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D4.3 The Interaction and Visualization Service and Personalization Module – Final Release

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Deliverable Summary

The aim of this deliverable is to describe the components of the DVPIS (Data Visualization, Personalization and Interaction Service) to reflect the current status of the integrated system in its Final Release. The deliverable is a natural continuation of D4.2 that introduces some of the concepts also addressed here. It is worth observing that the additional year of work since D4.2 contributed to gain maturity and strength to all the parts of the work package work. The deliverables is mainly distributed in 4 sections, the first one being introductory, the subsequent three sections are dedicated to key aspects of the tool, namely the services for the secondary users, for the primary users and a description of the current personalisation services. The appendix contains the user manual regarding the tool toward secondary users.

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2 Introduction

The GiraffPlus WP4 is the work package dedicated to the design and development of services that allow the GiraffPlus system to serve specific classes of users. According to the project DoW the contribution of WP4 was expected into two main services:

- The **Interaction and Visualization Service (IVS)**, whose objective is to produce a well-organized set of functionalities to allow different users the access to the GiraffPlus environment;
- The **Personalization Service (PerS)**, whose objective is to contribute with new functionalities that continuously guarantee fine-grained personalization to the healthcare professionals, to the informal caregivers and to the specific elderly at home.

During the architectural design phase of GiraffPlus (see the description in D1.3) the user interaction services are allocated to the *Data Visualization, Personalization and Interaction Service (DVPIS)* with the aim to cover the complete issue of bringing data in the right form to each category of users. In particular, two different instances of the DVPIS have been designed, implemented and provided: one devoted to the secondary users (DVPIS@Office), and another dedicated to the primary users (DVPIS@Home).

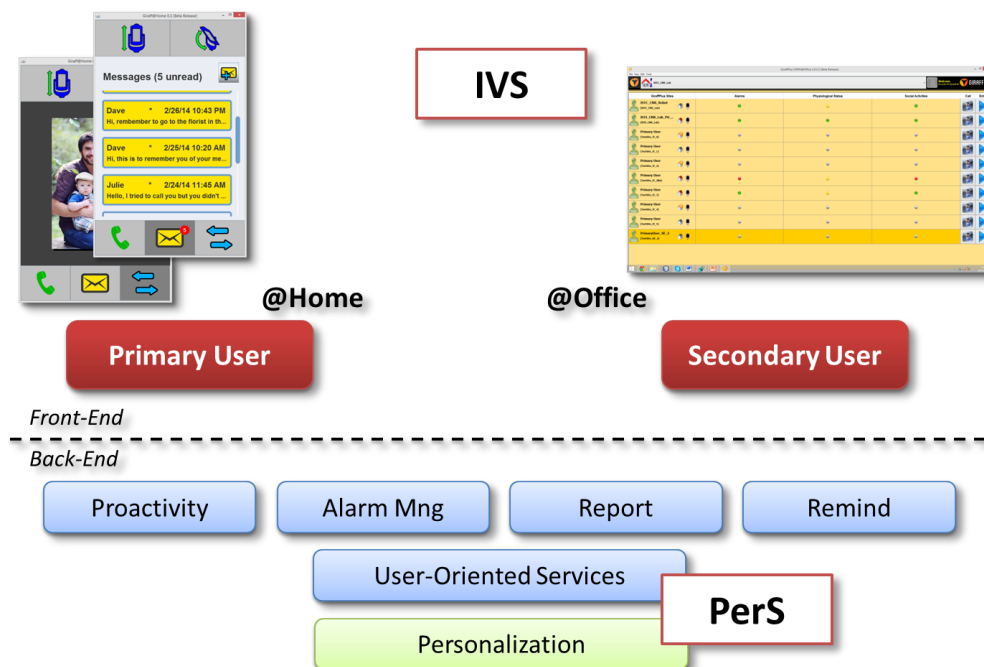


Figure 1 - The WP4 set of services based on the DVPIS.

Figure 1 illustrates the general idea of the DVPIS. The DVPIS **back-end** is responsible for preparing “personalized information to the users” and to offer support for different types of services like reminders, reports and alarms as well as the proactive suggestions and warnings. The **front-end** is responsible for presenting the information and services to the different categories of users, mainly resulting in the development of the two modules:

- @Office devoted to the secondary users and
- @Home dedicated to the primary users.

The rest of the deliverable will first recall the main concepts of these two modules and will show their evolution during the last six months of work since D4.2.

Additionally, the deliverable describes the overall state of the Install and Maintenance module, already introduced in previous WP4 reports, the new @Mobile tool, for allowing data access through common web browsers, as well as the new user modelling editing tool (DVPIS-UM), for the definition and initialization of personalization rules (none of these tools is included in the general picture above).

2.1 Scope of the document

The first WP4 deliverable (D4.1), released at M19, described the Alpha Release of the DVPIS Modules. The second deliverable (D4.2) described the situation at M30, introducing the Beta Release of the DVPIS. Such release constituted a significantly more mature version of the system including both modification to services as a result of the input from intensive field test, as well as completely new services not present in the previous release. The present deliverable describes the final release of the Interaction and Visualization Service and of the Personalization Module, promoting stability and robustness of the early developed tools as well as to the integration of further additional tools, whose main goal is to make the user experience satisfactory as much as possible.

2.2 Deliverable structure

The main aim of this deliverable is to describe the components of the DVPIS so as to reflect the current status of the Final Release. The deliverable is a natural continuation of the D4.1 and the D4.2 deliverables that further describe some of the concepts also addressed here.

The rest of this deliverable is subdivided in 4 parts:

- Section 3 describes the overall DVPIS final release.
- Section 4 describes the @Office final release, detailing last progresses in the DVPIS 2.0 and the current state of the new @Mobile version of the DVPIS.
- Section 5 describes the final release of the @Home, currently deployed on the Giraff robot.

- Section 6 presents the new features of the current personalization services as implemented in the DVPIS back-end.

The deliverable appendix contains the user manual of the final version of DVPIS.

2.3 Deviations with respect to the plan

The WP is in-line with expectation.

3 An Overview of the DVPIS final release

The final release of the Data Visualization, Personalization and Interaction Service is the result of the three years of effort of the work package 4. The DVPIS is a complex software architecture composed of several modules each dedicated to different purposes as well as different users. The front-end part is responsible for presenting the information and services to the different categories of users. Users can be roughly distinguished between end users (either primary or secondary) and GiraffPlus engineers, i.e., system operators who are responsible for initializing and maintaining the GiraffPlus installation. This distinction is functional to discriminate the different services for different users. In particular, the graphical user interfaces toward different users can be enumerated in:

- *Secondary users*
 - @Office
 - @Mobile
- *Primary users*
 - @Home
- *GiraffPlus engineers*
 - Install and Maintenance System
 - @UM

Most of these modules have already been presented in previous deliverables (and further described in [1, 2, 3]). In the last project period (a) the @Office and the @Home modules have been significantly improved, hence the updates will be described in the following section, (b) the Install and Maintenance System has not undergone major updates since the description in D4.2, nevertheless for report completeness we insert here a short summary section on that work. Finally, this report introduces two new contributions: (c) web version of the @Office module, allowing a more immediate access to data to secondary users using mobile devices, (d) the @UM module (where UM stands for User Modelling), devoted to the definition of user preferences, classification rules and personalized interaction rules, are both presented as new tools available to users.

4 The DVPIS@Office

The DVPIS@Office is the software environment dedicated to allow access to the GiraffPlus system by secondary users. In particular it contains services for both formal and informal caregivers that can inspect the data gathered in the house, and also have the possibility to use the Giraff Pilot to communicate with the house.

Roughly speaking, the DVPIS@Office system allows a generic secondary user to follow a list of primary users inside their homes, which have the GiraffPlus system installed in their apartments. Through the DVPIS@Office, secondary users can access to both environmental sensors, providing the status of the homes in terms of active appliances or movement in rooms, and physiological sensors, like blood pressure or blood saturation.

The first version of the DVPIS provided a list of followed primary users has also an indication on the status of the house (connected or disconnected, the house icon that is coloured or grey respectively) and the Giraff Robot presence (present or absent, Giraff robot icon). A central panel provided a summary view of the latest news related to the test sites (see Figure 2 A). For each of the followed primary users, the secondary users could observe the environmental sensors data in form of timelines (see Figure 2 B) and the physiological data specific for the patient (Figure 3 C). Possible deviations from routines could have been observed through daily/weekly or monthly report for the main activities (Figure 3 D). Finally, thanks to the integration with the Context Recognition Module, the secondary users could observe the set of “high level activities” (i.e., activities like, cooking, watching TV, sleeping) inferred by reasoning upon data coming from raw sensors.

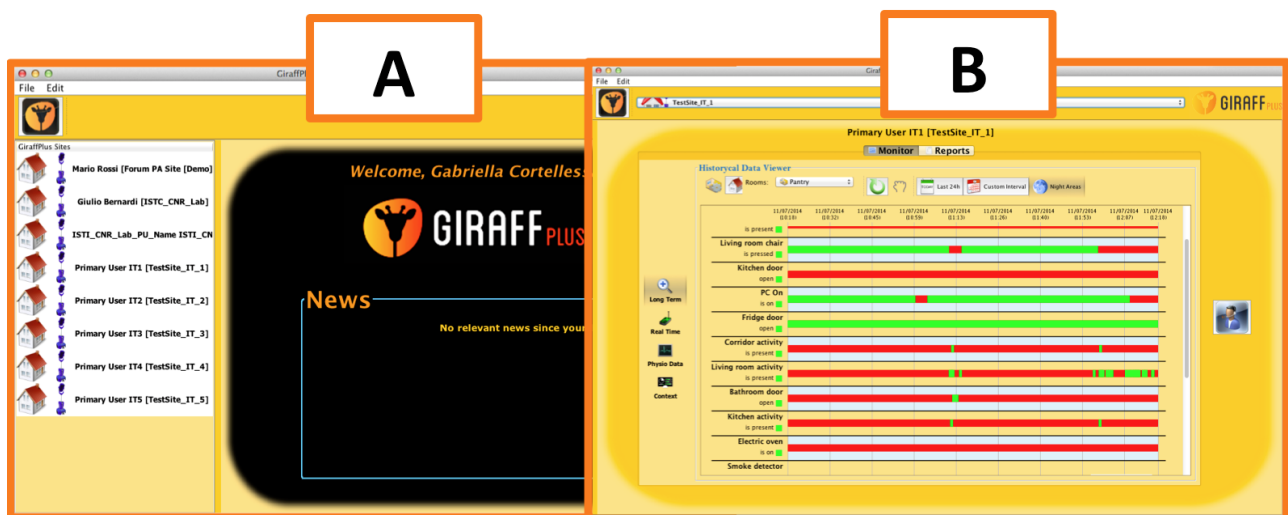


Figure 2 - Home Panel and Environmental Data Visualization in the DVPIS@Office v1.0.

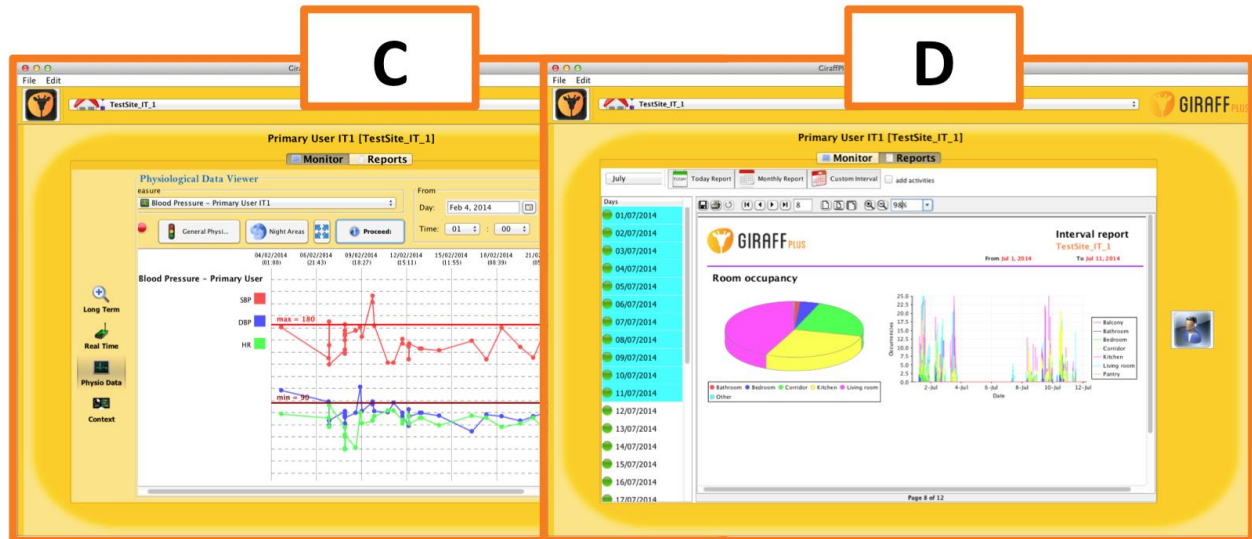


Figure 3 - Physiological Data and Report Visualization in DVPIS@Office v1.0.

The feedback obtained from representative secondary users along the project has been extremely useful for re-designing the module according to concrete requests and for solving many problems that were spotted. Specifically, version 2.0 of the DVPIS@Office has undergone a substantial refactoring which led secondary users to have a more immediate access to data.

GiraffPlus Sites	Alarms	Physiological Status	Social Activities	Call	Enter
ISTC_CNR_Robot [ISTC_CNR_Lab]	●	WARNING ●	●		
ISTI_CNR_Lab_PU_... [ISTI_CNR_Lab]	●	●	●		
Primary User [TestSite_IT_0]	●	●	●		
Primary User [TestSite_IT_1]	●	●	●		
Primary User [TestSite_IT_2]	●	●	●		
Primary User [TestSite_IT_2Bis]	●	●	●		
Primary User [TestSite_IT_3]	●	●	●		
Primary User [TestSite_IT_4]	●	●	●		
Primary User [TestSite_IT_5]	●	●	●		
PrimaryUser_SE_2 [TestSite_SE_2]	●	●	●		

Figure 4 - The Home Page layout of the DVPIS@Office

Figure 4 shows the layout of the home page of the DVPIS@Office implemented following the improvement suggestions reported above. Specifically the list of followed user contains brief and immediate information on the status of the assisted person in terms of three main indicators: **Alarms, Physiological** and **Social Activities**. For each of this dimension an immediate feedback is given with a judgment on the level of each indicator: *green* = good; *yellow* = warning; *red* = risk. In this way a secondary user who is following several assisted persons can easily judge if he/she needs to urgently intervene on some specific situations and in general he/she can modulate and prioritize the visit to the different patients thanks to an immediate feedback without the need to entering into the details of each home.

For each primary user the status of the house is provided and the possibility to both call the person through the telepresence robot and visit the details of the house is still provided.

4.1 The final refactoring of DVPIS 2.0

Compared to previous versions, the DVPIS@Office graphical user interface has been significantly reorganized so as to provide a more uniform experience. Although the final version doesn't provide new significant features, a notable effort has been spent toward a consistent use of terms, layouts, colours and sizes with the objective of minimizing disorientation even for users who are facing the tool for the very first time.

The first step towards the GUI consistency has been to move all the control buttons on the right side of the panels, regardless of the panel. The reason for this is that users might get confused if the position of control tools changes with respect the context. Conversely, consistency allows the users to recognize usage patterns, allowing them to perform their tasks more easily.

Since secondary users have appreciated the distinction between real time and long term monitoring, this distinction persists in the final release of the DVPIS@Office. The alternative panel that has been added in the DVPIS@Office2.0 release, showing a map of the primary user's house and icons of sensors available in the house, has been enhanced so as to show the current position as well as relative movements of the elderly in his/her home. The secondary user is quickly informed about the most recent movements of the primary users, possibly realizing whether they are normal or not, and acting consequently (e.g., making a call through the Giraff robot). As an example, Figure 5 shows a user moving from living room to the kitchen. The secondary user is now aware whether the primary user is in his/her home or has gone outside.

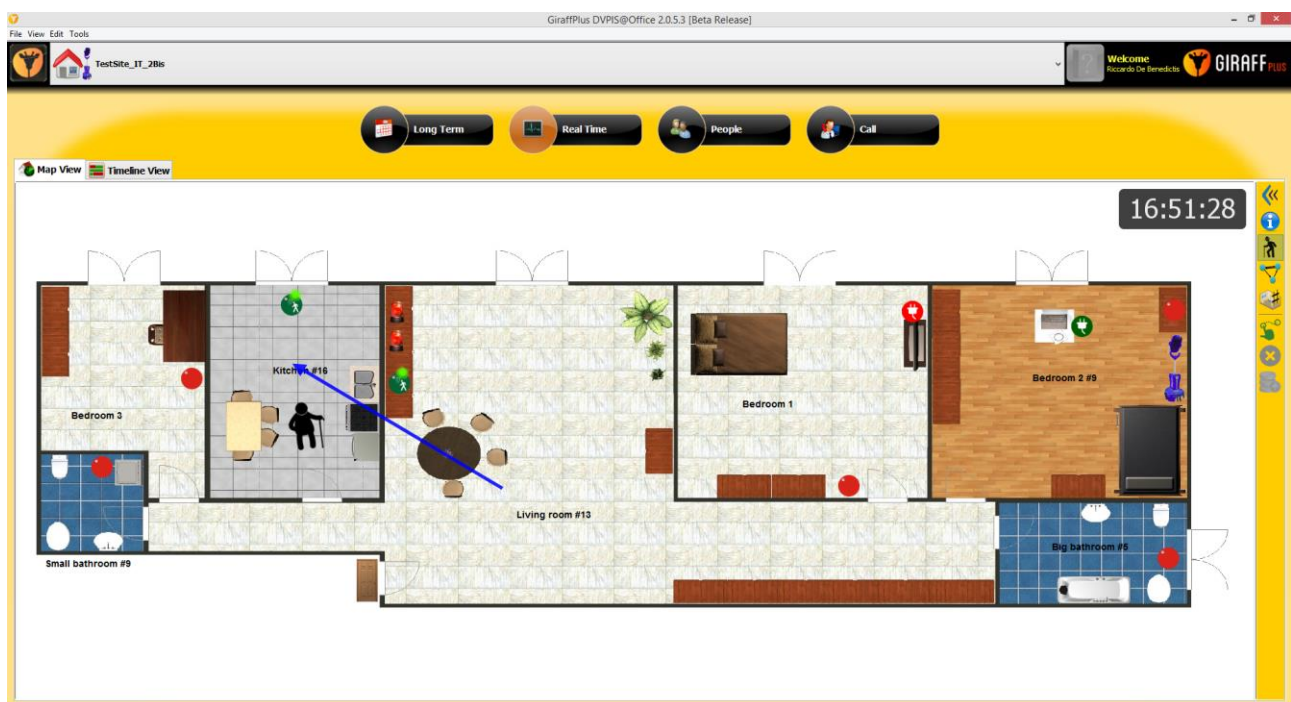


Figure 5 - User moving from one room to another.

