sensory ecosystem synthesis required the installation and preconfiguration of both the hardware and software components, in preparation for their deployment on a larger scale in the pilot initiatives.

The primary function of this ecosystem is to facilitate the integration and harmonisation of a diverse array of disparate devices and sensors. This integration is crucial for the purpose of gathering and consolidating health-related and physiological measurements. The primary processing unit responsible for this task is the Raspberry Pi, which unifies Zigbee-powered smart home devices chosen for their advantageous feature of low energy consumption.

The Smart Bear Mobile Application serves as the central node for the coordination of both the transmission and monitoring of data collected with the wearable devices and home sensors. This application plays a pivotal role not only in managing the data generated within the smart home environment but also in seamlessly integrating an extensive array of medical devices, including but not limited to thermometers and oximeters. This application is equipped with the requisite software development kits (SDKs) and application programming interfaces (APIs) to facilitate this process. For a comprehensive overview of the anticipated outcomes versus the actual achievements, please refer to Table 1.

Table 1: The expected outcomes vs the actual achieved ones.

Deliverable Description as described in the Grant Agreement	**Actual Implementation**
Smart Bear @ Home Enabling Components v3 (Demonstrator): This deliverable will include the third version of the implementation of SMART BEAR @ Home Enabling Components.	The third iteration of the SMART BEAR @ Home Enabling Components implementation demonstrator showcases the progress made in the incorporation of supplementary devices and sensors, along with the associated data measurements. This includes the deployment of the 2nd Xiaomi Aqara Temperature and Humidity Sensor, strategically positioned within the participants' bedrooms. Additionally, this iteration highlights the development of further enhancements and functionalities capable of further facilitating the large-scale pilots.

Deliverable Description as described in the Grant Agreement	Actual Implementation
These components will be the basic SMART BEAR Hub communication software (contributed by T3.1), the monitor (contributed by T3.2), the component supporting the summarisation and local analytics of data at the SMART BEAR Hub (contributed by T3.3), and the SMART BEAR mobile application, visualisation and user interfaces (contributed by T3.4).	The primary goal is to establish a thorough home automation ecosystem within real-world settings operating under the framework of a Raspberry Pi unit with preinstalled openHAB, further configured to align with the specific requirements of the SMART BEAR project. This adaptation includes the implementation of new user interfaces and the automation of scripts for key retrieval, among other refinements. The hardware installation retains its consistency, as elucidated in comprehensive detail in the previous deliverables of D3.3 and D3.4. In this deliverable, the initial section delves into the revised software installation (Section 1.1), the validation of the developed measurement collection protocols (Section 1.2), and the presentation of a demonstrator executable that encapsulates the current configuration (Section 1.3). The monitoring of this sensory ecosystem is made possible through the Smart Bear Mobile Application, which efficiently collects health-related measurements and offers a user interface designed for the elderly population, supporting their pursuit of a healthy and independent daily life. The capabilities of the Smart Bear Mobile Application are comprehensively demonstrated in this document through a series of screens (Section 2.1), showcasing every facet of the solution, including newly crafted features such as the hearing aids screen and cognitive games, alongside the corresponding demonstrator (Section 2.2). *The data summarisation and local analytics component will be presented in detail in D4.6.* *For additional information on and further specifics of the devices, please refer to the corresponding report deliverable D3.4.*

Table 2: List of the currently deployed devices for the Smart Bear project.

Device	Model
Smartphone	Samsung Galaxy S10 https://www.samsung.com/uk/smartphones/galaxy-s10/ 
Smartphone	Samsung Galaxy A13 https://www.samsung.com/uk/smartphones/galaxy-a/galaxy-a13-light-blue-64gb-sm-a137flbveub/ 
Smartphone	Redmi 10C https://www.mi.com/global/product/redmi-10c/ 
Smart watch	Garmin Venu SQ https://www.garmin.com/en-US/p/707174/pn/010-02427-00 
Hearing Aids	Oticon More 1 MiniRite T 85 https://www.oticon.com/solutions/product-details?productId=343763 

Device	Model
Smart blood pressure	Omron M7 Intelli IT hem-7361t –ebk https://www.omron-healthcare.com/eu/blood-pressure-monitors/m7_intelli_it_2.html 
Smart scale	Smart body composition scale iHealth Fit (HS2S) https://ihealthlabs.eu/en/74-smart-body-composition-scale-ihealth-fit-hs2s-856362005135.html 
Smart scale	Beurer BF 600 Pure Black diagnostic bathroom scale https://www.beurer.com/web/gb/products/wellbeing/weight-and-diagnosis/diagnostic-bathroom-scale/bf-600-pure-schwarz.php 
Smart thermometer	iHealth ThermoPro (NT13B) https://ihealthlabs.eu/en/86-smart-non-contact-infrared-thermometer-ihealth-thermopro-nt13b.html 

Device	Model
Smart thermometer	Beurer non-contact thermometer FT 95 Bluetooth® https://www.beurer.com/web/gb/products/medical/fever-thermometers/infrared-clinical-thermometer/ft-95.php 
Smart oximeter	iHealth Air (POM3) https://ihealthlabs.eu/en/14-smart-pulse-oximeter-ihealth-air-pom3-855111003910.html 
Smart oximeter	Beurer PO 60 Bluetooth® pulse oximeter https://www.beurer.com/web/gb/products/medical/pulse-oximeter/po-60-bluetooth.php 
Smart home devices	PHILIPS Hue Bridge (Hub) https://www.philips-hue.com/en-gb/p/hue-bridge/8718696516850 
Smart home devices	PHILIPS Hue Motion, Temperature & Light sensor https://www.philips-hue.com/en-us/p/hue-motion-sensor/046677473389 

Device	Model
Smart home devices	Philip Hue Smart Light Bulb https://www.philips-hue.com/en-us/p/hue-white-and-color-ambiance-1-pack-e26/046677548483 
Smart home devices	USB ZigBee adapter https://www.ti.com/product/CC2531 
Smart home devices	Aqara Temperature & Humidity sensor (x2) https://www.aqara.com/us/temperature_humidity_sensor.html 
Smart home devices	Integration Hub (openHAB) on Raspberry Pi kit https://www.raspberrypi.org/products/raspberry-pi-4-desktop-kit/ 

Within Table 2, a thorough summary is provided, encompassing all devices deployed during the current development stage. The details presented encompass the designated model of each device and a hyperlink to the manufacturer's website.

*Please note that **definitions and acronyms** are defined at the beginning of the deliverable D3.6.*

1. HomeHub and Home Automation

This chapter encompasses the demonstration of the deployed devices and sensor set that are provided for the home environment, highlighting the incorporation of new functionalities and an updated installation process. The figures presented herein showcase the products utilised, which play pivotal roles as integral components within the HomeHub automation. This approach is a key component of the Smart Bear solution, with the aim of facilitating large-scale deployment within the homes of elderly participants. The figures that illustrate the setup and installation processes on the software layer serve to provide proof-of-concept, shedding light on the dedicated effort required to establish home automation.

Regarding hardware installation, it should be noted that there is no substantial change, except for the inclusion of the 2nd Xiaomi Aqara Temperature and Humidity Sensor. Therefore, for the successful installation of the HomeHub, the requisite equipment consists of: a) Philips Hue Bridge, b) Philips Hue Motion, Temperature, and Light Sensor, c) Philips Hue Smart Light Bulb E27/E14, d) USB ZigBee Adapter, e) 2 x Xiaomi Aqara Temperature & Humidity Sensor, f) SD card, and g) Integration Hub on Raspberry Pi Kit.

On the software front, the integration of the 2nd Xiaomi Aqara Temperature and Humidity Sensor is introduced, accompanied by adjustments in data handling procedures necessitated by this integration, with the aim of maintaining the measurements from both Xiaomi Aqara sensors. The aggregation of measurements is finalised, and validation processes have been conducted over an extended period. Moreover, new functionalities have been introduced to streamline large-scale deployment, including, but not limited to, scripted key retrieval for cloud registration and the reduction of the IMG digital size.

