
**HEARTFAID**

# D40 – Integration and Configuration of the Prototype

**Submission date: 19/06/2009**
**Due date of document: 31/10/2008**

# HEARTFAID

## A KNOWLEDGE BASED PLATFORM OF SERVICES FOR SUPPORTING MEDICAL-CLINICAL MANAGEMENT OF THE HEART FAILURE WITHIN THE ELDERLY POPULATION

| **Project summary** | |
|---|---|
| **Project acronym:** | HEARTFAID |
| **Project identifier:** | IST – 2005 – 027107 |
| **Duration of the Project:** | 01/02/2006 – 30/04/2009 |
| **Project Co-ordinator:** | UNICAL University of Calabria (Italy) |
| **Thematic Priority:** | Information Society Technology |
| **Instrument:** | Specific Targeted Research or Innovation Project |

**Consortium**

- UNICAL- Università della Calabria (Italy)
- UNICZ- Università degli studi Magna Graecia di Catanzaro (Italy)
- UNIMIB- Università degli studi di Milano Bicocca (Italy)
- JUMC- Jagiellonian University Medical College (Poland)
- VMWS- Virtual Medical World Solutions Ltd (United Kingdom)
- FORTHNET S. A.- Hellenic Telecommunications and Telematic Applications Company S. A. (Greece)
- SYNAP- Synapsis s.r.l. (Italy)
- CNR- Consiglio Nazionale delle Ricerche (Italy)
- FORTH-Foundation for Research and Technology Hellas (Greece)
- RBI- Rudjer Boskovic Institute (Croatia)
- AUXOL- Istituto Auxologico Italiano (Italy)

# D40 – Integration and Configuration of the Prototype

| Document summary | |
|---|---|
| **Document title:** | **D40 – Integration and Configuration of the Prototype** |
| **Document classification:** | Derivable D40 |
| **Dissemination level:** | CO |
| **Submission date:** | 19 June 2009 |
| **Due date:** | 31 October 2008 |
| **Authors:** | VMWS<br>FORTHNET<br>SYNAP<br>CNR<br>FORTH |
| **Work package:** | WP7 – Testing and Validation |
| **Report version:** | 1.0 |

| Short description |
|---|
| This document concerns the integration, configuration and deployment of the prototypes into the every day clinical activities. Suitable clinical setting and health care environments have been selected with the contribution of the clinical partners. |

| Change record | | |
|---|---|---|
| **Version number** | Changes | Release date |
| **0.1** | First draft of the document | 15/01/09 |
| **0.5** | Advanced draft | 15/02/09 |
| **1.0** | Final version | 19/06/09 |

# Table of contents

# Table of figures

# Executive Summary

The objective of Workpackage WP7 “Testing and Validation” is to validate the HEARTFAID Platform (HFP) prototype into suitable clinical settings. This document describes how the HFP has been deployed in the selected clinical settings in order to allow the clinical partners to assess the different services of the platform and perform validation process. In particular, we describes how the modules specifically developed or adapted to the project needs, have been integrated and configured in order to provide the end users with a centralized access point of a highly distributed system.
In fact, it is important to highlight that all the validation sites have used the same installation of the interoperable HFP. In addition, this platform should not be considered as a centralised software package installed on a single server, whilst, on the contrary, as a set of independent modules, totally distributed among the technological Partners’ sites and accessed though the web whenever needed.

The key module of the Heartfaid platform in terms of integration is the middleware, designed and developed in the Workpackage WP3. The deliverables D20 and D28 describe the technical details of the integration protocols and the interoperability profiles used for implementing the HFP. Moreover the Deliverables “D8 - Definition and formulation of the organization and management models for the healthcare delivery” and “D23 - User needs analysis and functional specifications of the Heartfaid platform services” describe the clinical sites selected for the validation process, the workflows defined for the assessment and the services provided by the HFP.

In order to identify a clear context to be used as reference setting for the validation phase and, thus, uniform the validation activity performed by the clinical sites, in Section 2 we describe a hypothetical scenario in which a patient, named Alex, represents the real patients selected by the Clinical Partners to validate the services of the HFP, and we describe how the assistance path of Alex is supported by the HFP.

Section 3 will then describe how the middleware layer of the HFP is able to support the these workflows, and we show all the interactions among the modules of the HFP implemented by the middleware.

Finally, we demonstrate that the integrated and distributed HEARTFAID platform is able to technically and functionally support all the workflows defined by the clinical partners.

The Appendices of this document will report the installation, configuration and use details of the major modules developed in the context of the HEARTFAID project and integrated into the HFP through the middleware.

# 1. Glossary of terms

| TERM | DEFINITION |
|---|---|
| **AmI** | Ambient Intelligence |
| **AmIE** | AmI enrolment |
| **ASE** | Alarm System enrolment |
| **CDSS** | Clinical Decision Support System |
| **DSS** | Decision Support System |
| **EPR** | Electronic Patient Record |
| **ESB** | Enterprise Service Bus |
| **GPE** | Global Patient Enrolment |
| **HF** | HEARTFAID |
| **HFP** | HEARTFAID Platform |
| **KB** | Knowledge Base |
| **MPI** | Master Patient Index |
| **SOA** | Service Oriented Architecture |
| **SPC** | Select Patient Context |
| | |

# 2. Application scenarios for the validation phase

The HFP has been validated in three clinical validation sites, which have been selected to test the functionalities of the Platform in all of the typical environments served for the support of the heart failure (HF) patient: home, the general practitioner (GP)'s office, the specialized cardiology hospital (both outpatient and inpatient services).

In order to identify a clear context to be used as reference setting for the validation phase and, thus, uniform the validation activity performed by the three sites, we have depicted a hypothetical scenario in which a patient, named Alex, represents the real patients selected by the Clinical Partners to validate the services of the HFP:

1. Alex feels bad and goes to his cardiologist;
2. After the visit, the doctor decides to enrol Alex into the HEARTFAID programme;
3. The doctor checks that Alex is not already enrolled and then inserts his demographic data;
4. Afterwards he accesses the eCRF and inserts the clinical data of Alex;
5. Now the doctor is able to exploit the KB of the "Hospital care" scenario (based only on clinical data) for a preliminary assessment of the overall conditions of Alex (baseline visit)
6. Before ending the visit, he decides to enrol Alex for the continuous monitoring and to activate the CDSS of the HFP for the Early Detection of Decompensation;
7. The measurements start arriving during the subsequent days;
8. After few days, the HFP has enough data to invoke the DSS automatically (so called *automatic* DSS);
9. If the values acquired are in a normal range, an e-mail confirming the healthy state of Alex is regularly sent to the doctor;
10. Once the DSS identifies an abnormal situation, an alarm is issued according to the severity detected by the DSS itself (e-mail and/or SMS);
11. Whenever needed, the doctor can access the platform in order to either visualise the measurements acquired by the sensors or to select a subset of these values and activate the KB-based DSS on the selected values (so called *on-demand* DSS).

The following pictures show a graphical representations of the workflows related to the basic services of the platform.

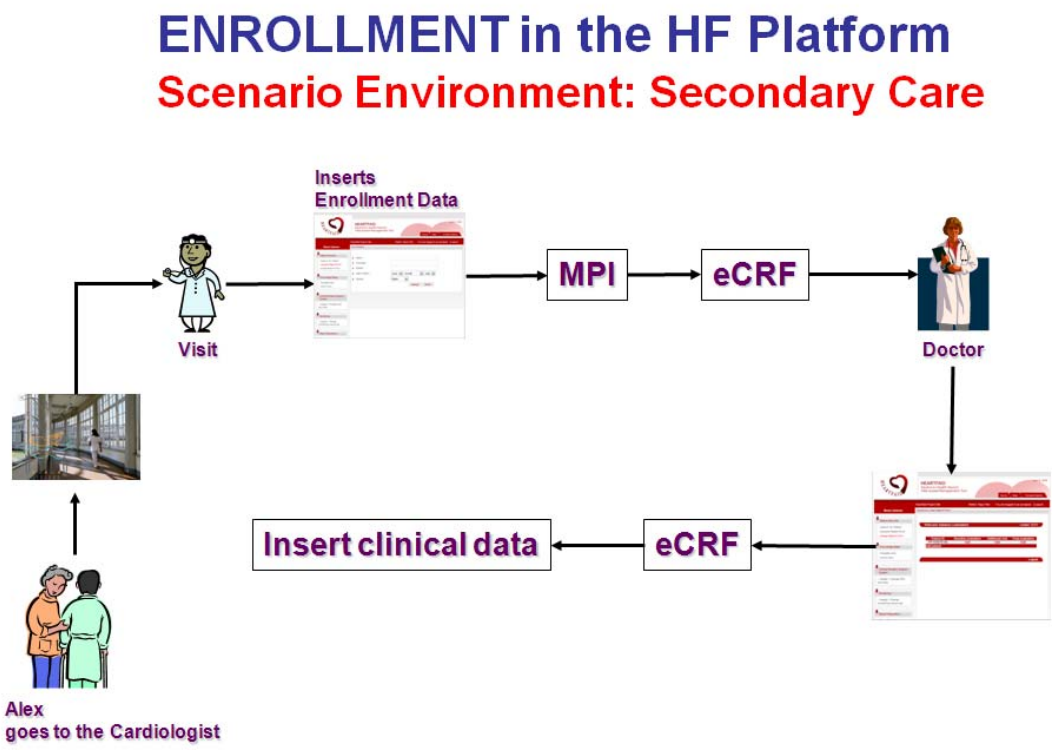



**Figure 2.1 – Data workflow of the patient enrolment and registration of clinical data.**

Figure 2.1 shows the workflow related to the enrolment of a new patient. When Alex goes to the cardiologist, the doctor evaluates his conditions and, in case, decides to enrol him in the HEARTFAID programme.
To do so, the cardiologist needs to insert, into the platform, the demographic information of Alex. These data are stored into the Master Patient Index (MPI) of the middleware that guarantees the unique representation of a patient within the entire HFP architecture. The demographic data are automatically sent by the middleware to the eCRF through a web-based messaging service.
This procedure is completely transparent to the cardiologist. In fact, after the insertion of Alex's demographic data, the doctor can access the eCRF where Alex is immediately recognised as enrolled patient and, thus, insert the clinical data.
Finally, a complete file related to Alex and containing both demographic and clinical data, is available to all the modules of the platform and, of course, to the authorised users.

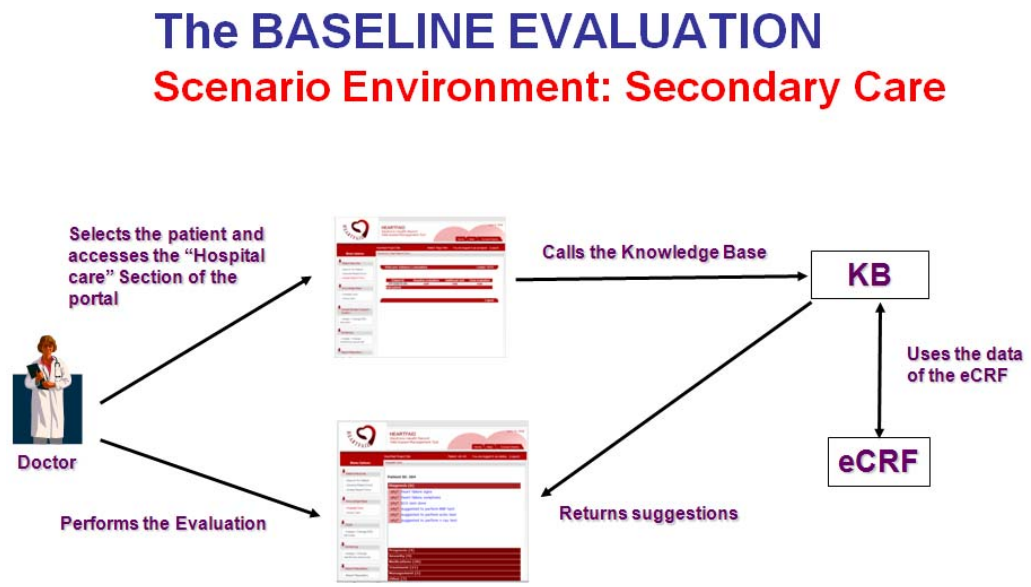



**Figure 2.2 – Data workflow of the clinical data visualisation and example of *on-demand* CDSS.**

After the clinical data have inserted into the eCRF through the web Portal, at any time the doctor can recall the data stored and perform the baseline evaluation exploiting the support of the KB (Knowledge Base)-based DSS (see Figure 2.2), which has been developed using a deductive approach on historical data.
This approach has been called *on-demand* CDSS; in fact, the decision support is explicitly invoked by the doctor whenever needed and on the data selected by the doctor himself.
The middleware will, then, activate the KB that interacts with the eCRF, receive the response and show the results to the user using the Portal. All this procedure is completely transparent for the user who will automatically see the answer of the DSS.

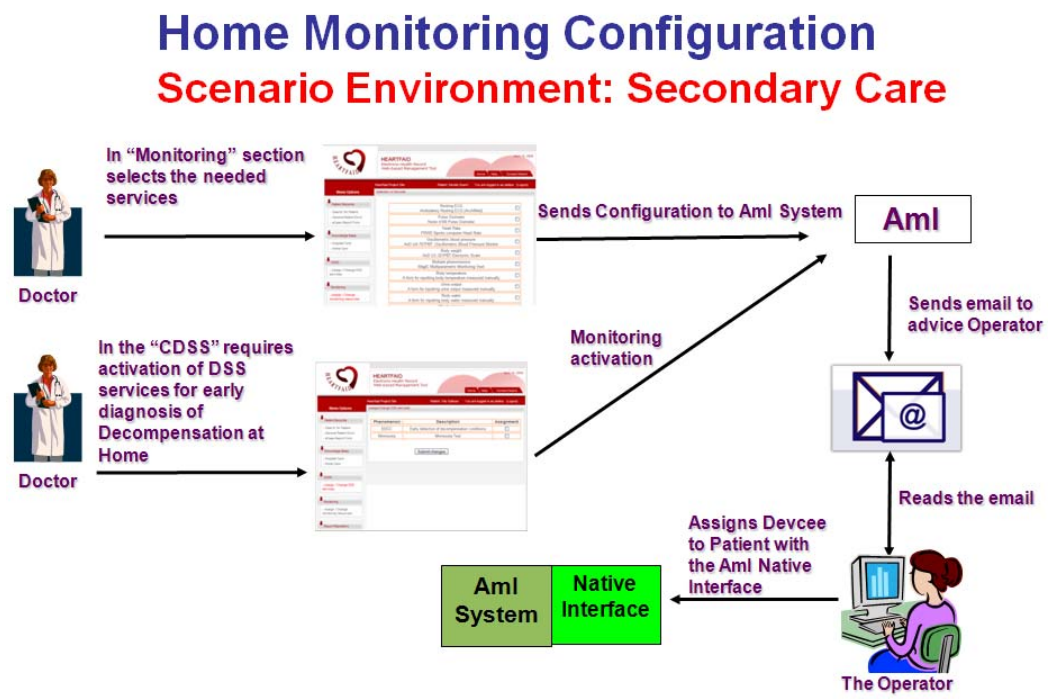



**Figure 2.3 – Data workflow of the monitoring and *automatic* CDSS activation.**

In order to activate the *automatic* decision support for the early detection of decompensation, it is necessary to start monitoring the patient with the personal acquisition sensors. Therefore, the acquisition devices should be provided (or connected) to the patient in order to start the measurement of monitored values.
Similarly to the other procedures, the Portal provides the user with the functionalities to assign the acquisition devices to the patient and to configure the desired decision support algorithm(s).
The middleware will perform all the necessary configuration to the AmI (Ambient Intelligence) system and will send a communication to an operator who is responsible to setup the devices and to deliver (or to connect, in case of inmates) the devices to the patient.

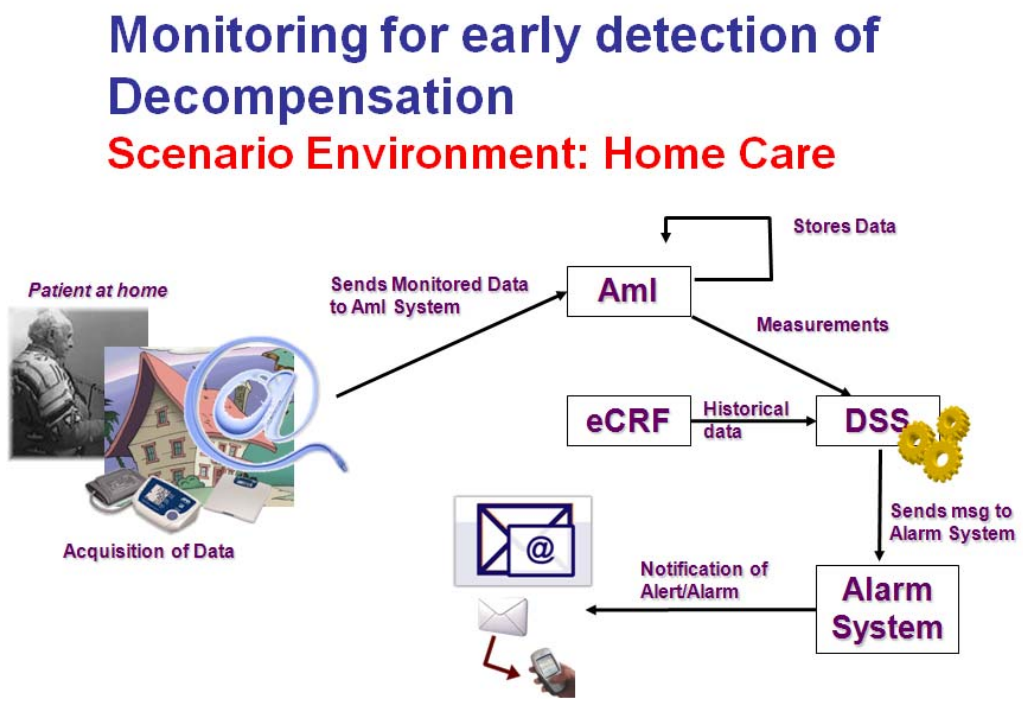



**Figure 2.4 – Data workflow of the monitoring service with automatic activation of DSS and alarming system.**

After the monitoring has been started from the Portal, the HFP is ready to acquire the measurements from the acquisition devices. Either these devices are operated manually or automatically, all the measurements are sent to the middleware through the web, and then to the AmI system that stores all the values acquired.
If the user has activated the automatic DSS, anytime a new value is acquired and sent to the HFP, the middleware verifies if the conditions to invoke the CDSS are verified. In fact, it might be the case that the measurements acquired are not sufficient to activate the CDSS for the early detection of decompensation since the decision support algorithms need also additional data, such as clinical information, combination of measurements, past measurements, and so on.
When the required conditions are verified, the middleware is in charge to activate the CDSS by means of a web-based messaging service, passing all the measurements, historical data and clinical information needed for the computation.
Once the CDSS has finished the computation, the result is received and managed by the middleware of the HFP. It is important to notice that being this service real-time with respect to the acquisition of new measurements from the patient, there is no interaction between the doctors and the Portal.
Therefore, different from the on-demand service, the doctors (or the patient's relatives) cannot receive the results of the CDSS on the monitor. For this reason, the middleware is in charge to manage the answers of the CDSS and, in case an alert (i.e. a low risk of decompensation) or an alarm (i.e. a high risk of decompensation) has been raised, it will automatically activate the emergency notification mechanisms (e.g. e-mails, SMS, ring bells, etc.).