The shared space section has been enhanced for sending different kinds of media (i.e., pictures, audio files or videos) to the primary user (see Figure 6). Specifically, the secondary user can now

send single YouTube¹ videos as well as YouTube playlists that will be reproduced on the Giraff robot through the DVPIS@Home. In addition, the secondary user can now send generic images to the primary user or specific screenshots of the DVPIS@Office representing, for example, physiological measurements. Finally, the secondary user can send music files to the primary user.

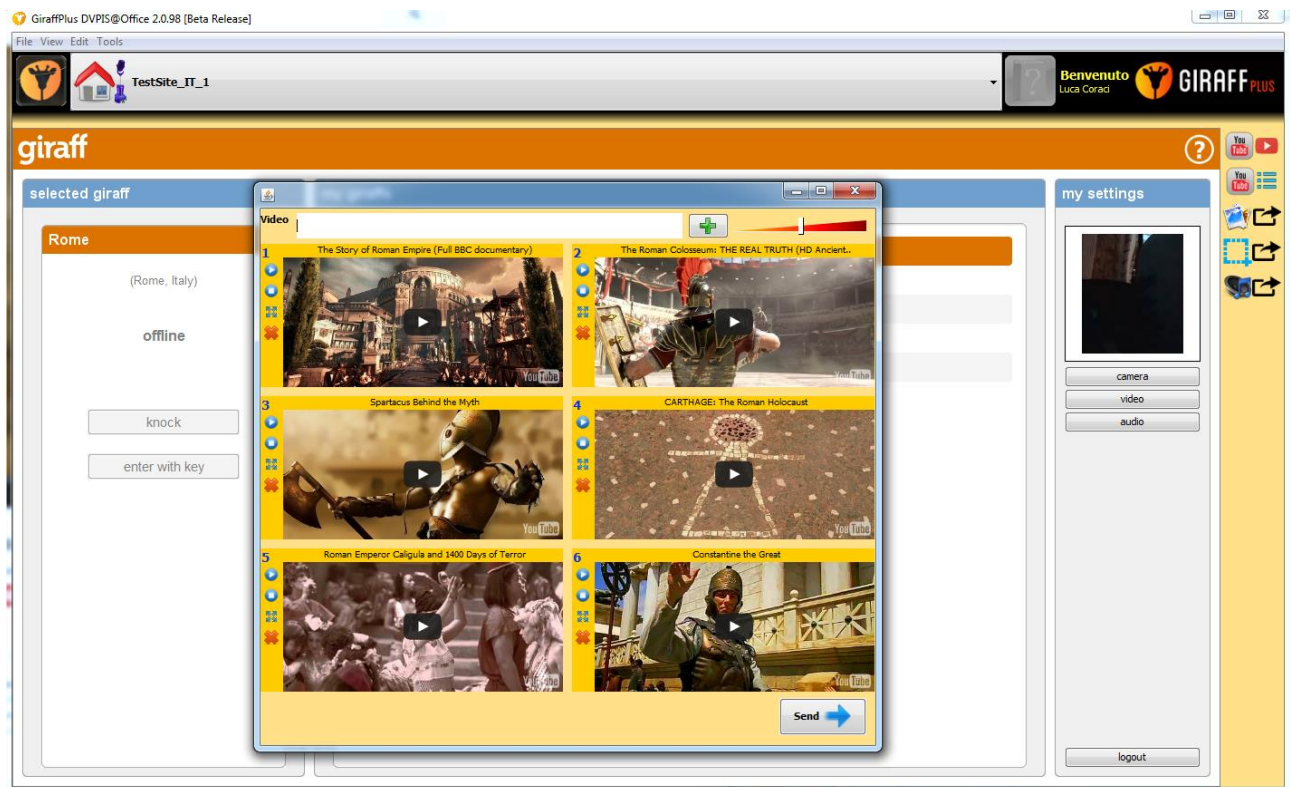


Figure 6 - Sending media through the DVPIS shared space.

4.2 The new @Mobile

GiraffPlus data client tool DVPIS@Office was designed and implemented as a desktop application run in a java environment. It could access all the data generated in one of the observed locations (i.e. home) and visualize the data on a timeline and other views, depending on the data at hand.

Other than displaying historical data, the following important functionalities are also supported:

- display real-time data

¹ <http://www.youtube.com>

- display alerts
- allow for two-way communication with the primary user (patient)
- display reminders
- etc

The @Office client is a full-blown desktop java-based application, running stand alone in a desktop or laptop computer.

Any secondary user (i.e. doctor) in charge of monitoring or analysing the data from a specified home is bound to a desktop application and office workstation, thus making it hard to have the data at hand at any time and any location.

Provided the doctor has any kind of hand-held device with a data connection to the internet, a web application makes accessing the data much easier regardless of the doctors current location.

Data is in a form optimized for the web and mobile devices, which allows the user to have instant overview of necessary data.

At the moment, the application will display the vital dataset, which includes:

- complete sensor data (e.g., motion sensors, blood pressure sensors, etc.)
- alerts (e.g., falls)
- user activities (e.g., cooking, working at pc, etc.)

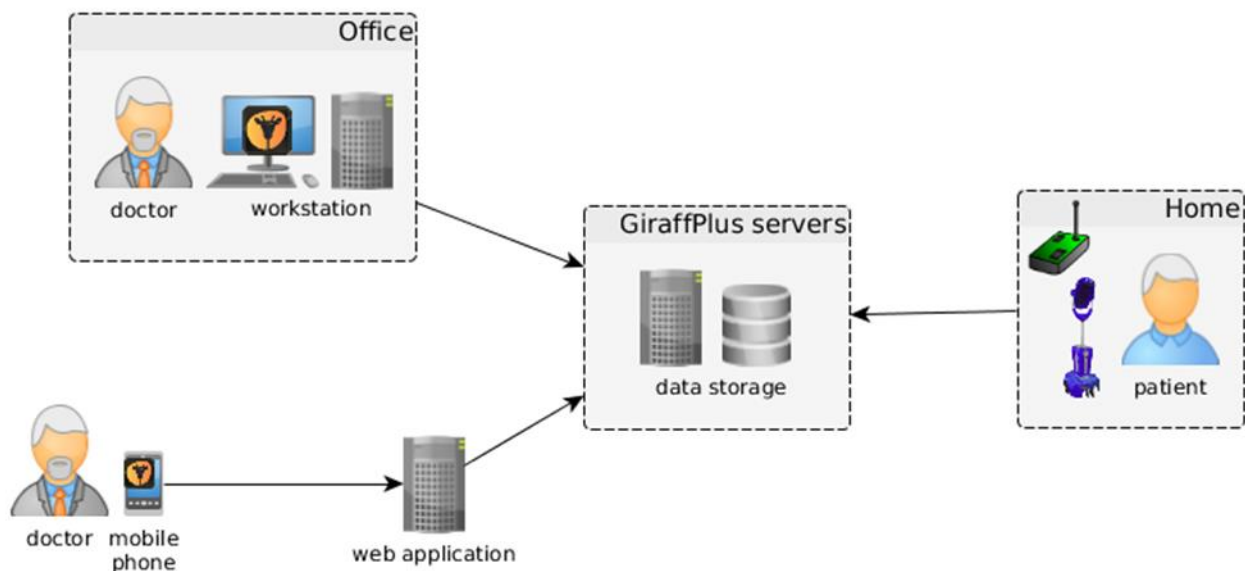


Figure 7 - General GiraffPlus system layout.

4.2.1 Implementation details

Web application requires only little specific business logic, mostly dealing with security issues and data transformation to a form factor suitable for presentation on mobile devices.

All the necessary data is already stored in a common data storage, which serves the same data to the desktop application already through the web service REST API.

Some sensor data must be interpreted to get the actual information about the patient activities, which is a process running on an context recognition server and is accessible via simple API.

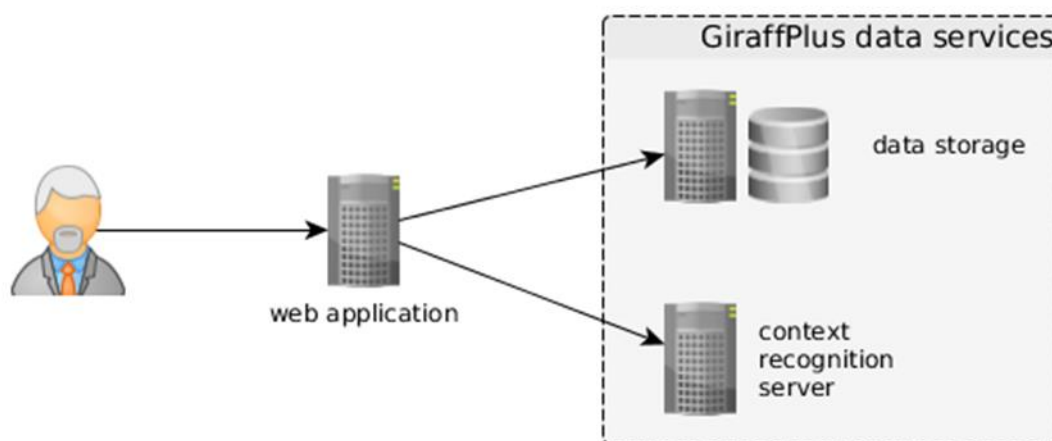


Figure 8 - Interactions between web-app and other systems.

Web application requires no permanent local data storage and only serves data from remote storage. All user information is also stored and managed remotely. A local data cache is established for flow optimization.

Once the user is logged in, all data is stored in session and invalidated after the session expires.

Data is initially loaded for a predefined period dating back from the current date/time. More data from the past is loaded automatically as the user browses the timeline.

We do not access real-time data packets but do query the data storage regularly at a predefined time interval – for instance, every 60 seconds.

GiraffPlus @Mobile is a WSGI application written with Django framework, which allows fast application performance and quick development cycles.

Typical setup looks like this:

Legend:

- http server: Apache 2 (<http://httpd.apache.org/>)
- proxy/WSGI HTTP server: Gunicorn (<http://gunicorn.org/>)
- process monitoring: Supervisor (<http://supervisord.org/>)

Apache http server forwards any request for the web application to the internal proxy, which in turn passes the request to one of many pre-forked Django server instances.

Django server processes are monitored by process control system Supervisor, which is a tool that can monitor and restart failed processes.

All outgoing requests are http REST API calls to the data storage service and context recognition server.

In order to be able to support as many user-end devices we're using the HTML5 and CSS3 standard code, but no special interfaces or elements are used, to be backwards compatible with most of the web browsers. Currently the aim is to support the web browser or operating system as listed, or newer:

- Internet Explorer 9
- Chrome 20
- Firefox 11
- Safari 5.1
- Opera 12.1
- iOS 6.1
- Android 4.0

Web browsers have to have JavaScript enabled and must allow cookies on the web application site.

Libraries that are used on the client side are the following:

- jQuery 1.11.1 for data and event manipulation (<http://jquery.com/>)
- Bootstrap 3 for general layout (<http://getbootstrap.com/>)
- vis.js 3.7.1 for timeline data visualization (<http://visjs.org/>)

All libraries used are released under MIT license.

Data visualization will use responsive design to maximize the usability on wide range of devices.

All the listed components have full touch support, therefore making the web application usable in full range also on touch driven devices.

All communication channels explicitly use SSL encryption, from user to web application server, as well as between the web application server to data storage service.

Part of the GiraffPlus project is also a GiraffPlus Certificate Authority, which issues x.509 certificates used to authenticate communication endpoints and initiate SSL protocol.



Figure 9 - Secure communication channels.

User authentication is performed with user certificates issued by GiraffPlus Certificate Authority.

Each issued certificate identifies a user, which must be listed as one of the users in the data service Users collection. If user cannot be identified as an active user in the backend service, the application denies access to the user.

Following security tests performed each time a user wants to start a session:

- http server requires a valid GiraffPlus CA issued certificate from the user
- http servers allows only SSL connections
- web application identifies the user from the certificate and requires its data to be present in the data storage service Users collection

At the moment no particular ACL system is implemented on the data storage service side, as long as the accessing user has a valid GiraffPlus CA issued certificate.

Web application can access all the data available at the data storage service.

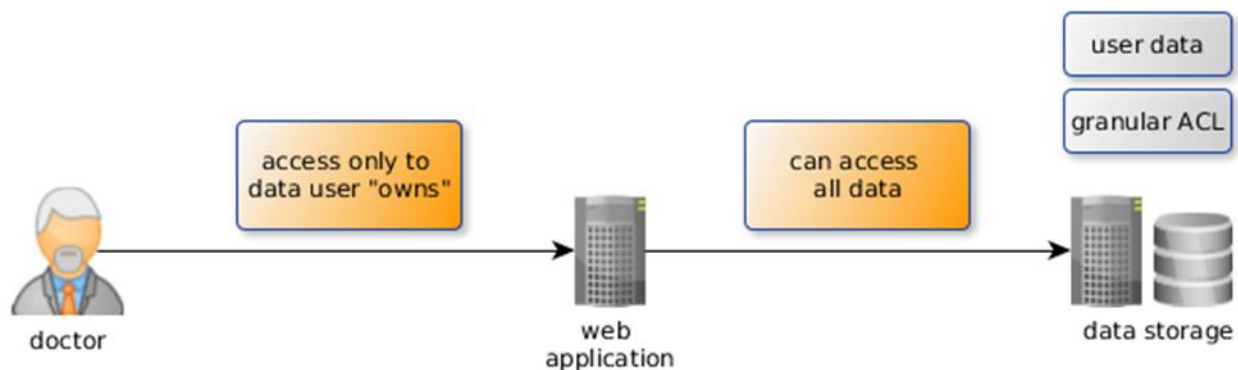


Figure 10 - Secure data access.

When a user is identified by the web application, it queries the data storage services for homes (Giraff enabled sites) where the authenticated user is either a secondary user or an engineer. Implicitly, the web application can only display and handle data that the user has right to see. No further limitation is implemented regarding the data access within the home, where the user is registered as secondary user or an engineer.

All the data is queried by reference and thus preventing data harvesting or data injection.

User roles for particular homes are managed by the GiraffPlus Engineer GUI interface (<https://gui.giraffplus.xlab.si/>).

4.2.2 Functionality

DVPIS@Mobile is a web application, that can present sensor data, alarms and activities for a certain home in any modern web browser. All it requires is internet connection with an installed GiraffPlus CA issued certificate.

It is primarily designed with mobile devices in mind, but can be used as any regular web application in a browser on any desktop computer also. Application fully supports touch gestures.

Figure 11: Once a user opens up the web application, a list of homes equipped by Giraff technology is presented to him. A user can access only the homes where he is listed as an engineer or secondary user.

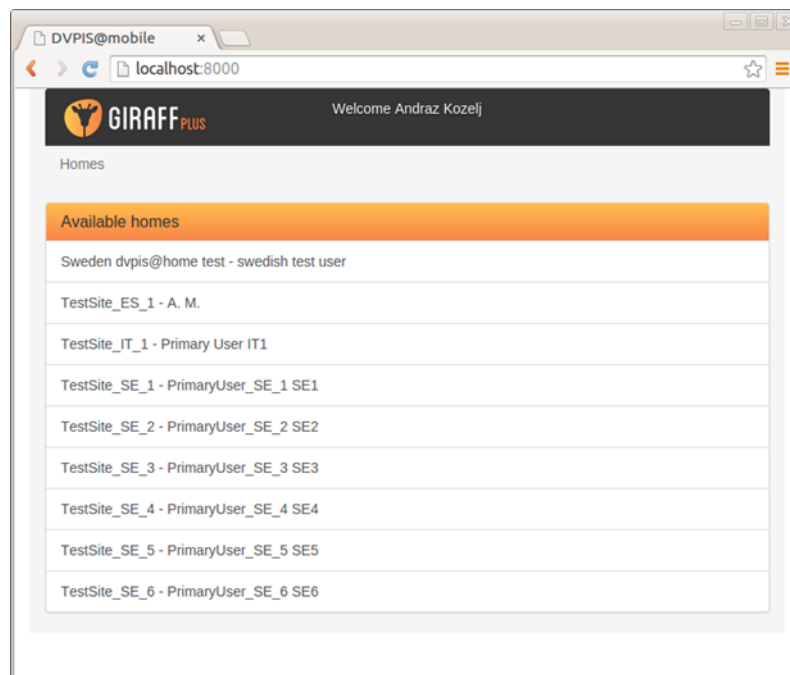


Figure 11 - DVPIS@Mobile welcome screen.

Figure 12: Once a home is selected, user can immediately see the name of the primary user, birth date and Physiological and Social indicators and Alerts state for quick assessment.

A list of sensors is presented to the user, grouped by the rooms where they are located. Sensors not bound to a location are listed in the last section.

Here the user checks the sensors he/she would like to observe on the timeline and clicks “Show data” button once done. This way the user can control the amount of loaded data preventing cluttering.

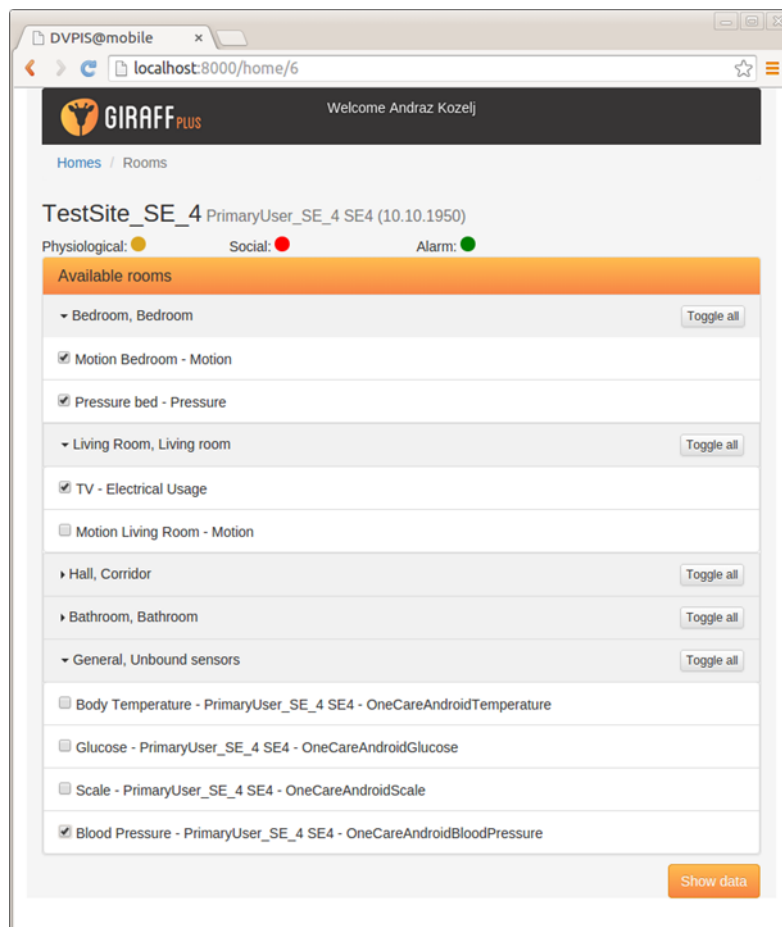


Figure 12 - List of rooms and sensors in a home.