1.1 *Updated Software Installation*

The installation of software residing within the SD Cards encompasses specific openHAB configuration (Figure 1), alongside its associated refined dependencies. This installation procedure is systematically divided into six primary processes: a) burning the HomeHub Image, b) openHAB and Xiaomi devices pairing, c) setting up Philips devices, d) openHAB and Philips devices pairing, e) openHAB cloud registration, and f) validation through the mobile application, as it is outlined in HomeHub Technical Manual.

```
# See https://www.openhab.org/docs/configuration/packages.html for a detailed explanation of
#
package = standard

# Access Remote Add-on Repository
# Defines whether the remote openHAB add-on repository should be used for browsing and instal
# This not only makes latest snapshots of add-ons available, it is also required for the inst
# any legacy 1.x add-on. (default is true)
#
#remote = true

# Include legacy 1.x bindings. If set to true, it also allows the installation of 1.x binding
# already a 2.x version available (requires remote repo access, see above). (default is false
#
#legacy = true

# A comma-separated list of bindings to install (e.g. "binding = sonos,knx,zwave")
binding = hue,mqtt

# A comma-separated list of UIs to install (e.g. "ui = basic,paper")
ui = basic,paper,restdocs

# A comma-separated list of persistence services to install (e.g. "persistence = rrd4j,jpa")
persistence = mysql

# A comma-separated list of actions to install (e.g. "action = mail,pushover")
#action =

# A comma-separated list of transformation services to install (e.g. "transformation = map,js
transformation = jsonpath

# A comma-separated list of voice services to install (e.g. "voice = marytts,freetts")
#voice =

# A comma-separated list of miscellaneous services to install (e.g. "misc = myopenhab")
misc = openhabcloud
```

Figure 1: Addons openHAB configuration file.

Please note that the process of burning the HomeHub image remains consistent, with the only variable being the version of the image employed.

1.1.1 OpenHAB and Xiaomi Devices Pairing

Upon accessing openhabian:8080, it is imperative to assess the configuration of the Things to determine their status. Specifically, this assessment should focus on verifying if the status indicator for each Thing reflects "online" (Figure 2).

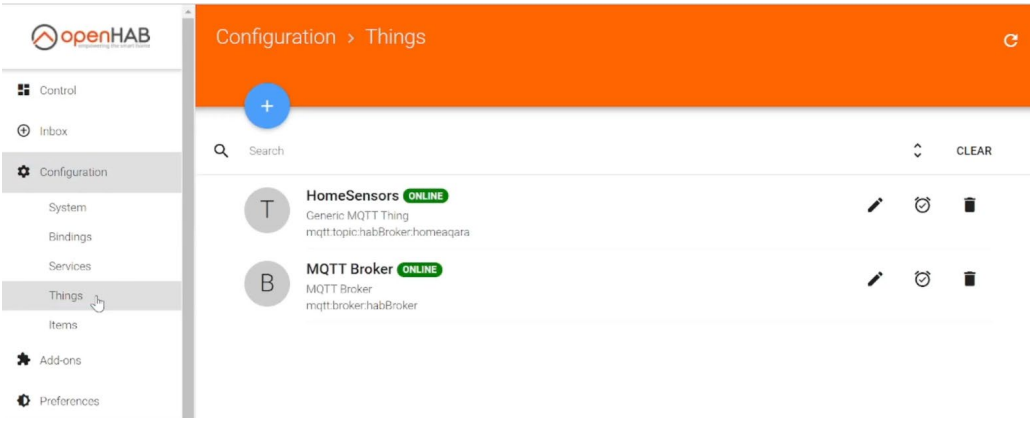

Figure 2: HomeSensors and MQTT Broker indicating "Online" status.

A new interface, designated as openhabian:9090, has been introduced for the purpose of facilitating the pairing of Xiaomi devices. Following the interaction with the Xiaomi devices and the subsequent actuation of the pairing buttons, a set of new devices will be automatically detected and integrated into the user interface, as illustrated in Figure 3.

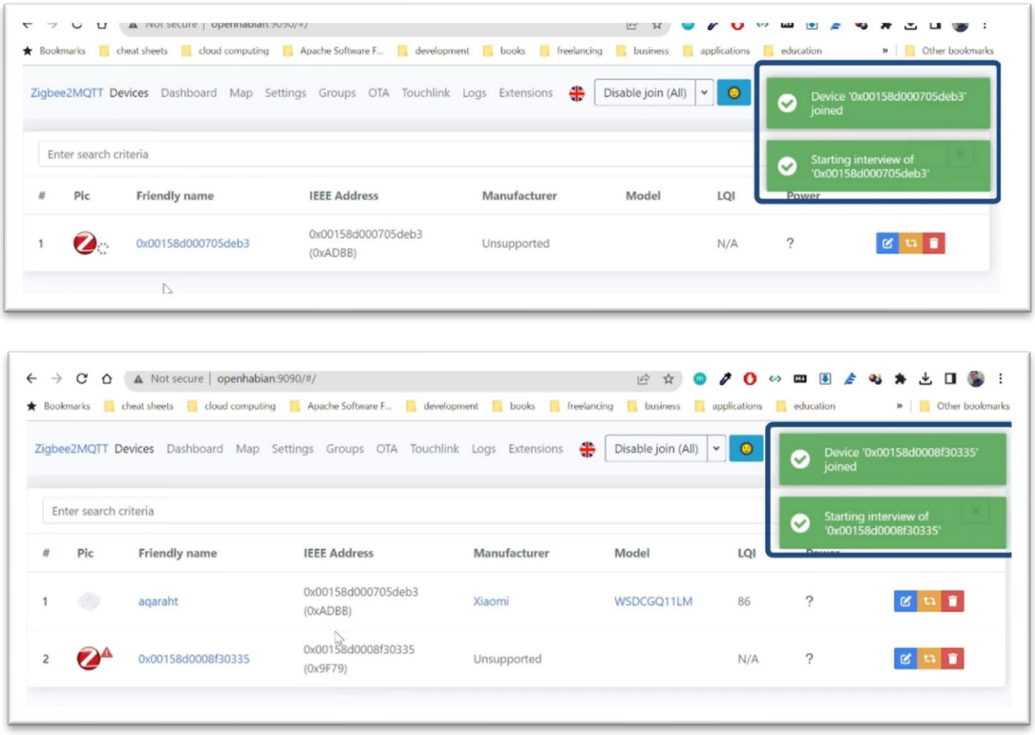

Figure 3: a) Discovery of Xiaomi Aqara device dedicated for living room; discovery of Xiaomi Aqara device dedicated for bedroom.

After their discovery, it is necessary to rename the newly detected devices to align them with the preconfigured naming conventions (Figure 4). This naming adjustment is also demanded to enable the activation of measurement mapping. It is noteworthy that each Xiaomi Aqara temperature and humidity sensor is assigned a unique name, which corresponds to the specific room in which it will be situated, either the living room (i.e., aqaraht) or bedroom (i.e., aqaraht2).

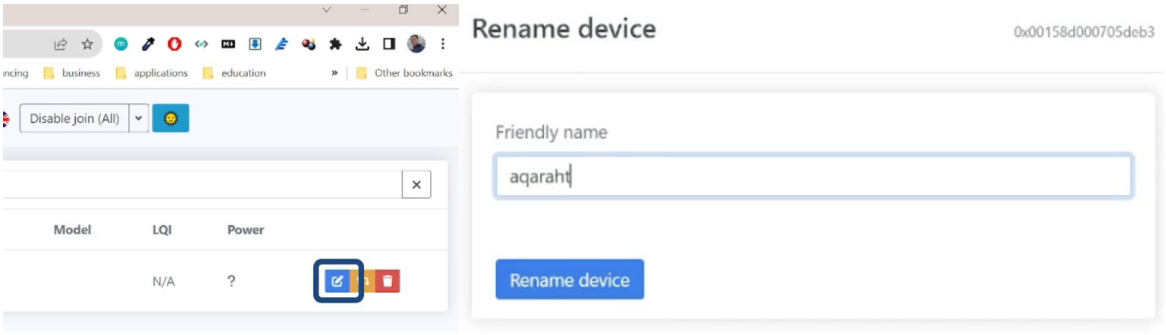

Figure 4: (a) Navigating to renaming tab; (b) Renaming the device to "aqaraht".

Upon the completion of both renaming processes, the environmental measurements will be visibly displayed on the openHAB control panel (Figure 5). It is noteworthy, at this timepoint, to acknowledge that the battery status indications may not immediately furnish measurements, as they require additional time for their initiation.

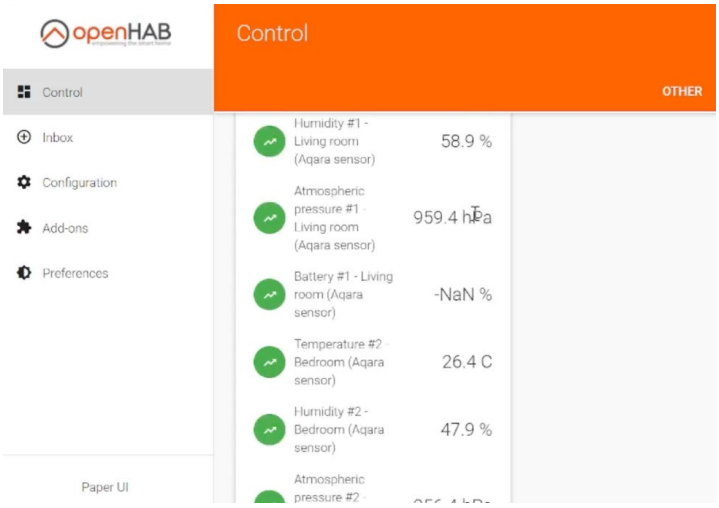

Figure 5: The current environmental measurements according to Xiaomi Aqara sensors.