# 3. General architecture of the platform

In this section we will describe the general architecture of the HEARTFAID Platform and we will describe how the exposed functionalities are the result of a distributed interoperable platform of services that is able to guarantee a stable integration among heterogeneous modules.
Although the driving keywords of the HEARTFAID Project have always been “Interoperability” and “Integration”, these modules have been developed using different technologies and methodologies. The main objectives to design and develop a fully interoperable and integrated Platform, have been achieved by implementing a messaging and service based middleware, in which the use of standard protocols within any abstraction level of the Platform has been the key of our success.

The HFP has been deployed in a distributed context in order to prove the usability in a real scenario. The results have demonstrated the effectiveness of the integration realised. In particular, the integration of the HFP has been implemented with the goal to support the scenarios identified by the Clinical Partners at the beginning of the project, and reported in Deliverable D8, as well as the workflows described in the previous Section. The technical details including the integration protocols and the interoperability profiles, have been detailed in the Deliverables “D20 - Clinical standards and first middleware prototype” and “D28 – Integration and Interoperability middleware prototype”.
In this Section we will describe how the midlleware is able to support all the necessary interactions among the modules of the HFP in such a way as to support the workflows described above.

In order to correctly evaluate the results achieved, it is important to highlight that all the three validation site have used the same installation of the interoperable HFP. In addition, this platform should not be considered as a centralised software package installed on a single server, whilest, on the contrary, as a set of independent modules, totally distributed among the technological Partners’ sites and accessed though the web whenever needed.

Figure 3.1 shows the real architecture that has been used to validate the Platform.

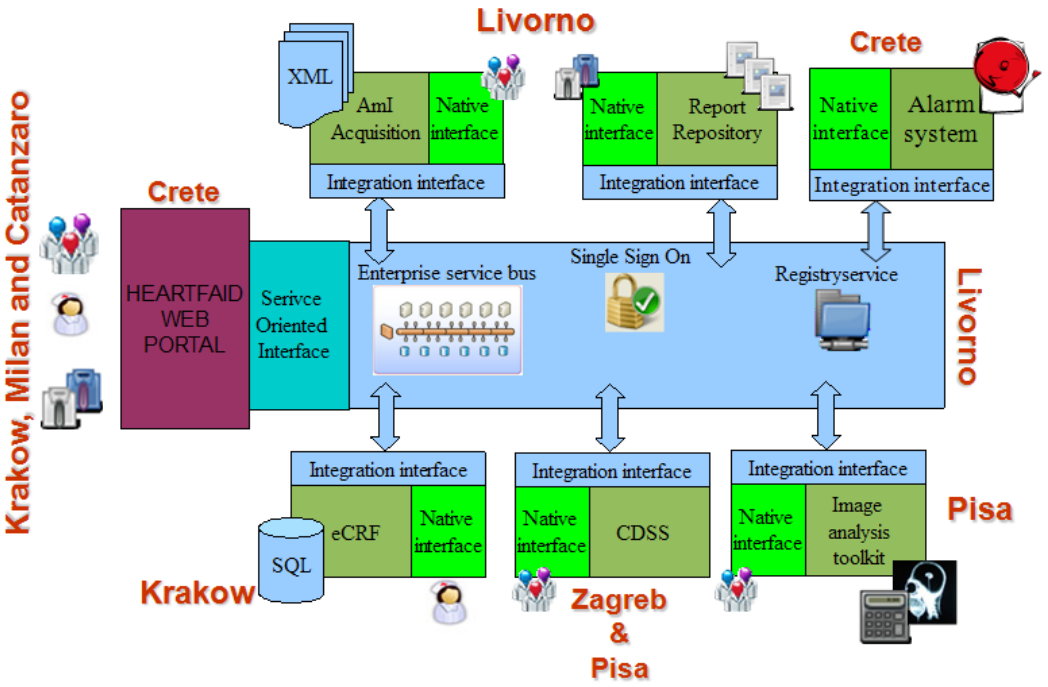



**Figure 3.1 - General architecture of the HFP and installation sites of the components**

The reader may notice that the HFP has been accessed for validation by the doctors at their validation sites, that is in Milan, in Krakow and in Catanzaro. The components of the Platform are all distributed and the interoperability among them is guaranteed by the middleware. In particular, the WEB Portal used by the doctors to access the services is running on a server in Crete (Greece) as well as the Alarming System, although there is no direct interaction between them. The middleware, together with the service-oriented interface, the AmI System for data monitoring and the Platform Repository are located in Livorno (Italy). The Electronic Patient Record with all the clinical data is located in Kracow (Poland) while the Image analysis toolkit is located in Pisa (Italy). Concerning the CDSS, the *on-demand* services, that is the decision support activated by the doctor whenever needed, are running on a server in Zagreb, while the *automatic* services, that is the decision support activated automatically by the system whenever all the necessary data are acquired, are running on a server in Pisa (Italy).

Figure 3.2 shows the services exposed by the HFP to the final user through the WEB Portal. In particular, the picture shows which services have been integrated by using their “native interface” (in dotted boxes) and the services that have been realised by developing a new protocol using standard approaches.

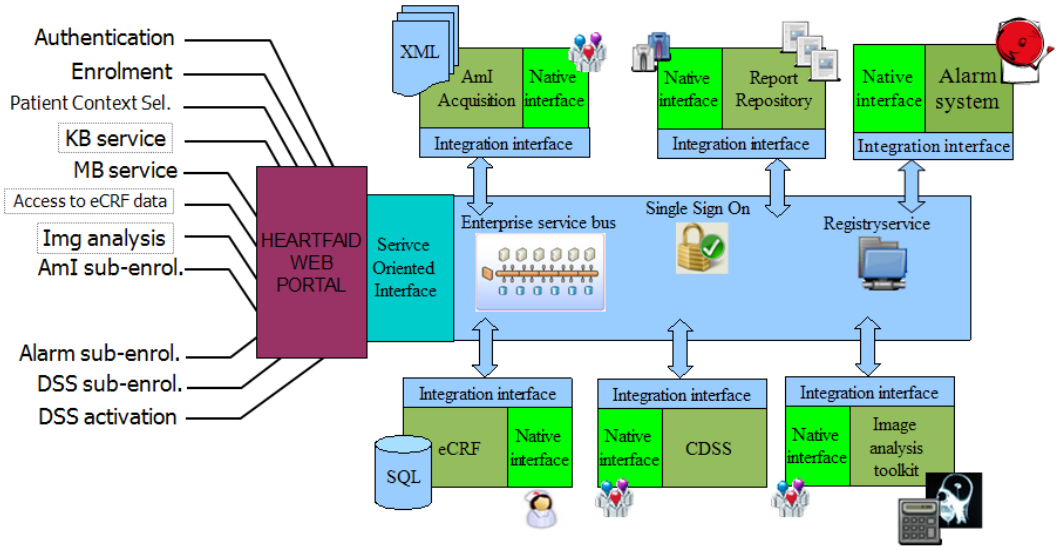



**Figure 3.2 – List of services implemented by the HFP**

The services provided by the HFP to the final user are the following:

- Authentication: this service is used to identify the user as authorised person to access the HFP services.
- Enrolment: this service allows the user to enrol a new patient into the HF programme.
- Patient Context Selection: this service is used to search for a patient and to recover his identification detail. This is a basic step to all the other activities that can be performed on the HFP since they all require the unique identification of a patient. Moreover, once a patient has been identified, that is the "context selection" has been performed, the middleware will guarantee that all the interacting modules will operate on the correct patient without the need, for the final user, to identify again the same patient when using the native interface of other modules.
- KB service: this service represents the "on-demand CDSS" and is operated through the native interface of the KB-module, although the patients' identification details are automatically send by the middleware and the user do not need to select them again.
- eCRF data: this service allows the user to access the clinical data of a patient.
- Img. analysis: this service allows to access the image analysis toolkit to perform eco-images elaborations.
- AmI sub-enrolment: this service allows the user to start the acquisition of measurements from the patient.
- Alarm sub-enrolment: this service allows to activate the alarm system in order to generate alerts, by SMS, in case the CDSS highlights a risk of decompensation.

- DSS sub-enrolment: this service allows to select which automatic CDSS should be active on a patient.
- DSS activation: this service allows to start and stop the DSS monitoring activity on a patient.

The following figures shows the most important integration workflows realised. The other workflows are comparable to the ones described.

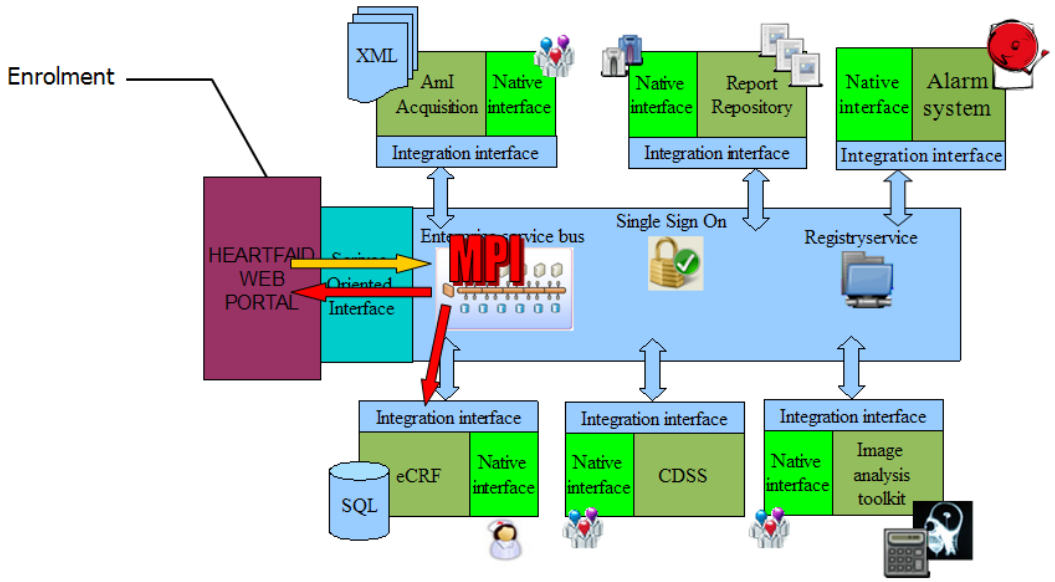



**Figure 3.3 – Workflows and integration of the "Enrolment" service**

Figure 3.3 shows the workflow implemented to realise the enrolment service and to guarantee the interoperability among the Portal, the middleware and the eCRF. When a new patient is enrolled, the identification details are provided by the user through the web interface. This information is then sent, by using a message-based protocol, to the middleware that activates the MPI in order to register the patient and to generate a unique identifier within the entire HFP architecture.
The MPI is responsible to guarantee the unique identification of the patients; in other words, although each module of the HFP has a proprietary patients identification method, the data belonging to the same patient can be exchanged without any mistake.
After the MPI has registered the patient and has generated the unique identifier, it notifies this identified to both the Portal and the eCRF that will, therefore, be ready to receive the clinical data of that patient.

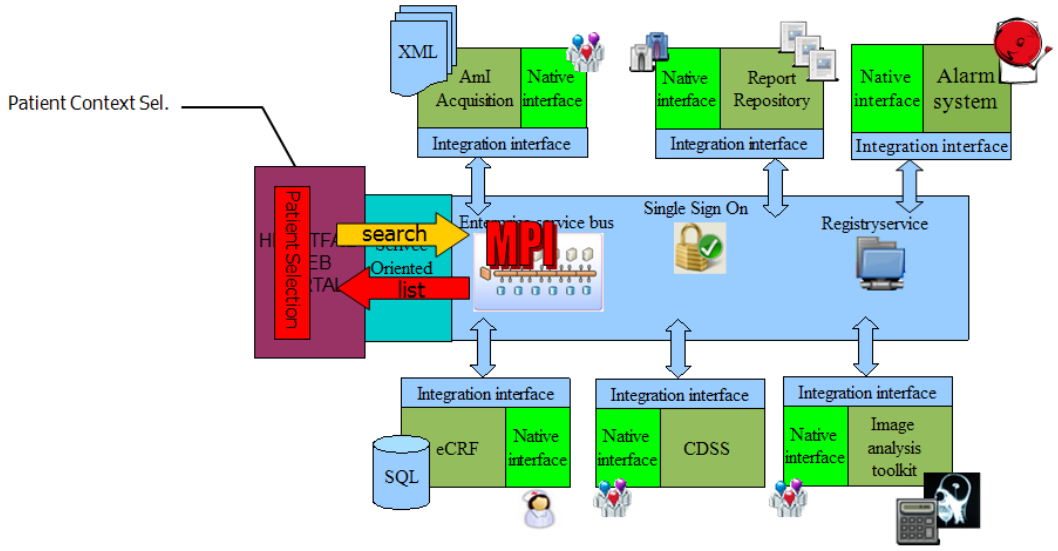



**Figure 3.4 – Workflows and integration of the "Patient Context Selection" service**

Figure 3.4 shows the integration workflow implemented for the Patient Context Selection service. At first, the end-user perform a "search" request by providing some patient's identification information, such as name, surname, date of birth, etc. The search request is forwarded to the MPI that provides the list of patient whose data match the information provided by the user. The searching is performed using the criteria of "partial match", i.e. the user is allowed to provide partially complete information such as a part of the surname.
The list of patients matching the searching criteria provided by the user, is then shown on the Portal and the user is able to select the correct one.

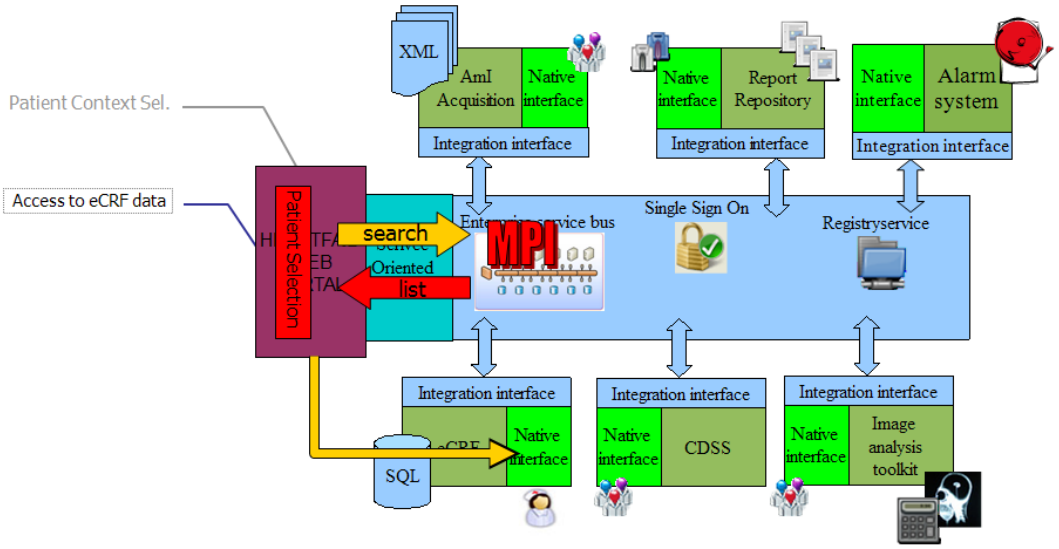



**Figure 3.5 – Workflows and integration of the HFP service to access clinical data**

Figure 3.5 shows the integration workflows implemented to insert, visualise or change the clinical data of a patient. After the patient context has been selected,

the access to eCRF is straightforward because the unique identifier of the patient defined by the MPI allows the Portal to load the correct data using the native interface of the eCRF itself and, if necessary, to submit a request of modification.

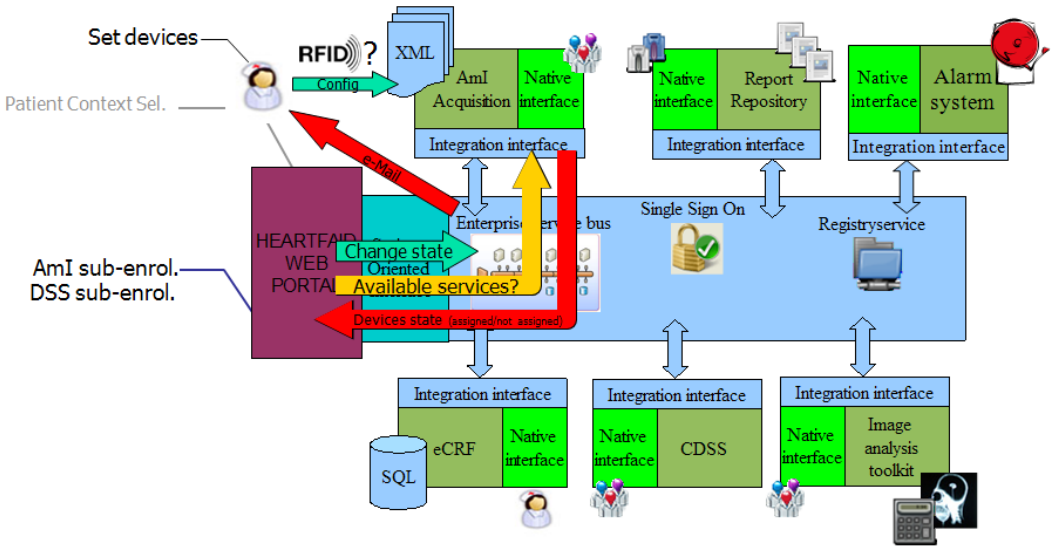



**Figure 3.6 – Workflows and integration of the services for activating the monitoring of a patients and the DSS on every newly acquired measurements (respectively AmI and DSS sub-enrollment)**

Figure 3.6 shows the integration workflows related to the AmI and DSS sub-enrolment services. This can be considered the most structured service among those implemented and will be described with a numbered list:

1) The Portal sends to the middleware a request of available monitoring services;
2) The middleware interacts with the AmI system to recover the available monitoring services that will then be forwarded back to the Portal;
3) The Portal shows the list of available services and the user can select those that should be activated on the selected patient;
4) The request is sent to the middleware that activates all the necessary communication mechanisms to notify the technicians that a new monitoring service has been requested. The message contains all the details needed to identify the sensors to be activated;
5) The technicians configures and provides (or connects) the acquisition devices to the patient;
6) All the measurements acquired by the monitoring devices are automatically sent to the AmI system;
7) When new measurements are received, the AmI system will notify the middleware of the HFP about the new values.

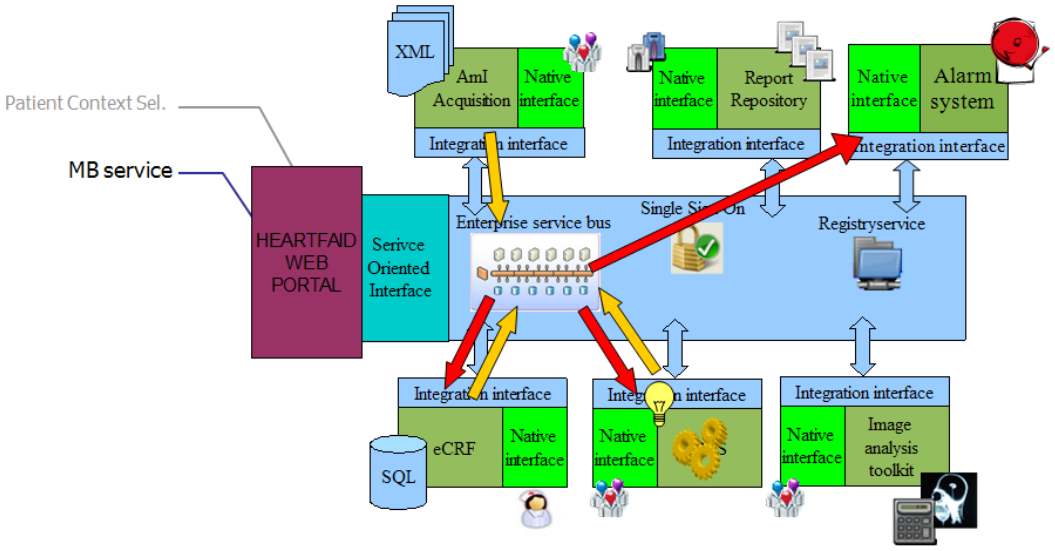



**Figure 3.7 – Workflows and integration of the services for the automatic activation o DSS modules on new measurements**

Figure 3.7 shows the integration workflows for the automatic CDSS activation on new measurements acquired by the monitoring devices. When a new measure is received, the AmI system sends to the middleware a notification about the type of measurements received and the patient from whom it has been acquired.
If the doctor has previously enrolled the patient for the automatic CDSS activation, the middleware will collect all the necessary data from all over the HFP, for example the new measurements, previous historical measurements and clinical data, and sends a processing request to the CDSS providing all the data gathered.
When the CDSS will provide the answer, if there is no risk of decompensation nothing happens, otherwise the middleware will activate the alarm system.