Figure 13: Once the data for selected sensors is loaded, it is displayed in a scrollable timeline. Initial display shows only data for the last 7 days, but additional data is loaded automatically when user scrolls in the past.

Timeline displays different kind of data:

- single data points for sensors that mark single-instance actions (e.g. movement)
- single data points with data for measurements (e.g. glucose measurement, body temperature or hear pressure measurements)
- time-spans for data that has a beginning and an end point (e.g. electricity usage)
- always present alerts

A click on any of the data points/strips reveals more detailed data about the event.

Data display is compressed, clustered, for more details the user must zoom-in to access single data points. There are different time-range view pre-sets (14 days, week, today) for different zoom factors and free-zoom. Zoom can also be manipulated by mouse-wheel and pinching in mobile devices.

The system does not show the data in real time, but it updates every minute. Thin red line on the right side of timeline presents the current time, while darker background on timeline covers the time range for which the data is displayed. Last update timestamp is noted on top of the timeline.

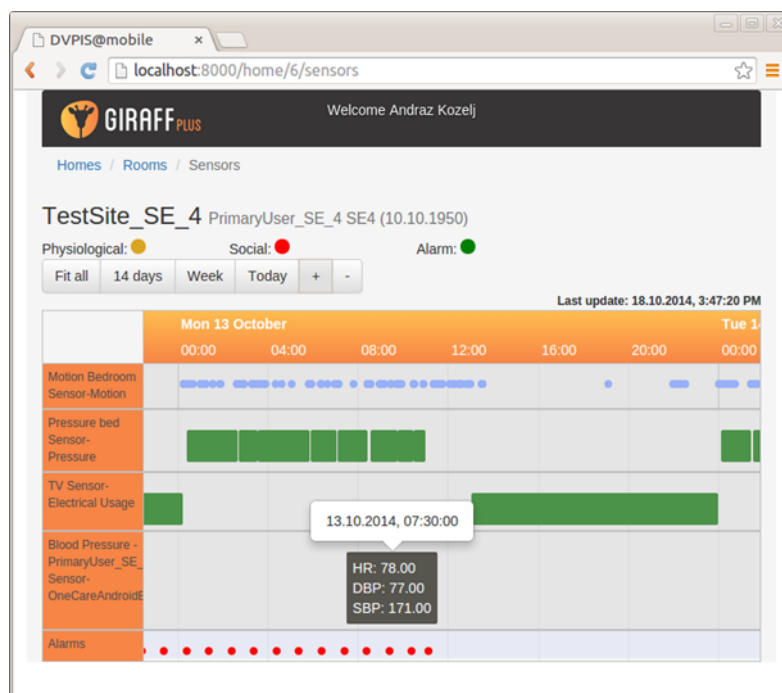


Figure 13 - Sensors data displayed on a timeline.

5 The DVPIS@Home

As already introduced in deliverable D4.1 and in D4.2, the DVPIS@Home (also shortly referred to as @Home in the following) is an environment specifically designed for running on the telepresence robot and constituting an additional communication channel between outside the home to inside and vice versa. With the passing of time, this environment has evolved from the Alpha version described in D4.1, providing only few initial functionalities, to the more stable Beta version described in D4.2, representing both a consolidation of the initial ideas and proposing additional GiraffPlus functionalities. The final version of the @Home presents new functionalities as the possibility to send voice messages, YouTube integration and the possibility to control robot head movements as well as some interface restyling.

5.1 The final @Home frontend

The @Home aims at enriching the features already provided by the standard Giraff robot exposing some additional services to the primary user. An “obvious” key requirement is that all these features had to be preserved, and @Home should not interfere with the existing behaviour. The Final version of @Home can be seen in Figure 14, Figure 15 and Figure 16. Similar to the Beta version, we can identify three main different functionalities:

- **Avatar** (Figure 14): this functionality preserves the “telepresence” service that the Giraff robot provides. The Giraff application has been indeed embedded within the @Home so as to maintain the possibility for secondary users to visit the older user’s apartment through the telepresence robot.



Figure 14 - The "Avatar mode" of the DVPIS@Home.

- **Messages** (Figure 15): an environment has been designed to allow the primary user to receive messages from secondary users or reminders and suggestions (hence this functionality is directly connected with the personalization capabilities described in section 6). As an evolution of the Beta version, messages and reminders maintain both the textual and the spoken form.

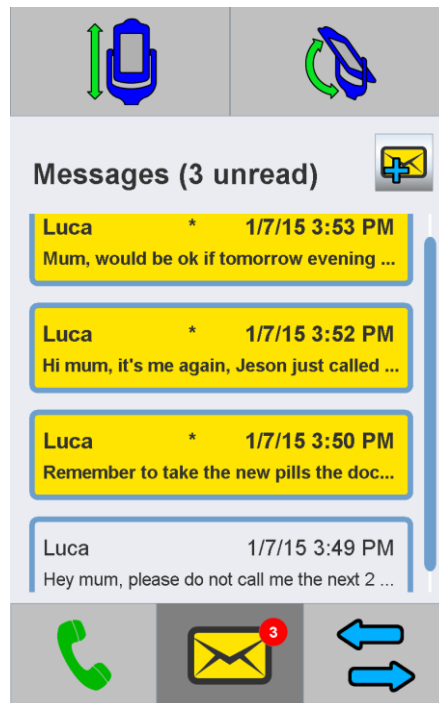


Figure 15 - The "Messaging mode" of the DVPIS@Home.

- **Shared space** (Figure 16): endow the system with a shared space between the primary user and the secondary users that could foster a discussion on the health status and habits of the old person. For example, this panel allows to show personal data to the primary user (e.g., physiological measures) integrating the telepresence with further information content as a support to the interaction between primary and secondary users.

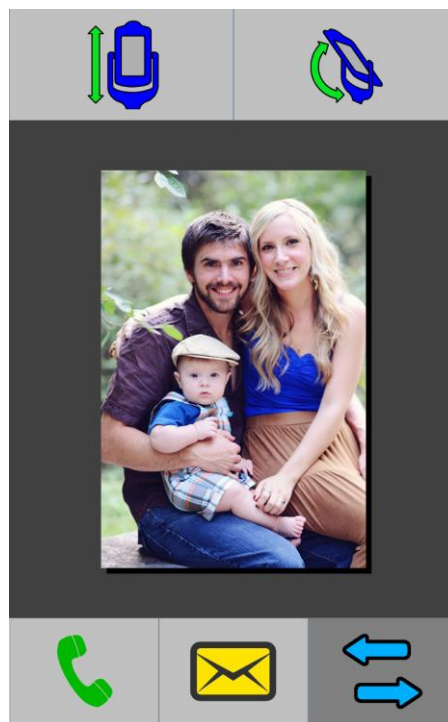


Figure 16 - The "Shared space mode" of the DVPIS@Home.

5.1.1 Voice Messages

Besides being able to receive text messages from a secondary user (sent by the means of the DVPIS@Office software), primary users can receive – and send – voice messages too: this feature is somewhat similar to a voice-mail service.

In fact, it is not practical to send text messages from the robot using an on-screen keyboard, particularly for an elder person, while recording a voice message is just a matter of choosing the recipient from the list of secondary users, tapping “record” button and then “send” when finished. As before, voice messages can be sent by and received from the secondary user by the means of DVPIS@Office tool.

5.1.2 Physiological Data Display

The GiraffPlus ecosystem is also composed by a number of sensors that gather data from the primary user – and their environment – and send these data to GiraffPlus servers for further elaboration and analysis. During the test phase some primary users reported the need of being informed about what was happening under the hood, especially concerning physiological data measurements: which measure was acquired? was it sent correctly?

For this reason, DVPIS@Home now provides feedback to the primary user, showing on the robot screen the result of the last physiological measurement as soon as the data reaches GiraffPlus servers. The result is also read out by the means of the text-to-speech service.

5.1.3 YouTube integration

During the tests, a secondary user expressed the desire of being able to make her elder mother listen to some music of her son's choice: following his advice, we added support for playing YouTube videos through the robot.

The actions are initiated by the secondary user through the DVPIS@Office tool, which can be used to define a playlist, play, pause, seek to a certain position, advance to a specific video in the playlist and so on: the DVPIS@Home acts thus like a remote TV, even if the primary user is not completely passive as they are endowed by some control over the playback process; namely, they can play, pause, seek, advance/go back in the playlist, mute the volume: basically, the only thing they cannot do is define the playlist themselves.

5.1.4 Robot head movement

Newer models of the Giraff robot are capable of rotating their head up to 180° and to raise/lower their neck.

Normally, the first feature is used when the robot is charging, facing the wall, and a call from a secondary user does arrive: the head rotates and the screen is put upside-down so that the primary user can see who is calling without having to reach the wall and watch the monitor from an uncomfortable position.

We exploited this capability in two ways: first, if the robot is charging the screen rotates whenever a new message or physiological measurement is received, so that the user might easily read the collected data or interact with the user interface to read the new message. Second, we made it possible for the primary user to rotate the screen at their wish when the robot is charging, allowing for an easy way to use the robot even if someone is not calling or data is not being received; if the user wants to send a new vocal message, for example, they just need to touch the screen on whichever part to make it rotate. When they are finished, they can touch the “rotate screen” button in the upper part of the screen to make the head return to its “rest” position.

The ability to raise/lower the Giraff neck is meant to make the usage of the robot more comfortable if the primary user is seated, when the screen is too far away from the person. We added a new button, “toggle stand/sit”, to make the primary user able to select the desired height of the robot head autonomously, instead of having to rely on the secondary user activating this feature using the pilot software (see Figure 17).

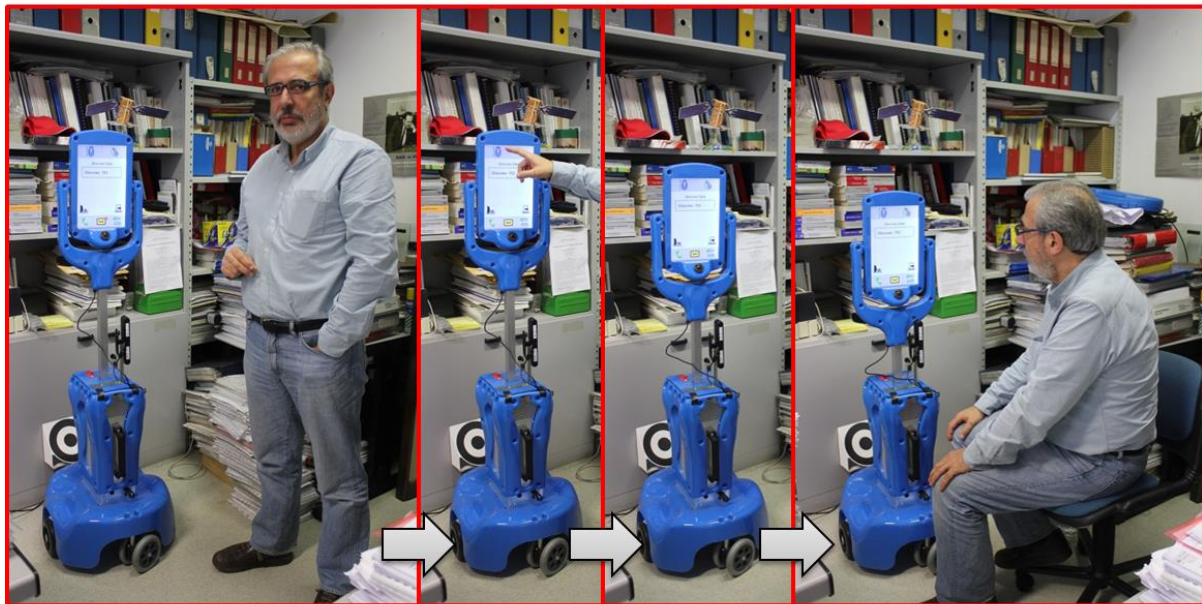


Figure 17 - The Giraff robot with raised/lowered neck.

5.1.5 Implementation details

Voice messages: the DVPIS@Home records WAVE or FLAC data at 16 bit, 16Khz. FLAC audio files are currently not supported by the DVPIS@office. It can currently play WAV and FLAC files at whichever resolution and frequency.

YouTube integration: the integration is made possible by the means of the DJ Native Swing library (<http://djproject.sourceforge.net/ns>), which provides a bridge to connect native components (such as a web browser) inside Java Swing components. The player itself is the YouTube Flash Player, which is controlled using the official YouTube API version 3.0 through some synthesized JavaScript code.

6 The Personalization in GiraffPlus: New Features

In addition to the data visualization services described above, another aspect of the GiraffPlus system is the provision of personalized and proactive interaction services. The DVPIS back end is indeed responsible for preparing the “personalized information to the users” and for offering support for different types of services like *reminders*, *reports*, *proactive suggestions*, *warnings* and *alarms*.

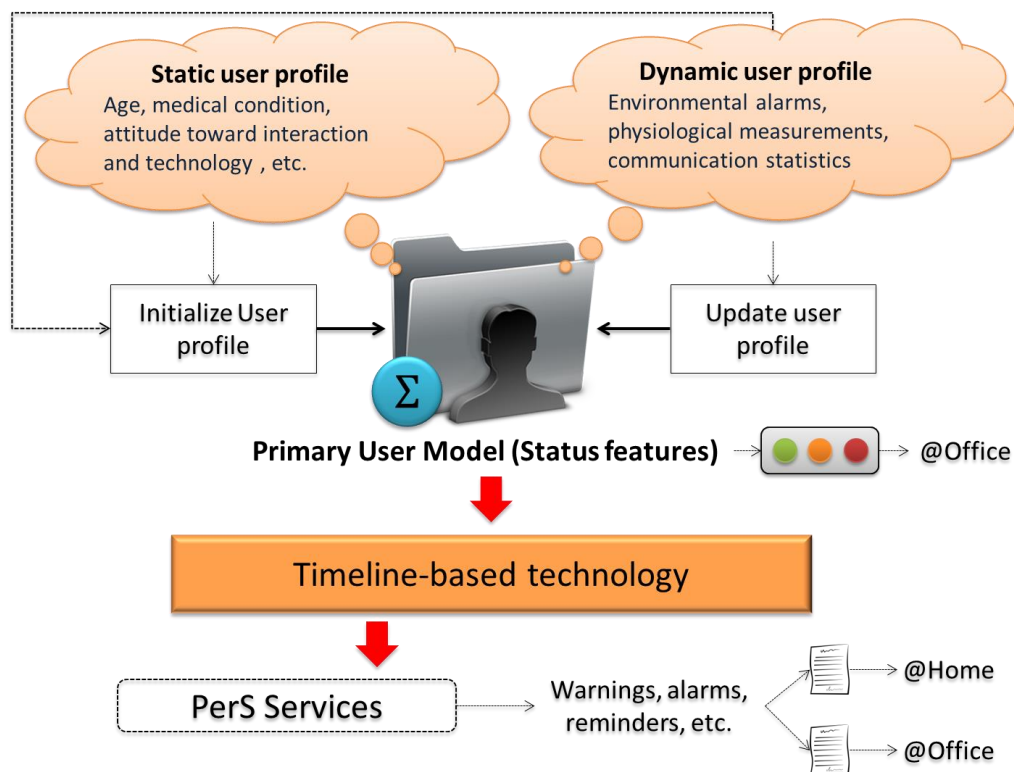


Figure 18 - The personalization service idea in GiraffPlus

The general idea behind the personalization services in GiraffPlus is shown in Figure 18 (but see [4, 5] or D4.2 for further details). A user model is created that enables the personalization of services. In the current version of the software, two different type of information are used to create a user model, that is a combination of: (a) *static* user parameters, considered immutable during the care process, describing both general data (e.g., his/her age), medical condition (a chronic disease), and also his/her attitude toward interaction and technology (e.g., the degree of extroversion, to be used for example, to avoid sending a person an excess of undesired information or recommendations in the case he/she is not willing to accept them); (b) *dynamic* user parameters, whose values are extracted from the physiological monitoring of the person and from observing variability of other continuous data flows like, for example, the monitored interactions that the user has with the system (both through DVPIS and through the Giraff robot) as well as the state of specific sensors dedicated to the alarm detection.

This kind of behaviour is obtained by exploiting a particular temporal planning approach, known as timeline-based, which allows us to easily represent information in time. We then enhanced this process with a classification system, which enables us to include complex domain knowledge inside the system (as shortly described in D4.2).

As a result of a still in progress study on the nutritional needs of elder people, the final PerS release considers the addition of further parameters for describing both the static state of an elder (e.g., his/her height) and the dynamic state (e.g., his/her body mass index).

A special attention has been given to the implementation of a tool for editing user preferences. In particular, the DVPIS-UM tool (UM stands for User Modelling) has been developed as an additional tool for GiraffPlus system administrators so as to provide them utilities for the definition of preferences on the single users (see Figure 19). Such preferences, for example, allow GiraffPlus system administrators to reduce access to some sensors which might be more sensible than others for privacy reasons.

The screenshot shows the 'DVPIS-UM' application window. On the left, under the 'Users' tab, there is a scrollable list of users. 'Riccardo De Benedicis' is selected. The main area on the right contains a form for editing user preferences. The form includes fields for personal information (Name, Surname, Sex, Height), system settings (Category, Preferred language, Back time, Start night, End night), health thresholds (Daily SBP, Nightly SBP, Daily DBP, Nightly DBP), location (Home), and time (Start time, End time). There are also sections for 'Environmental sensors' and 'Physiological sensors' with checkboxes and dropdowns to select specific sensors. A 'Context recognizers' section is at the bottom. A 'Save' button is located at the bottom right of the form.

Figure 19 - DVPIS-UM User preferences.

6.1 Proactive services

In addition to user preferences, the DVPIS-UM tool might be used for editing rules which characterize the proactive services (see Figure 20). A graphical user interface allows a user friendly definition of reminders, alerts, mails, reports, etc. which might react to the combination of static and dynamic parameters of the elderlies living in their homes.