1.1.2 Setting Up Philips Devices

Initially, it is advisable to download and install the Philips Hue Mobile Application onto the participants' smartphones. Subsequently, upon launching the application, a technician should proceed to establish a connection with the Philips Hue Bridge, and subsequently integrate the Hue Motion and Smart Bulbs into the system. Following this integration, the technician should create a designated room and arrange the sensors within that room through the method of dragging and dropping, as illustrated in the accompanying Figure 6.

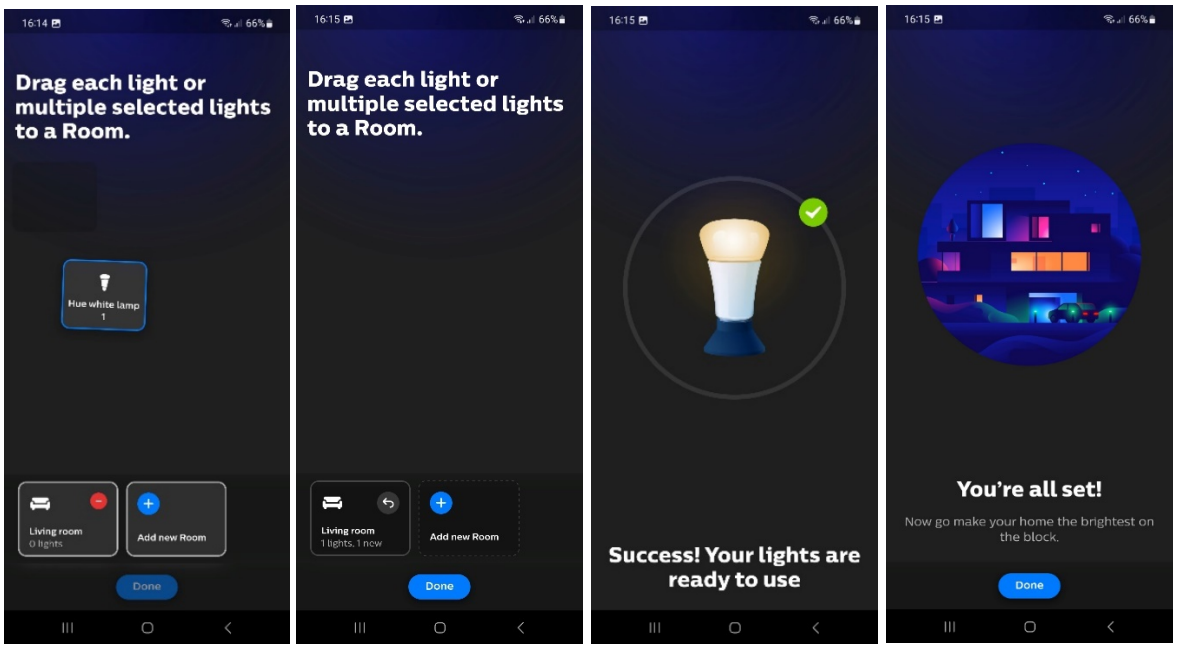

Figure 6: (a) Dragging and dropping the Hue white lamp 1 to the Living room; (b) Completing the room management; (c) Indicator that lights have been successfully added; (d) Indicator that all changes are successfully integrated.

Please note that the version of the Philips Hue mobile application utilised for this demonstrator generation is 4.48.0 (14123), therefore minor changes may occur in later versions.

1.1.3 OpenHAB and Philips Devices Pairing

The procedure for initiating the pairing process between openHAB and Philips devices necessitates the use of a laptop connected to the local area network. This process involves several steps as they are presented below. Initially, the technician accesses the designated URL openhabian:8080 through a web browser, selects the "PAPER UI" option, and then initiates the device discovery process by clicking the transmission symbol within the PAPER UI interface. After selecting the "Hue Binding" option (Figure 7), an inbox entry appears, and the technician proceeds to add the Hue Bridge as a Thing.

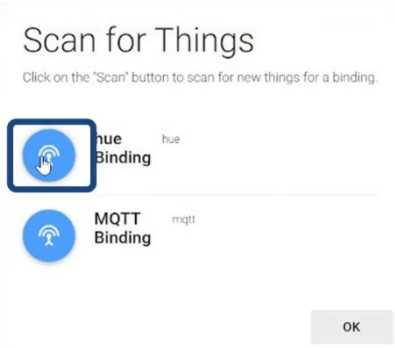

Figure 7: Scan for Things screen.

Moving on, the technician navigates to the "Things" tab under the "Configuration" category, where the Philips Hue entry initially displays an offline status (Figure 8). To correct this, the technician presses the central button on the Philips Hue Bridge, transitioning it to an online state. Subsequently, eight new messages appear in the "Inbox," each corresponding to a new entity that must be added as a thing.

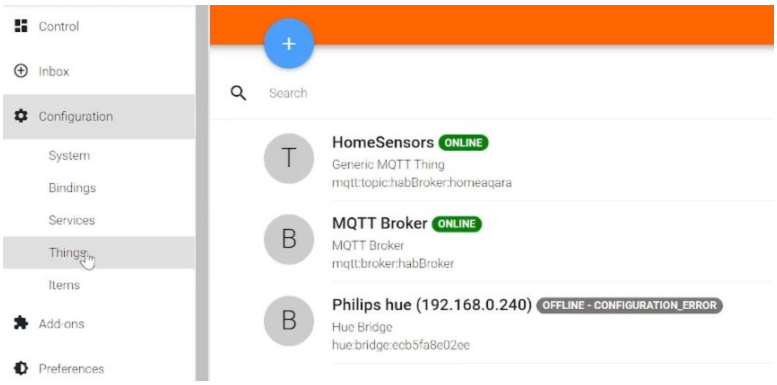

Figure 8: Philips Hue offline status.

Once this is accomplished, six variable mappings are executed as indicated in Table 3, ensuring proper linkage between Things, Channels, and Items. Finally, the technician verifies the accuracy of measurements displayed on the openHAB dashboard, aligning them with real-world environmental measurements, while noting that *the battery indication may require additional time to display*. A subsequent validation for the battery is scheduled for a later timepoint.

Table 3: Mappings between Things, Channels and Items for Linkage.

Things	Channels	Items for linkage
Hue Ambient Light Sensor	Illuminance	HueMotionSensorLightIlluminance
Hue Motion Sensor 1	Motion	HueMotionSensorPresence
Hue Motion Sensor 1	Last Updated	HueMotionSensorLastUpdate
Hue Motion Sensor 1	Battery Level	HueMotionSensorBatteryPercentage
Hue Motion Sensor 1	Temperature	HueMotionSensorTemperature
Hue White Lamp 1	Brightness	HueLightBulbBrightness

1.1.4 OpenHAB Cloud Registration

To facilitate the cloud registration process, the technician will employ the command prompt on the laptop in an attempt to establish a connection using the command "ssh openhabian@openhabian." Following the input of the requisite credentials, which typically involve the use of the password "openhabian," the technician can proceed to initiate the automated script by entering "ohc," as it is illustrated in Figure 9.

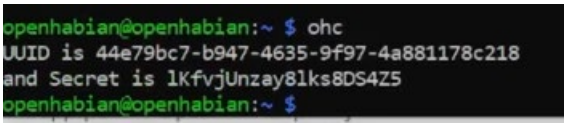

Figure 9: Running the "ohc" script.

Subsequently, the script will generate and present the UUID and Secret keys, which are essential for the cloud registration process, hosted at openhabcloud.preciouscloud.eu:8443. After successful registration, the technician is advised to patiently await the transition of the status from "offline" to "online." Once this status transformation occurs, a clickable link labeled "click here to access your openHAB's dashboard" will manifest in the central region of the screen. By clicking this link, the technician will be directed to the dashboard interface, where "PAPER UI" and "Control" options should be selected. Within the control panel, the prevailing measurements

can be accessed via the cloud, rather than from a local perspective, as visually depicted in Figure 10.

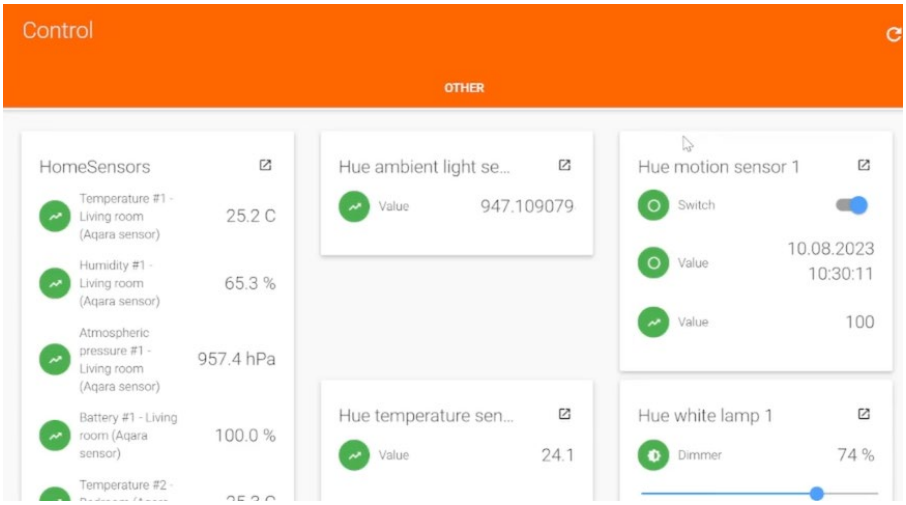

Figure 10: Current environmental measurements found online.