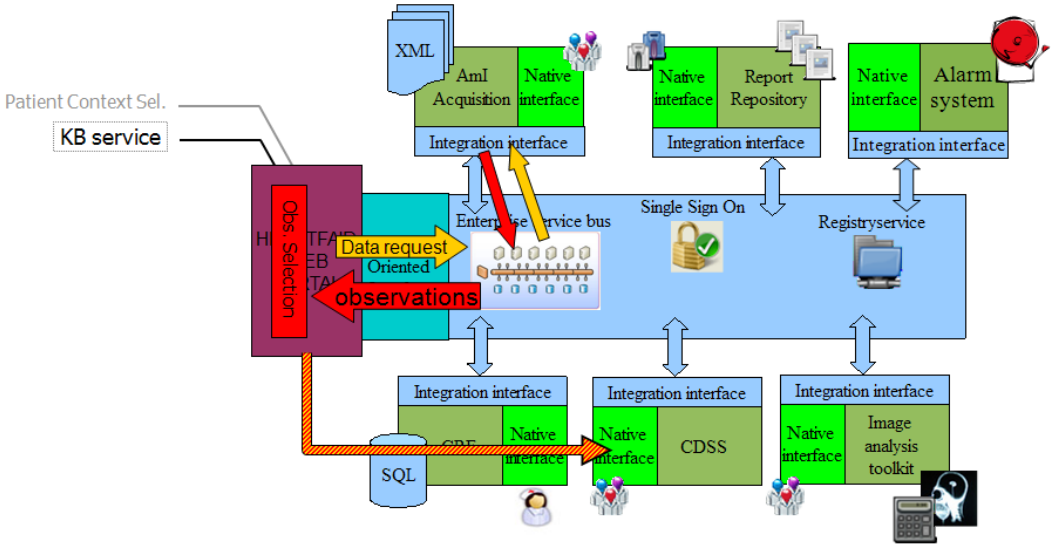



**Figure 3.8 – Workflows and integration of the service for using the KB-based CDSS**

Figure 3.8 shows the integration workflow implemented for the on-demand CDSS service. This service is invoked by the doctor only when needed and requires the selection of measures on which the decision support should be provided.
Therefore, a request of data visualization is sent to the middleware. By interacting with the AmI system, the middleware recovers all the measures acquired from the patient within a range of dates (which are provided by the end-user on the Portal).
The measures are then sent back to the Portal and shown to the doctor. Finally, the doctor selects the desired values and sends the request to the Knowledge base service that will perform the processing and will answer, real-time and through the Portal, providing the decision support conclusions and the related motivations.

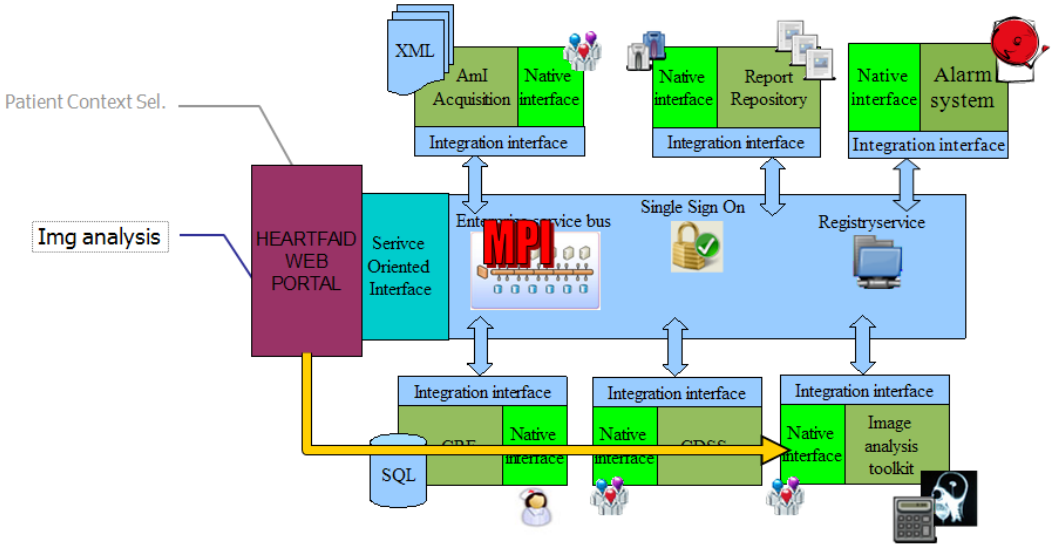



**Figure 3.9 – Workflows and integration of the service for using image analysis tool-kit**

Figure 3.9 shows the integration with the eco imaging toolkit. In this case, the unique identifier of the patient is sent to the toolkit that will, then, be able to show the images available for that patient and provides a dedicated interface to exploit the image processing algorithms developed.

# A. Appendix 1 - Font-end: the Portal

The portal aims at integrating all platform features in a user-friendly, user-intuitive way so as to limit the complexity of the interface and minimize the amount of clicks required for a specific destination within the Front-End. The latter will serve as a single access point for all the services assimilated within the platform and will ensure that the communication between the offered utilities will be optimal. Furthermore, issues like error handling, user feedback, information display and page layout will be kept uniform throughout the platform. In synoptic terms, the Front-End objectives will be to:

- Provide a user-friendly and user-intuitive interface
- Incorporate all available services in the most robust and efficient way
- Ensure uniformity among all portal features (e.g. error handling, user feedback, information display, page layout)
- Maintain high access principles in terms of speed, efficiency, data transfer and acquisition
- Make the platform accessible via any web browsing application
- Deliver a high-standard interface both for the amateur and professional user

The aforementioned principles give the perspective and guidelines for our Front-End development, as it will become evident below.

## A.1 The Design and Technologies of the Front-End

The graphical user interface of the Front-End conforms to popular conventions among web designers and developers. Since the Platform will assimilate all available services – some written and developed with different and possibly unintuitive methods – it includes valid cross-references between the various sections so as to enhance usability and ensure that the desired functionalities will be reachable and appropriately integrated. iFrames have been used for the integration of the various services into the platform and php sessions have been created in order to bypass double user authorization requests between the different services. Xml forms have been used for the communication with the central middleware and the php language has been running on Forthnet's server. The intuitive hierarchical structure ensures the minimization of the required amount of clicks in order for any user to reach the desired functionality in time. All the above have been described in detail in Deliverables D23 and D31.

## A.2 Description of the Front-End

### A.2.1 Login Page

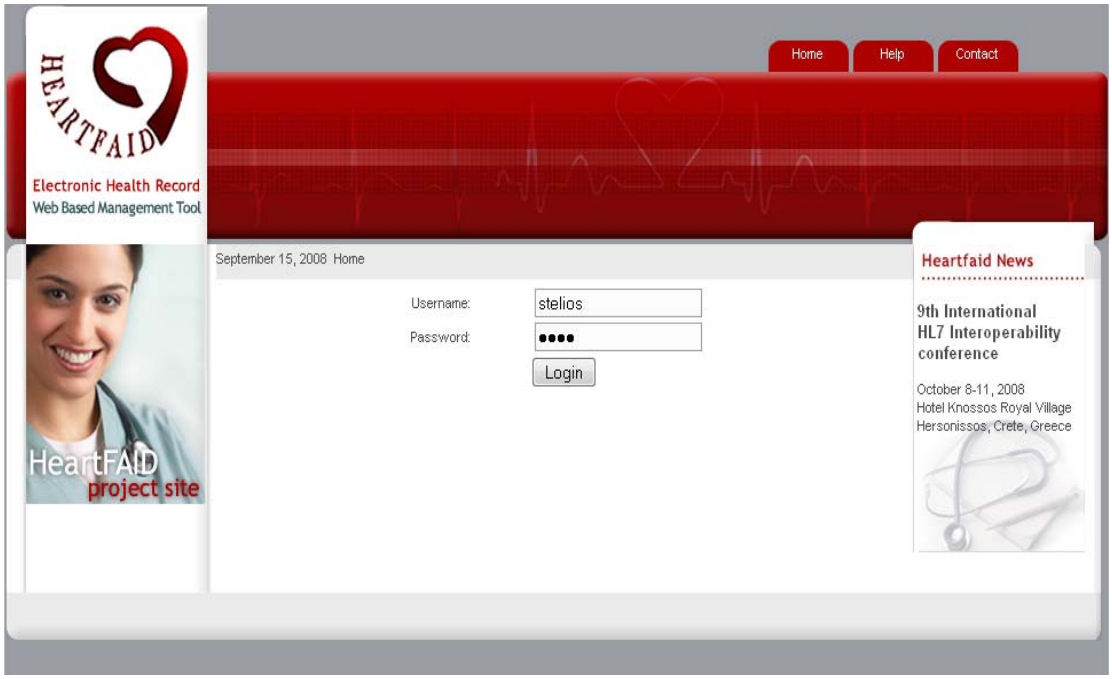



**Figure A.1 – HEARTFAID Login Page**

The login page (http://www.staging.gr/heartfaid ) is where the **registered** users will be able to insert their Username and Password in order to access the HEARTFAID platform. User registration will take place at an earlier stage, outside the platform, as, otherwise, the strict security principles that have been set, given the platform's character, will be compromised.
The platform provides a single login access to all services within the HEARTFAID project's scope. Two user attributes have been considered for accessing the platform. On the one hand there will be the fully authorized user who will have access to all platform services and on the other, there will be a user with limited access who will have permission to use specific HEARTFAID services (e.g. the search engine). A system administrator will decide on all user access levels.

The login-page displays the current date at the top right corner and provides access to HEARTFAID project's official website (the link is located above and to the left of the login dialog box and opens in a separate window). The HEARTFAID logo at the top left corner is clickable and returns the user to the initial page – once the user has logged in, or, otherwise, the login page.

### A.2.2 First Page upon successful login

Once the user has provided his/her access credentials and has been let through by the platform, (s)he will be able to access all available services appropriate to his/her access credentials.

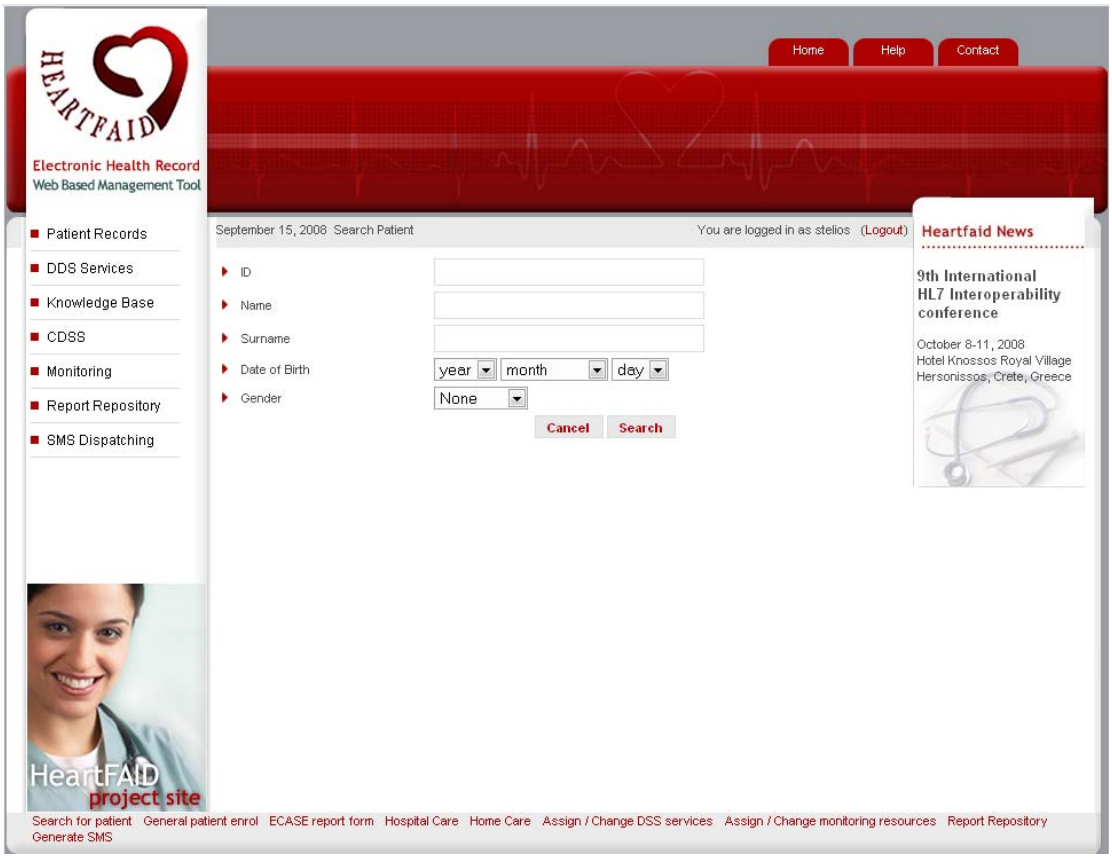



**Figure A.2 – HEARTFAID Search for Patient**

The initial page any user will see with appropriate access credentials is the one shown above. That corresponds to the search patient utility. In order for a patient record to be located, the user will have to input **either** a patient ID (if known), a Name, a Surname, a Date of Birth or a Gender. The platform sends xml requests to the central middleware in order to retrieve the appropriate results. Once the patient has been found and selected, the patient's ID is kept throughout a session. This, results in delivering all menu options (e.g. Hospital Care, Home Care etc.) relative to that particular patient alone.

The initial page will be accessible from any other page within the platform by a simple click on the top left corner HEARTFAID logo or the **Search for Patient** link under Menu Options ▪→ Patient Records.

As it becomes evident from the picture above, the Front-End incorporates a **two-columned layout**. On the left, there are the menu options relative to a particular patient with links to the available services and on the right there will be the services themselves. Each click on a link on the left will produce an output on the column to the right.

The page displays the current date on the top right corner, and a list of tabs with the following tags:

- Home
- Help

- Contact Details

The tag names are rather intuitive but we will walk through them nonetheless.

### A.2.3 Top Tabs

At the top of each Front-End page there is a three tab menu. The menu consists of the following three tabs:

- Home
- Help
- Contact Details

#### *A.2.3.1 Home*

The **Home** tab takes the user to the page where all the Menu Options available on the left column, are given as buttons on the page on the right:

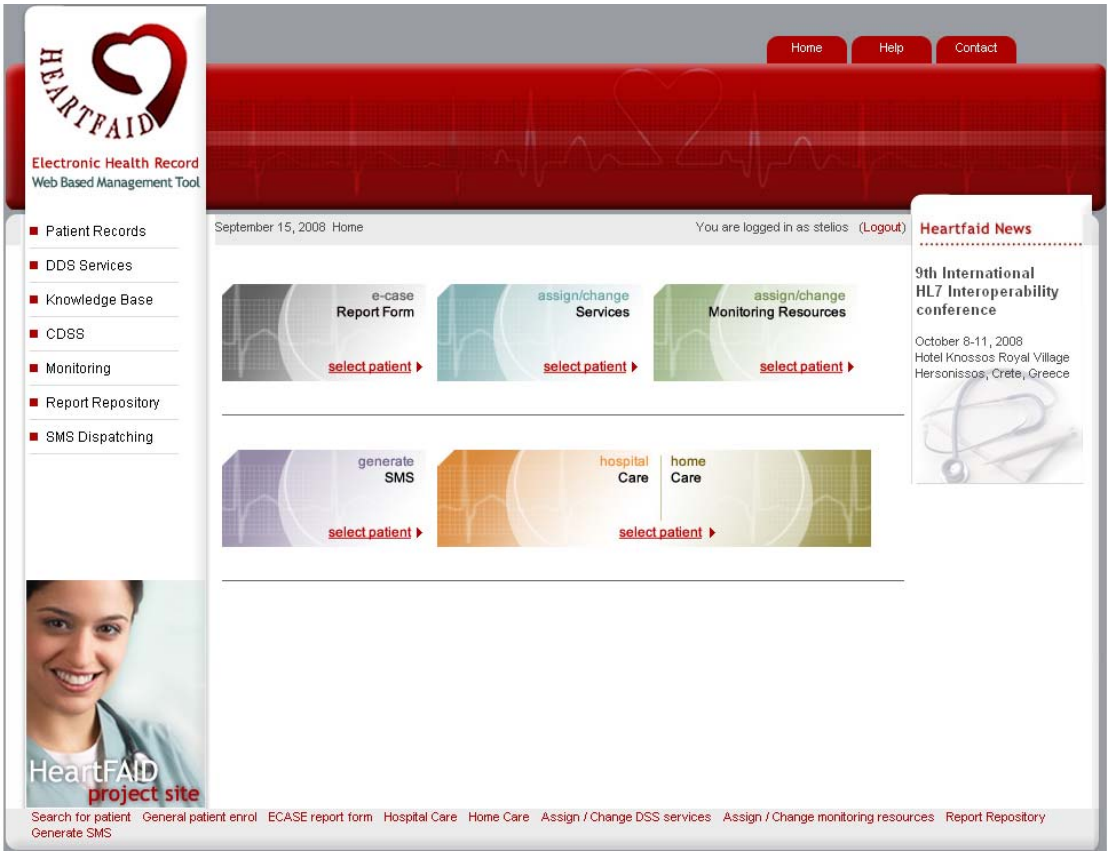



**Figure A.3 – HEARTFAID Home Tab**

The user will be able to click on any button and get automatically transported to the appropriate page. By selecting the 'Select Patient' option, the user will be able to specify the patient (s)he would like to focus on during a particular session and thus, get results relevant to that particular target healthcare recipient alone.