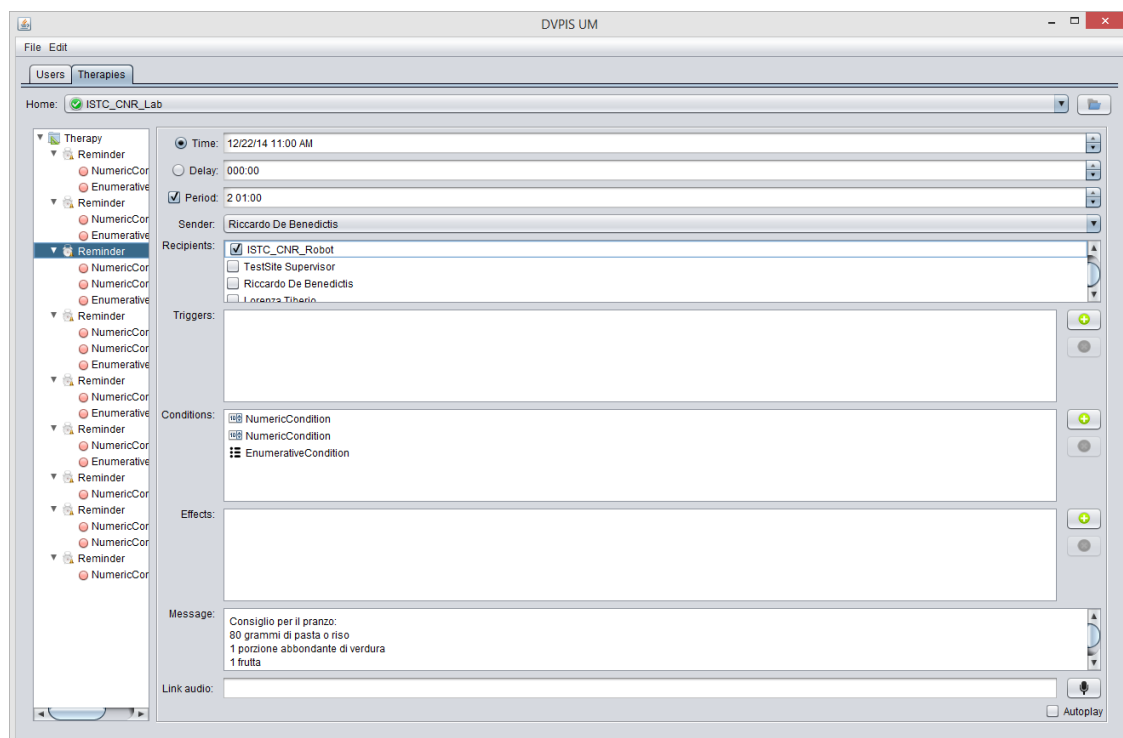


Figure 20 - DVPIS-UM Rule editor.

Each event has associated a set of conditions that must be verified in order for the event to be activated. For example, it may be convenient to do not send some less important reminders when the system detects the primary user is sleeping. Conditions might be used for discriminating reminders sending, for example, tips on diet to follow depending on the current body mass index. The DVPIS-UM can be exploited for the definition of new conditions on all the events that are planned on a home.

Similar to conditions, triggers are a kind of annotation that might be associated to events. Contrary to conditions, triggers establish when an event happens. In other words, whenever the condition defined in the trigger is verified, the associated event is activated. The combination of triggers and conditions allows several complex behaviours. One might think, for example, to trigger some event when a blood pressure measurement is taken, yet only when some condition on other sensors is verified.

Among the different kinds of events that the personalization system can handle, questions play an important role. In particular, questions have associated answers with resulting consequences (i.e., other events). For example, the personalization system might ask to the elder whether the lunch consisted of meat or fish, providing suggestions for dinner so as to ensure a correct and complete nutrition.

7 The Install and Maintenance Service

The Install and Maintenance Service is the web application responsible for the configuration and the maintenance of the GiraffPlus system. Since this service did not receive any updates since D4.2 and therefore does not offer new services, it is briefly described here for completeness.

The Install and Maintenance Service (accessible from <https://gui.giraffplus.xlab.si/>) is the main tool to be used to edit existing and add new:

- complete home configuration
- sensor types
- room types
- organizations involved in the project
- primary, secondary users and engineers
- assign users to specific homes, thus allowing access for DVPIS
- DVPIS user interface translation packs

On the welcome screen, as seen of Figure 21, the GiraffPlus Engineer can choose to either create a new home, sensor type, room tape, organization, user or edit one of the existing. He can also edit user interface translations for DVPIS software package.

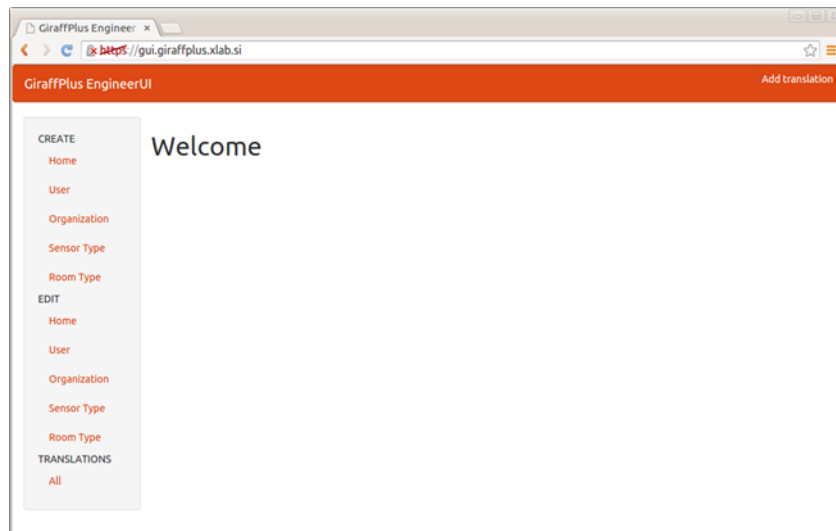


Figure 21 - Welcome screen.

The web application takes the user through each of the operations in a wizard like mode, where certain tasks are performed in a step by step fashion.

The screenshot shows the 'GiraffPlus Engineer' application window with the URL `http://gui.giraffplus.xlab.si/user/edit`. The interface is divided into three main sections:

- Organization:** A sidebar menu with options: Organization, Sensor Type, Room Type, TRANSLATIONS, and All.
- Account information:** Contains fields for Primary user, Secondary user, and Engineer (all checked). Below are input fields for Healthcare ID, Healthcare ID, Alarm PushID, Alarm PushID, Healthcare Key, Healthcare Key, and Organization (set to 'XLab d.o.o.').
- Contact information:** Includes fields for Street (Pot na Brdo 100), Postal code (1000), City (Ljubljana), Country (Slovenia), Phone, Mobile Phone (+386 41 524 814), and E-mail (andraz.kozelj@xlab.si).
- Responsibilities:** A dropdown menu showing a list of names: A. M., ATest User, Annica Kristofferson, and Antonio Pedro Damasceno.

Figure 22 - User information editing.

For example, observe the following sequence of steps when editing an existing home configuration. Each step has at least one more sub-step, where the entities are edited.

The screenshot shows the 'GiraffPlus Engineer' application window with the URL `http://gui.giraffplus.xlab.si/home/list`. The interface displays a sidebar menu with options: CREATE, Home, User, Organization, Sensor Type, Room Type, EDIT, Home, User, Organization, Sensor Type, Room Type, TRANSLATIONS, and All. The main content area is titled 'List of all GiraffPlus enabled homes' and shows a table with three rows of data: 'TestSite_1', 'TestSite_2', and 'TestSite_3'. There are 'Cancel' and 'Next' buttons at the bottom right.

Figure 23 - List of all homes.

The screenshot shows the 'GiraffPlus Engineer' application window with the URL `http://gui.giraffplus.xlab.si/home/edit`. The interface displays a sidebar menu with options: CREATE, Home, User, Organization, Sensor Type, Room Type, EDIT, Home, User, Organization, Sensor Type, Room Type, TRANSLATIONS, and All. The main content area is titled 'Home configuration' and shows a form with fields for Name (TestSite_1), Organization (Giraff Technologies AB), User (ISTV-CHB), and Sensor Type (IMB-CHB). There are 'Cancel' and 'Next' buttons at the bottom right.

Figure 24 - Home name and responsible organization.

Engineer selects a home and can edit it's basic information such as name and responsible organization.

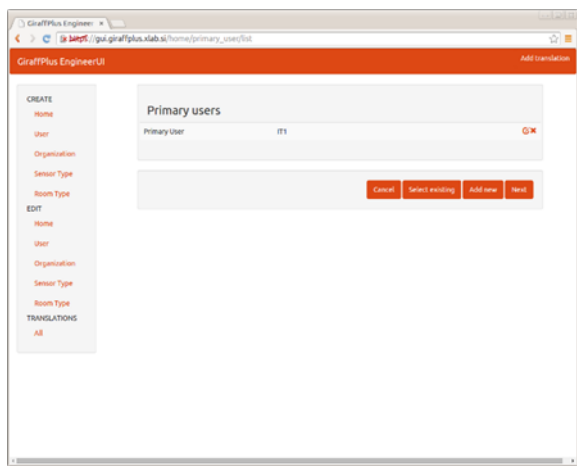


Figure 25 - List of primary users.

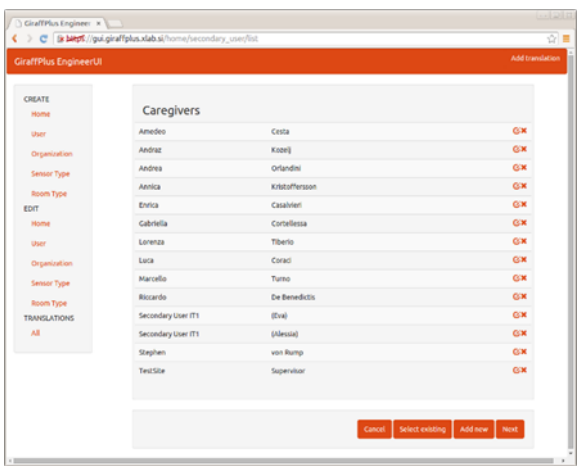


Figure 26 - List of secondary users.

The following screens take the engineer through the list of primary users (patients living in the home) and secondary users (caregivers), which can access the data through DVPIS application and receive alarms configured for this home.

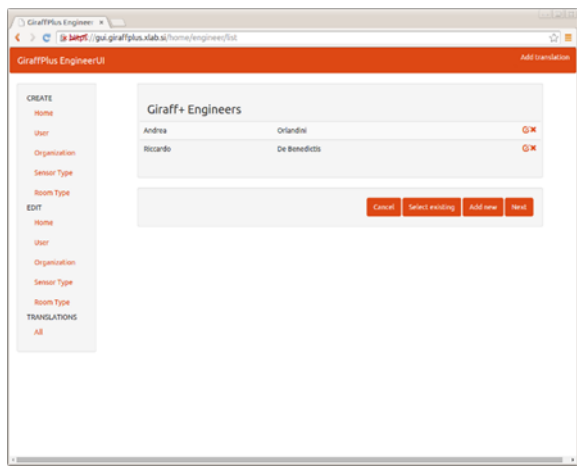


Figure 27 - List of engineers.

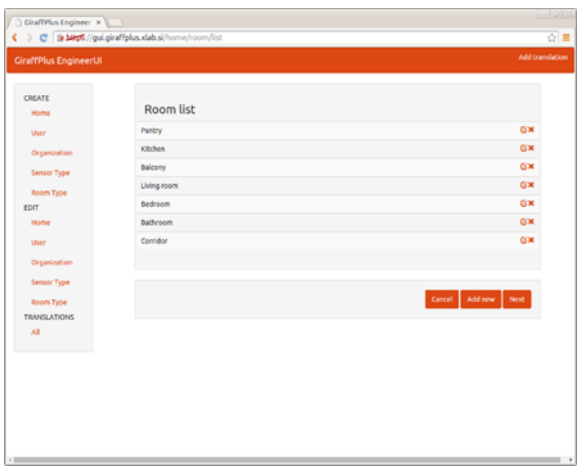


Figure 28 - Rooms within the home.

Giraff engineers are assigned to each home for technical administration purposes. Rooms define the configuration of the home and provide locations for the sensors, which are then displayed in DVPIS software package.

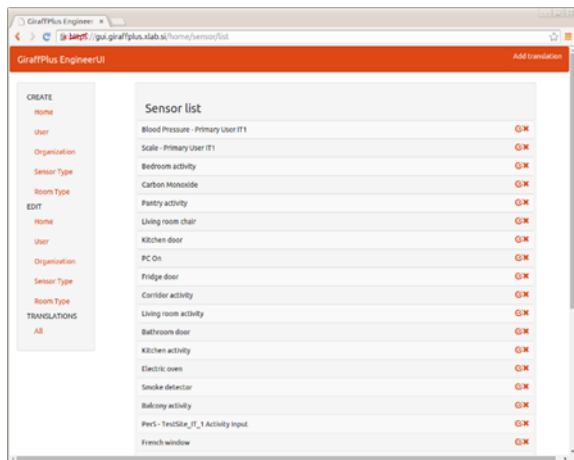


Figure 29 - Sensor list.

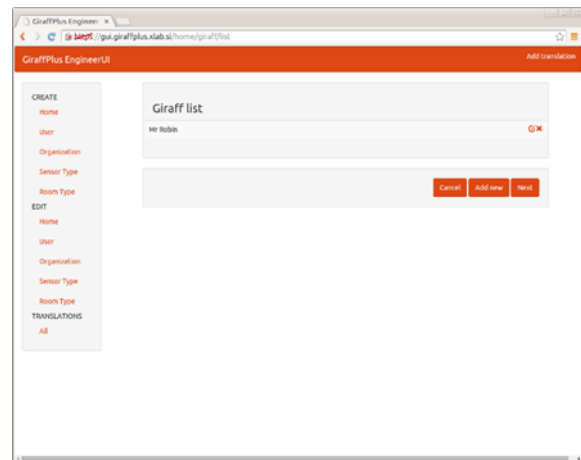


Figure 30 - List of Giraff robots.

Sensor list exposes all the sensors that are registered with the home and placed in different rooms. Included are also the sensors a patient wears or uses regularly (such as blood pressure measurement sensor or glucose level measurement).

A home can also have a Giraff telepresence robot, which is listed in one of the screens.

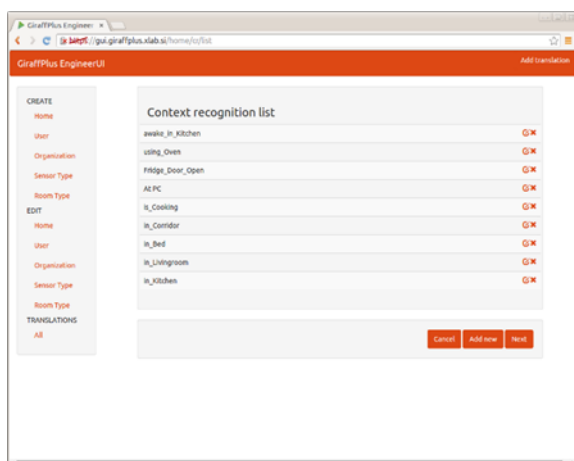


Figure 31 - List of activities.

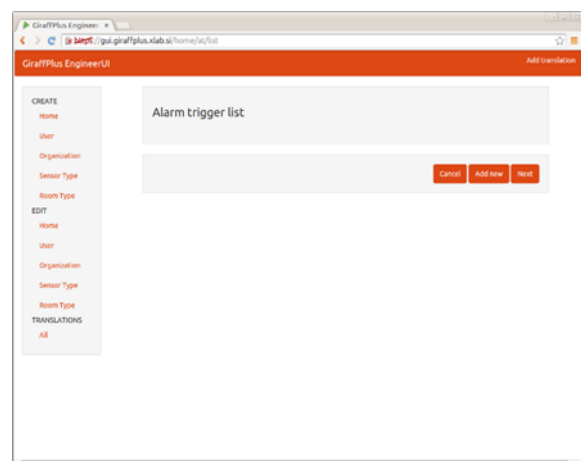


Figure 32 - List of alarms.

Activities are raw data interpreted through rules, which deduct new states and help us understand some of the data in a glance. Each activity has a rule-set which is registered here but processed separately on a “Context recognition server”.

Alarms behave in similar ways.

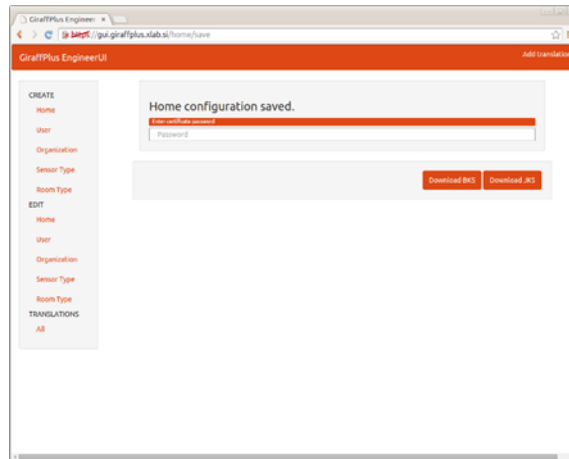


Figure 33 - Certificate download.

Each entity listed in Install and Maintenance Service web application can be issued a GiraffPlus Certificate Authority certificate, in BKS (android) or JKS format. Certificates help establish a secure communication channel between components and help with identification between middleware components.

To support internationalization feature, translation language packs for DVPIS software are edited through the web application.

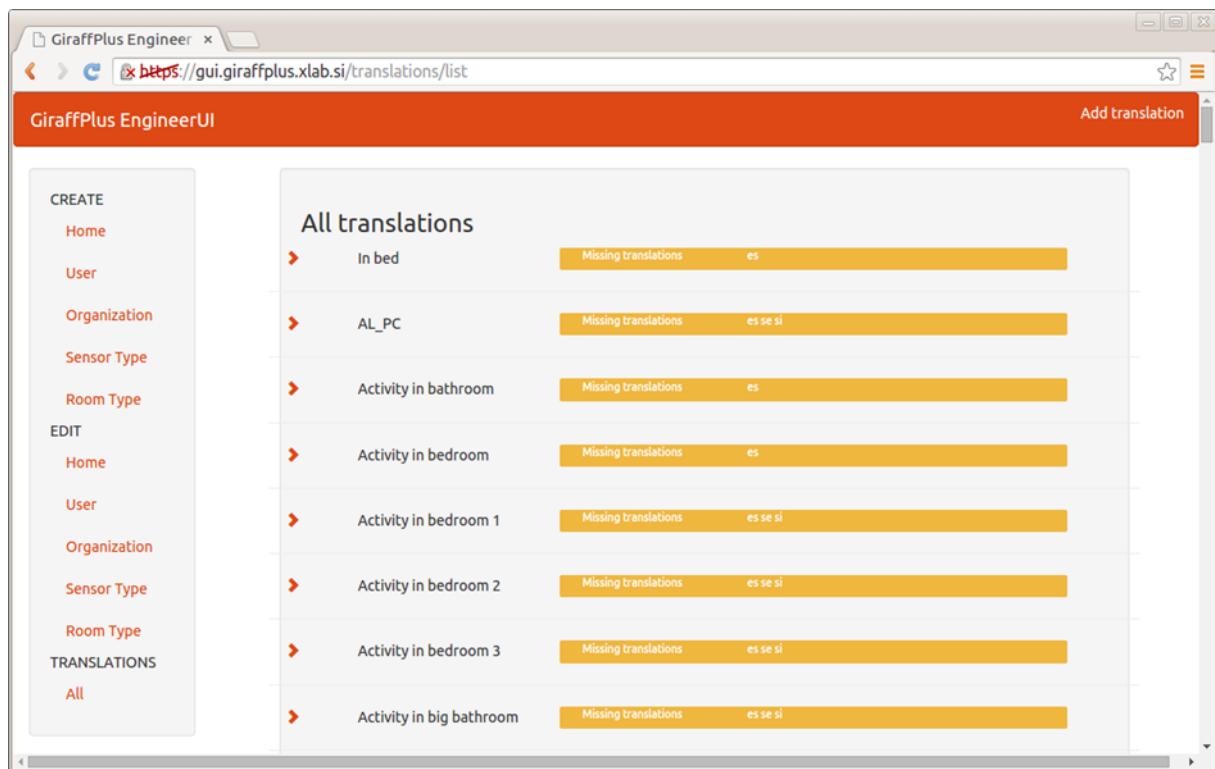


Figure 34 - List of string values to be translated.

