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

D4.1 (D13) - SMART BEAR Cloud Enabling Components v1

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D4.1 (D13) - SMART BEAR Cloud Enabling Components v1

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Executive Summary

The present deliverable summarises the deployed instances of the SMART BEAR Cloud Enabling Components v1, as they are described in D4.2. The present state of the integrated solution is also covered in D6.1, which provides details on the integration of the components. The platform components described in this document are deployed on Kubernetes, which is a portable, extensible, open-source platform for managing containerised workloads and services. Most of the components are not exposing a graphical interface because they are either Rest APIs or infrastructure components. The main interface that is exposed and the user is able to interact with is the Dashboard of SMART BEAR. In the following sections, a brief summary of the components is provided.
Contents

Executive Summary........................................................................................................................................ 3
List of Figures ............................................................................................................................................... 5
1 Introduction .............................................................................................................................................. 6
2 FHIR Database and APIs .................................................................................................................... 7
3 DSS, non-FHIR Database and APIs .................................................................................................. 10
4 Dashboard (v0.5) .................................................................................................................................. 11
  4.1 Registration and login ..................................................................................................................... 11
  4.2 Patient management ....................................................................................................................... 13
    4.2.1 Available patients .................................................................................................................... 13
    4.2.2 Patient overview ..................................................................................................................... 14
    4.2.3 Medical History ..................................................................................................................... 16
    4.2.4 Patient creation ..................................................................................................................... 17
    4.2.5 External ID creation ............................................................................................................... 18
    4.2.6 Device allocation ................................................................................................................... 19
    4.2.7 Cardiovascular Diseases use case ........................................................................................ 20
  4.3 Interventions (v0.5) ...................................................................................................................... 21
    4.3.1 Intervention creation .............................................................................................................. 22
    4.3.2 Notification creation .............................................................................................................. 24
    4.3.3 Intervention Logs .................................................................................................................. 26
List of Figures

Figure 1 - Main screen of the FHIR Data Repository ................................................................. 7
Figure 2 - Conformance statement ............................................................................................ 8
Figure 3 - Search Patients .......................................................................................................... 9
Figure 4 - DSS Rest APIs ........................................................................................................... 10
Figure 5 - Registration form ..................................................................................................... 11
Figure 6 - Login screen ............................................................................................................. 12
Figure 7 - Home page ............................................................................................................... 12
Figure 8 - Patients page ............................................................................................................ 13
Figure 9 - Patient overview screen .......................................................................................... 14
Figure 10 - Device Management screen ................................................................................. 15
Figure 11 - External ID screen ................................................................................................ 15
Figure 12 - Medical History screen ........................................................................................ 16
Figure 13 - Create patient form ............................................................................................... 17
Figure 14 - Create External ID form ........................................................................................ 18
Figure 15 - Assign Device form .............................................................................................. 19
Figure 16 - Cardiovascular ....................................................................................................... 20
Figure 17 - Medical Interventions page ................................................................................ 21
Figure 18 - Creation of a Medical Intervention ...................................................................... 22
Figure 19 - Criteria and Notifications for creating new Interventions ................................. 23
Figure 20 - Notifications page ................................................................................................ 24
Figure 21 - Create Notification form ....................................................................................... 25
Figure 22 - Interventions Logs ............................................................................................... 26
1 Introduction

This deliverable includes the first version of the components of SMART BEAR, which include the Data Repository developed using FHIR data models, the DSS, along with the non-FHIR database (to store non-FHIR data and generate interventions and alerts) and the visualisation component (Dashboard). The current development status of the Cloud Enabling Components v1 will allow the execution of the Pilot of the Pilots (PoP), to verify that data are collected, analysed and trigger interventions. In the two next releases that follow, more functionalities will be added in those components and changes will be applied based on the feedback of the platform stakeholders. The URLs of the components are not publicly available due to security reasons. All the components reside in Kubernetes pods, within the SMART BEAR Cloud Kubernetes Cluster. The cluster is hosted on cloud.smart-bear.eu. The final endpoints of the interfaces will be provided in D6.1 when all the integration steps will be completed.
2  FHIR Database and APIs

The Data Repository of the SMART BEAR is FHIR compliant, based on the HAPI FHIR Server. The data model in use is R4. The following screenshots demonstrate some indicative data that are stored and retrieved in the repository.

![Main screen of the FHIR Data Repository](image)

*Figure 1 - Main screen of the FHIR Data Repository*
Figure 2 - Conformance statement
Figure 3 - Search Patients
3 DSS, non-FHIR Database and APIs

The DSS along with the non-FHIR database, are used to store data that are not related to medical entities. Such data sources are summarised in D4.2 and contain configuration files, intermediate data from the analytics, non-FHIR compliant data arriving from external sources (e.g. synergies, device vendors, etc.) and data related to the interventions, alerts and notifications. The following image represents a subset of the Rest APIs of the DSS.