### *A.2.3.2 Help*

The **Help** tab displays the contact details of the people that are responsible for the Front-End implementation:

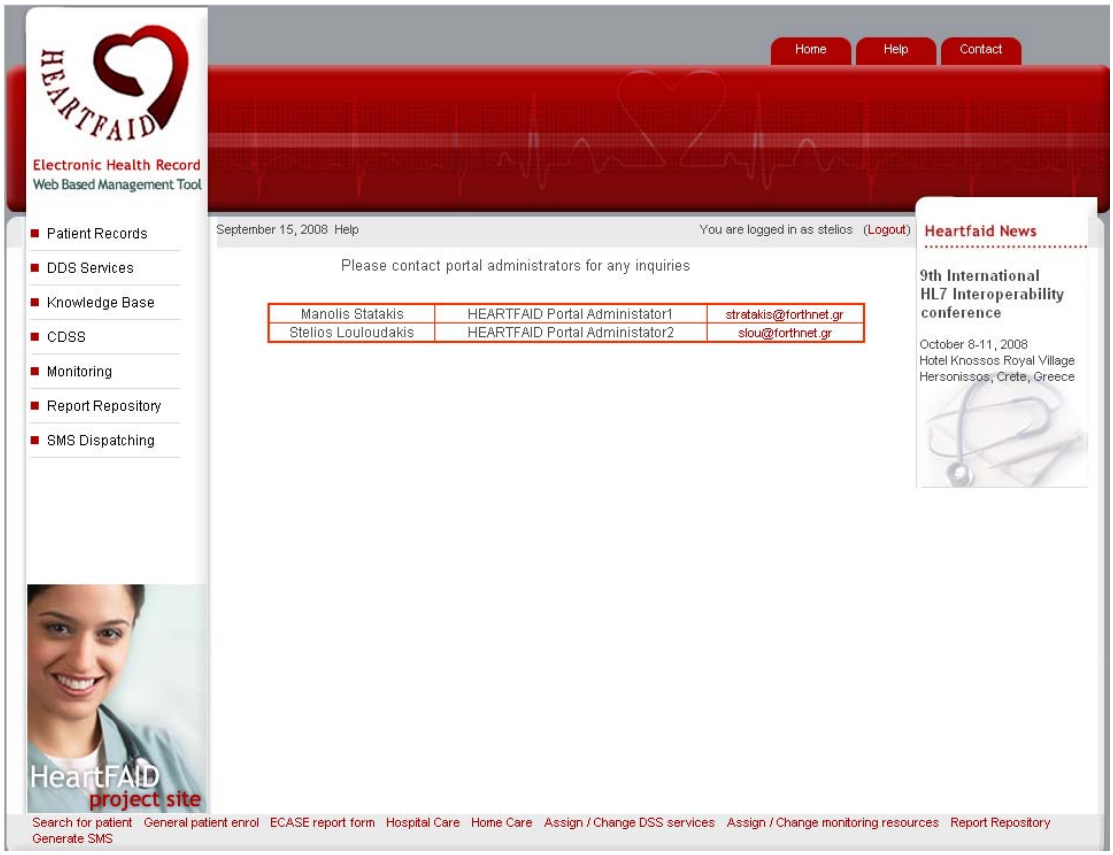



**Figure A.4 – HEARTFAID Help**

The portal administrators are outlined in the Help tab's page and the user may send appropriate enquiries by email to any person listed there.

### *A.2.3.3 Contact Details*

The **Contact Details**' page is reachable via the Contact Details tab on the Front-End. There, the people responsible for the implementation of the HEARTFAID project are outlined and the user may send enquiries by email to any (or all) of them.

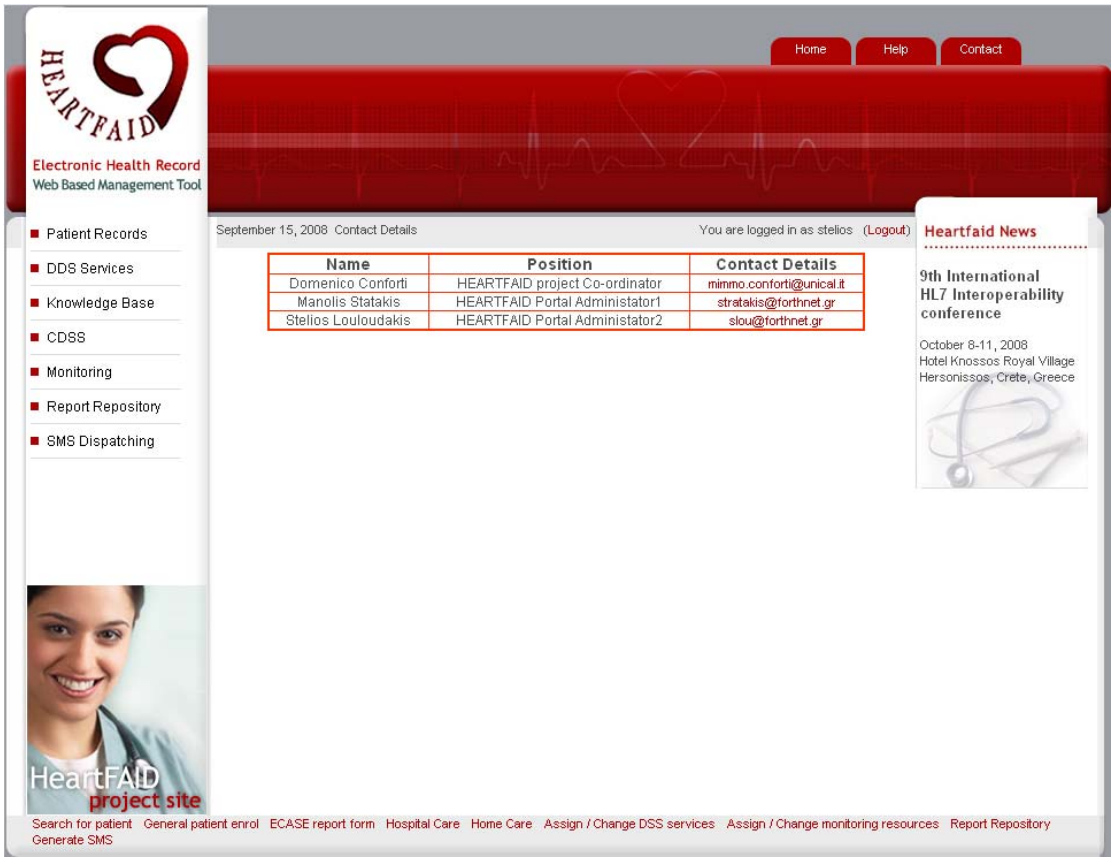



**Figure A.5 – HEARTFAID Contact Details**

## A.2.4 Menu Options

### *A.2.4.1 Patient Records*

There are three options within the particular menu option:

- Search for Patient
- General Patient Enroll
- eCase Report Form

The Search for Patient link takes the user back to the initial page (Figure A.2 – HEARTFAID Search for Patient) where (s)he will have to look for a particular patient within the platform's database. The **General Patient Enroll** link takes the user into the general patient enrollment form. There the following fields will have to be completed in order for the patient record to be considered intact:

- Name
- Surname
- Mother's Name
- Date of Birth
- Gender

All fields are mandatory as indicated by the asterisk that supersedes each field name. The demographic data of each patient are kept in the central middleware's database. The enrollment form, upon successful completion, assigns to each patient a unique patient ID that is necessary for the identification of each patient within the various services offered by the platform.


**Figure A.6 – HEARTFAID General Patient Enroll**

The **eCase Report Form** (eCRF) integrates the Electronic Health Record (EHR) for each patient. The EHR incorporates the overall health progress of the patient along with detailed info about each patient visit and the latter's evaluation.

In order for the eCRF to be incorporated into the Front-End, the use of iFrames has been employed. Since the eCRF service is hosted at a remote location, additional user authentication and authorization procedures would have been required. The latter, however, have been securely bypassed by means of appropriately formulated login sessions to the Front-End. Upon user logon, authentication codes are being sent through the 'GET' request to the eCRF server which then, acknowledges user login and permits access to the eCRF service.

Each patient is listed within the eCRF form by his/her Patient ID, as given to him/her by the platform upon Patient Enrollment. The user has the options of editing his/her evaluation of the patient's data, add patient visits and review or edit a final patient health analysis.

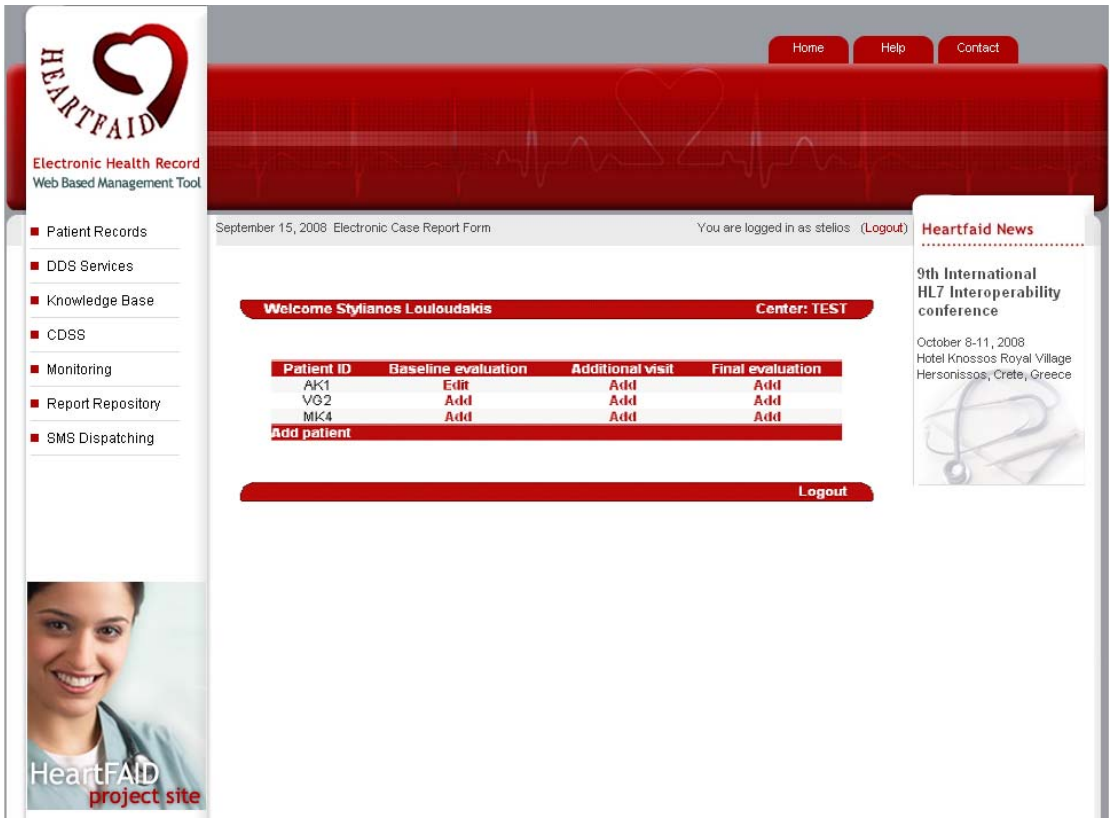



**Figure A.7 – HEARTFAID eCase Report Form**

The eCase Report Form displays the resources of each patient alone since it is dependent on the initial patient selection option (via the Search for Patient page).

### *A.2.4.2 Knowledge Base*

The knowledge base menu option comprises of two further options:

- Hospital Care
- Home Care

The **Hospital Care** menu option allows for the user to administer the treatment and general management of the patient. In connection with an advanced decision support system (DSS), the Hospital Care option allows for two main items in reference to a particular patient to be extracted:

- *Diagnosis*, showing possible health conditions depending on patient data
- *Prognosis*, showing possible health risks depending on patient health data and patient demographic facts

The Hospital Care option, also, offers several options as far as the condition of the patient is concerned:

- *Severity*, outlining the seriousness of the patient's situation based on appropriate decision support models
- *Medications*, listing the medications that are or should be taken by the patient according to his condition and prognosis
- *Treatment*, profiling the appropriate treatment in relation to the user's condition taking under consideration all of the befitting parameters
- *Management*, providing a schematic of possible management features of the patient's condition
- *Other*, incorporating all other available and relevant information about the health condition of the patient

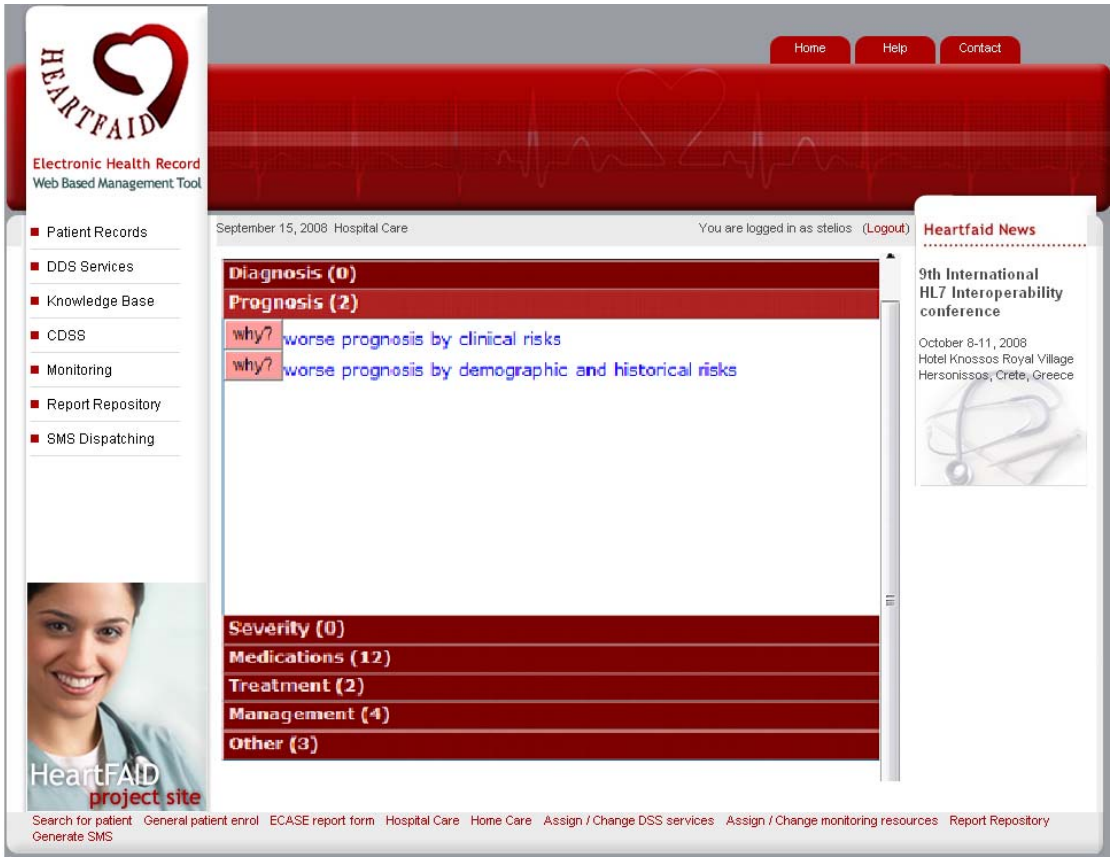



**Figure A.8 – HEARTFAID Hospital Care**

The user will have to click on each item (s)he wishes to review and the platform will automatically display the available options. The output of the Hospital Care menu option is based on an innovative decision support mechanism. The Hospital care has been integrated via an iFrame development option into the Front-End.

The **Home Care** option incorporates the patient specific health measurements that have been made through the appropriate medical devices that are linked with the platform. Each set of measurements is categorized according to the date

it has been taken and each set is clearly separated from the others. Next to each measurement there is a checkbox which lets the user select and submit the desired measurements to the knowledge base. The patient data are utilized in the decision support process in order to provide the best possible reasoning and the best possible outcome regarding the patient's health condition.

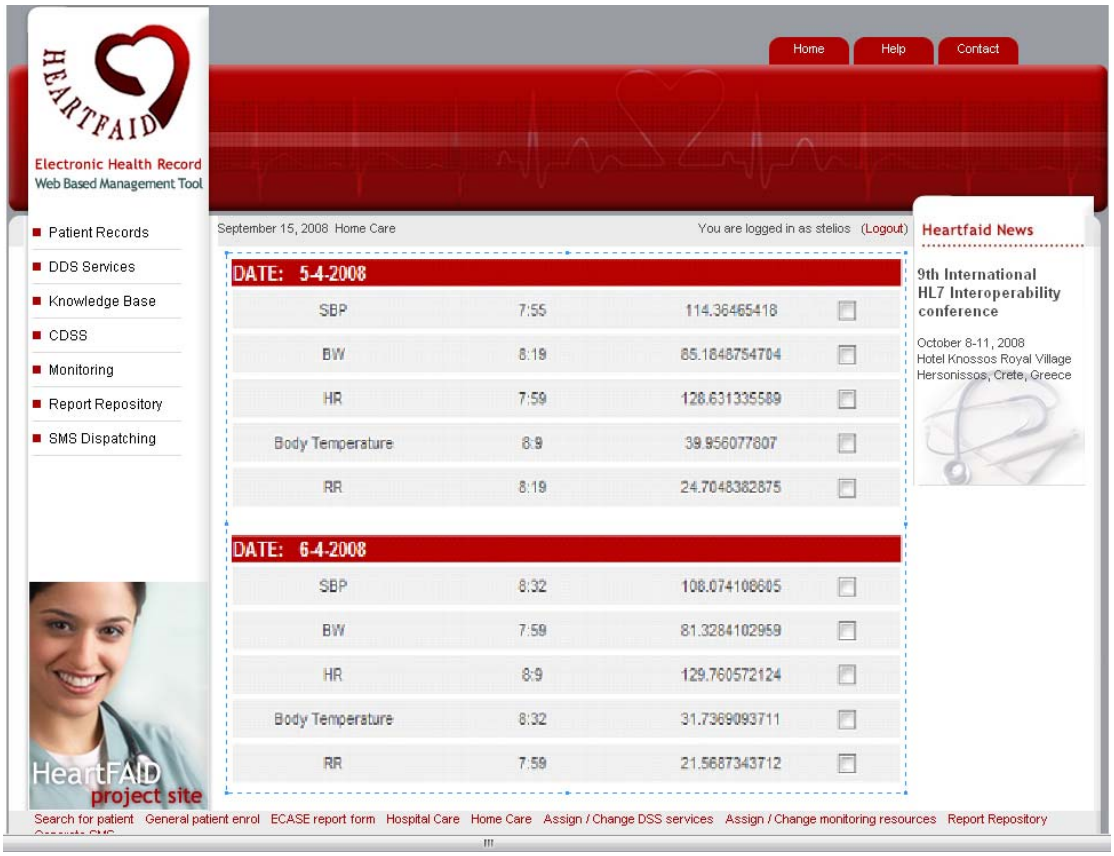



**Figure A.9 – HEARTFAID Home Care**

### *A.2.4.3 CDSS*

The **CDSS** comprises of the available Decision Support mechanisms (DSS) the platform will use that will supplement the user's own assessment of the patient's condition. The DSS should provide the user with a certain level of intelligence by using a specifically designed inference engine. The menu option:

- Assign/Change DSS services

lets the user select the appropriate decision support method (s)he wishes according to his/her requirements. The CDSS will outline all available DSS services and the user will be able to check which available DSS engine (s)he would like to use.

The HEARTFAID platform's assigned administrator will be responsible for checking for updates and make modifications to the core code of the decision support systems available. Each user will be able to select only one DSS

mechanism for each patient query and by selecting the appropriate checkbox, the user's preference is recorded within the platform's middleware.