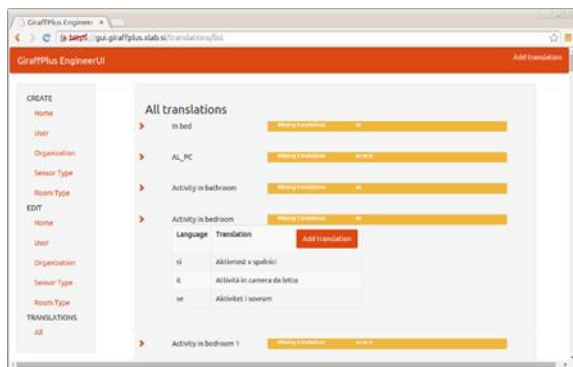


Figure 35 - Browsing the translations.

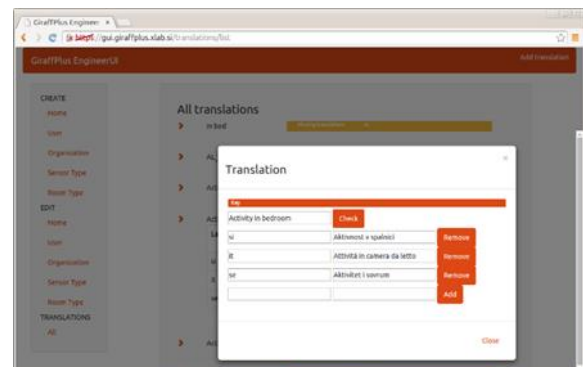


Figure 36 - Editing the translations.

Application is written in Java with Play framework 2.2 and connects directly to the GiraffPlus data storage via RESTful API.

8 Conclusions

This deliverable describes the final prototype of the Personalization and Interaction Services as the result of the work performed within Work Package 4. The deliverable is the natural arrival point of the process whose intermediate steps have been described in deliverables D4.1 and D4.2. This document describes the enhancements with respects to Alpha and Beta versions of WP4 software contributions to GiraffPlus

The final version of the Visualization Services incorporates the input from the last evaluation phase, integrating feedback collected by both primary and secondary users. Specifically, the @Office graphical user interface has been reorganized so as to provide a more uniform experience, guaranteeing, as much as possible, interface consistency. Further improvements have been undergone the @Home service on which we have focused on tools for controlling the height of the neck and orientation of the head, and in a more mature design and realization of several functionalities. The @Home and the @Office versions of the DVPIS have been enhanced with the possibility for sending media files (i.e., picture, audio and video files) to primary users.

The new @Mobile service has been developed as a new web application so as to respond to the ever increasing mobility needs of secondary users. Finally, the @UM tool has been developed with the aim of responding to the configuration needs of the personalization services.

9 References

- [1] A. Cesta, L. Coraci, G. Cortellessa, R. De Benedictis, A. Orlandini, F. Palumbo e A. Štimec, «Steps Toward End-to-End Personalized AAL Services,» in *AITAmI'14*, Athens, 2013.
- [2] A. Cesta, L. Coraci, G. Cortellessa, R. De Benedictis, F. Furfari, A. Orlandini, F. Palumbo e A. Štimec, «From Sensor Data to User Services in GiraffPlus,» in *ForItAAL*, Ancona, 2013.
- [3] P. Barsocchi, G. Bernardi, A. Cesta, L. Coraci, G. Cortellessa, R. De Benedictis, F. Furfari, A. Orlandini, F. Palumbo e A. Štimec, «User-oriented services based on sensor data,» in *ForItAAL*, Catania, 2014.

- [4] R. De Benedictis, A. Cesta, L. Coraci, G. Cortellessa e A. Orlandini, «A User-adaptive Reminding Service,» in *AITAmI'14*, Shangai, 2014.

- [5] R. De Benedictis, A. Cesta, L. Coraci, G. Cortellessa e A. Orlandini, «Adaptive Reminders in an Ambient Assisted Living Environment,» in *ForItAAL*, Catania, 2014.

A Appendix

A.1 The DVPIS user manual

This manual is supposed to support the delivery of the DVPIS Final Release. The software can be downloaded from the following links:

- WINDOWS users:

http://pst.istc.cnr.it/giraffplus/demo-releases/dvpis_office_beta_setup.exe

- MAC OS users:

http://pst.istc.cnr.it/giraffplus/demo-releases/dvpis_office_beta.zip

A.1.1 System requirements

For Windows Users there are no particular system requirements. For non-Windows users the following requirement is mandatory:

Mandatory Requirement	Downloadable at
Java Development Kit, Version 7+	http://www.oracle.com/technetwork/java/javase/downloads/jdk7-downloads-1880260.html

Table 1 - System requirements.

In fact the distribution for Windows user includes Java7.

Note: It is worth noticing that the embedded Giraff Pilot (integrated within the DVPIS) is available only for Windows users. Non-window users should use the pilot of the telepresence robot as separate software due to the fact that the Giraff Pilot software only runs on Windows machines (for example under MacOS it is possible to run the Pilot inside the Parallel environment).

A.1.2 Instructions for Installation

While the Final Windows version has a user friendly installer, Mac OS users need to unpack the zip file to run the software. We provide a detailed description of the required steps to take in order to correctly initialize and start the DVPIS@Office.

A.1.2.1 DVPIS@Office for Windows

Once the download is complete, just double click on the .exe file. Windows operating system requires administrator privileges to install new software. The installer software (see Figure 37) completely guides the user in all the required steps for the installation of the DVPIS@Office.

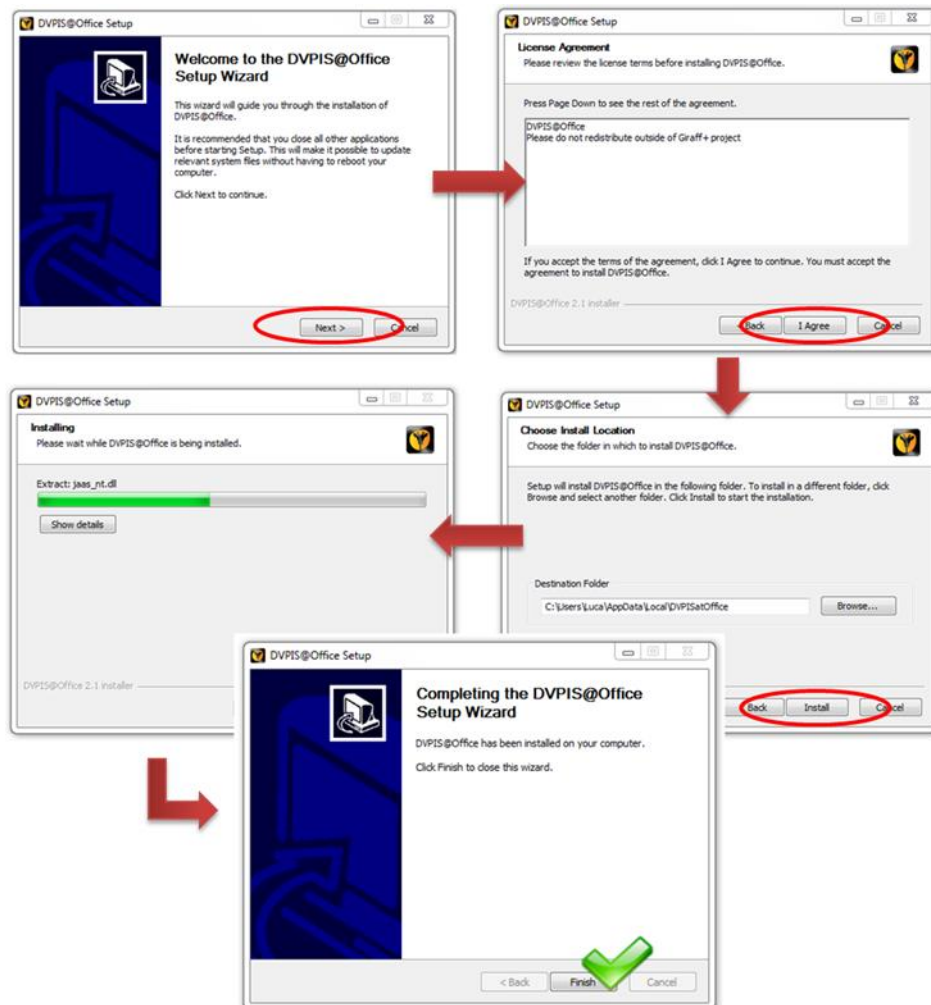


Figure 37 - The DVPIS@Office installer for Windows users.

Once the installing procedure has terminated, two executable items will be added to the Windows Start menu (see Figure 38). Unlike the simple one, which will start the DVPIS@Office, the one labelled with “(debug mode)” will enable a DOS-like console that can be used for debugging purposes.

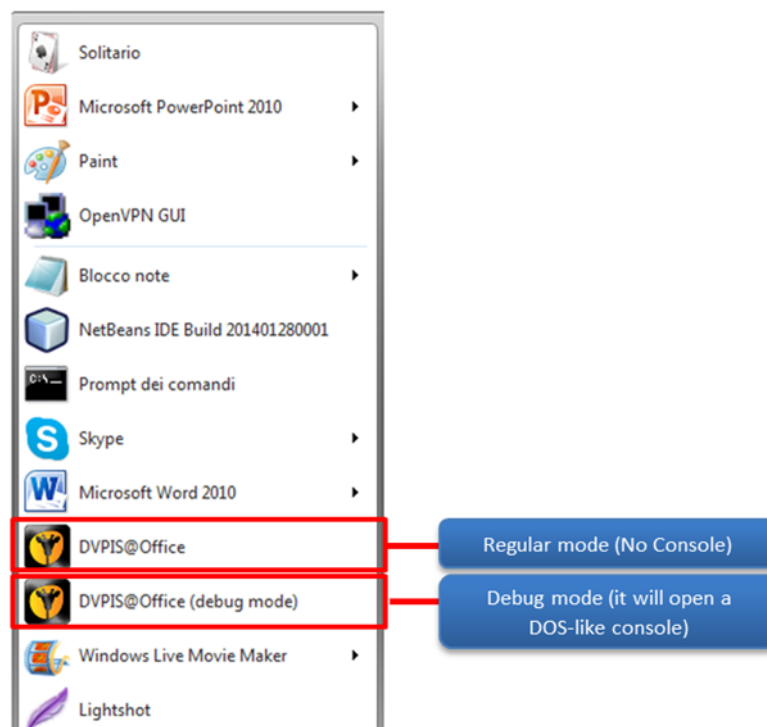


Figure 38 - DVPIS@Office icons in the Windows Start menu.

Finally, when needed, the DVPIS@Office can be easily uninstalled through the provided uninstaller in the Windows start menu (see Figure 39).

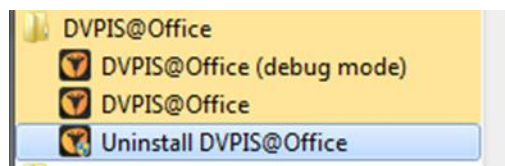
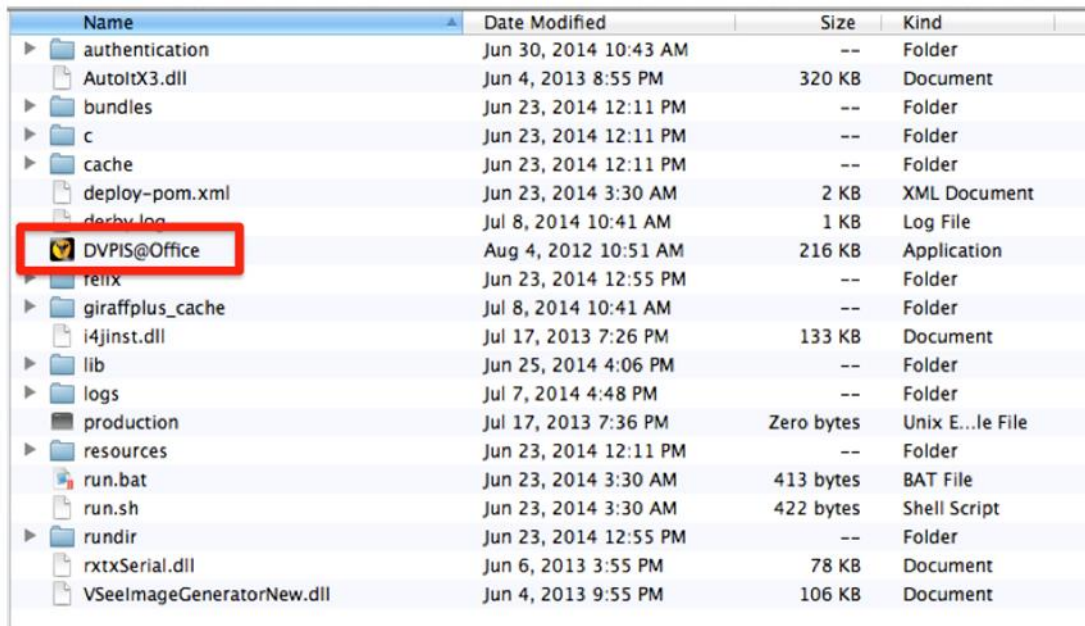


Figure 39 - Uninstalling the DVPIS@Office for Windows.

A.1.2.2 DVPIS@Office for Mac OS

The distribution dedicated to Mac OS users is presented as a zipped package that contains all software components. To start the DVPIS@Office please download the package at the proper link shown above, unzip the package and click on the application icon as shown in Figure 40.



Name	Date Modified	Size	Kind
authentication	Jun 30, 2014 10:43 AM	--	Folder
AutoItX3.dll	Jun 4, 2013 8:55 PM	320 KB	Document
bundles	Jun 23, 2014 12:11 PM	--	Folder
c	Jun 23, 2014 12:11 PM	--	Folder
cache	Jun 23, 2014 12:11 PM	--	Folder
deploy-pom.xml	Jun 23, 2014 3:30 AM	2 KB	XML Document
derby.log	Jul 8, 2014 10:41 AM	1 KB	Log File
DVPIS@Office	Aug 4, 2012 10:51 AM	216 KB	Application
relix	Jun 23, 2014 12:55 PM	--	Folder
giraffplus_cache	Jul 8, 2014 10:41 AM	--	Folder
i4jinst.dll	Jul 17, 2013 7:26 PM	133 KB	Document
lib	Jun 25, 2014 4:06 PM	--	Folder
logs	Jul 7, 2014 4:48 PM	--	Folder
production	Jul 17, 2013 7:36 PM	Zero bytes	Unix E...le File
resources	Jun 23, 2014 12:11 PM	--	Folder
run.bat	Jun 23, 2014 3:30 AM	413 bytes	BAT File
run.sh	Jun 23, 2014 3:30 AM	422 bytes	Shell Script
rundir	Jun 23, 2014 12:55 PM	--	Folder
rxtxSerial.dll	Jun 6, 2013 3:55 PM	78 KB	Document
VSeelImageGeneratorNew.dll	Jun 4, 2013 9:55 PM	106 KB	Document

Figure 40 - Main application folder of DVPIS@Office on mac and application icon to start the software.

To enable the console please open the MAC shell and browse to the DVPIS@Office main folder directory and just execute the run.sh by typing:

```
./run.sh
```

Since this distribution is completely self-contained, to uninstall the product it's enough to completely delete from the system the main DVPIS@Office folder.

A.2 Updating the DVPIS@Office

Since the version 2.0 the DVPIS@Office can be easily updated. Whenever the DVPIS@Office is started, a specific module will check whether a new version is deployed. In case a new version is found, the application informs the user about it letting the user decide whether to perform the update or not. If the user accepts to update the software, the application will download the needed files and will automatically restart the DVPIS@Office.

If the application is correctly updated, a green label ("System is up to date!") will appear on top of the login prompt.

A.3 The DVPIS@Office Login

Once the installation has been successful and the DVPIS@Office has been started, the system requires the user to login (see Figure 41). The DVPIS@Office does support internationalization, it is possible to select another language by clicking the drop-down menu.



Figure 41 - Login dialog.

In order to access the application, the user must own his/her authentication files (a Java Key Store File (.jks)) provided by GiraffPlus Engineers. Each authentication file is unique and personal. The authentication file could be chosen by means of the “browse” button. When the certificate is set, it’s sufficient to insert in the proper field the password in order to enter the DVPIS@Office. The authentication file and the password will be internally stored in order to facilitate subsequent accesses to the DVPIS@Office.

A.4 DVPIS@Office Home View

Once accessed to the DVPIS@Office, the Home View is proposed to the user providing an overview about all GiraffPlus sites the user is currently monitoring (see Figure 42). Each row provides different overall information about the connectivity status of the house and 3 different macro areas of interest.

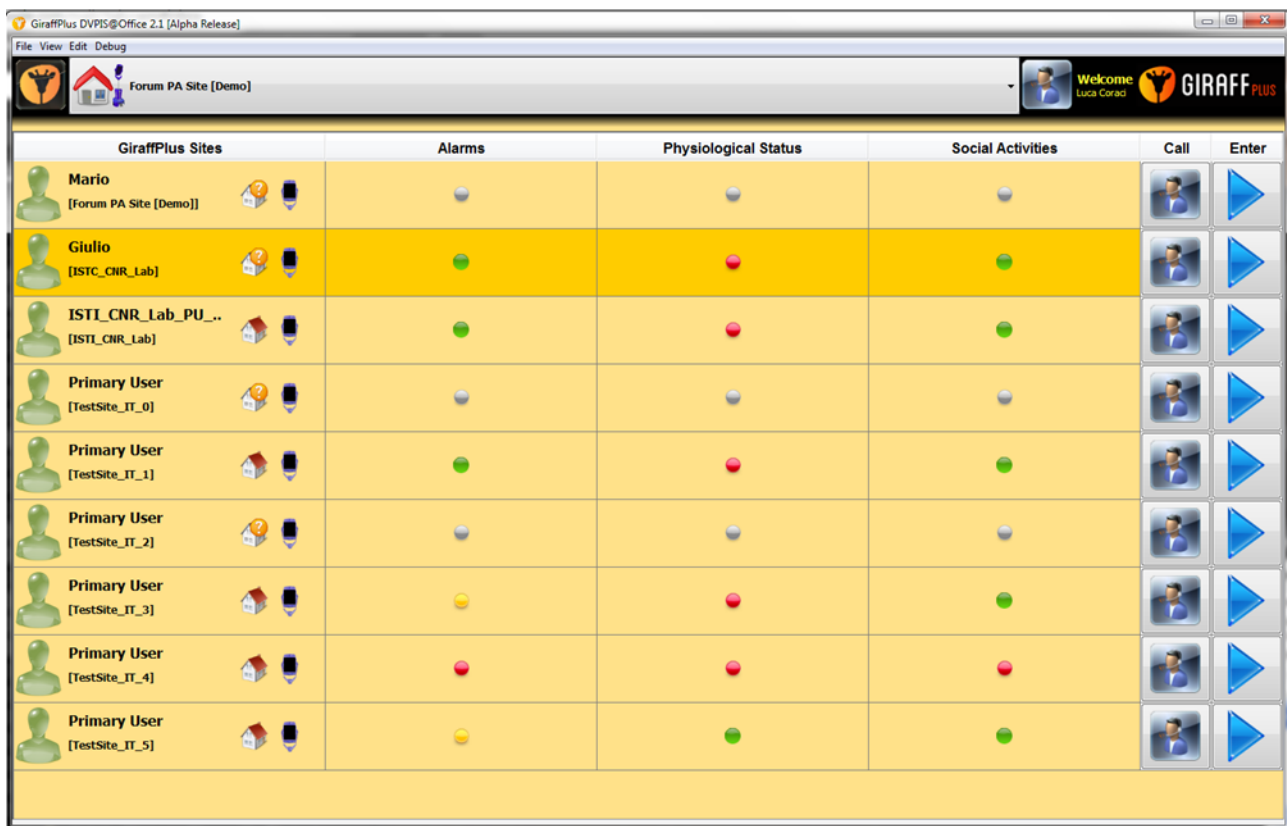


Figure 42 - DVPIS@Office Home View.