1.1.5 Validation Through the Mobile Application

After accessing the settings of the SMART BEAR mobile application, the technician should fillin the cloud username and password in the Patient has OpenHAB account as they were specified during the openHAB cloud registration (Figure 11). Three tests will be utilised to assess the functionality of smart home devices.

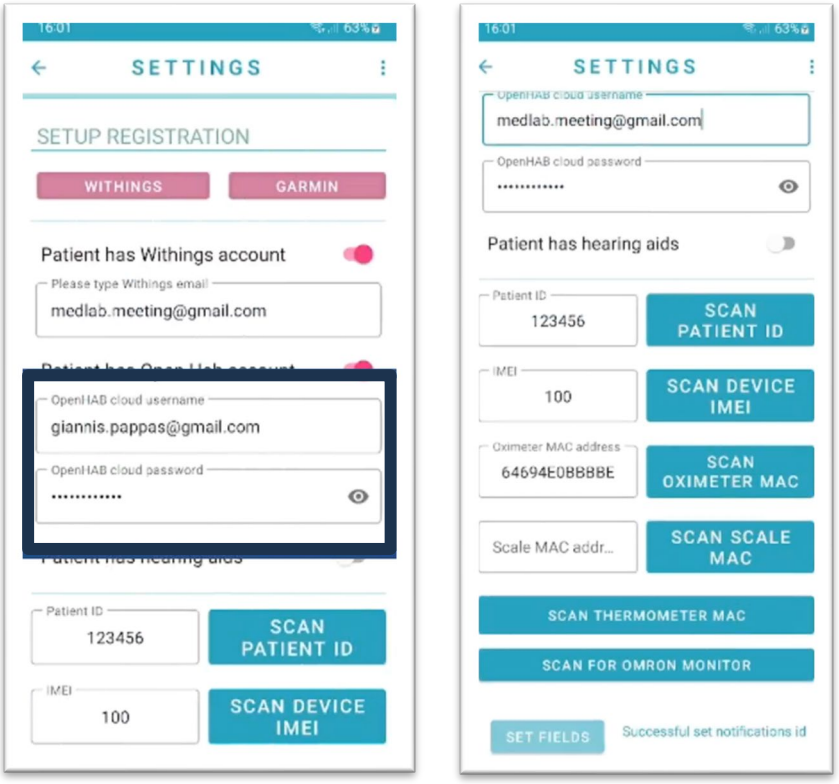

Figure 11: (a) Updating the openHAB cloud username and password; (b) Set fields notification.

First, the technician should navigate to the main dashboard, mood screen and then to movement screen. The displayed time should closely approximate real-time. If the displayed time deviates from actual time, a physical motion, such as moving one's hand in front of the Philips Hue motion sensor and reassessing the displayed time is necessary.

Then, the technician should navigate to the main menu of the mobile application, then to mood screen, and to light levels screen, where the technician should modify the percentage of light levels to assess if the smart bulb reflects these changes.

Lastly, the technician should navigate to the main menu of the mobile application, then to memory screen, and then to comfort screen where the current measurements of all devices and sensors are displayed. It is crucial to determine that the battery indications are now displayed properly and are at maximum capacity, indicating maximum power supply (Figure 12).

Figure 12: (a) Main dashboard; (b) Memory screen; (c) Upper comfort screen; (d) Lower comfort screen.

1.2 *Services/Installation Validation*

1.2.1 Validation through Second Set

In addition to the validation process conducted through the mobile application, a secondary ensemble of devices and sensors was incorporated to comprehensively evaluate the holistic functionality and operational effectiveness of the entire solution of HomeHub (Figure 13). This assessment was undertaken with a dedicated focus on ensuring that the objectives outlined in WP3 were accurately met.

Figure 13: The two device sets.

Leveraging these predefined equipment sets, a thorough installation of the HomeHub was undertaken, utilising SD cards loaded with the most up-to-date HomeHub images. A meticulous adherence to the user manual guided this installation process. Subsequently, both equipment sets were strategically positioned within a laboratory environment at the University of Ioannina to facilitate the examination and comparison of environmental data. This involved the assessment and comparison of measurements, not only from local storage but also from the cloud infrastructure of openHAB.

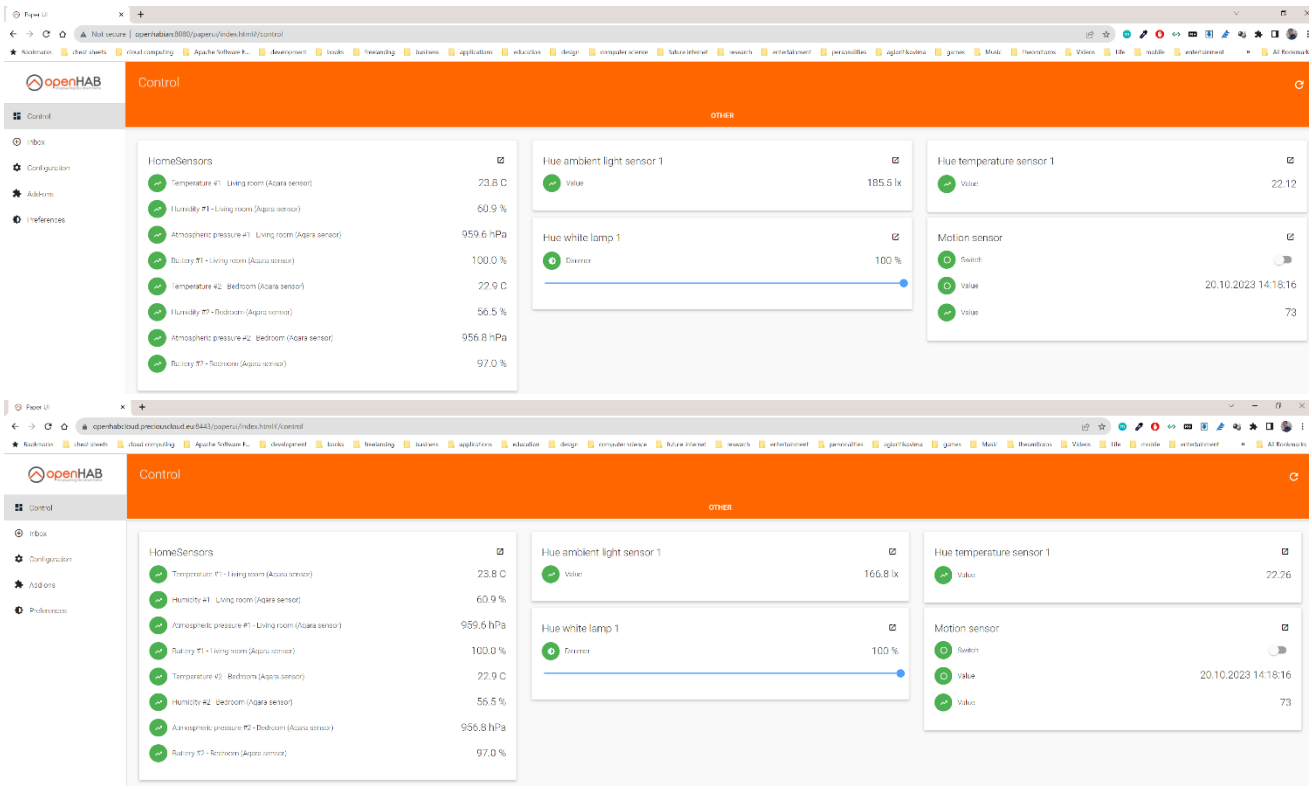

Figure 14: a) 1st device set local measurements; b) 1st device set cloud measurements.

Initially, as depicted in Figure 14, the measurements obtained from the 1st equipment set exhibit a uniform consistency, indicating the seamless and timely operation of the cloud service. This consistency extends to the 2nd set, as demonstrated in Figure 15. In the case of the first set, the recorded temperature stands at 23.8 degrees Celsius, with humidity registering at 60.9, and atmospheric pressure at 959.6 hPa, while the second set corresponds closely with values of 24.3, 63.3, and 959.7, respectively.