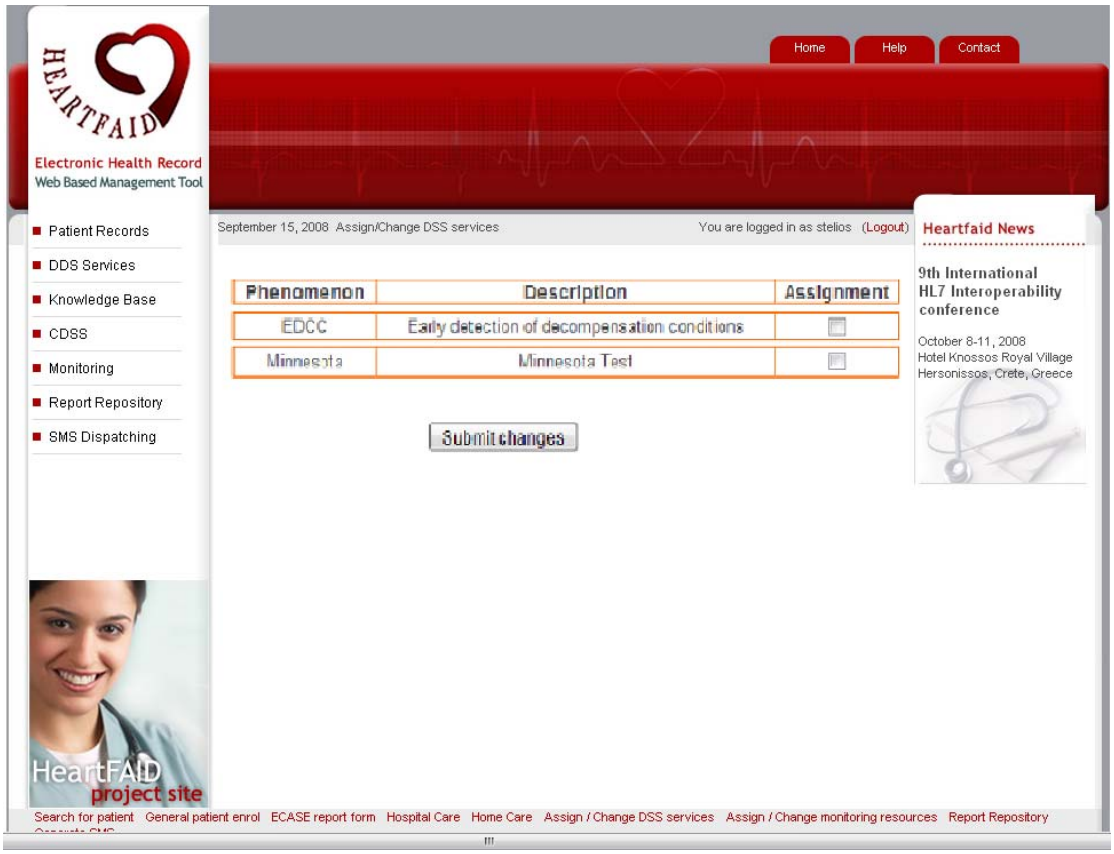



**Figure A.10 – HEARTFAID Assign / Change DSS Service**

### *A.2.4.4 Monitoring*

The **Monitoring** Menu Option included a single sub-option:

- Assign / Change monitoring resources

The HEARTFAID platform is interlinked with a variety of hardware devices that measure valuable and relevant to the HEARTFAID platform's scope and aim, medical parameters. The HEARTFAID platform's user will be able to organize and systematize his/her patient monitoring process by selecting the appropriate medical devices from the Monitoring Menu Option. The measurements taken by the devices are, then, viewable through the Knowledge Base Menu Option ▪→ Home Care link (as in Figure A.9).

Upon the user's visit, the Monitoring page displays the number and type of medical devices available to the platform and further, by indicating a checked checkbox, the number and type of medical devices that are, at the time, used for

monitoring the patient. It is at the user's discretion to select which devices (s)he would like to enable for the monitoring of a particular patient by (un)checking the appropriate checkboxes. Once the monitoring devices have been picked out, the user should save his/her selections to the platform's middleware by clicking the Submit button at the end of the Monitoring page.

For each patient a certain set of medical devices are utilized for his/her monitoring via the HEARTFAID platform. Those devices have to be operable from within the patient's home premises. This should be maintained whenever modifications to the patient's monitoring resources are made. The HEARTFAID platform's administrator is authorized to check for any changes to the monitoring methods relevant to each patient registered within the platform, and ensure that the devices available at the home environment of the patient align with the ones selected within the Monitoring Option of the HEARTFAID platform.

Once the monitoring resources have been selected and deployed, the monitoring is then implemented and put into action. The Monitoring Menu Option with the Assign/Change monitoring resources link clicked produces the following output within the HEARTFAID platform:


**Figure A.11 – HEARTFAID Assign/Change Monitoring Resources**

### *A.2.4.5 SMS Dispatching*

The alert & notification system intended for the HEARTFAID platform has been implemented to include **only** GSM enabled devices. For each patient, a personalized profile is being stored on the platform where details about the patient's mobile phone number are reserved. The alert & notification service includes:

- A User generated SMS

The service is reachable via the Front-End by clicking on the **Generate SMS** link under the SMS Dispatching menu option as shown below:

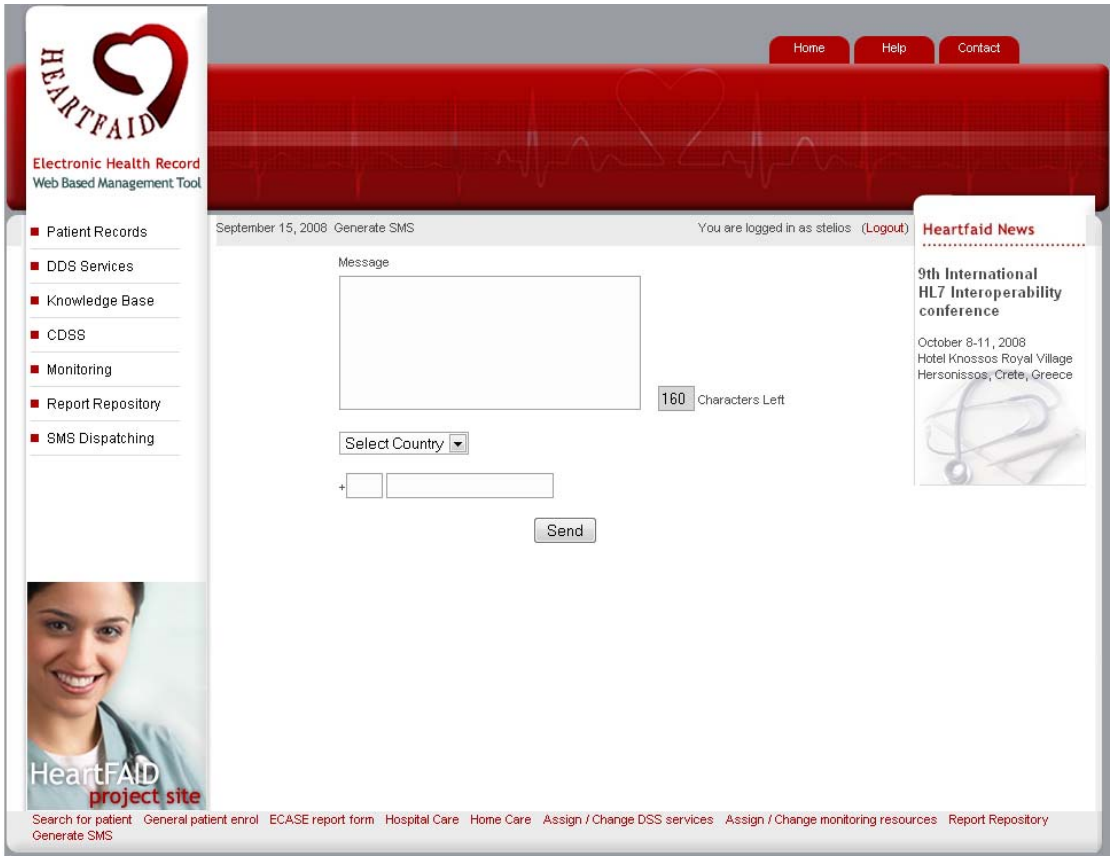



**Figure A.12 – HEARTFAID Generate SMS**

Each user will be able to send to any EU destination, an SMS message of up to 160 characters. The SMS messages are sent using the B2B Server mechanism of the GroupSMS$^{TM}$ service provided by FORTHnet S.A. In this way, SMS messages are being sent using either an HTTP request or a standard TCP/IP call via any custom application.

In order for the SMS messages to be sent, the user will need to have sufficient SMS account credit. In case there is zero balance in the user's account at the time of the SMS dispatch, the SMS will not be sent to the desired destination and an error message will be returned to the HEARTFAID application.

Each user will be able to send one SMS message to a single destination, at a time. To be sure, account credit permitting, the user will be able to send as many SMS messages as (s)he finds necessary at any single user session. Apart from the message body, which is mandatory, the user will have to specify a country and, obviously, a valid mobile phone number. Upon selection of the country where the patient is located at, the country prefix is being automatically filled up. Thus, the user will only have to input the mobile phone number in the available field.

## A.3 Conclusions

The HEARTFAID project's Front-End has been designed to integrate various e-Health related services within the medical subject area of Heart disease. The platform has been aimed to become as scalar and as modular and robust as possible with a particular focus on user-intuitiveness and user- friendliness. The platform incorporates an advanced medical decision support system that aspires to assist doctors with their appropriate diagnosis of a certain health condition of a particular patient. The HEARTFAID platform also includes tele-monitoring services complimented with an advanced SMS messaging functionality that will alert & notify the appropriate patient at the arrangement of the platform's user. Several medical monitoring devices are interlinked with the main platform and their output is being both automatically user assessed and evaluated. The Front-End brings together all those advanced functionalities and integrates the web-based software modules in such a way so as both the amateur and the advanced user to be equally satisfied and compensated.

# B. Appendix 2 - Installation and configuration of the Nurse@Home module

## B.1 Installation

### B.1.1 Prerequisite (check for Java)

1. Make sure that you have Java installed on your system. To check if you have Java installed:
    a. Open a Command Window. Click on ***Start➔Run***.
    b. Type ***cmd*** and press enter.
    c. In the Command Prompt type ***java –version*** and press enter.
    d. If you receive an "Unknown Command" error message or your Java build number is less than 1.5 then you need to install the latest (free) edition of JRE, which can be found at www.java.com


### B.1.2 Install main features

2. Download the appropriate version of the software. There are 2 versions:
    a. ***nurse.at.home.zip***
    This version contains the files needed to setup the application but without the files to perform measurements from the MagIC system.
    **b.** ***nurse.at.home.magic.zip***
    This version contains the files needed to setup the complete Nurse@Home application (including functionality for the MagIC system).
3. Extract the contents of the zipped file to the local drive C:. The folder ***C:\Nurse_at_Home*** should have been created.
4. Move to the ***C:\Nurse_at_Home\Heartfaid_Measurement*** folder
5. Right click the ***nurse_home.bat*** file, click ***Edit***.
6. Set the right path for Java. Change the red text (as shown to the box at the

```
@echo set parameters for HeartFAID
@echo off
set JAVA_HOME=C:\Program Files\Java\jre1.6.0_05
set path=%JAVA_HOME%\bin;%path%
java -jar "%CD%\nurse_home.jar"
```

right) to point to the correct path of Java Runtime Environment for your PC. Save the changes and exit.

7. Right click on the ***nurse_home.bat*** file. Click ***Send To➔Desktop (create shortcut)***.
   Now the icon that is going to be used by the user - in order to start the application - has been created.
8. Move to the ***C:\Nurse_at_Home\Heartfaid_conf*** folder.
9. Right click the ***heartfaid_config.bat*** file, click ***Edit***.
10. Set the right path for Java. Change the red text (as shown to the box at the right) to point to the correct path of Java Runtime Environment for your PC. Save the changes and exit.

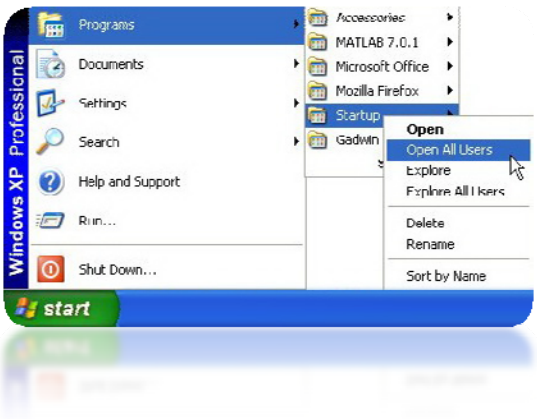
```
@ echo off
C:
@ echo Set parameters for HeartFAID
@ echo off
set                    JAVA_HOME=C:\Program
Files\Java\jre1.6.0_05
set path=%JAVA_HOME%\bin;%path%
java -jar "%CD%\nurse_home_configuration.jar"
```

### B.1.3 Install functionality for the MagIC system

11. In this case prerequisite is that you have downloaded at the second step the ***nurse.at.home.magic.zip*** file. In order to verify that you have downloaded the appropriate file check if the following folders are inside the ***C:\Nurse_at_Home*** folder:

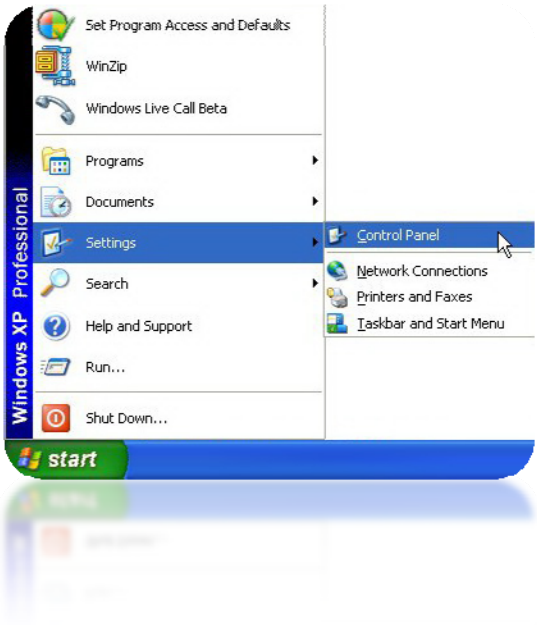
***C:\Nurse_at_Home\Vest_server***
***C:\Nurse_at_Home\MagIC***

12. Move to the folder ***C:\Nurse_at_Home\Vest_server*** and ***Copy*** the file ***vest.server.bat***.
13. Move to the startup folder of the system. In order to do so go ***Start➔Programs➔***Right click on the ***Startup*** and click ***Open All Users*** (as shown in the image beside).




14. Right click at the empty space and click ***Paste Shortcut***. This way every time Windows start will start the application that receives the MagIC systems measurements.

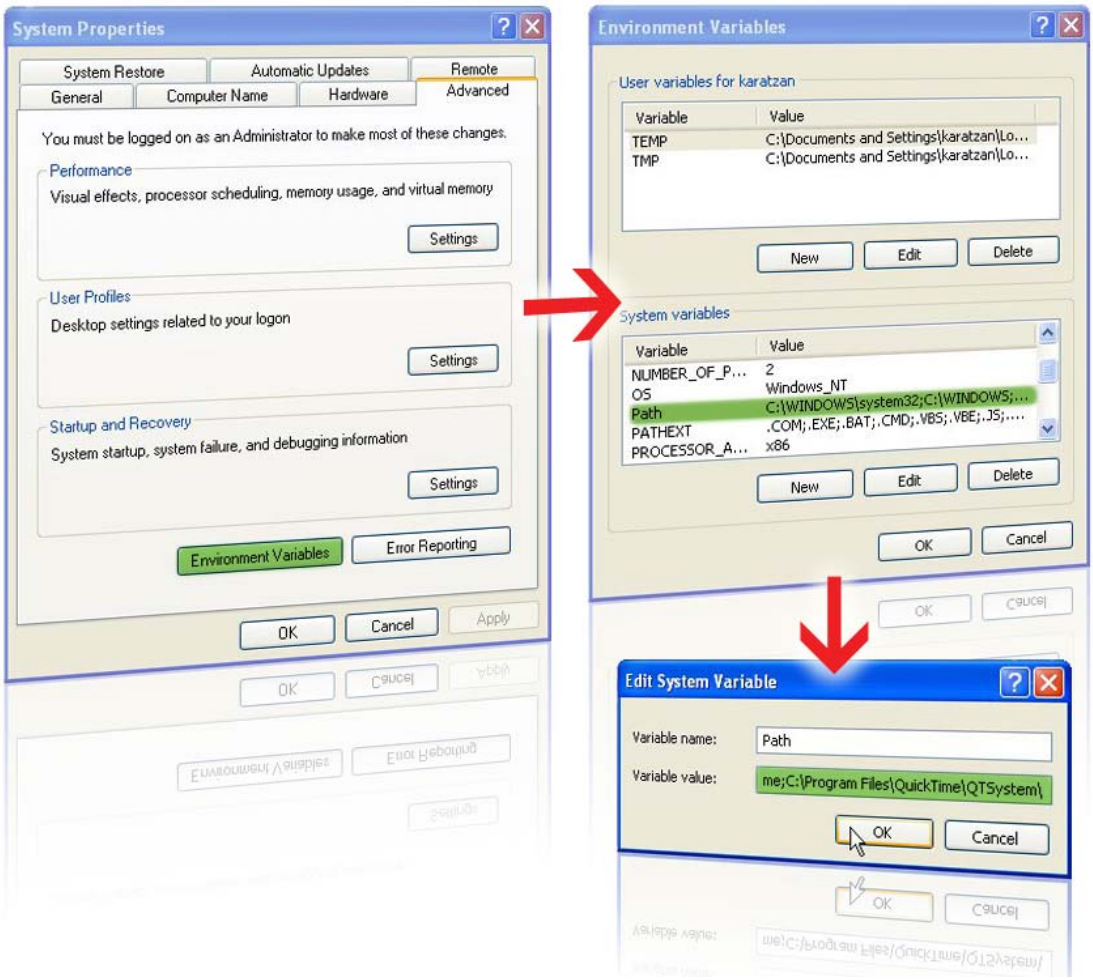
15. Go ***Start➔Settings➔Control Panel***




16. At the Control Panel double click the *System* Icon. The System Properties window will appear.
17. Select the *Advanced* tab and click the *Environmental Variables* button at the bottom. The Environmental Variables window will appear.
18. At the *System variables* frame at the bottom of the window, locate the *Path* variable, select it and press the *Edit* button that lies beneath.
19. At the end of the Path variable string add the following:

```
;C:\Nurse_at_Home\MagIC;C:\Nurse_at_Home\MagIC\runtime\win32
```

***NOTE: ➔ Make sure that you include the colon delimeter (;) at the front of the string.***




20. Close any window that is still open. Restart the PC.

### B.1.4 Setting the Language

In order to change the language that appears at the menus of the ***"Nurse At Home"*** application perform the following steps:

1. First of all make sure that the ***"Nurse At Home"*** application is not executing at the time. If the application is open please exit before proceeding.
2. Move to the ***C:\Nurse_at_Home*** folder
    a. Try to locate the ***labels.txt*** file. This file contains the Menu Commands.
    b. Try to locate the following folders:
        i. ***labels_en***: Contains the Menu commands in ***English***
        ii. ***labels_it***: Contains the menu commands in ***Italian***
        iii. ***labels_pl***: Contains the menu commands in ***Polish***
3. ***Move to the folder that corresponds to your language.***
4. In the folder exists a labels.txt file. ***Copy*** the file (Right click on the file→Copy)
5. ***Return*** to the ***C:\Nurse_at_Home*** folder
6. ***Paste*** the ***labels.txt*** file that you have copied (Right click on an empty space in the window→Paste). Right after Windows will ask you if you want to ***overwrite*** the labels.txt file. Select ***OK***.
7. ***Start*** the ***"Nurse At Home"*** application. This time the application must execute at your native language.

### B.1.5 Setting the Unique ID for Nurse@Home

In order to complete the installation you must define the Unique ID [*UID*] of the of Nurse@Home application. Each installation has a specific and unique ID that can be acquired by communicating with Synapsis. To set the *UID* go to the ***C:\Nurse_at_Home*** folder and open the ***conf.txt*** file. At the end of the file, modify the ***unique_id*** so it looks like:

> ***unique_id*=UID acquired from Synapsis**

Save your changes and quit.