- GiraffPlus Sites** provides information about the associated primary users and, between square brackets, the name of the GiraffPlus site where the sensors network has been deployed. The connectivity status of the software components that have been deployed into the house is also provided:
 - indicates that the system is working properly and data gathered by the GiraffPlus system can be shown in real time.
 - warns the user that real time data is currently not available. The house is probably suffering some loss of internet connectivity or other software problems that are disabling the communications. In this case it might be appropriate to contact the GiraffPlus Engineers in order to solve the problem.
 - informs the user that the software components deployed in the house are not up to date. Real time communication could still be available, nevertheless it is suggested to inform the GiraffPlus Engineer for a software update.
 - informs the user about the presence of the Giraff Robot component. Please note that this info only means that a Giraff Robot has been deployed into the

house. No info about the power on/off of the robot is available yet in this DVPIS version.

- **Alarms** indicates (among the three values: *green = good*; *yellow = warning*; *red = risk*) whether some alarm has been triggered by the GiraffPlus system. Generally, alarms are triggered directly from dedicated sensors deployed inside the homes (i.e., fall detectors, flood detectors, smoke detectors, CO detectors, etc.)
- **Physiological Status** indicates (among the three values: *green = good*; *yellow = warning*; *red = risk*) the physiological state of a primary user. The GiraffPlus system simultaneously analyses different data taken from the user's static and dynamic profile to determine the health status of the primary user.
- **Social Activities** indicates (among the three values: *green = good*; *yellow = warning*; *red = risk*) the communications that have happened with the primary user (i.e., robot connections and DVPIS connections)

Semaphores				
Semantic				
				
Alarms	No data available yet	An unmanaged alarm has been triggered recently by the GiraffPlus system	An unmanaged alarm has been triggered by the GiraffPlus system not recently or the alarm has been managed recently	No alarms
Physiological Status	No data available yet	The GiraffPlus system has recognized the primary user as risky from a physiological point of view	The physiological status of the primary user is not perfect	The primary user is healthy
Social Activities	No data available yet	The primary user has not had social activities recently, i.e., the user has been overlooked by the related	Time has passed since the last interaction with the primary user, it might be appropriate to contact the	Interactions with the primary user occurred recently

secondary users	primary user through the Giraff robot
-----------------	---

Table 2 - Semaphores semantic.

In addition, for each row contains two buttons which allow to use the Giraff-Pilot through the DVPIS@Office or enter the selected house, more precisely:

-  will switch the main view with the Giraff-Pilot main presenter. The secondary user will have to insert his/her Giraff-Pilot credential to access the system and be able to see the list of enabled to call robots.
-  allows to “enter” the selected home. The secondary user has access to both real-time data and historical data in several shapes and views as well as the GiraffPlus network system.

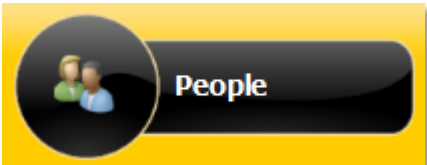
A.5 Inside the home

Once a desired home has been selected, the DVPIS@Office will enter inside the home in order to provide more detailed information.



Figure 43 - The DVPIS@Office main toolbar.

The home layout provides a main toolbar with four main buttons (see Figure 43):

-  **Long Term** for long term monitoring (i.e., reports, timelines, etc.);
-  **Real Time** for real time monitoring (i.e., map view, recent timelines, etc.);
-  **People** for social interaction;
-  **Call** for calling the primary user through the Giraff Robot.

Real Time view is the preselected one. The user can, anytime, switch back to the main view by clicking at the Home button on the top left corner or switch to another house by using the top drop down menu.

A.5.1 The Real Time View

The real time panel is totally focused on real-time events and offer two main views about data:

- Map view
- Timeline view

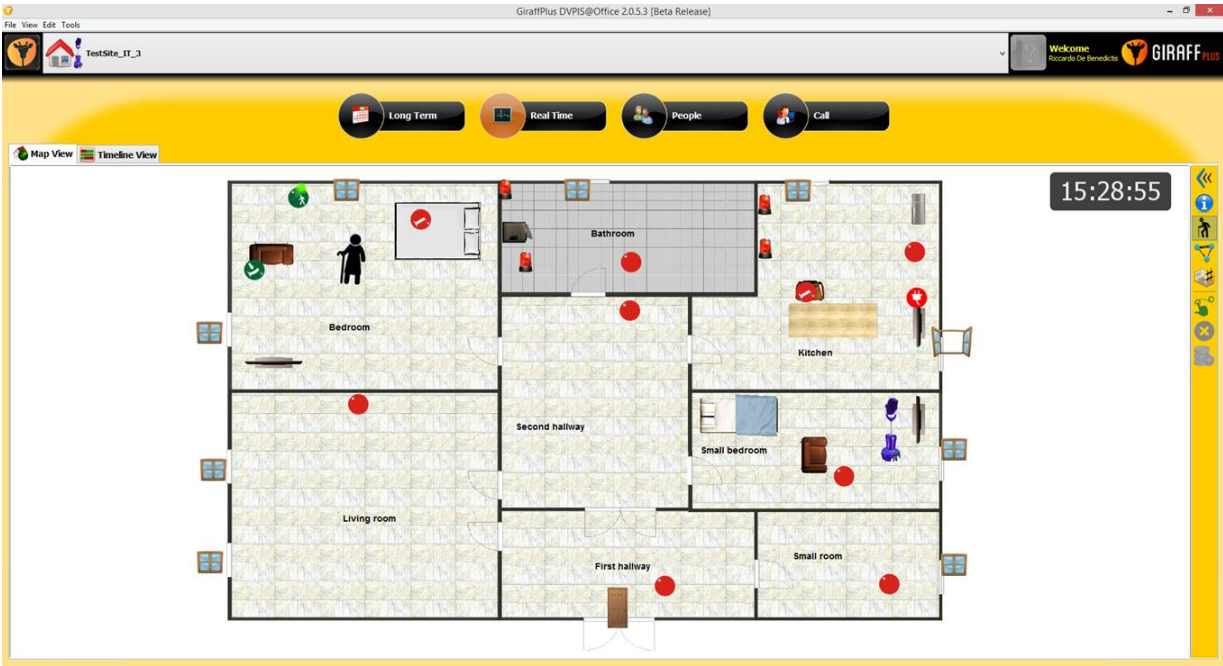


Figure 44 - Map View.

The Map View (see Figure 44) offers a spatial view about all the current activities currently detected by the sensors. The map of the house is shown together with a responsive icon (positioned in the map in order to properly reflect the real location of the sensor into the real house) for each of deployed sensor. In addition, each room will be labelled with its room name, in order to be easily recognized, especially by formal caregivers who don't necessarily know the planimetry of the house. Each sensor is represented by an icon which aims at immediately representing the current status of the sensor together with his type. It is worth noting that door contact sensors (normally used to monitor when a door is opened or closed) could also be used to measure, for instance, when a fridge is opened or closed as well as the state of a window. In this case the DVPIS@Office will show the proper icon considering also the location of the sensor. Currently only 4 kind of positioning are supported: doors, fridges, wardrobes and windows. The icon shown is the combination of sensor's type and current value. Table 3 Table 3 - Environmental sensor icons.shows all the possible icons for each possible sensor state:

Value/Sensor Type	Electrical usage	Pressure	Door contact	Fridge	Wardrobe	Window	Movement
False							

True							
------	---	---	---	---	---	---	---

Table 3 - Environmental sensor icons.

In addition to the Map View, on the right side of the panel there is a simple toolbar which allows the user to perform some personalization:

-  shows some further personalization options;
-  shows a box with the icons legend;
-  shows/hides an icon that indicates inside the map the estimated position of the primary user;
-  customizes the graphical movements track indicators;
- 
-  (only for GiraffPlus Engineers) starts the editing of sensor positioning. By clicking the editing button it will be possible to drag and drop the sensor icons and also the room labels;
-  (only for GiraffPlus Engineers) cancels the editing of sensor positioning;
-  (only for GiraffPlus Engineers) stores the editing of sensor positioning on the GiraffPlus Data Storage.

The Timeline View (see Figure 45) is an alternative way for visualizing real time data. Specifically, this view provides a complement of the Map View aiming at providing the user a more detailed representation on what is being registered by the sensor network at actual time. The Timeline View shows a basic timeline for each sensor with the last 5 minutes of data. Only environmental sensors and alarms are represented. Some filtering options might help the user to get the desired info.



Figure 45 - Timeline View.

By default, all environmental sensors deployed into the selected house are displayed. Each row represents a sensor and green segments are placed upon the timeline to indicate where a sensor has been active over time. All charts contained in this panel are updated each 200 milliseconds with upcoming data produced by the house. Since the Now-Time is represented with the right side of the chart all data will be slowly shifted to left over time.

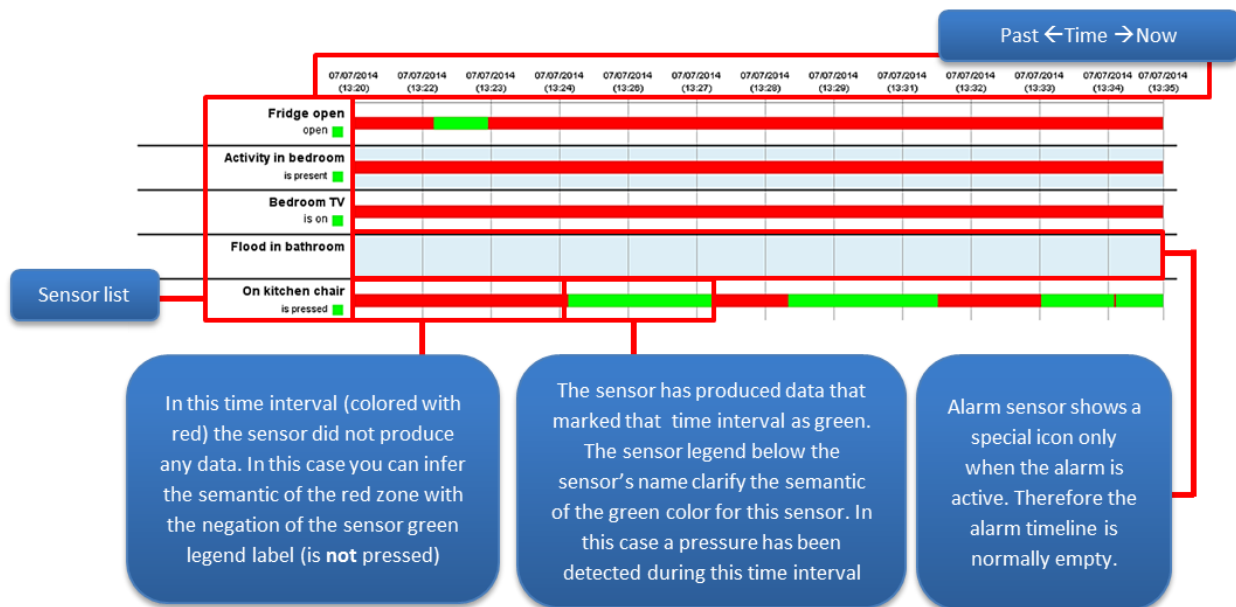


Figure 46 - Details about the Timeline View.

The Timeline View toolbar allows the user to access to some filtering feature that might help to improve the visualization and monitoring of upcoming data. Specifically:

-  updates the chart within the given temporal window;
-  shows/hides the manual sensor selector. Sensors are grouped per room and it is possible to select/deselect which sensor will be shown or hidden;
-  opens a new window showing the current chart within the given temporal window.

It is worth noting that moving the mouse over any chart of the DVPIS@Office will produce a tooltip showing the exact time that the point occupied by the mouse cursor represents.

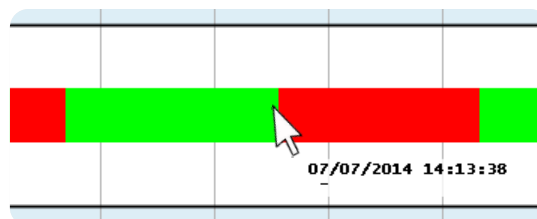


Figure 47 - Timeline tooltip.

It is possible to zoom each timeline chart shown in the DVPIS@Office. To select a time interval, the secondary user should select the start point (the temporal chart tooltip could help in this operation) by clicking with the left mouse button on the desired point and then simply start to drag the mouse on the direction of end interval point. A blue semi-transparent area will start to appear to indicate the zoom selection area that the user is selecting. When dragging the mouse cursor, the temporal chart tooltip will also indicate the exact start and end point of selected time interval. Releasing the mouse button will end the interval selection and the chart will be updated enlarging the desired area to full chart size. A double click in any point inside the chart area will reset the chart area.



Figure 48 - Timeline zoom.

A.5.1.1 About PIR Sensors

Since alarms and PIR sensors produce only simple pulse values, they need to be managed separately. The PIR sensor, indeed, produces a pulse as soon a movement is detected. In case the movement is persistent, the sensor produces further pulses at a given period (typically 10-20 seconds). For this reason when a PIR sensor produces a new pulse, the sensor's icon will switch to an icon that indicates the presence of some movement around the sensor and this icon will persist for a fixed amount of time of 30seconds. In addition to show the temporal distance from the time when the data has been produced and the actual time a blinking green light it's been added next to the sensor, the blinking rate will decrease in time, from a very fast blinking (when the value has been produced) to a very slow blinking next to the end of the 30 second time window of this event. If during this time interval another new PIR pulse occurs, the blinking is restarted at full speed (see Figure 49). The aim of this behaviour is to indicate to the user how much movement is being registered through the frequency of the blinking light.

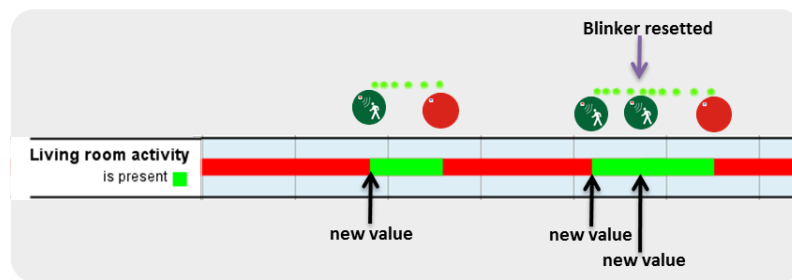


Figure 49 - PIR behaviour inside the DVPIS@Office.

A.5.1.2 Anomalies on sensor data

During the real time data collection it can happen that some sensor data anomaly occurs. Anomalies are essentially dirty data that can potentially cause data inconsistencies. When the DVPIS@Office detect a real time anomaly a symbol like the one shown in Figure 50 will be placed at the anomaly-timestamp. It is possible, however, to refresh the chart with the proper button to invoke a clean-up procedure that will remove all anomalies from the chart. It is important to do not underestimate sensors that often generate such anomalies; in case of a large amount of detected anomalies it is suggested to report it to a GiraffPlus Engineer.

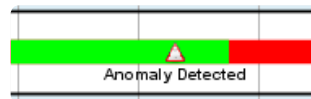


Figure 50 - Anomalies on sensor data.

A.6 The Long Term View

The Long Term View is the DVPIS@Office view for generating long term statistics in terms of:

- Reports
- Environmental data
- Physiological data
- Activities, as extrapolated from the context recognition

The Reporting utility (see Figure 51) is one of the main feature of the DVPIS@Office. Reports are thought to offer a deeper view upon the collected data gathered by the sensor network. Reporting System also tries to offer to the user some long term analysis by visualizing the collected data in different types of charts possibly highlighting primary user trends in terms of space occupancy and activity detection statics.

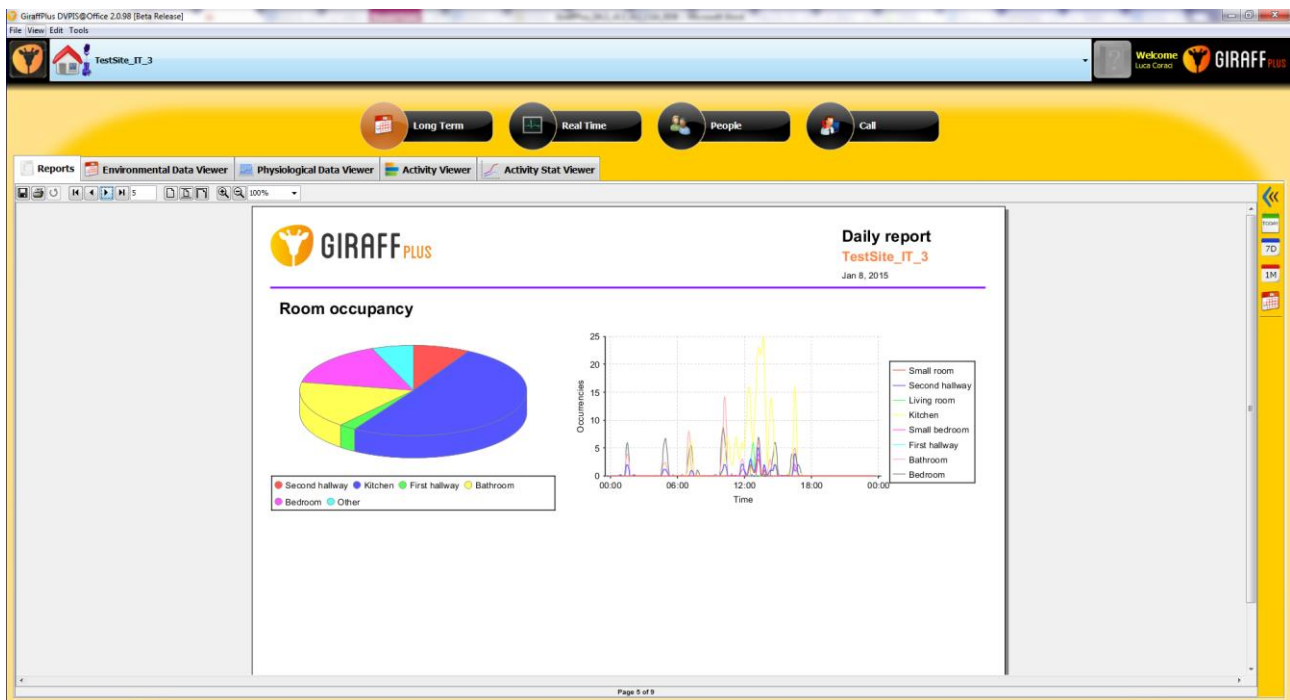


Figure 51 - Long Term Reports.