![Figure 4 - DSS Rest APIs](image-url)
4 Dashboard (v0.5)

The Dashboard of SMART BEAR, is the main UI interface for the clinicians. The graphical interfaces allow the registration of the patients, the monitoring of the measurements by the devices, the investigation of the analytics, along with the interventions and alerts for each of the patients that participate in the pilot studies. The following screenshot represent steps of the registration process and the patient management. The implementation of interaction elements continues on the basis of the requirements elaborated in D2.1, and have been imprinted in D4.2.

4.1 Registration and login

The user must register by filling the Registration form with the following information:

- First name
- Last name
- Email
- Role
- Organisation
- Password

To complete the procedure, the user must read and accept the policy and then click on the the REGISTER button. The registration form is shown in Figure 5.

![Registration form](image)

*Figure 5 - Registration form*
After registering, the user can log in via the form that is shown in Figure 6.

![Login screen](image)

**Figure 6 - Login screen**

After the user logs in, the **Home** page will appear, where general statistics on average platform use, percentage of diseases, type of devices etc. are present, in addition to notifications of delivered alerts and status of performed analytics. The **Home** page is shown in Figure 7.

![Home page](image)

**Figure 7 - Home page**
4.2 **Patient management**

4.2.1 **Available patients**

After registering and logging in, the user must click on the Patients button on the left, and the Patients page appears that shows the managed patients. The name and surname of all patients are not reported in compliance to GDPR, but the patients’ IDs and the age group are reported instead. The **SHOW**, **EDIT** and **DELETE** buttons are present for each patient, that can be used to respectively visualise, modify or delete the data about him/her. The **+BUTTON** button is also present on the upper right corner for creating a new patient. The Patients page is shown in Figure 8.

![Figure 8 - Patients page](image)
4.2.2 Patient overview

In case a clinician needs to visualise an overview of the status of a specific patient, he can click on his/her name and the OVERVIEW page will appear that is shown in Figure 9. The OVERVIEW page contains the demographic information: ID, birthday date, age group and email, in addition to the Medical History. Below the Overview button, the following buttons are found that redirect to the homonymous pages: DEVICES MANAGEMENT, ID MANAGEMENT, DEMOGRAPHICS, PHYSICAL EXAMINATION.

In order to visualise the devices that are allocated to a patient, the clinician must click on the DEVICES MANAGEMENT button, and a screen will appear where the Unique Identifier, the Category (e.g. Smart Home devices, Smart Blood Pressure monitoring etc.) and the status (e.g. Active) for each device are shown. Like in the case of the Patients page, the EDIT and DELETE buttons are present for each device, which can be used to respectively modify or delete the data about it. A +DEVICE button is also present in the upper right corner for creating a new device. The Device Management screen is shown in Figure 10.
In case a patient is participating to a synergy between SMART BEAR and Holobalance and/or Smart4Health, he will receive an ID for each project he/she is participating to and an External ID that identifies the association of the project-related IDs. In order to visualise the External ID of a patient, the clinician must click on the ID MANAGEMENT button and the Identifier, the Project name and status will appear. The [EDIT] and [DELETE] buttons are present for each External ID, that can be used to respectively modify or delete the element. The [EXTERNA L ID] button is also present on the upper right corner for creating a new External ID. The External ID screen is shown in Figure 11.

Figure 10 - Device Management screen

Figure 11 - External ID screen
4.2.3 Medical History

In order to visualise, add or update information concerning the Medical History of a patient, the clinician must scroll the Overview page, in which the MEDICAL HISTORY section is also found that is shown in Figure 12. In the Medical History section, the targeted conditions are indicated, in addition to the Assessments and Clinical data. The Medical History section also contains the following subsections: Life Habits, where information such as Salt Intake and Smoker status can be found; medications, where the medications and daily doses are indicated; and Diet Supplements. Like in the case of the Patients page, the EDIT and DELETE buttons are present for each subsection, which can be used to respectively modify or delete the data in them. A button is also present on the upper right corner of each subsection for creating a new element, e.g. +SUPPLEMENT and +MEDICATION.

Figure 12 - Medical History screen
4.2.4 Patient creation

In order to create a new patient, the user must click on the **+PATIENT** button in the upper right corner of the Patients page, and the Create Patient form will appear (shown in Figure 13). The form must be filled with the following data: Pilot, Organization, email address, date of birth, date of participation consent. In addition, up to 3 Clinical Case Managers from the Pilot and up to 3 external Clinical Case Managers can be indicated to be notified in case a Yellow or Red alert is sent to the patient or an Adverse Event occurs. A Pilot or an External Clinical Case Managers can be added by typing their email addresses, and another one can be added by clicking on the **+** button or removed by clicking on the **-** button. After filling up the form, the user must click on **CREATE PATIENT** in the lower right corner.