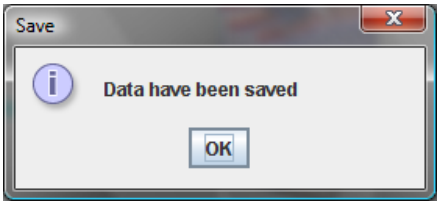
## B.2 Configuration

The technician who has performed the installation has also to execute the service configuration. This configuration has to be done just once immediately after the installation and does not need to be done again for all the duration of the home monitoring of the patient.

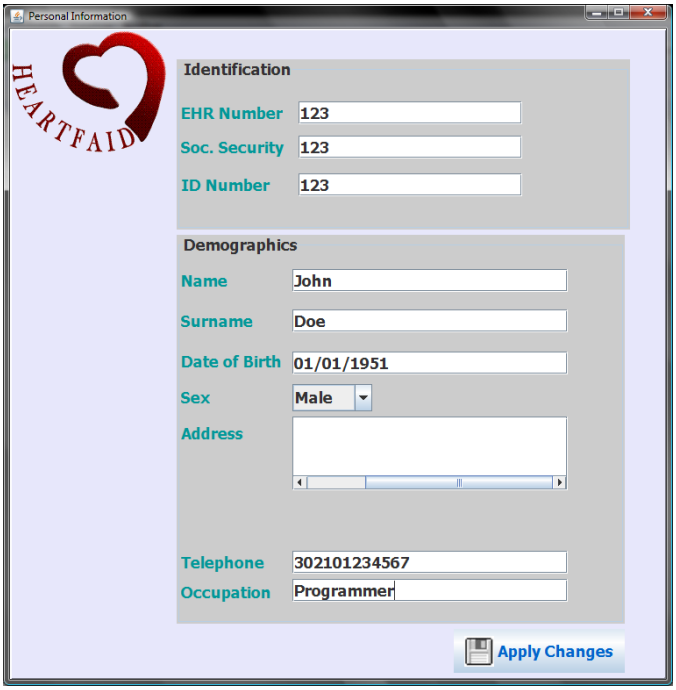
In order to configure the Nurse@Home application you must use the Nurse@Home configuration utility. The utility is the file ***heartfaid_config.bat***; which lies in the folder ***C:\Nurse_at_Home\Heartfaid_conf***.

The configuration of the Nurse@Home system is a three-step procedure. At the first step you have to define the wireless devices that are available at your home environment. As it can be seen from the following image there are four types of wireless devices that can provide the measurements automatically. Select the available devices by clicking on the corresponding checkbox and when you have finished click on the “Apply Changes” button in order to proceed to the next step.


If the Nurse@Home configuration utility accepts the changes, it will respond with the window below. Press OK to continue.




At the second step you must provide personal information and demographic data to the Nurse@Home application.




At the final step of the configuration you must specify the connection settings between the Nurse@Home application and the Server that receives and stores the data (the so-called “data repository”). If the MagIC vest wearable device is used, you must also specify the path where the temporary XML files received from the vest are stored. If the Nonin 4100 pulse oximeter is used, you must specify its ID (it is written on the device).


**NOTE ➔** *A **valid Vest File Path** must end with a '****' character*
(e.g. ***C:\Nurse_at_Home\Vest_server\IncomingFiles*** is not a valid folder path. The valid one should be ***C:\Nurse_at_Home\Vest_server\IncomingFiles***)

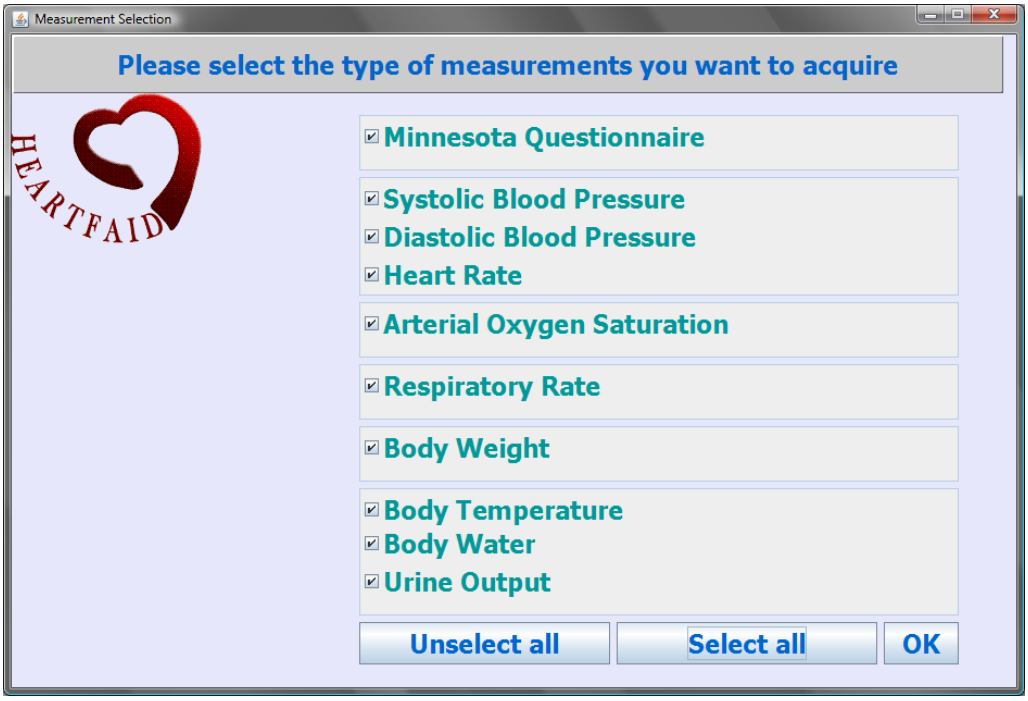
## B.3 Use of Devices

Every time that the patient is required to perform some measurements he has to use the Nurse@Home service and eventually the wireless devices for the automatic transmission of the acquired measurements.

The patient must start the Nurse@Home service on the home gateway (home PC) and follows accurately all the steps described below.

In order to start the Nurse@Home application use the Nurse@Home shortcut that lies on the desktop. If the shortcut does not exist then you may use the file ***nurse_home.bat***; which lies in the folder ***C:\Nurse_at_Home\Heartfaid_Measurement***.

When starting the Nurse@Home application the following screen appears.




At this point you must select the measurements you wish to acquire and sent. In order to do so you must check the appropriate check box. You can have more than one check boxes checked. In that case the Nurse@Home application will acquire the measurements one by one. When you check one of the Systolic Blood Pressure, Diastolic Blood Pressure or Heart Rate check boxes then the other two will be checked automatically. That is happening because the specific measurements are required as a set.

If you want to perform all the measurements press on the ***Select all*** button. If you want to clear all the check boxes in order to pick another set of measurements then press on the ***Unselect all*** button *(in the previous screenshot a full set of measurements is selected).*

If you have done with the selection of measurements, according to the list of measurements you have been informed by clinicians to acquire, then press the ***OK*** button and start the acquisition.

## B.4 The Minnesota Questionnaire

The questions of the Minnesota Questionnaire ask how much your heart failure (heart condition) affected your life during the past month (4 weeks). After each question, check the 0, 1, 2, 3, 4 or 5 to show how much your life was affected. If a question does not apply to you, check the 0 after that question.

When you are done with the questions press the ***Apply Changes*** button to proceed to the next measurement.



## B.5 Measurement of the Blood Pressure

Blood pressure and heart rate can be acquired automatically, if you have been provided with the A&D UA-767 PBT Blood Pressure Monitor, or manually with a conventional (mechanical) sphygmomanometer and the arterial pulsations.

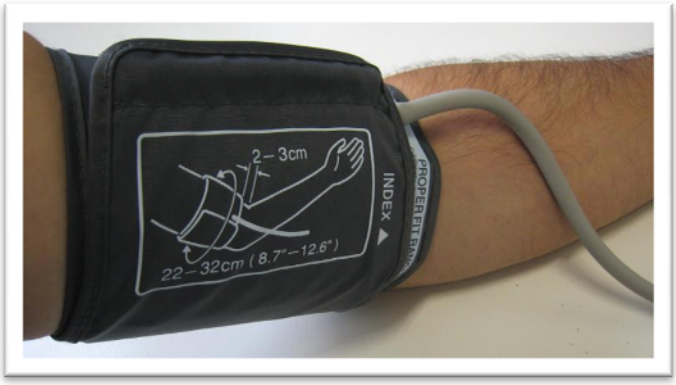
Below are described the two different ways of measurements.

### B.5.1 Automatic measurement using the A&D blood pressure monitor device

1. Attach 4 AA batteries in the device, in the battery case of the main unit.
2. Make sure that you have activated Bluetooth in your computer. If you don't know how to do this, please refer to a technician or to a person who knows. Please enable all the following properties on your Bluetooth settings:
    a. **Turn discovery on**. This is necessary so that your computer is discoverable by other Bluetooth devices.
    b. **Allow Bluetooth devices to connect to your computer**.
    c. **Show an alert when a Bluetooth device wants to connect with your computer**.

d. **Show the Bluetooth icon in the notification area of your computer**.

3. When you want to acquire a measurement :
   a. Connect the cuff to the main unit, if it is not connected
   b. Place the cuff at your arm and tight it firmly by following the displayed instructions




   c. Press the ***Start*** button on the main unit. The cuff will automatically inflate and after a few seconds you will see the acquired measurements on the main unit's screen.

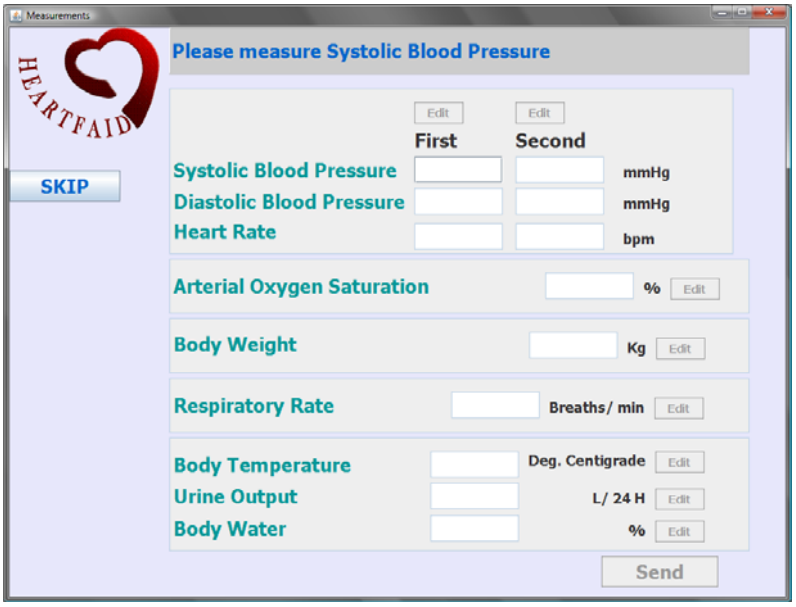

   d. After a few seconds you will notice a pop-up balloon at your screen.


   e. Click with your mouse at the pop-up balloon. Immediately after that, a text field will appear at your screen asking for a PIN (pass key) in order to confirm that you want the connection between the PC and your device.

The correct PIN for the A&D Blood Pressure Monitor is the number **39121440**. This PIN is the same for all A&D devices.


f. After you enter the PIN a window will appear in your screen, asking if you want to turn off the discovery of your computer by other devices. Please make sure that you **don't select** this option (uncheck this button if it is checked), in order to keep your computer discoverable. Then click on the "Finish" button to complete the connection of the device to your computer.

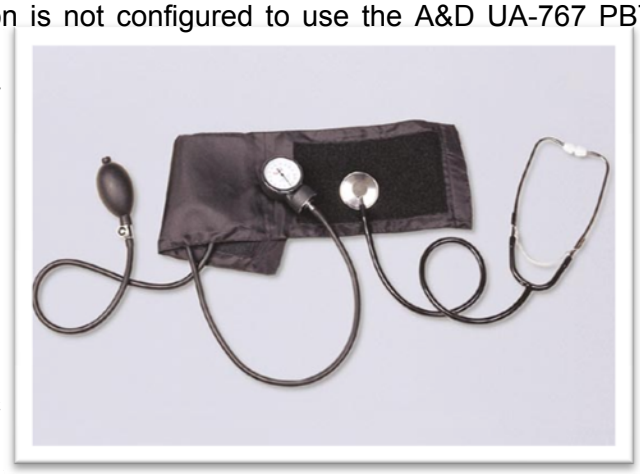

g. After some seconds, you will see the measurement appearing at the Nurse@Home application.



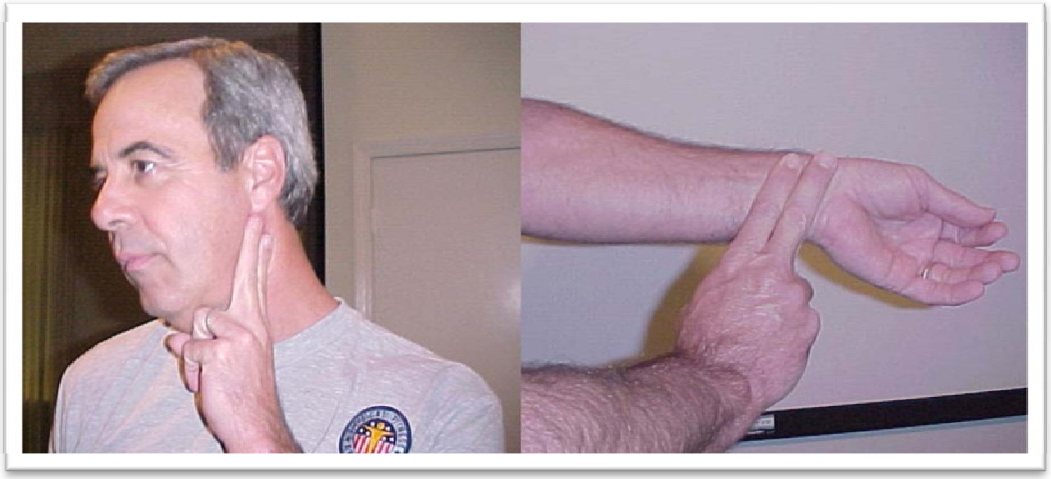

**NOTE ➔** If you have followed all the steps above and you don't see any measurement displayed in the application, although you have waited for 2-3 minutes since the device automatically turned off, then try again following the instructions from the beginning. If the problem persists and you continue not taking a valid measurement after a few attempts, please refer to the troubleshooting guide below or to an appropriate technician.
**NOTE ➔** The blood pressure and heart rate have to be collected in sitting position at rest and that the measurements have to be performed twice.

### B.5.2 Manual measurement

If the Nurse@Home application is not configured to use the A&D UA-767 PBT Blood Pressure Monitor then you have to measure your blood pressure manually using a conventional (mechanical) sphygmomanometer with aneroid manometer and stethoscope. From the conventional device you acquire the Systolic blood pressure and the Diastolic blood pressure.



The Heart rate can be measured at any point on the body where an artery's pulsation is transmitted to the surface - often as it is compressed against an underlying structure like bone.



In case of manual measurements you have to insert manually the measured values in the Nurse@Home user interface.
**NOTE ➔** The blood pressure and heart rate have to be collected in sitting position at rest and that the measurements have to be performed twice.

## B.6 Measurement of the Arterial Oxygen Saturation

The oxygen saturation can be acquired automatically, if you have been provided with the Nonin 4100 pulse oximeter, or manually with another generic pulse oximeter device.

Below are described the two different ways of measurements.

### B.6.1 Automatic measurement using the Nonin 4100 pulse oximeter

1. Attach 2 AA batteries in the device, in the battery case of the main unit.

2. Make sure that you have activated Bluetooth on your computer. If you don't know how to do this, please refer to a technician or a person who knows.

Please enable all the following properties on your Bluetooth settings:

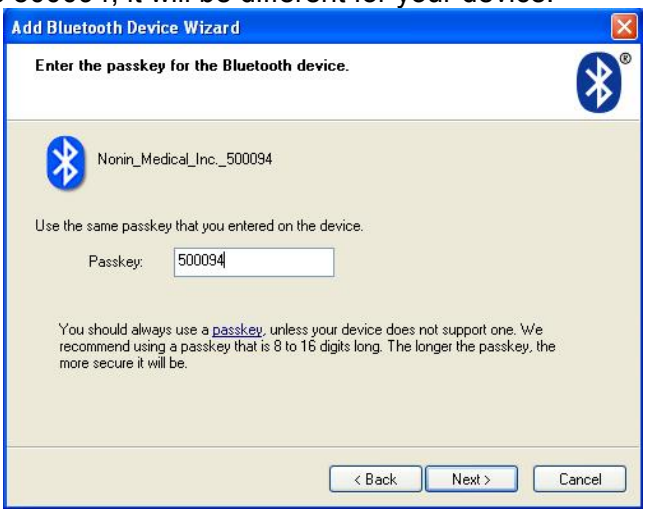
a. **Turn discovery on**. This is necessary so that your computer is discoverable by other Bluetooth devices.
b. **Allow Bluetooth devices to connect to your computer**.
c. **Show an alert when a Bluetooth device wants to connect with your computer**.
d. **Show the Bluetooth icon in the notification area of your computer**.

3. When you want to take a measurement :

a. Connect the sensor to the main unit
b. After a few seconds you will notice a pop-up balloon at your screen.


c. Click with your mouse at the pop-up balloon. After that, a text field will appear at your screen asking for a PIN (pass key) in order to confirm that you want the connection between the PC and your device.

The correct PIN is the number written in the side of the main unit, which will also be displayed in the name of the device. In the provided example is 500094; it will be different for your device.




d. After you enter the PIN a window will appear in your screen, asking if you want to turn off the discovery of your computer by other devices. Please make sure that you **don't select** this option (uncheck this button if it is checked), in order to keep your

computer discoverable. Then click on the “Finish” button to complete the connection of the device to your computer.


e. If your device has been connected to your computer, a **green** light will flash at the main unit of the device. If you only see a **red** light flashing, then your device is functioning but not connected.

f. Then, you need to insert your finger at the sensor and take the measurements that will be transmitted at your computer.

g. After a few seconds, you will see the measurement appearing at the Nurse@Home application. If you have followed all the steps above and you don’t see any measurement in your screen, disconnect the sensor and then connect it again following the instructions from the beginning (steps 3a-3f). If you cannot take a valid measurement after a few attempts, please refer to the troubleshooting guide below or to an appropriate technician.

### B.6.2 Manual measurement

If the Nurse@Home application is not configured to use the Nonin 4100 pulse oximeter then you have to measure your oxygen saturation manually using another generic pulse oximeter device.
In case of manual measurements you have to insert manually the measured values in the Nurse@Home user interface.

## B.7 Measurement of the Body Weight

The body weight can be acquired automatically, if you have been provided with the A&D UC-321 PBT digital scale, or manually with another generic scale.

Below are described the two different ways of measurements.

### B.7.1 Automatically using the A&D Personal Health Scale

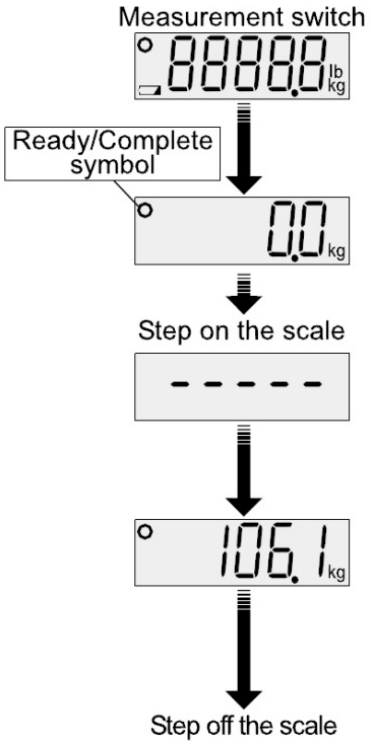
1. Attach 4 AA batteries in the device, in the battery compartment of the main unit (it is located at the bottom side of the unit).