The main two type of reports the DVPIS@Office can offer are:

- Daily reports
- Monthly reports

Additionally the user can also define custom interval such as some day or even some month.

Reports are visualized inside a document visualizer that offers an interactive preview of the generated reports. By the integrated toolbar on top of this container it's also possible to save the document into the common .pdf format in the user computer, to print the document or to use other options like zoom, resize etc.

Each report has a predefined structures that can be here schematized:

1. A brief summary of the important things that happened into the selected time interval;
2. The primary user personal data (address, phone number etc..);
3. The possible list of alarms that occurred into the selected time interval;
4. Statistics about movement sensors;
5. Statistics about monitored activities (not available in daily reports);
6. Physiological measurements charts;
7. Room occupancy statistics;

8. Amount of detected movement per room.

An example of chart inside a report is shown in Figure 52. This chart represents weekly statistics about different kind of data that can be retrieved from the database. Namely, the following kind of data can be displayed:

- Activities performed by the primary users, as recognized by the context recognition
- Boolean sensors (i.e., electrical usage sensors, bed/chair sensors and door contact sensors)

The same information is represented as a bar chart and as a line chart. The represented information is basically the mean of the represented data and its standard deviation.



Figure 52 - Statistics inside reports.

Additionally, reports contain line charts for representing physiological measurements (see Figure 53). This chart is a regular line chart representing the evolution of the measured feature in time. The figure shows data detected by the system for blood pressure measurements distinguishing among systolic blood pressure (in red), diastolic blood pressure (in blue) and heart rate (in green).

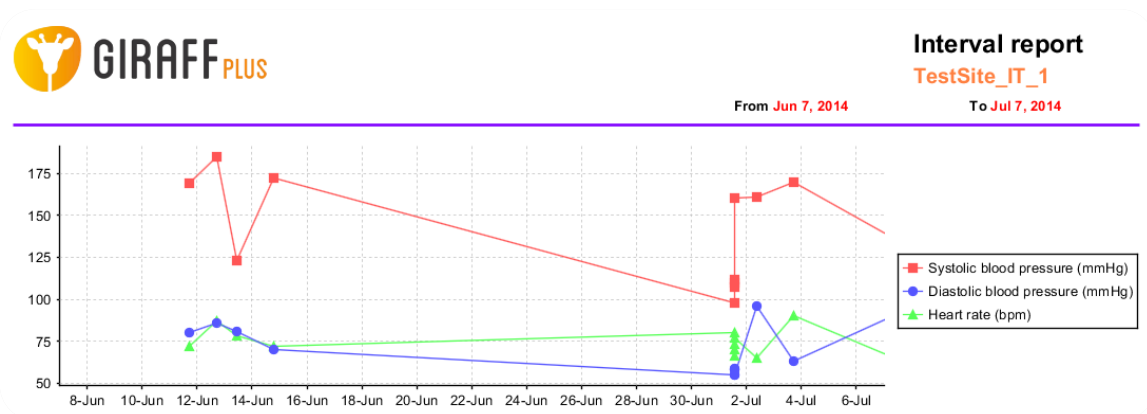


Figure 53 - Physiological data inside reports.

Finally, reports contain the percentage of room occupancy in the selected interval of time together with its distribution in time. As an example, Figure 54 tells us that the given primary user has spent around 45% of time in the living room, around 25% in the kitchen and the remaining time in the other rooms. It is worth mentioning that the system is not capable of detecting the presence of the primary user inside a room but only his/her motion.

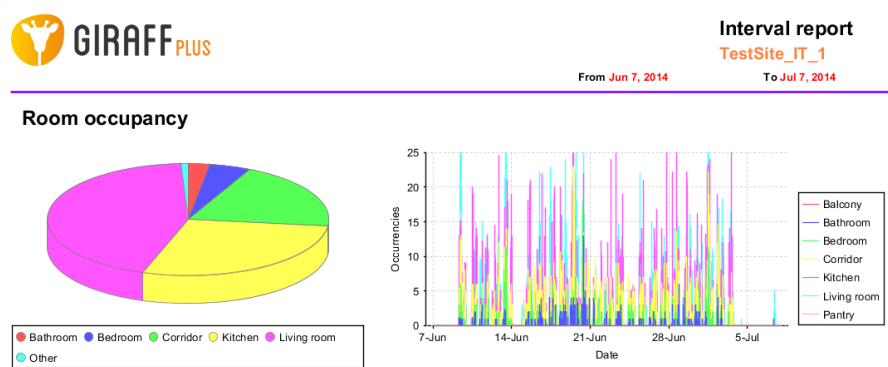


Figure 54 - Room occupancy in reports.

A more detailed temporal distribution of the detected motion is provided by the chart in Figure 55. The chart shows the amount of detected motion occurrences grouped in intervals of 15 minutes. This means that if in a given interval of 15 minutes the system detects 12 movement occurrences, the “Occurrences” value for that given interval is 12.

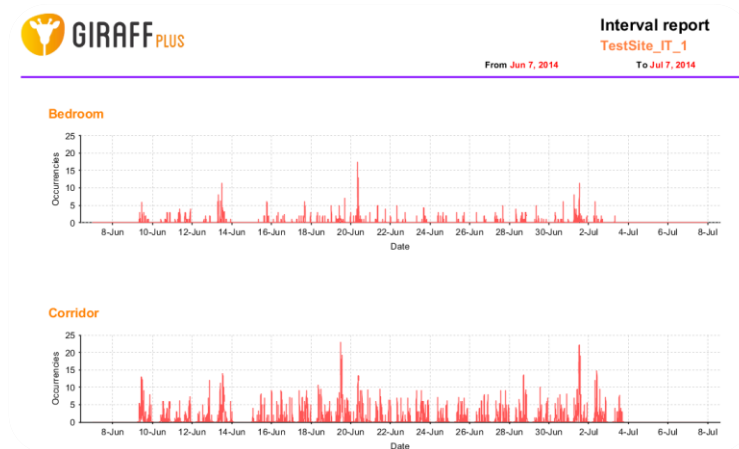


Figure 55 - Temporal distribution of room occupancy in reports.

The report toolbar helps the secondary user to generate different kind of reports and offer some additional option. Specifically:

-  shows some further personalization options as a list of all days of the selected month. By clicking on a day, the DVPIS@Office will automatically generate a daily report, while selecting a multiple day interval a report of such interval will be generated. To select a day-interval it is enough to click on a day and select the interval by dragging the mouse and releasing on the last day of the desired interval;
-  generates a daily report;
-  generates a one week report;
-  generates a monthly report;
-  generates a custom time interval report.

Figure 56 contains an example of physiological data that can be inspected through the DVPIS@Home tool. Specifically, the picture shows one week of blood pressure measurements.

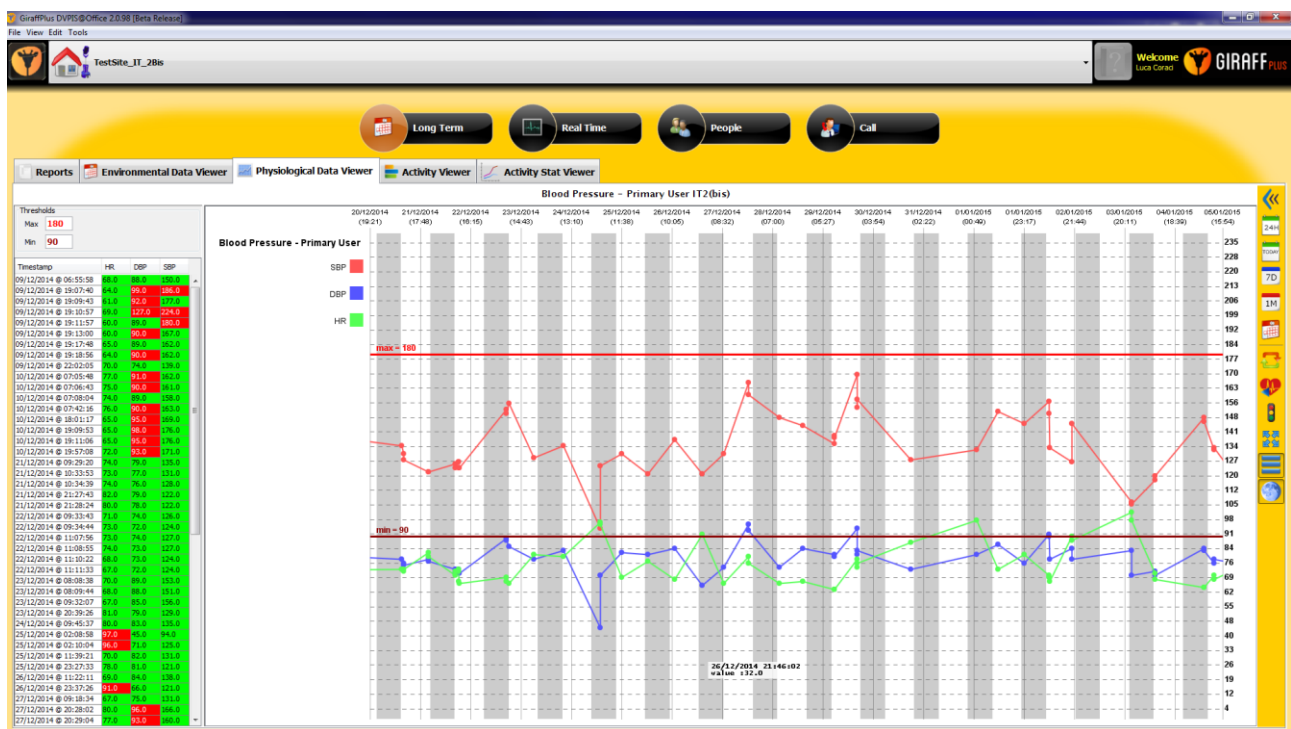


Figure 56 - Long Term Physiological data.

The physiological toolbar helps the secondary user to generate different kind of charts and offer some additional option. Specifically:

-  shows some additional personalization features;
-  creates a chart of the last 24 hours for the selected physiological sensor;
-  creates a chart from the last midnight to now for the selected physiological sensor;
-  creates a chart of the last week for the selected physiological sensor;
-  creates a chart of the last month for the selected physiological sensor;
-  creates a chart of a custom time interval for the selected physiological sensor;
-  refresh the current chart;

-  selects the desired physiological sensor;
-  shows/hides the physiological semaphore timeline (please note that physiological timeline is an aggregate of several physiological parameters thus the timeline values might not be correlated with the selected physiological sensor);
-  opens a new window showing the current chart within the given temporal window;
-  shows/hides a detailed table for the current physiological data;
-  shows/hides night areas.

Activity Viewer (see Figure 57) collects inference data performed by the Activity Recognition engine. Activities are detected by analysing the stored data according to a set of defined rules. The result of this analysis produces a set of time interval identifying the different activities. Therefore this panel present the data in a common timeline view.

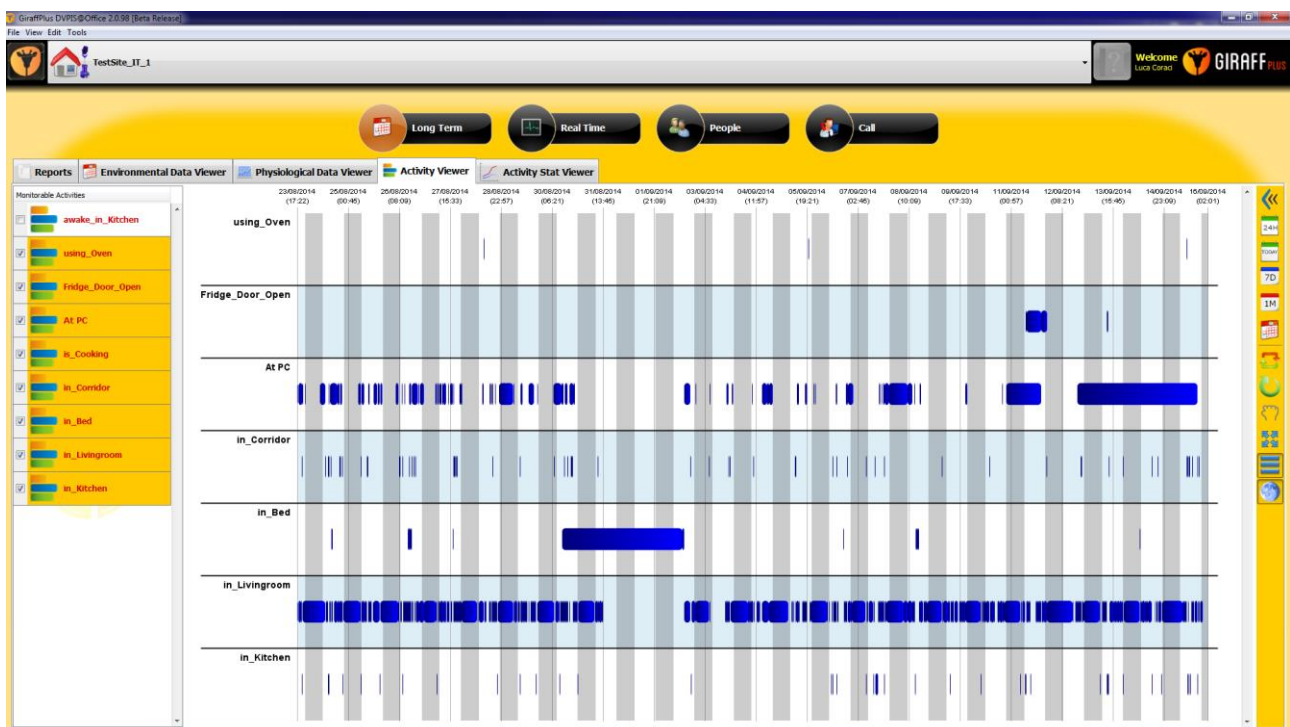


Figure 57 - Long Term Activity Viewer.

The left part of the view contains all the activities that the user can monitor on the specified home. Selecting/ here are shown the collected data for the selected activities and time interval.

The Activity View toolbar helps the secondary user to generate different kind of charts and offer some additional option. Specifically:

-  shows some additional personalization features;
-  creates a chart of the last 24 hours for the selected activities;
-  creates a chart from the last midnight to now for the selected activities;
-  creates a chart of the last week for the selected activities;
-  creates a chart of the last month for the selected activities;
-  creates a chart of a custom time interval for the selected activities;
-  refresh the current chart;
-  refresh the current chart with the last two hours;
-  scrolls the chart after a zoom on a specific area;
-  opens a new window showing the current chart within the given temporal window;
-  shows/hides a the activity list on the left of the Activity View;
-  shows/hides night areas.

The last panel in the Long Term View is the Activity Stat Viewer (see Figure 58) for performing Long Term Trend Analysis (LTTA; see deliverable D3.4 for further details). The panel generates different statistics about how much/often an activity is performed in terms of: (a) number of occurrences, (b) sum of durations, (c) average duration, (d) earliest starting time, (e) latest ending time and (f) average time for activity.

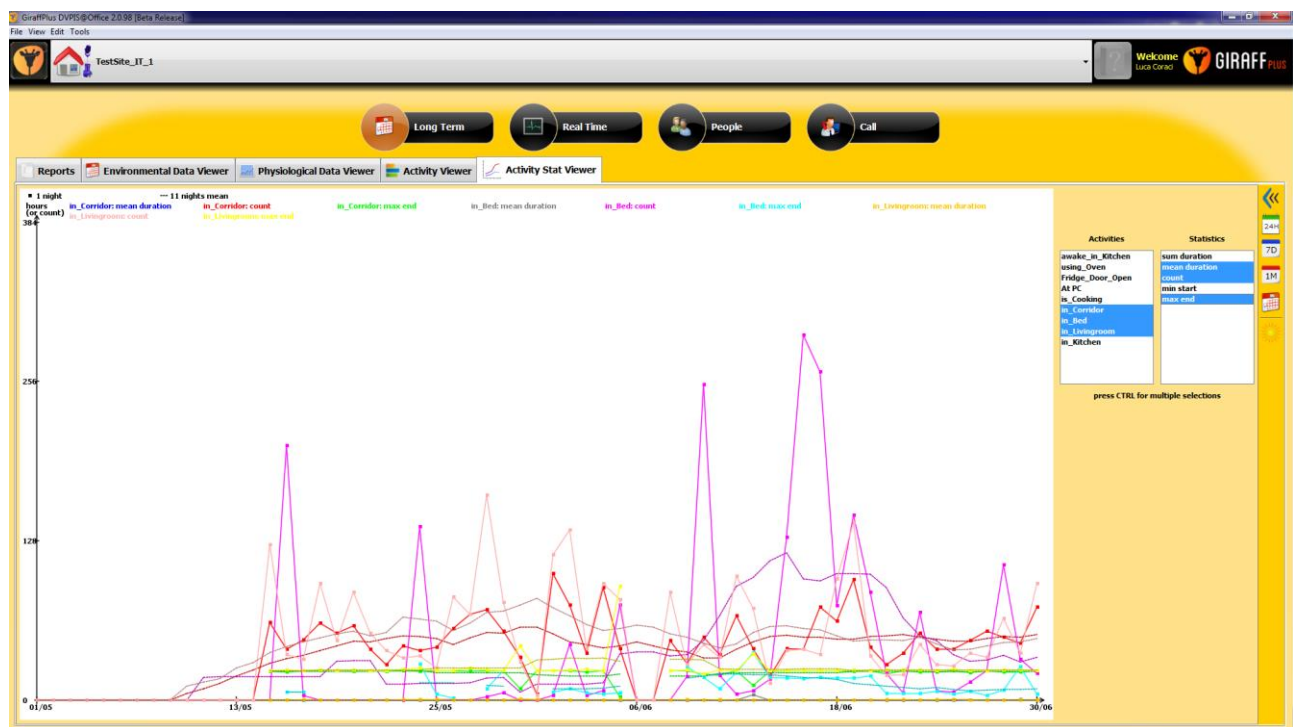


Figure 58 - Long Term Activity Stat Viewer.