Furthermore, when considering the second sensor within the first set, it records measurements of 22.9 degrees Celsius, 56.5% humidity, and atmospheric pressure at 956.8 hPa. Remarkably, the second set presents identical measurements, as they are placed at the exact same places within the “bedroom”. It is noteworthy that the disparities observed between the first and second sets, particularly concerning the sensor located in the "living room," do not exhibit significant variations in terms of temperature, humidity, or atmospheric pressure, suggesting a consistent environment across both sets and can potentially be attributed to inherent device range. Hence, the validation of the device sets' installation and services aligns cohesively with the project's objectives, as the HomeHub replication operates as intended, ensuring proper data transmission to the cloud and the accurate extraction and storage of relevant measurements.

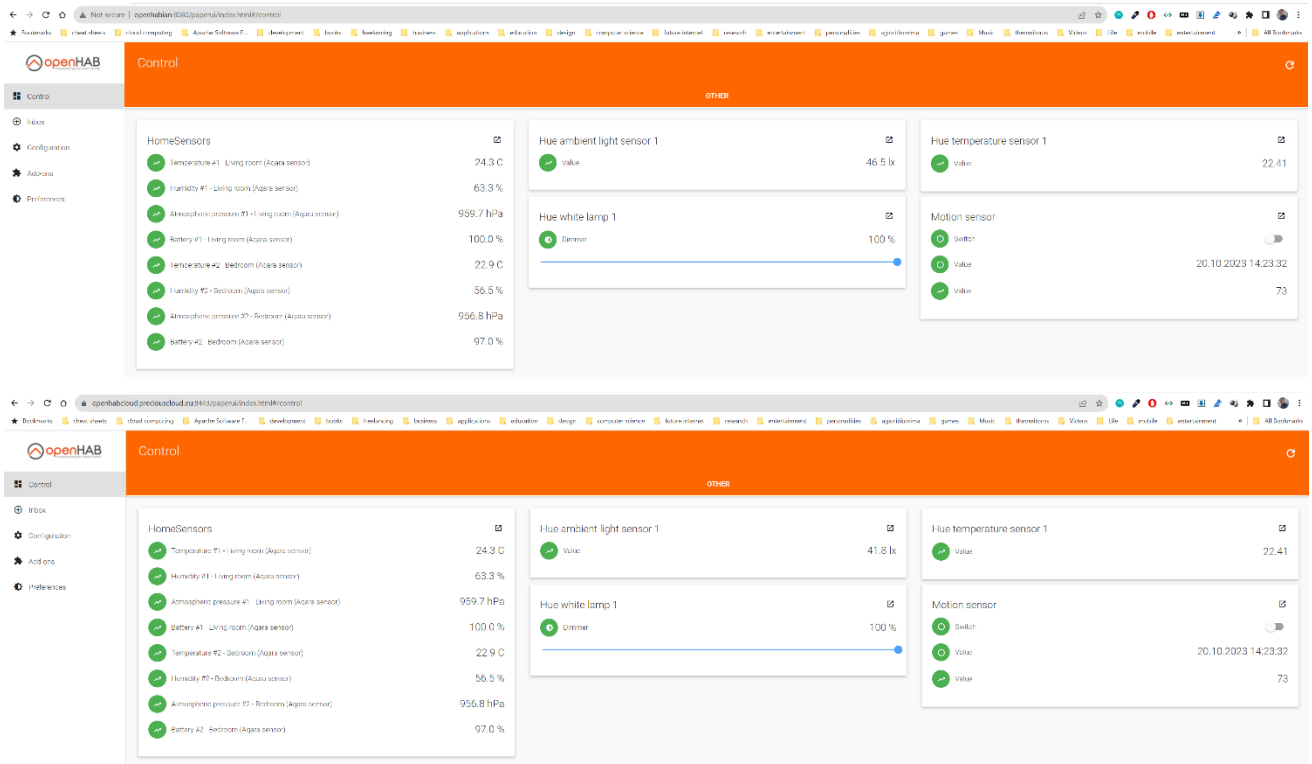

Figure 15: a) 2nd device set local measurements; b) 2nd device set cloud measurements.

1.2.2 Validation through Rest API

The REST API used to facilitate communication between HomeHub and any external system, such as the Smart Bear Mobile Application, remains the same. Nevertheless, a requisite phase of supplementary testing was undertaken, primarily owing to the transition from RR4J to the MariaDB database. The purpose of this testing was to ascertain the system's capacity to sustain measurements over an extended duration without encountering any operational challenges.

1.3 *Demonstrator*

The final and fully operational iteration of the openHAB pre-configured software installation has been successfully replicated into an IMG file. This achievement not only facilitates the seamless detection of devices and sensors but also significantly contributes to the automated recording of sensor measurements, an essential element for large-scale deployment endeavors. Following the transmission of an official email request for authorisation to **fotiadis@uoi.gr**, access to all produced versions of the IMG file can be obtained by navigating to the subsequent URL:

https://drive.google.com/drive/folders/18MpTey6QTKWt-gYpXIjRTMpaO_-dVeut?usp=sharing

2. Smart Bear Mobile Application

This section provides a concise summary of the efforts invested in developing the latest iteration of the mobile application. It serves as a demonstrative display of the work carried out, showcasing multiple screens from the Smart Bear Mobile Application. These screens effectively underscore the user-friendliness, utility, efficiency, and overall performance of the application. It's worth noting that all these screens have undergone revisions since the previous deployment, which were documented in D3.3. These revisions were driven by a multitude of reasons, as explained in D3.6. These include enhancements aimed at improving usability and elevating the user experience.

2.1 Smart Bear Mobile App User Interface

This section compiles screenshots extracted from the latest iteration of the mobile application. Within this section, distinct mobile interfaces are dedicated to heart rate, blood pressure, sleep statistics, activity tracking, weight management, temperature readings, oximeter data, hearing aid functionalities, ambient light levels, inhouse motion information, comfort assessments, medication records, dietary information, and rehabilitation progress. These screens serve the essential purpose of providing users with comprehensive insights into their respective health metrics. Complementing the user interface, notifications are seamlessly integrated within this domain. Furthermore, the inclusion of two cognitive games, aimed at enhancing users' memory and cognitive capacity, has been introduced. The personalisation options for the application have also undergone significant improvements.

2.1.1 Heart Rate Screens

The measurement of heart rate is facilitated through the utilisation of the Garmin Venu SQ, as it is depicted in Figure 16. This is complemented by the presentation of past measurements, which are conveniently accessible under the "History" tab.

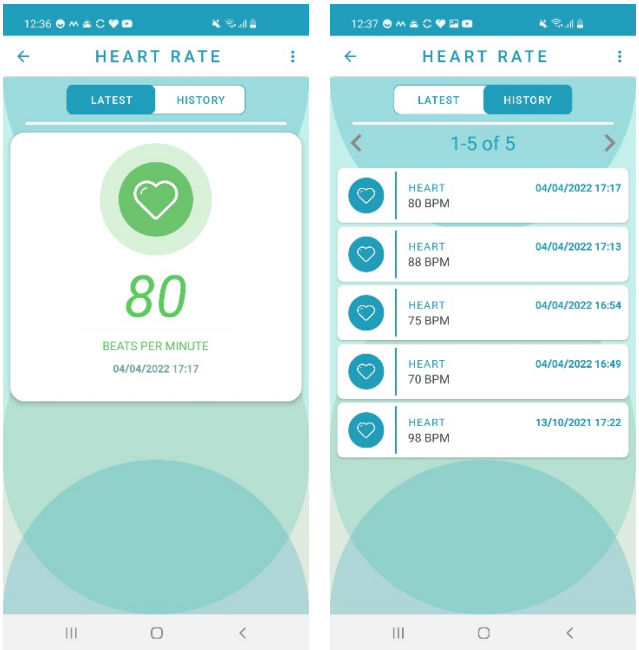

Figure 16: Heart Rate Screens.

2.1.2 Blood Pressure Screen

Blood pressure measurements are conducted using the Omron M7 device, as it is demonstrated in Figure 17. Furthermore, past user measurements are diligently compiled and accessible within the history log.

Figure 17: Blood pressure Screens.

2.1.3 Sleep Statistics Screen

The Sleep statistics screen serves the purpose of furnishing users with detailed information pertaining to their sleep patterns for the previous day, and it also offers access to the historical records of these measurements, as it is depicted inFigure 18. The sleep cycle data is sourced from the smartwatch in use, which contributes to the comprehensiveness of the data presented.

Figure 18: Sleep Statistics Screen.

2.1.4 Activity Screen

Within the Activity screen, users are afforded the opportunity to access and review their daily step and distance metrics. Additionally, a historical log chronicling their activity is available, as it is showcased inFigure 19. The Activity-related data is sourced from the smartwatch in use, which contributes to the comprehensiveness of the data presented.