2. Make sure that you have activated Bluetooth in your computer. If you don't know how to do this, please refer to a technician or to a person who knows. Please enable all the following properties on your Bluetooth settings:
    a. **Turn discovery on**. This is necessary so that your computer is discoverable by other Bluetooth devices.
    b. **Allow Bluetooth devices to connect to your computer**.
    c. **Show an alert when a Bluetooth device wants**

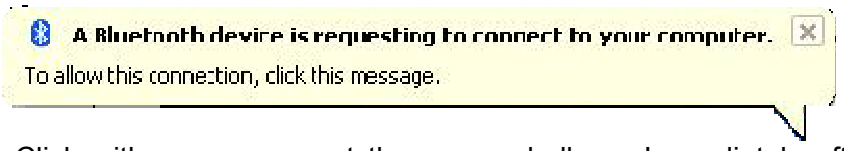
**to connect with your computer**.

d. **Show the Bluetooth icon in the notification area of your computer**.

3. When you want to acquire a measurement :
   a. Press the measurement switch gently. All display segments are visible for several seconds.




   b. Wait until the display 0.0 lb (0.00 kg) and Ready symbol **O** appear.
   c. Wait until the **O** symbol appears. Step on the scale gently and stand still during measurement. You will see the display changed to dashes. Please stay still as much as you can. *Note: If the display 0.0 lb (0.00kg) is visible for approximately 10 seconds, the scale will automatically turn off.*
   d. Your weight is displayed after the mark **O** appears. The scale will turn off automatically.
   e. Step off the scale.
   f. After a few seconds you will notice a pop-up balloon at your screen.

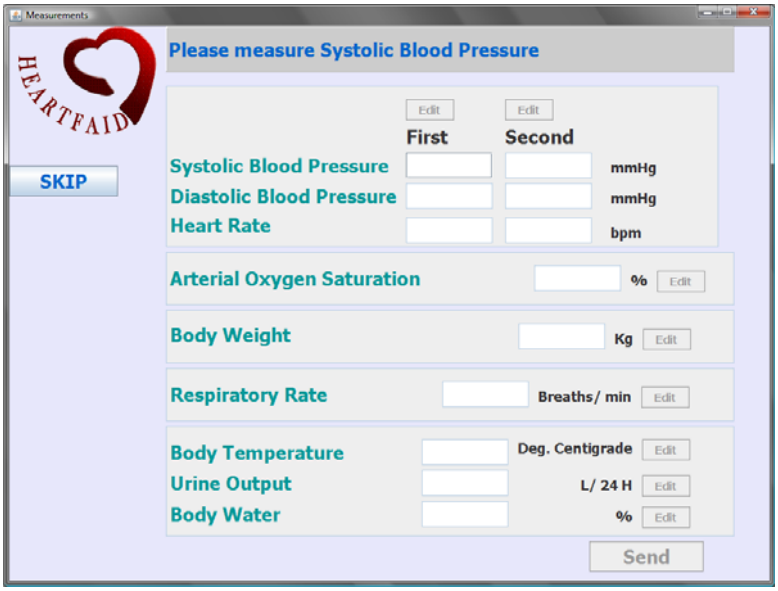



   g. Click with your mouse at the pop-up balloon. Immediately after that, a text field will appear at your screen asking for a PIN (pass key) in order to confirm that you want the connection between the PC and your device.

The correct PIN for the A&D Personal Health Scale is the number **39121440**. This PIN is the same for all A&D devices.


h. After you enter the PIN a window will appear in your screen, asking if you want to turn off the discovery of your computer by other devices. Please make sure that you **don't select** this option (uncheck this button if it is checked), in order to keep your computer discoverable. Then click on the "Finish" button to complete the connection of the device to your computer.


i. After a few seconds, you will see the measurement appearing at the Nurse@Home application.




**NOTE ➔** If you have followed all the steps above and you don't see any measurement displayed in the application, although you have waited for 2-3 minutes since the device automatically turned off, then try again following the instructions from the beginning. If the problem persists and you continue not taking a valid measurement after a few attempts, please refer to the troubleshooting guide below or to an appropriate technician.

### B.7.2 Manual measurement

Step on the scale gently and stand still during measurement. When the needle of the scale is stabilized, the value underneath is your weight (if you have a digital scale the procedure is almost the same. In that case instead of having a needle you have a digital display, that displays your weight). Type the value at the corresponding text field. After 10 seconds the text field will turn green. That means that the Nurse@Home application accepted the value and locked the corresponding field in order to prevent a mistaken data entry. In case you make a typing mistake, or in case you did not have the time to write the value at the text box before it locks, in order to edit the value press the "Edit" button which stands just beside the box.

## B.8 Measurement of the Respiratory Rate

The respiratory rate can be acquired automatically, if you have been provided with the MagIC system wearable device, or manually.

Below are described the two different ways of measurements.

### B.8.1 Automatically using the MagIC system

In order to measure the respiration rate using the MagIC system follow the instructions provided by the manufacture of the system. The Nurse@Home application is configured to automatically receive measurements from the PDA of the MagIC vest.

### B.8.2 Manual measurement

The respiration rate is measured when you are at rest by counting how many times your chest rises in a minute. Each rise of your chest is actually a breath that you count. So in a period of a minute the breaths that you have counted are (with a good approximation) your respiratory rate.

In case of manual measurement you have to insert manually the measured value in the Nurse@Home user interface.

## B.9 Measurement of the Body Temperature

**The body temperature can be acquired only manually.**

Body temperature is the operating temperature of the human body. The optimum temperature is 36.8 °C (98.2 °F). In order to measure your Body Temperature you have to use a thermometer. There are two kind of thermometers:

1. Glass mercury thermometers
   (these thermometers use mercury in order to operate).

2. Digital thermometers that are mercury free.

In order to measure your temperature perform the following steps:

1. Place the thermometer in a dry armpit (If it is a digital thermometer you have to turn it on first according to the package directions).
2. Close the armpit by holding the elbow against the chest.
3. Wait for the thermometer to measure your temperature. If you are using a glass mercury thermometer you must wait for five minutes in order to have an accurate measurement. If you are using a digital thermometer

you will hear a signal that informs you that the thermometer acquired the measurement.

4. Remove the thermometer and read the temperature.
5. Type that value at the corresponding text field of the Nurse@Home application.

**NOTE ➔** Mercury and most of its compounds are extremely toxic and they should be handled with care. For your safety it is better to use a digital mercury free thermometer to measure your temperature.

## B.10 Measurement of the Body Water

**The body water can be acquired only manually.**

The body water is all of the water content of the human body. The human body is about 60% water in adult males and 55% in adult females. In diseased states where body water is affected, the compartment or compartments that have changed can give clues to the nature of the problem.

In order to determine the amount of water in your body you must have a medical device for the FA-MS examination (Flowing Afterglow Mass Spectrometry) or the BIA examination (Bioelectrical Impedance Analysis).

In case of manual measurement you have to insert manually the measured value in the Nurse@Home user interface.

## B.11 Measurement of the Urine Output

**The urine output can be acquired only manually.**

Decreased Urine Output is a sign of a diseased body. You can measure your daily Urine Output (output volume per 24 hours) at home using a scaled urine container. Add the individual volume of output during a 24 hour cycle. Type that value at the corresponding text field of the Nurse@Home application.

## B.12 Correcting measurements

If an automatically acquired measurement provide erroneous output (such in the case of depleted batteries or in the case of starting a second measurement before the first measurement is submitted to the Nurse@Home application) or if a typing mistake occurs during a manually acquired measurement, then upon measurement completion the Nurse@Home application enables the ***Edit*** buttons just beside of each measurement. Clicking one of the ***Edit*** buttons

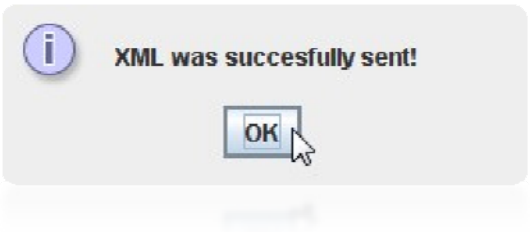
will:

1. Clear the measurement field and wait for you to perform a new measurement with the wireless device (if the Nurse@Home is configured to use such a device) or

2. Clear the measurement field and wait for you to manually enter the value.

## B.13 Completion of the acquisition and submission of the measurements

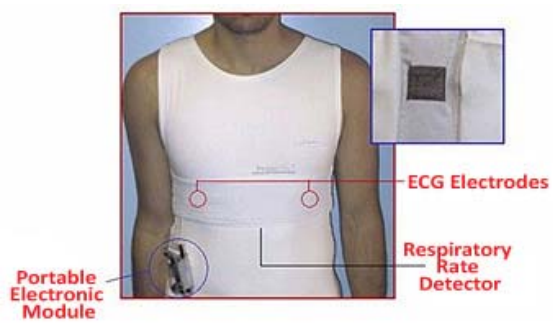
Upon completion press the ***Send*** button which lies at the bottom right side of the Nurse@Home window. If the data are successfully delivered to the data repository the following message box appears. Press ***OK*** to Exit.




## B.14 Description of the medical Devices

### B.14.1 The MagIC system

The MagIC system is composed of a vest including textile sensors and a portable electronic board. The vest is mainly made of cotton and lycra and is fully washable. At the thorax level the vest includes two woven electrodes made by conductive fibres so to obtain an ECG lead. The contact between textile electrodes and the thorax is guaranteed by the elastic properties of the garment, without requiring application of gel or of any other medium. The vest also includes a textile-based transducer, obtained by a patented processing of the conductive fibers, that provides a chest movement signal that can be used for the assessment of the respiratory frequency.
Through connections still obtained by using the same conductive fibers, ECG and chest movement signals feed a portable electronic module - having the typical size and weight of a small cell phone - which is placed on the vest through a velcro strip.




The MagIV vest is composed of four parts. The cloth, the ECG Electrodes, the Respiratory Rate Detector and the Portable Electronic Module.

The MagIC system. As it can be seen the MagIC vest is very easy to be worn (even underneath the clothes).

### B.14.2 The A&D Blood Pressure Monitor device

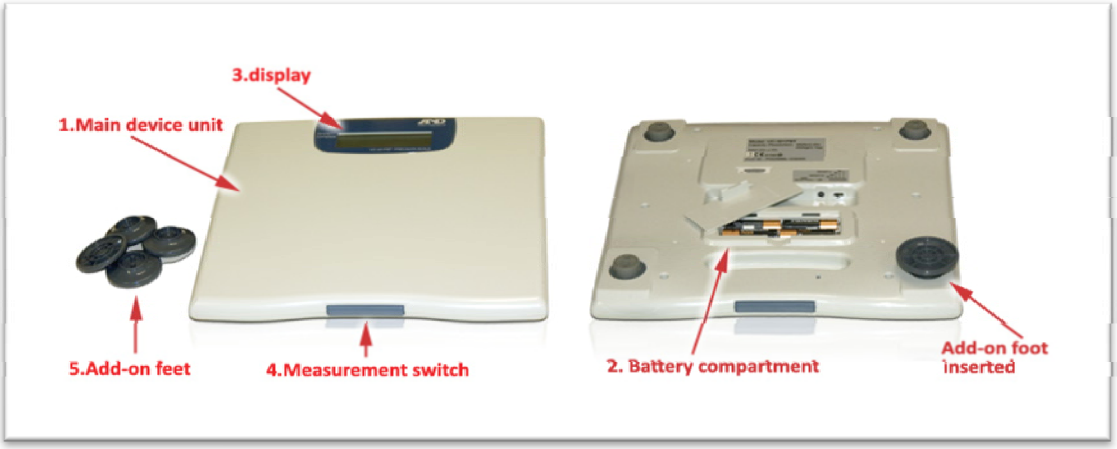
The A&D Blood Pressure Monitor device is composed of the following parts:

1. The main device unit, along with the battery case
2. The display screen
3. The “Start” button
4. The cuff


### B.14.3 The A&D Personal Health Scale

The A&D Personal Health Scale device is composed of the following parts:

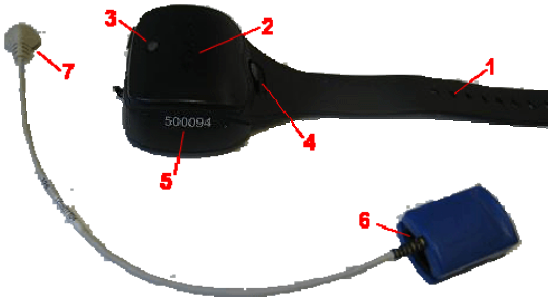
1. The main device unit
2. The battery compartment
3. The display
4. The measurement switch
5. The add-on feet




### B.14.4 The Nonin Pulse Oximeter

The Nonin Pulse Oximeter medical device is composed of the following parts:

A. The main unit, which is subsequently composed of :
    1. The wrist strap
    2. The battery case
    3. The connection status LED
    4. The sensor attachment point
    5. The PIN (personal identification number) of the device
B. The sensor, which is subsequently composed of :
    6. The finger sensor
    7. The sensor attachment pins




## B.15 Troubleshooting

### B.15.1 A&D Blood Pressure monitor device

1. **Check that your device has charged batteries**. Does the device inflate the cuff normally? Do you notice any noticeable difference to the functioning of the device? Have you noticed any warning messages for “Low battery” on the application? Check if the batteries are discharged and replace them. Please, mind the environment and properly dispose the old batteries or use re-chargeable!
2. **Check that the sensor is correctly attached to the main unit of the device**. If you are not sure, disconnect the sensor and reconnect it carefully. **Please take care not to damage the pins of the sensor**.
3. When your PC asks for a pass-key (PIN) with a pop-up balloon, click on the balloon with your mouse and type inside the text field the correct PIN. Please note that **if you don’t provide the PIN within reasonable time duration (a few seconds), the connection will fail** and you will have to acquire the measurement again, following the steps from the beginning.
4. When taking a measurement, please make sure that your arm is correctly positioned and aligned in the cuff.

### B.15.2 A&D Personal Health Scale device

1. **Check that your device has charged batteries**. Does the device turn on normally? Do you notice any noticeable difference to the functioning of the device? Have you noticed any warning messages for “Low battery” on the application? Check if the batteries are discharged and replace them. Please, mind the environment and properly dispose the old batteries or use re-chargeable!

2. When your PC asks for a pass-key (PIN) with a pop-up balloon, click on the balloon with your mouse and type inside the text field the correct PIN. Please note that **if you don't provide the PIN within reasonable time duration (a few seconds), the connection will fail** and you will have to acquire the measurement again, following the steps from the beginning.
3. When taking a measurement, please make sure that you are using this scale on firm and level ground.

### B.15.3 Nonin Pulse Oximeter medical device

1. **Check that your device has charged batteries**. When you connect the sensor to the main unit of your device, a red light should flash. If not, probably you need to replace its batteries.
2. Check that the sensor is correctly attached to the main unit of the device. If you are not sure, disconnect the sensor and reconnect it carefully. **Please take care not to damage the pins of the sensor**.
3. When your PC asks for a pass-key (PIN) with a pop-up balloon, click on the balloon with your mouse and type inside the text field the number which is written at the side of your device. **Please note that if you don't provide the PIN within reasonable time duration (a few seconds), the connection will fail and you will have to try again**.
4. When taking a measurement, please make sure that your finger is correctly positioned and aligned inside the sensor. Also, note that the sensor may be unable to make correct measurements if your finger nail is painted.

# C. Appendix 3 - Echocardiography Laboratory System: a work session example

A sonographer with his username and password logs into the Echocardiography Lab Web Application from the Web Portal then the sonographer main menu appears (fig. 1). This application has been realized taking into account the accessibility requirements for people with disabilities as requested by the Italian Republic law and by most of the laws of the European Union States.

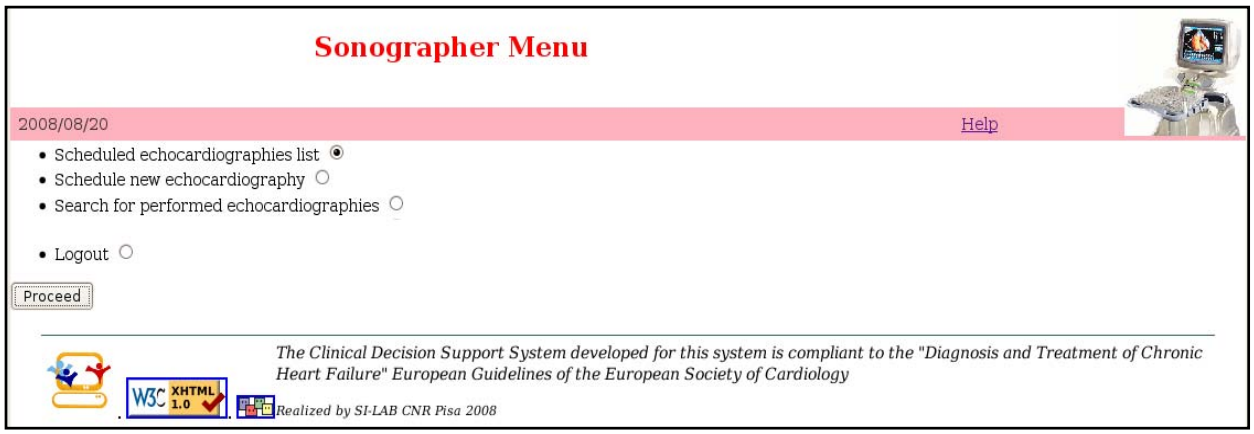



**Figure C.1 - Sonographer Main Menu**

Among the selections there is in particular the possibility to see the list of the scheduled echocardiographies and the list of the performed echocardiographies.
By selecting the first option a new page appears (fig. 2) showing the main information of the scheduled echocardiographies: id of the examination, patients initials, reason for the examination, date of the scheduling, and a field named “Data received” that denotes if the examination has been performed and it has to be finalized.
In case the latter value is equal to “YES” then the examination has been performed and the data has been sent by the echocardiographical system (Vivid 7) to the Echocardiography Lab Web Application using HL7/Dicom messages (or filled by a clinical care operator when there is no possibility of connection).