The secondary user can select the different activities to visualize (by holding CTRL key and selecting the activities) and the different statistics to generate for each selected activity (by holding CTRL key and selecting the statistics). The Activity Stat Viewer toolbar helps the secondary user to generate different kind of charts and offer some additional option. Specifically:

-  shows some additional personalization features;
-  creates a chart of the last 24 hours for the selected activities and chart types;
-  creates a chart of the last week for the selected activities and chart types;
-  creates a chart of the last month for the selected activities and chart types;
-  creates a chart of a custom time interval for the selected activities and chart types;
-  chooses between night epochs and day epochs.

A.7 People View

People View contains two main panels:

- Primary User, for communicating with the Primary User through the DVPIS@Home;
- Secondary User, for communicating with other secondary users through the DVPIS@Office.

The Primary User channel (see Figure 59) allows the secondary user to directly communicate with the Primary User through the DVPIS@Home which is installed on the telepresence robot platform Giraff. This panel also offer logs for scheduled messages and a short history of delivered messages.

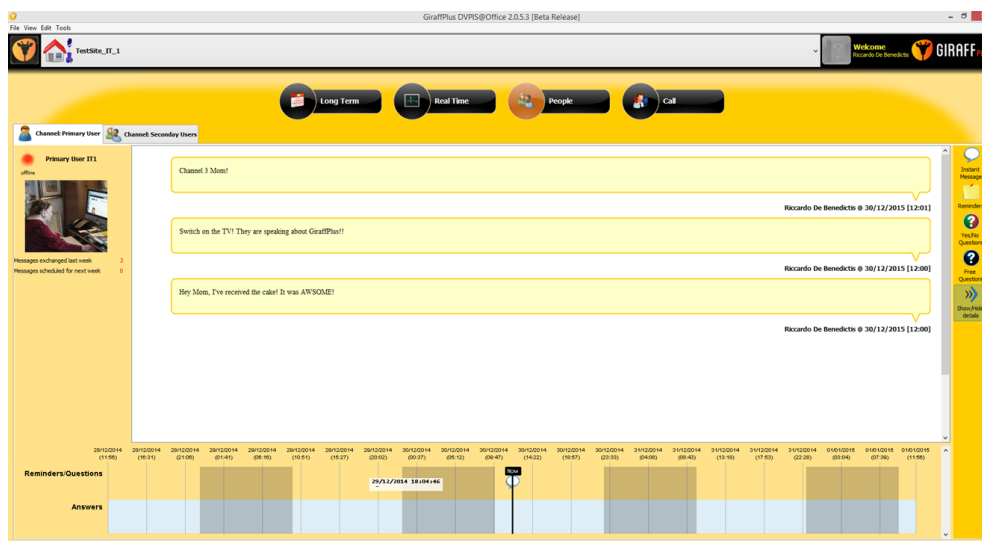


Figure 59 - Primary User channel.

The channel is organized with two main areas that provide an overall view about the messaging flow and a toolbar to let the secondary user to access provided features. The main container displays all the recent (i.e., two days backwards) instant messages exchanged with the primary user.

The upper left of the panel contains a semaphore-like showing the connection status of the DVPIS@Home deployed on the Giraff robot of the selected primary user. A green light indicates that the DVPIS@Home is online while a red light indicates an offline status. Please note that messages will be delivered only when the DVPIS@Home will become online.

Below, a detailed description about all components of the Primary User Channel:

-  This function is used for real time messaging. Specifically, this function sends an instant which will delivered instantly to the primary user through the DVPIS@Home. Other

secondary user will see that a message has been sent but they will not be able to read the content of the message.

-  This function is used for defining reminders for the primary user. Specifically, this function sets a reminder that will be delivered to the primary user on a desired time with a specified period (e.g., each day or each week). Other secondary users will see that the reminder has been set and when it will be delivered but they will not be able to read the content of the reminder.
-  This function is used for defining yes/no questions (e.g., “did you took your daily pill for blood pressure?”). Specifically, this function delivers a question to the primary user that providing the possibility to answer only Yes or No. Other secondary users will see that a question has been set and when it will be delivered but they will not be able to read the content of the question neither to identify which question type has been selected. In case of an answer, the text of the answer will be visible only to the creator of the question.
-  This function is used for defining free answers questions (see Figure 60). Specifically, this function delivers a question to the primary user that providing the possibility to answer to the question. The secondary user can choose the set of possible answers that will be shown to the primary user through a simple multi-choice dialog. Other secondary users will see that a question has been set and when it will be delivered but they will not be able to read the content of the question neither to identify which question type has been selected. In case of an answer, the text of the answer will be visible only to the creator of the question.

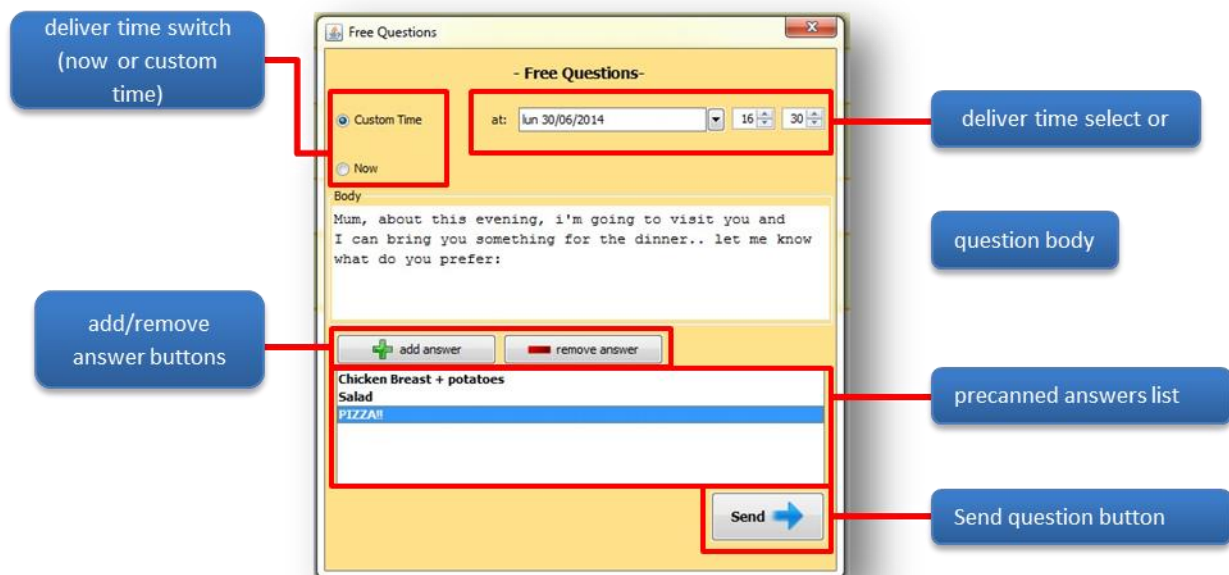


Figure 60 - A free question example.

The bottom part of the Primary User Channel contains two timelines (see Figure 61). The first one contains all kind of messages sent or scheduled to be sent to the primary user. The messages displayed here are all the messages created by all secondary users who are following the selected primary user. However, as specified above, the content of messages created by other secondary users will not be accessible to the current secondary user.

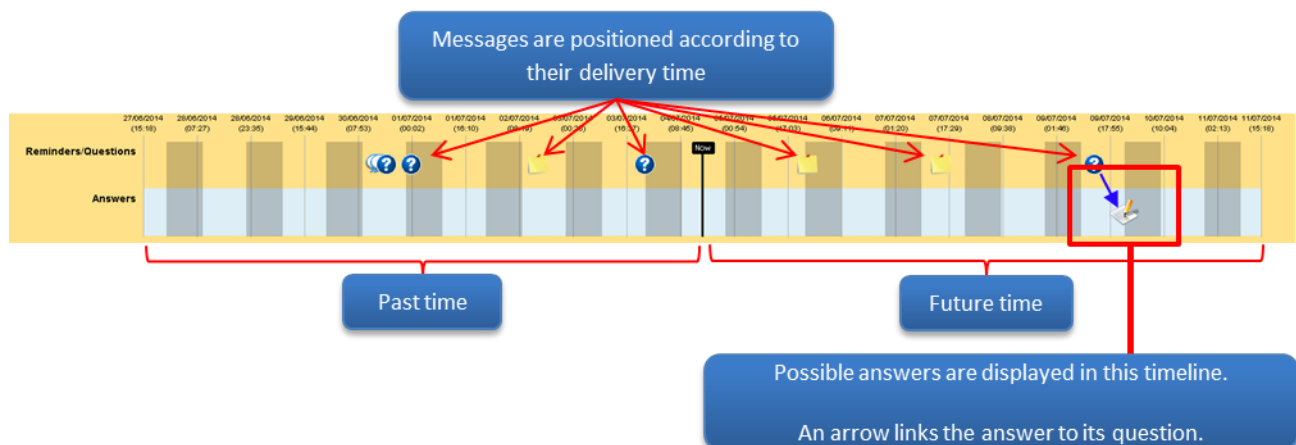


Figure 61 - Communication timelines.

The Secondary User Channel allows to communicate with the group of secondary users who is following the selected primary user. If needed, it is possible to privately interact with a single secondary user. Similarly to the Primary User Channel, the Secondary User Channel is organized with two main areas.

Furthermore, the panel shows also the list of the secondary users linked to the selected primary user. Each item list is enriched with the possibility to create a reminder directly to the selected user as well as some additional information as described in Figure 62.



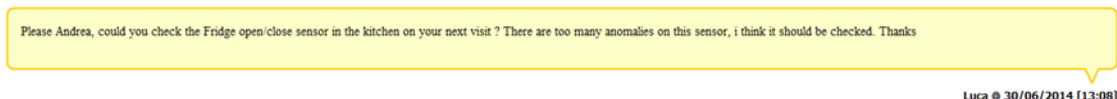
Figure 62 - Secondary users connected to a home.

The main area of the Secondary User Channel contains messages exchanged with other secondary users. All messages published on a house topic will be displayed in chronological order (newer on top). Messages can be displayed with 3 different layouts:

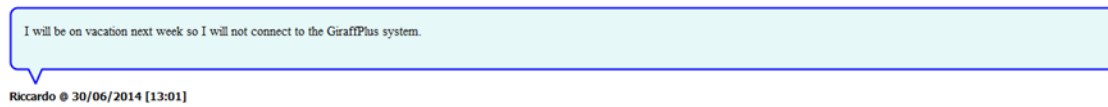
- **System Post:** created by GiraffPlus Engineers are usually used for official announces or important communications to all users of a certain house.



- **User's posts:** posts created by the user will be represented through a yellow callout



- **Other users' posts:** all posts created by other secondary users are represented through a blue callout



The toolbar contains the following functions:

-  publishes a post message. A post is a global message in the secondary user network. By pressing this button a wizard will help the user to create and send the post-message. This message will be displayed in the main area of all the DVPIS@Office of people on this network.
-  reserved for GiraffPlus Engineers, this functionality is used for generating system posts (e.g., update messages, etc.)

A.8 The telepresence robot Shared Space: interaction between @Office/@Home

The DVPIS@Office embeds the Giraff Pilot for communicating with primary users in the standard Giraff way. The desired Pilot application language can be selected in the drop-list in the upper-right corner. The user has to enter his/her e-mail address and password and press the OK button to log in. Once logged in, the user will see the list of Giraffs that he/she has access to (see Figure 63). Depending upon who the user is authorized to visit, he/she may see several Giraffs or only one. The Pilot provides the image that will appear on the Giraff, buttons for changing camera, changing video and audio settings.

There are two ways to visiting a Giraff. The user can either “knock” (and wait for the resident to let the user in) or “enter with key” (in which case the user will be let in unless the resident actively declines the call). For further details on how to drive a Giraff robot and on how to change Pilot settings please refer to the Pilot user manual.

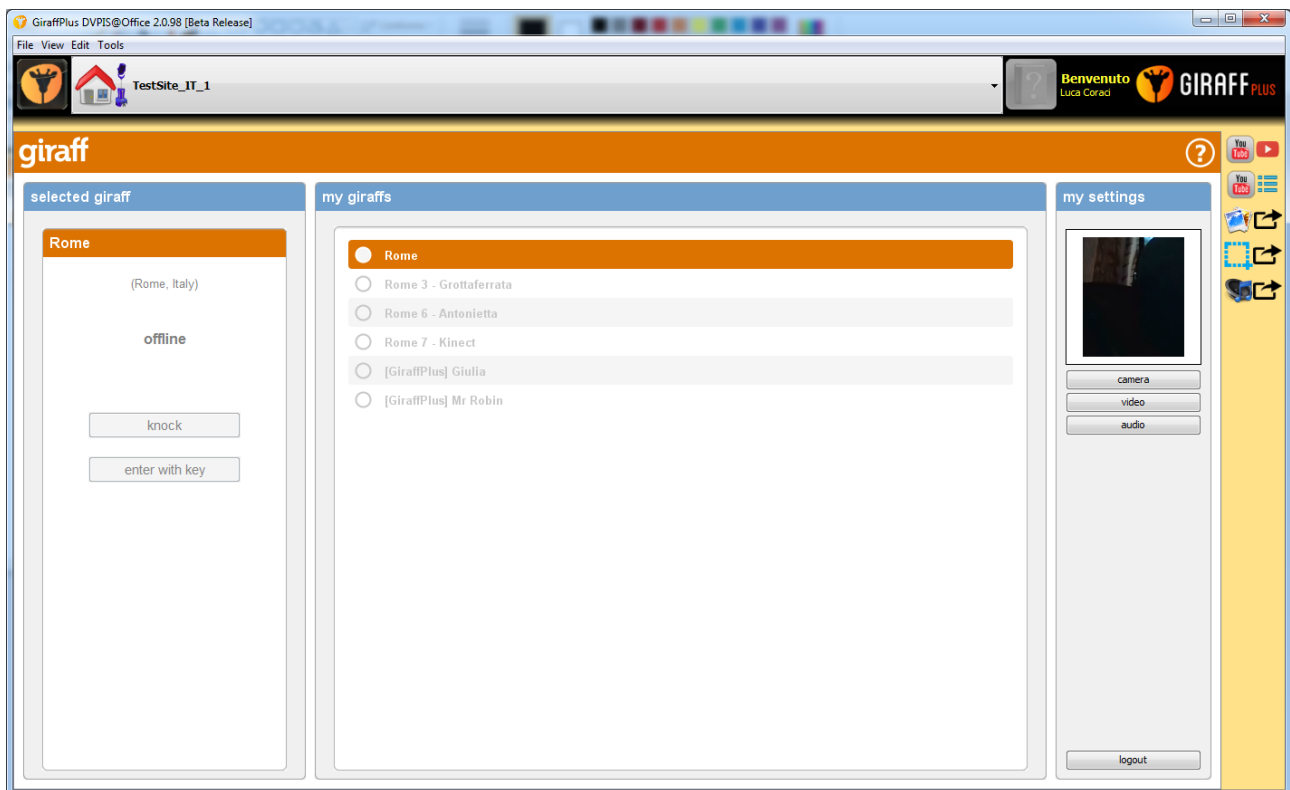


Figure 63 - The embedded Giraff Pilot.

The main aim of the shared space is to provide functionalities to enrich the conversation with the primary user via Giraff Robot. The secondary user has, at his/her disposal, several tools to interact during the call for sending different media files.

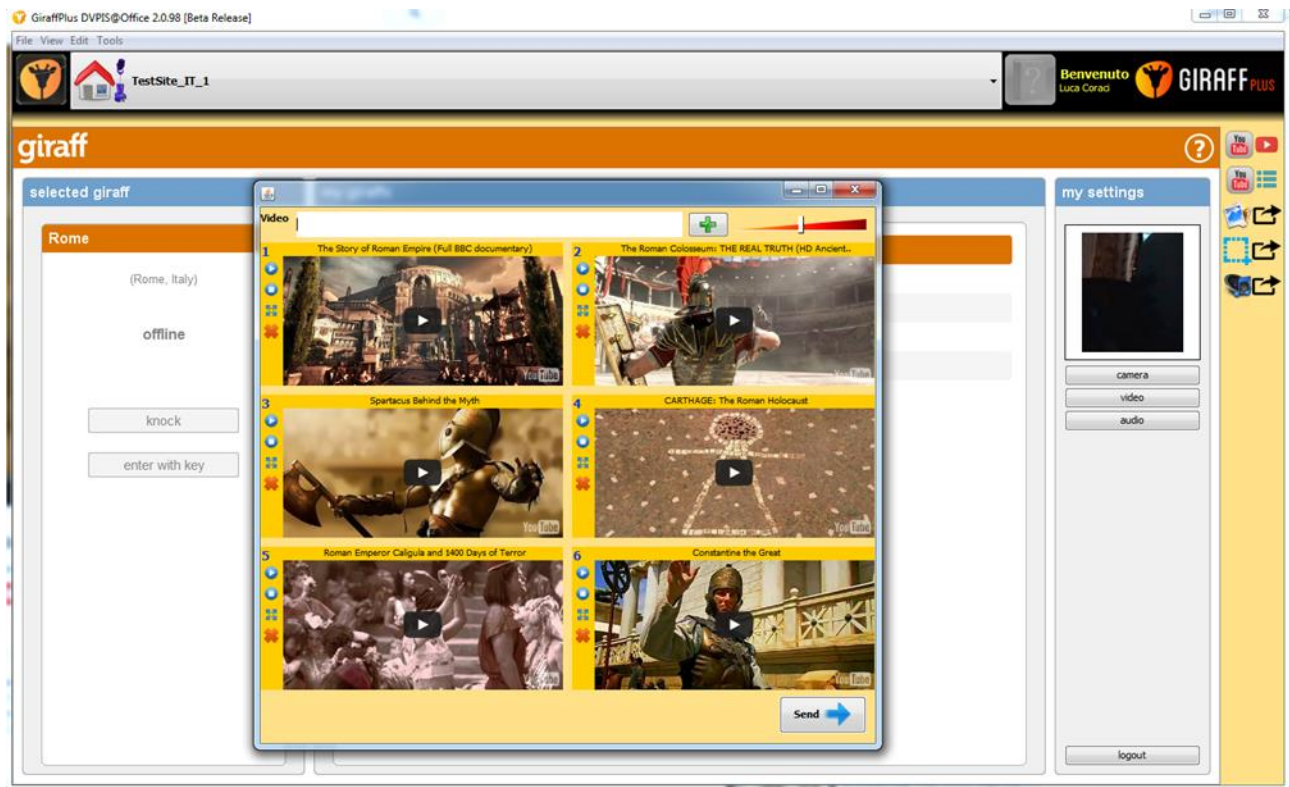


Figure 64 - Sending media through the DVPIS Shared Space.

The toolbar provides an entry point for the editors and the wizards that facilitate the user in sending media files to the primary user (see Figure 64). Custom messages are packed and sent to the DVPIS@Home which will unpack and prepare the GUI on the robot to properly show the media contents. More specifically:

-  Sends a single YouTube video;
-  Opens an editor for building and sending a custom YouTube playlist;
-  Sends a generic image;
-  Sends a screenshot of the DVPIS. Screenshots can be done by pressing CTRL+S when viewing any data panel;
-  Sends a generic audio file.