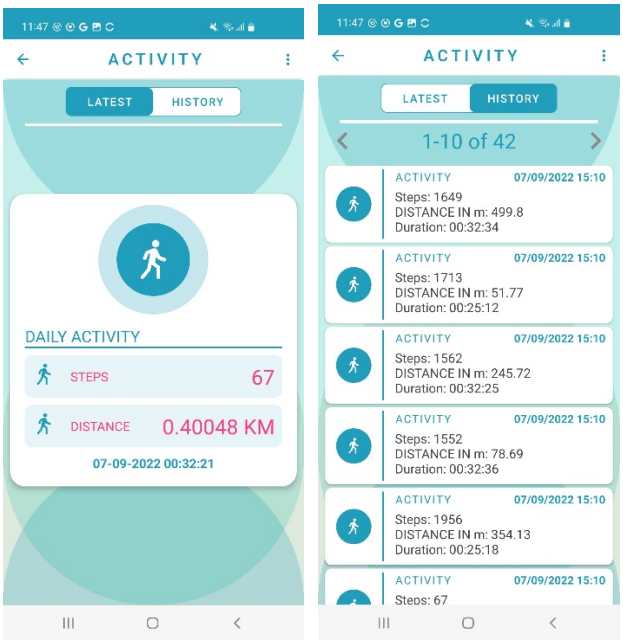

Figure 19: Activity Screen.

2.1.5 Weight Screen

The latest measurements display, as well as the respective historical data, are derived from either the iHealth Scale or the Beurer BF 600 Pure Black diagnostic bathroom scale, as demonstrated in Figure 20. Users can access a comprehensive record of their measurements through the utilisation of these devices.

Figure 20: Weight Screens.

2.1.6 Temperature Screen

The present temperature measurements are sourced from either the iHealth Thermo Pro or the Beurer non-contact thermometer FT 95. These measurements, alongside their previously collected data, are prominently featured below, as they are illustrated in Figure 21. This allows users to access a comprehensive record of their temperature data facilitated by these respective thermometer devices.

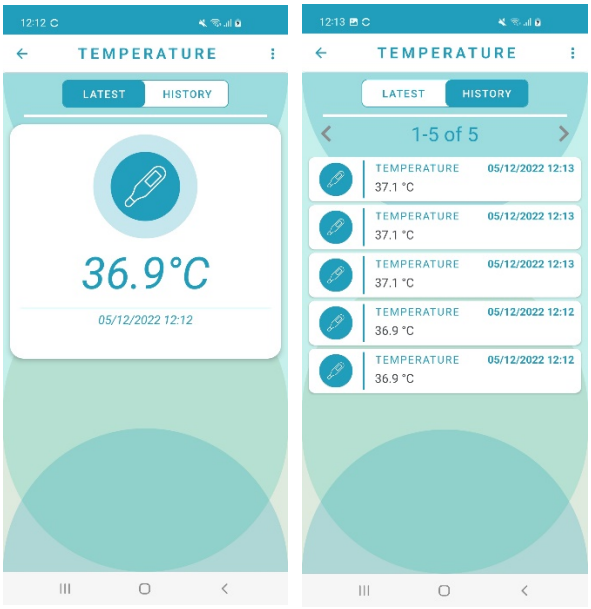

Figure 21: Temperature Screens.

2.1.7 Oximeter Screen

The oximeter measurements are derived from either the iHealth Oximeter or the Beurer PO 60 pulse oximeter. These measurements, in conjunction with past data, are prominently displayed in Figure *22*. This presentation enables users to access a thorough record of their oximetry measurements, facilitated by these specific oximeter devices.

Figure 22: Oximeter Screens.

2.1.8 Hearing Aids Screen

The present volume and program settings of the OTICON Hearing Aids are visibly presented, and these configurations are subject to modification directly through the application by the end users, as it is indicated in Figure *23*.

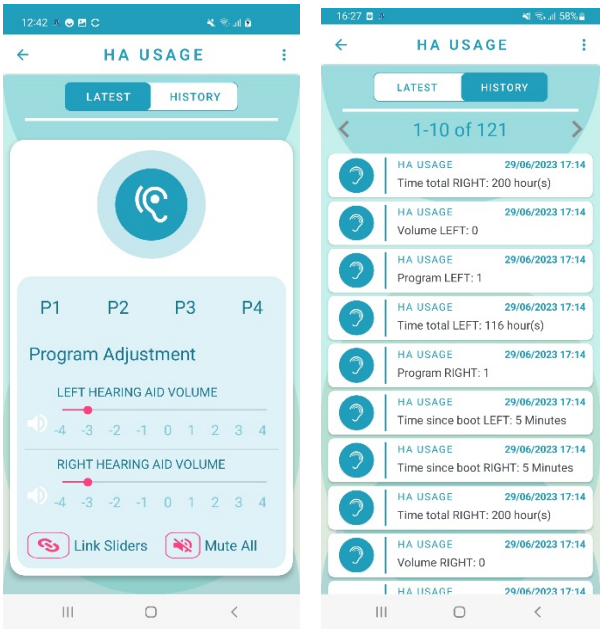

Figure 23: Hearing Aids Screen.

2.1.9 Light Levels Screen

The Light levels screen provides users with a real-time status update of the HomeHub smart light sensing devices within their premises. Users can choose from various registered rooms within their accommodations and fine-tune the brightness levels accordingly, as illustrated in Figure 24.

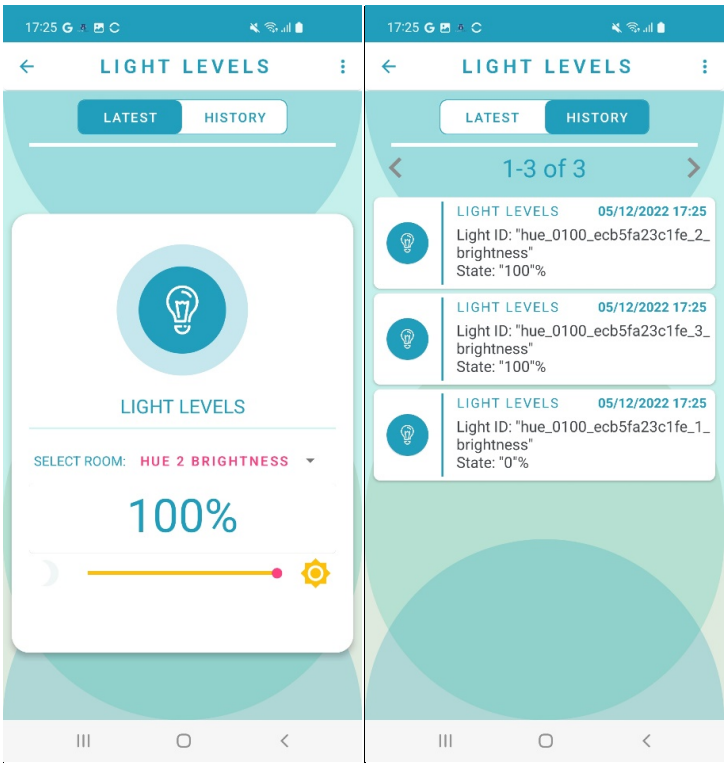

Figure 24: Light Levels Screen.

2.1.10 Movement Screen

The Movement screen presents information regarding the duration for which the user remained indoors or passed by the motion detection sensor. This data is sourced from the HomeHub motion sensing devices, as it is depicted in Figure 25.

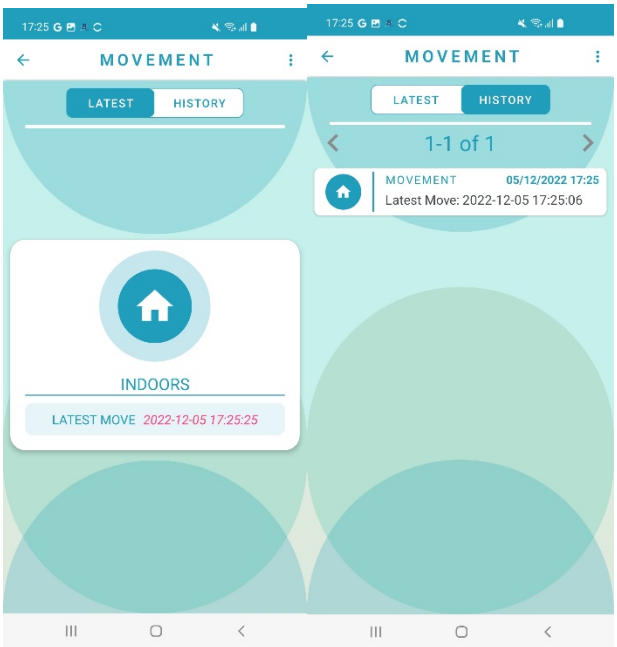

Figure 25: Movement Screen.

2.1.11 Comfort Screen

The Comfort screen provides users with insights into the temperature and humidity levels within their residential environment. Additionally, users can access the previous records of these measurements, as it is visually represented in Figure 26.