![Figure 13 - Create patient form](image-url)
4.2.5 External ID creation

In order to create an external ID, the user must click on the `<EXTERNAL ID>` button in the upper right corner of the ID Management page, and the Create External ID form will appear (shown in Figure 14). The External ID must be typed, and the Status and Project must be selected. In order to conclude the creation, the user must click on `CREATE IDENTITY` in the lower right corner of the form.

![Create External ID form](image.png)

*Figure 14 - Create External ID form.*
4.2.6 Device allocation

The users can allocate a device to a patient through the Assign Device form, which appears when the +DEVICE button at the upper right corner in the Devices Management page and is shown in Figure 15. The form must be filled with the ID, and the Status (e.g. Active) and Category (e.g. Smart Blood Pressure monitoring) must be selected. At the end of the process, the user can save the new device by clicking on CREATE DEVICE in the lower right corner.

![Figure 15 - Assign Device form](image-url)
4.2.7 Cardiovascular Diseases use case

In case a patient is monitored for Cardiovascular Diseases, the user can click on theocardiovascular section of Medical History, and a series of subsection will appear (e.g. General Info, Observations, ECG, Cholesterol and Scores) where data can be inserted. In each subsection, the data can be deleted by clicking on the [CANCEL] button, saved by clicking on the [SAVE] button, or edited by clicking on the [EDIT] button. A screen of the Cardiovascular section is shown in Figure 16.
4.3 Interventions (v0.5)

In order to visualise the Interventions, the user must click on the Interventions button, and the interventions will appear. Please note that the Interventions that are shown here are hardcoded ones and support the PoP functionalities, because the work on DSS component is currently in progress. The Medical Interventions page is shown in Figure 17 and visualises a list of Interventions each having an ID, the targeted Medical Conditions (all or a group of specified ones), a Priority level (Low, Medium, High), a Status (Active, Inactive), a Notification text (e.g. "Repeat the measurement" in the case of CVDs), the name of the creator and the last update date. In the upper right corner, the user can find a button to create a new Intervention, and each Intervention also has a SHOW and DELETE button, respectively, for view and deletion.
4.3.1 Intervention creation

In order to create an Intervention, the user must click on the +INTERVENTION button in the upper right corner of the abovementioned Interventions page, and a form will appear that is shown in Figure 18. The first section of the form is entitled "Target Filter" and allows to select which conditions are to target, for example, Cardiovascular Diseases. In addition, the Priority (High, Medium or Low) and the Status (Active or Unactive) must be selected: if an Intervention is on Unactive, it is not delivered to any patient.

![Figure 18 - Creation of a Medical Intervention](image)

In order to complete the creation of an Intervention, a clinician can indicate the range of clinical data (e.g. Systolic Blood Pressure SBP) that trigger the notifications in the Criterions section, as shown in Figure 19. For example, in the case of SBP, the user must define: the trigger value, if the measured value is > or < the trigger, and the Logical Operator (AND, OR, NOT) that defines the relationship between the parameters. In order to remove or add a new parameter, the user must click on the - and + buttons, respectively. If a Notification is required to be delivered with an Intervention, the user can select the targeted app, which is MyHeart in this case, and a text, for example, "Please contact your CCM", or alternatively he/she can click on the +NOTIFICATION button.
Figure 19 - Criteria and Notifications for creating new Interventions.
4.3.2 Notification creation

The list of Notifications is shown in Figure 20 and appears when the user clicks on the Notifications button. For each Notification, the following features are indicated: ID, Application (e.g. MyHeart, MyDiet, MyMemory etc.), Available languages, Creator, Last Update. Each Notification also has a **SHOW** and **DELETE** button, respectively, for view and deletion.

In order to create a new notification, the user must click on the **+NOTIFICATION** button, and the form will appear that is shown in Figure 21. The user must select in the form the targeted app, in this case MyHeart, select one or more languages and click on the **SAVE** button. The **-** and **+** buttons are visualised in the form, too, and they allow respectively to remove and add a language.

*Figure 20 - Notifications page*
Figure 21 - Create Notification form
4.3.3 Intervention Logs
The user can visualise the Intervention logs by clicking on the Intervention Logs button. The log page is shown in Figure 22. A clinician can check whether an Intervention was successfully received. The status is indicated as Read or Unread.

![Intervention Logs](image)

*Figure 22 - Interventions Logs*