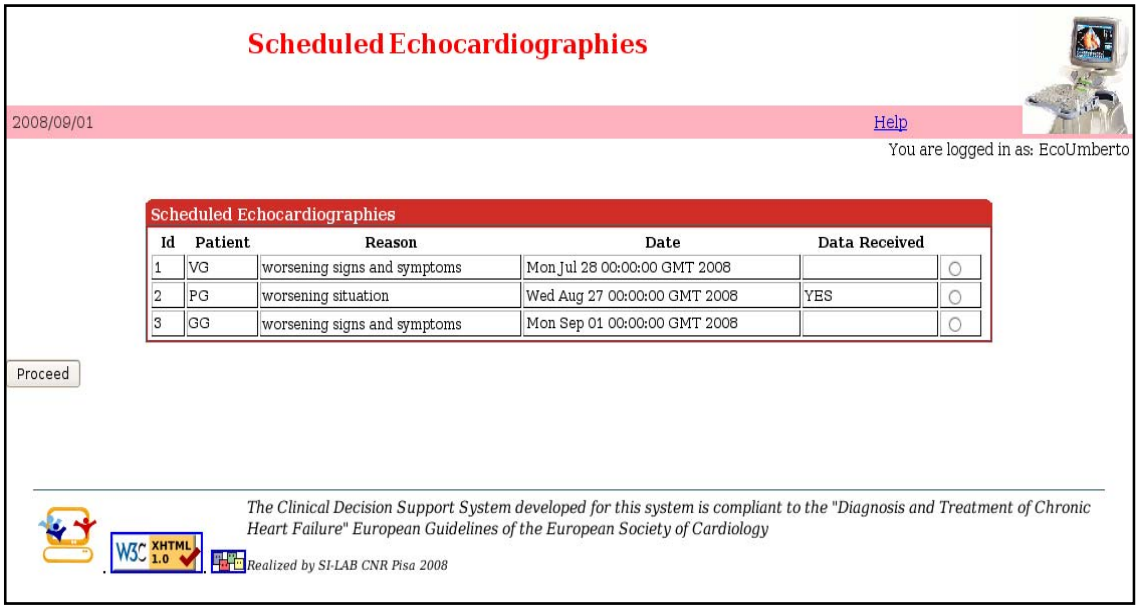



**Figure C.2 - Scheduled Echocardiographies List**

By selecting the scheduled echocardiography when data is received a new page appears (fig. 3) with the data sent by the echocardiographical system and has to be confirmed by the sonographer that will eventually update or add other information.

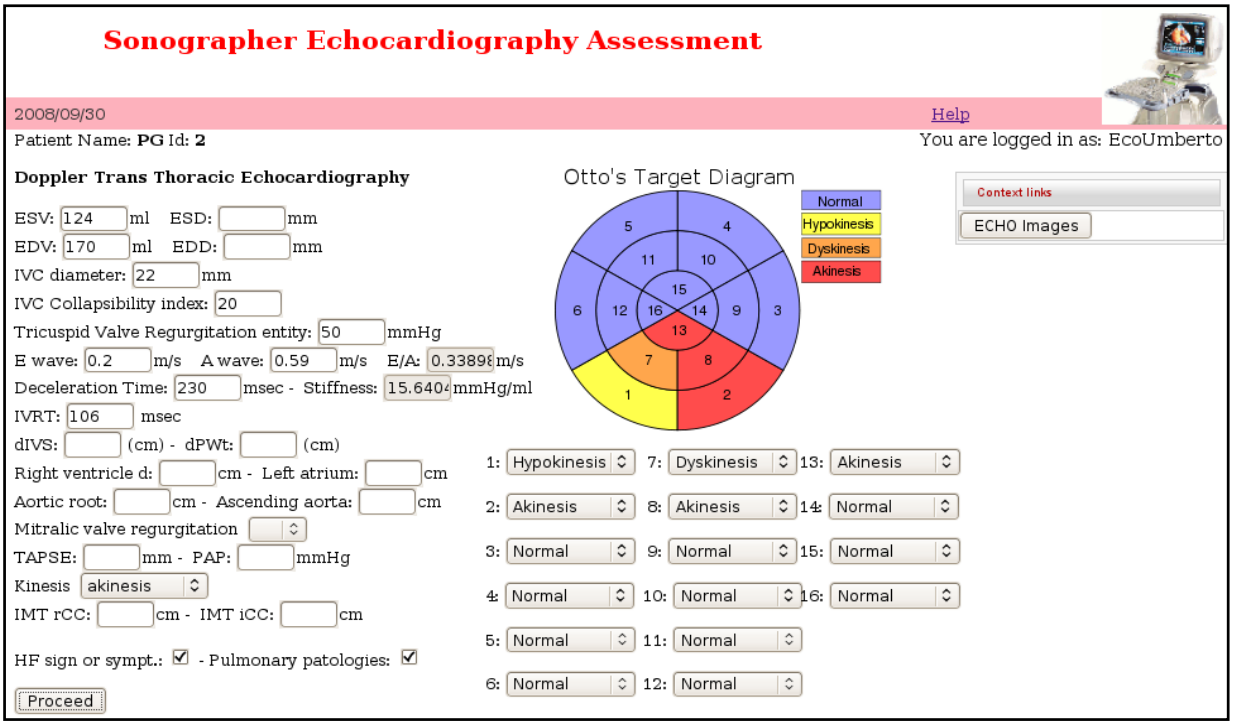



**Figure C.3 - Echocardiography Assessment**

By selecting the “Echo Images” button a new page is shown (fig. 4) with the echocardiographic images acquired and sent to the Heartfaid Image Archive.

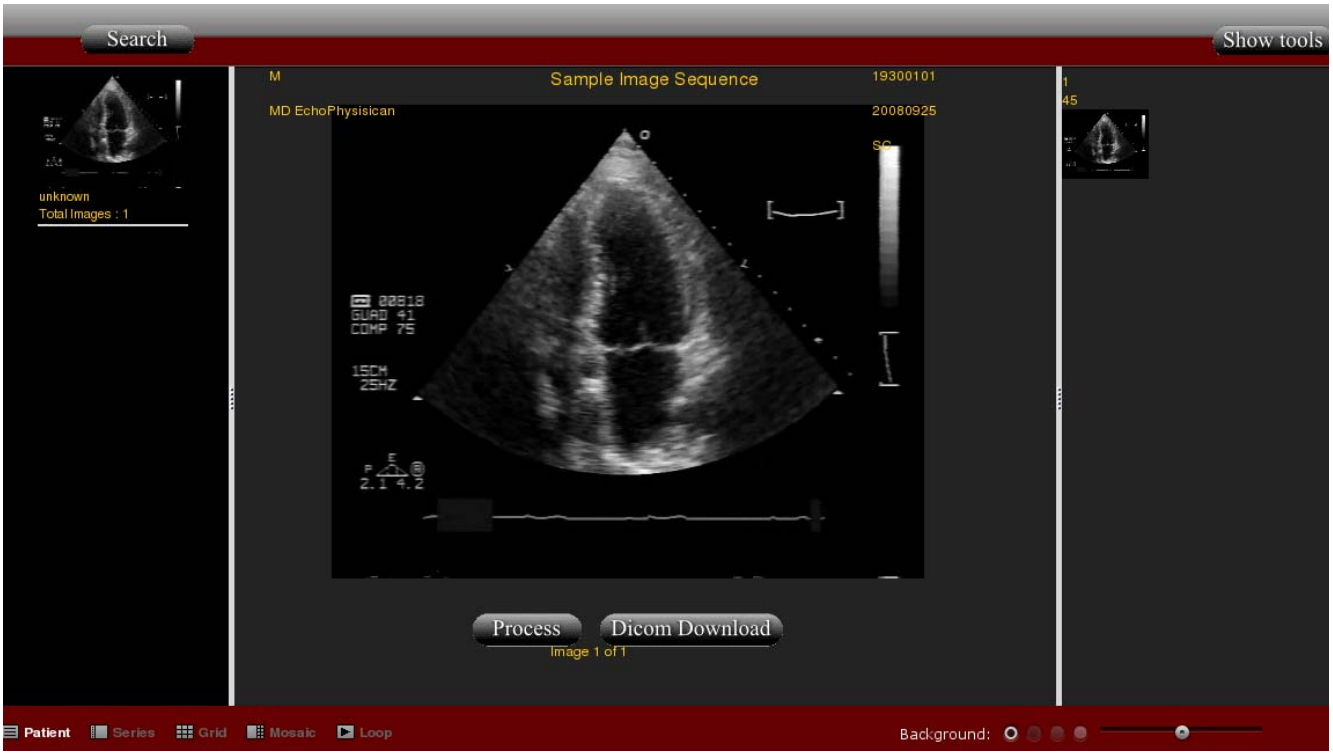



**Figure C.4 - Image Web Viewer**

The sonographer chooses one among the echocardiography image sequences and then can download it on his/her own computer or can decide to process it by clicking the specific button.

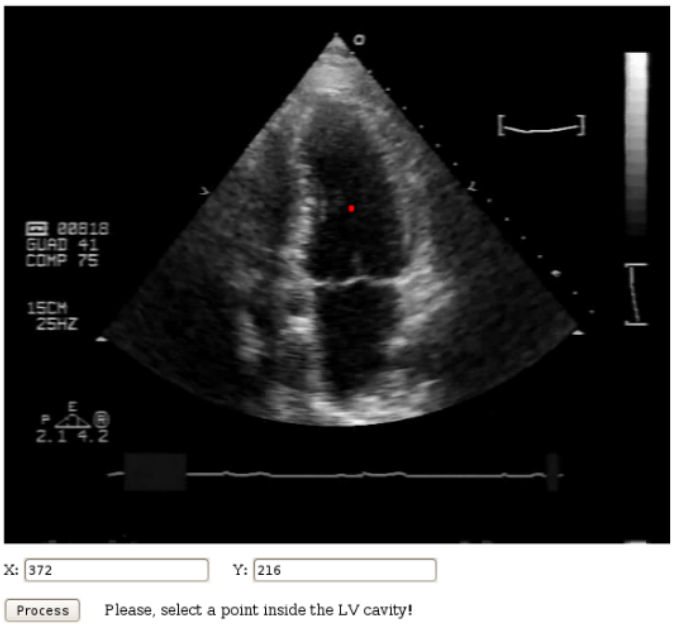



**Figure C.5 - Left Ventricle Cavity Selection**

The sonographer is then requested to select a point inside the left ventricle cavity (fig. 5), and after confirming by pressing the “Process” button an elaboration is invoked.

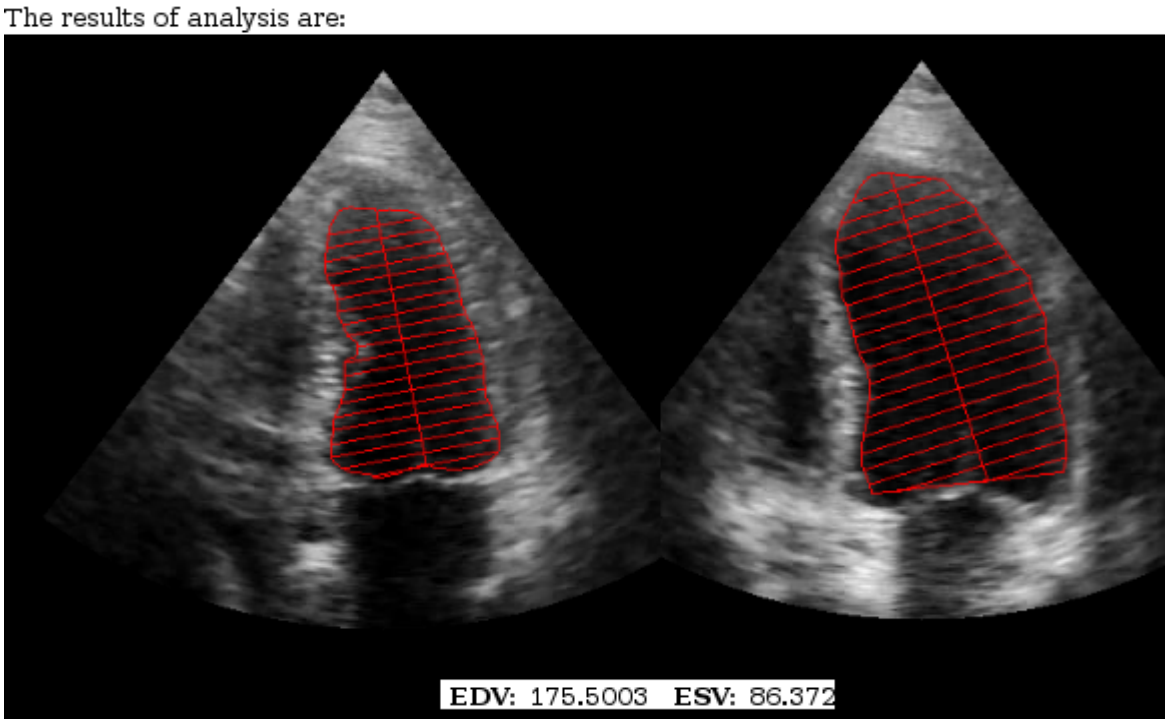



**Figure C.6 - Processing Results**

At the end of the elaboration the systolic and diastolic volumes are computed and highlighted on the respective images (fig. 6).

Using the new calculated volumes or confirming the ones extracted from the ecocardiographer the the CDSS is contextually called (fig. 7) to provide information regarding the ivrt range, estimation of the systolic pulmonary pressure, estimation of the ejection fraction and moreover diagnosis related to the filling pattern, the pulmonary hypertension estimation and the heart failure.

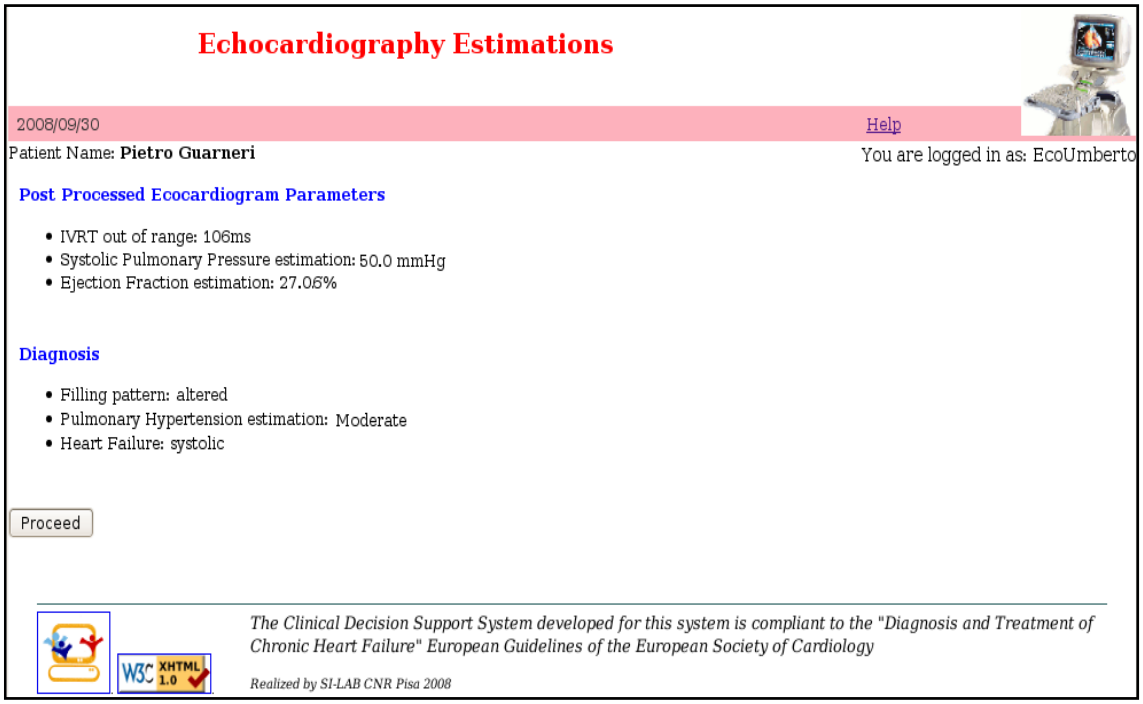



**Figure C.7 - CDSS Suggestions**

All the information now can be sent to the HeartFaid platform using an HL7 message (fig. 8):

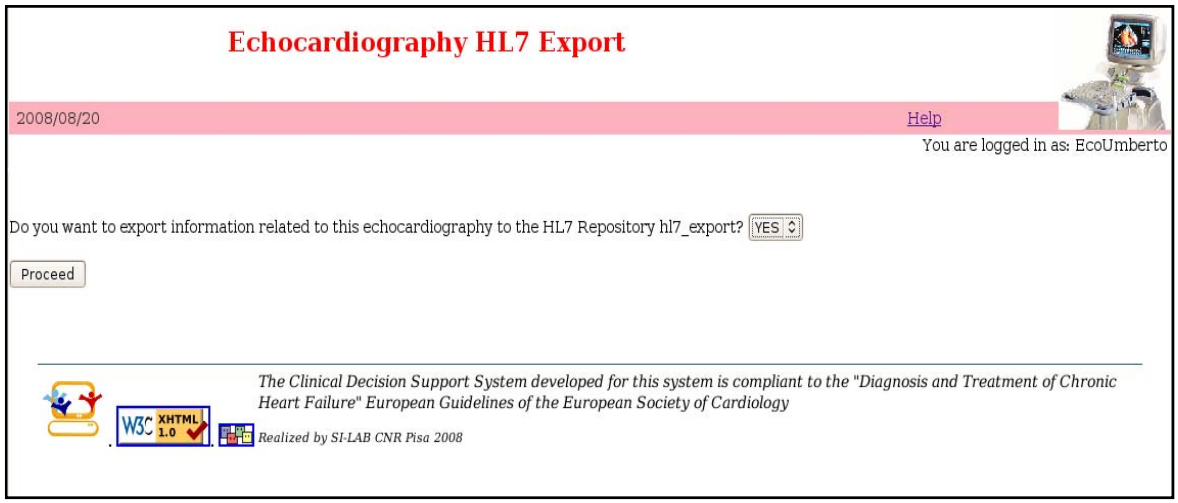



**Figure C.8 - HL7 Export**

Eventually an email (or other kind of messages) can also be sent for confirmation (fig. 9).

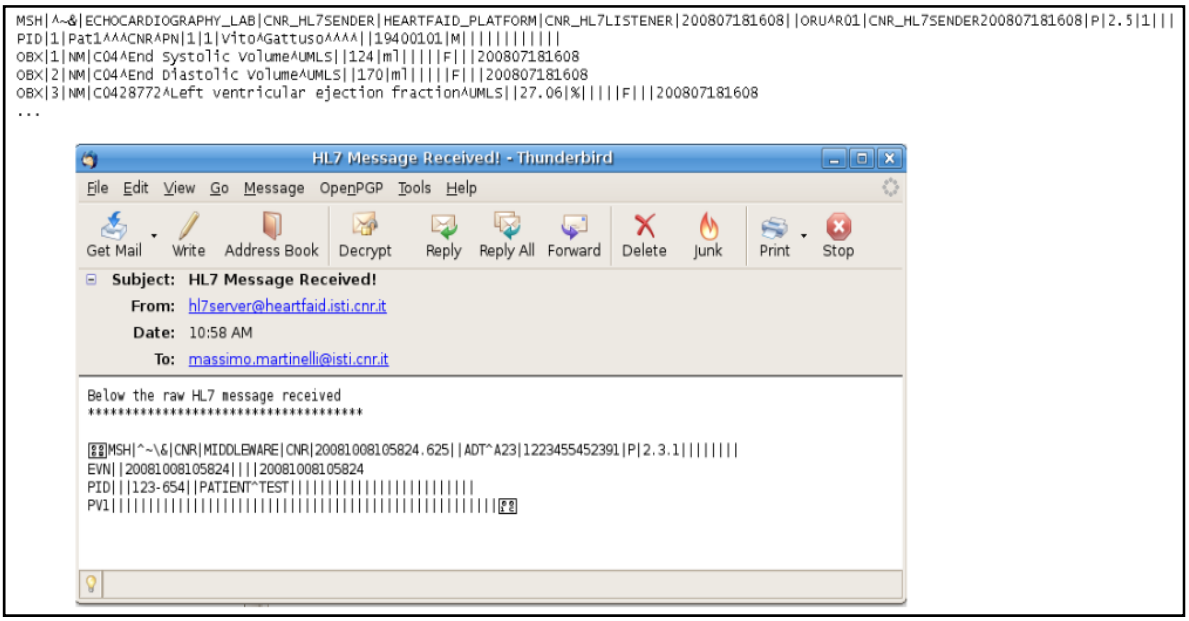



**Figure C.9 - HL7 E-mail Notification**