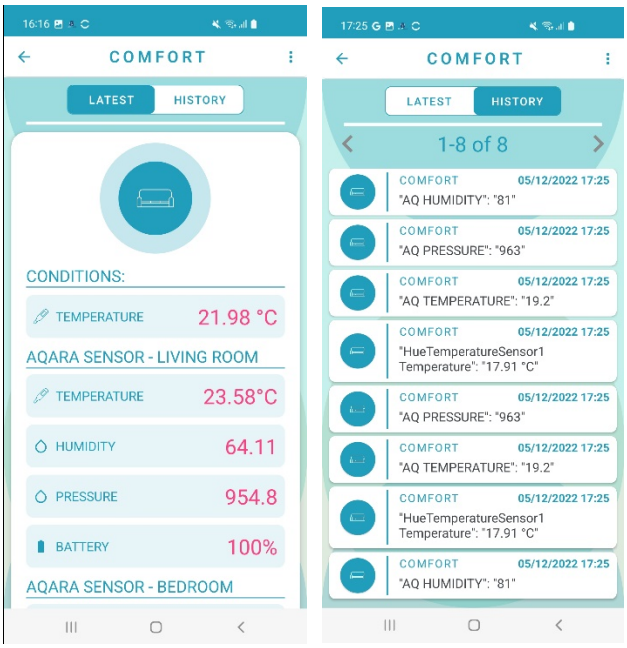

Figure 26: Comfort Screen.

2.1.12 Medication Screen

The Medication screen serves as a tool for users to access and manage their prescriptions, encompassing medications and related items. Users can specify the timeframes for their medications, and as a result, reminder notifications are automatically activated when it is nearing the designated time for the user to take their prescribed medication, as presented in Figure 27.

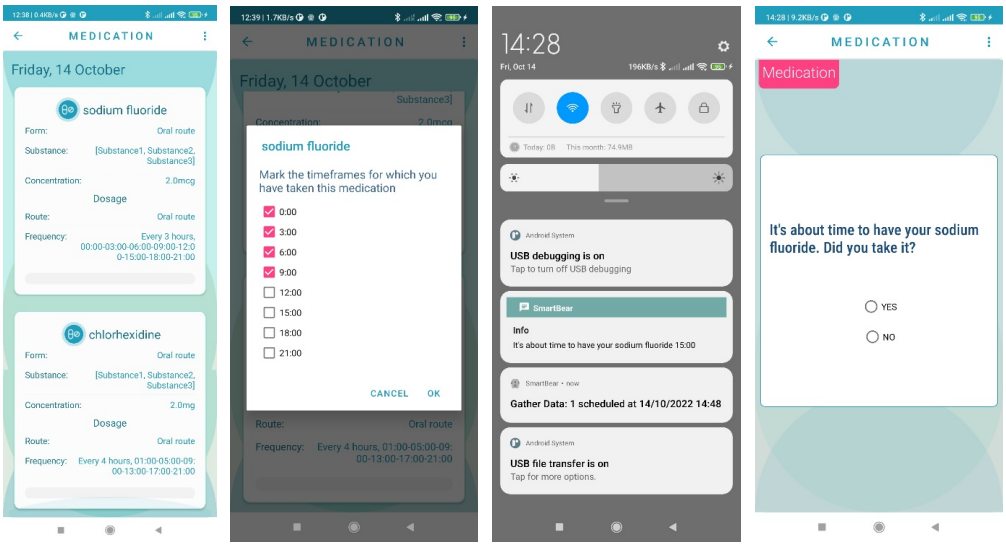

Figure 27: Medication Screen.

2.1.13 Diet Screen

The Diet screen showcases the recommended dietary routine tailored to the user's specific parameters, which include factors such as age, gender, weight, level of physical activity, and other pertinent health-related information, as presented in Figure 28. Users are further provided with the opportunity to input their daily food consumption across various food categories and to complete the monthly Mediterranean diet questionnaire.

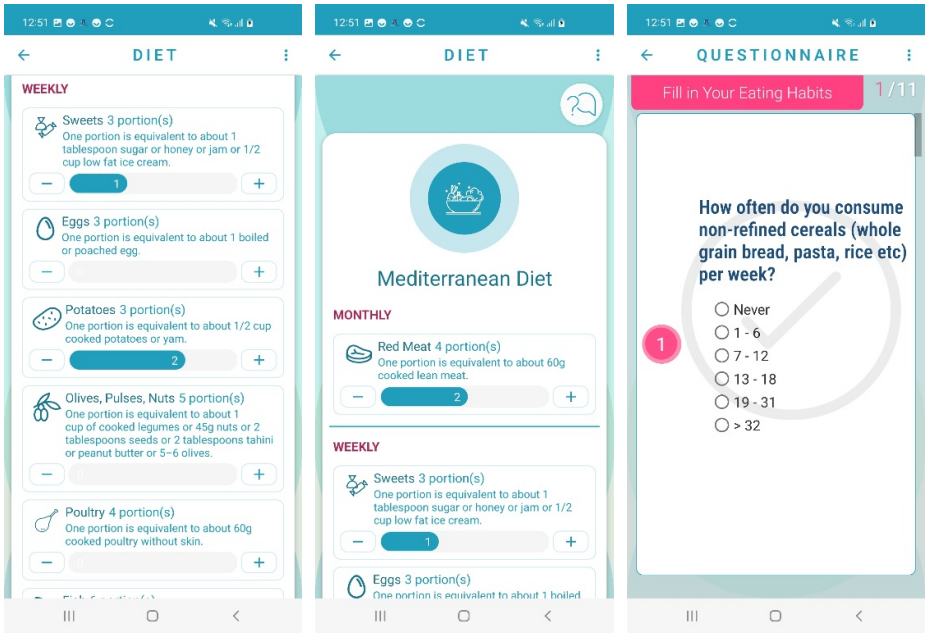

Figure 28: Diet Screens.

2.1.14 Rehabilitation Screens

The Rehabilitation screens empower the user to engage in a series of leg muscle strengthening and balance retraining exercises, commonly recognised as the "Otago exercise program," as depicted in Figure 29.

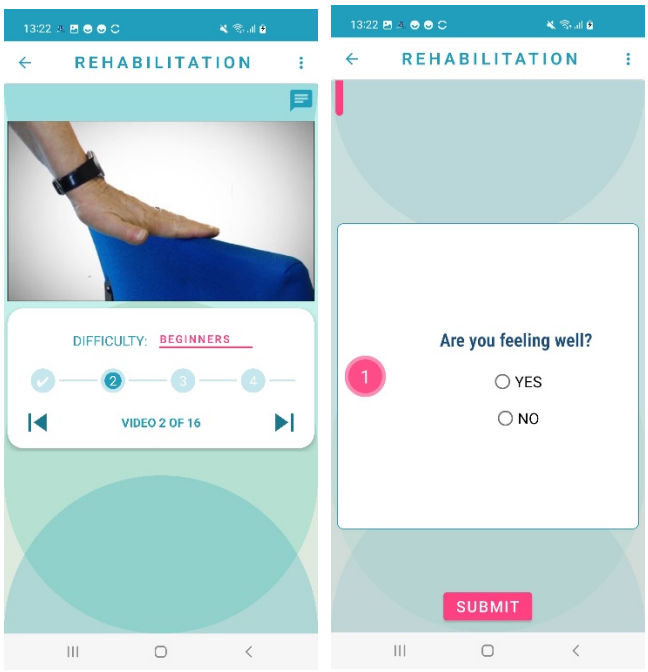

Figure 29: Rehabilitation Screens.

2.1.15 Cognitive Games

Within the application, two cognitive games, namely the Matching Game (Figure 30) and Quiz Game (Figure 31), are available for user engagement. Users can access these games through the Memory App. Upon opening each game, comprehensive instructions are presented, and these instructions remain readily accessible at any time through the information icon. Furthermore, a record of previous scores for both games is conveniently accessible within the history tab.

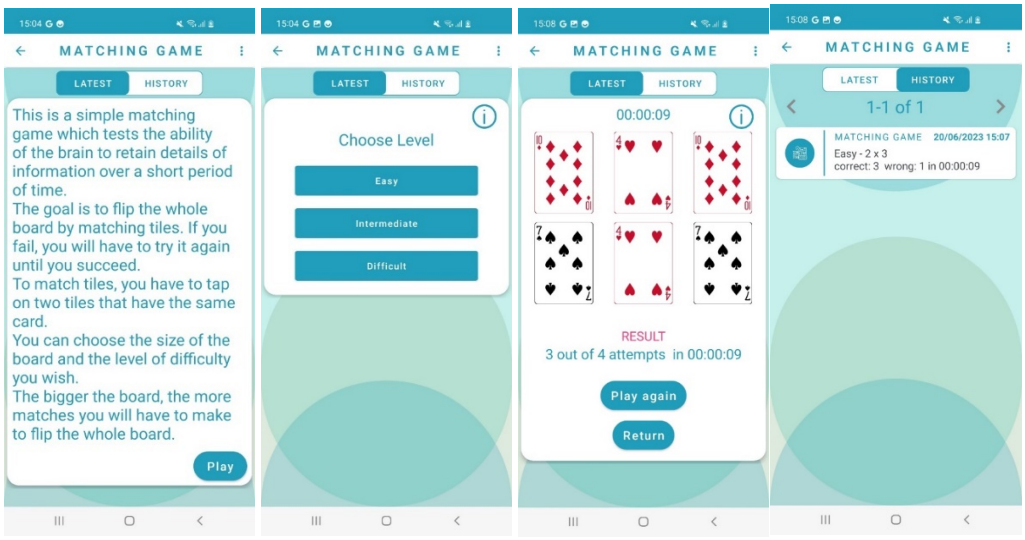

Figure 30: Matching Game Screens.

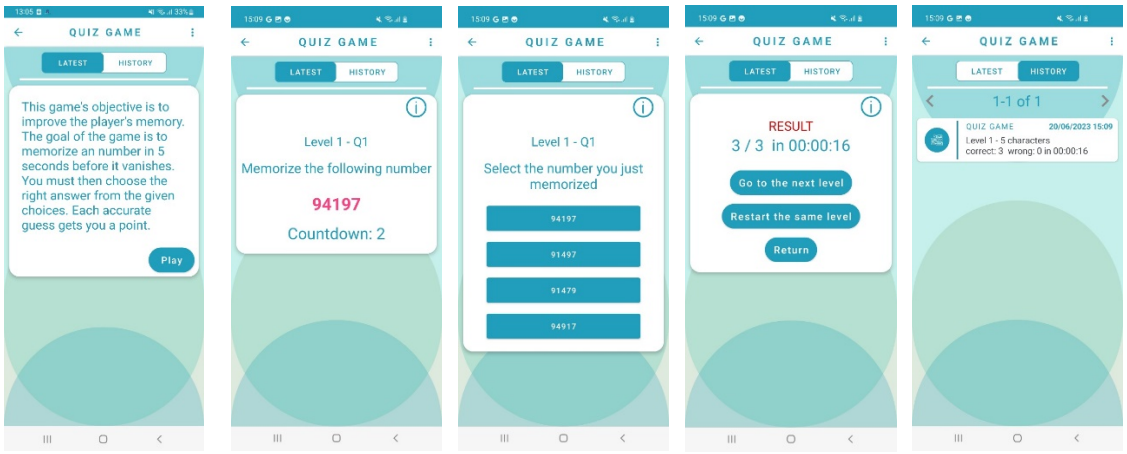

Figure 31: Quiz Game Screens.

2.1.16 My Settings

Within the "My Settings" section of the application, users have the capacity to adjust the font size for enhanced readability and configure their level of physical activity, which is essential for the diet application. Additionally, users who utilise hearing aids can opt to declare their present location as their home, should they choose to disclose this information (Figure 32).

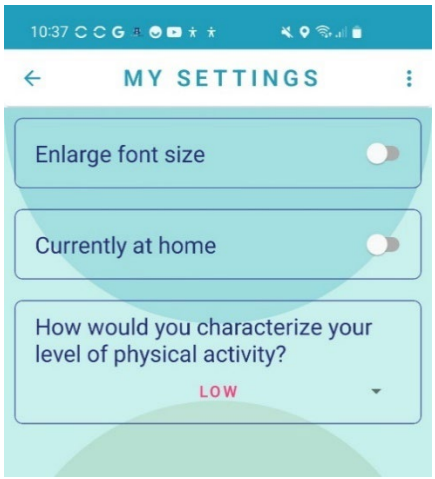

Figure 32: Current location indication button.

2.1.17 GDPR Management

Through the SB@App, users are enabled to generate new General Data Protection Regulation (GDPR) requests and access a compiled list of previously submitted requests, as it is presented in Figure 33.

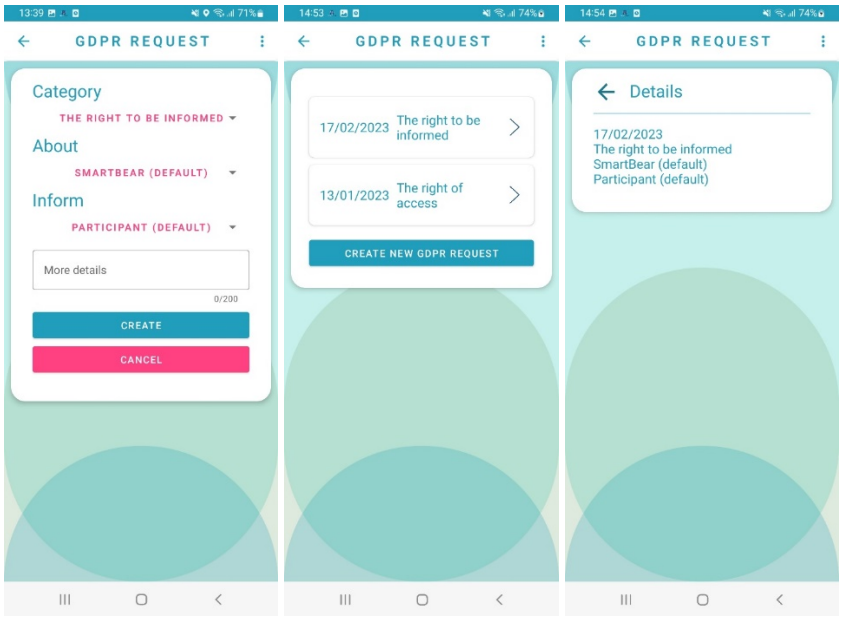

Figure 33: GDPR Request Screens.

2.1.18 Incoming Notifications

The SB@App also presents critical alerts and essential information to users in the form of discreet messages, which are presented as notifications, as they are visually presented in Figure 34.

Figure 34: Incoming Notifications.

2.2 Demonstrator

The executable (.apk) file for the demonstrator can be located at the following URL:

https://play.google.com/store/apps/details?id=gr.atc.smartbearp

It is important to note that for the successful installation and utilisation of the demonstrator, the following prerequisites must be met:

1. A Google account is required to access the .apk file on the Play Store.
2. To evaluate the current release within Play Store's closed tracked release, please reach out to **g.zissis@atc.gr** to obtain an invitation.
3. An active Internet connection is mandatory on the mobile device.
4. For HomeHub utilisation, both the HomeHub and the mobile device should be connected to the same local network (e.g., Wi-Fi for the mobile application) following their successful installation.
5. To access Garmin-related features, it is necessary to download and install the Garmin Connect app and create a user account. For initial results, it is advisable to use the Garmin Venu SQ Smart Watch for more than 8 hours. A sleep summary will be generated the following day.
6. All the tools (e.g., mobile device, HomeHub devices, Garmin Smart Watch, etc.) and resources (e.g., Smart Bear Mobile application, Garmin Connect application, etc.) mentioned must be readily accessible.
7. For the initial results, please use the devices at least once.

Furthermore, for a concise video presentation of the demonstrator, you can navigate to the following URL:
https://drive.google.com/file/d/12llXDzvqfiu0b7HIiunZEu3Ybqj1Orci/view?usp=sharing.

Conclusion

The present document, titled "Smart Bear @ Home Enabling Components v3," encompasses the third and final iteration of the SMART BEAR Home Enabling Components. This document serves as a thorough representation of the developments pursued by the WP3 partners in the achievement of project objectives, primarily oriented towards home automation and mobile application advancement.

The initial section of this deliverable pertains to HomeHub, an integral component of the smart home automation ecosystem, which harnesses the processing capabilities of a Raspberry Pi unit to record environmental and physiological measurements. Subsequently, the document shifts its focus to the Smart Bear Mobile Application, which acts as the conduit for acquiring these data, including data sourced from diverse medical devices.

This deliverable further delves into various aspects, including but not limited to HomeHub configuration, current installation procedure, data collection, and the extraction of aggregated data at 5-minute intervals. It also encompasses a comprehensive presentation of the Mobile Application screens, which depict measurement displays, notification delivery processes, the development of cognitive games, the utilisation of the OTAGO program, among other functionalities. This array of screens not only familiarises the end users with the software development associated with these components but also serves to showcase the significant work undertaken within this project.

Please note that both D3.5 and D3.6 presently lack the presentation of certain information, which is anticipated to be developed in the coming months and documented in the subsequent Annual Report. This forthcoming development encompasses the SESARAM synergy on the mobile app, along with enhancements to user experience, including reminder customization and adherence achievements. Furthermore, the integration of the new devices due to procurement updates such as hearing aids device is also part of this ongoing initiative, as well as the HomeHub validation.