



**HEARTFAID**

**D37 – End-user application and  
services prototype  
Accompanied document**

Submission date: 15/09/08  
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Information Society  
and Media

## HEARTFAID

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

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<b>Consortium</b>
<ul style="list-style-type: none"><li>➤ UNICAL - Università della Calabria (Italy)</li><li>➤ UNICZ - Università degli studi Magna Graecia di Catanzaro (Italy)</li><li>➤ UNIMIB - Università degli studi di Milano Bicocca (Italy)</li><li>➤ JUMC - Jagiellonian University Medical College (Poland)</li><li>➤ VMWS - Virtual Medical World Solutions Ltd (United Kingdom)</li><li>➤ FORTHNET - Hellenic Telecommunications and Telematic Applications Company S. A. (Greece)</li><li>➤ SYNAP - Synapsis s.r.l. (Italy)</li><li>➤ CNR - Consiglio Nazionale delle Ricerche (Italy)</li><li>➤ FORTH - Foundation for Research and Technology Hellas (Greece)</li><li>➤ RBI - Rudjer Boskovic Institute (Croatia)</li><li>➤ AUXOL - Istituto Auxologico Italiano (Italy)</li></ul>

## D37 – End-user application and services prototype Accompanied document

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Short description
This is an accompanied document to the end-user application and services prototype (The HEARTFAID front end). All the applications and services have been described in detail in other deliverables. This document is a User-Manual, for the end-users of the HEARTFAID Front-end, providing directions on how to navigate through the available on-line HEARTFAID applications and services, through the Front-end.

Change record		
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## Preface

HEARTFAID is a Research and Development project aimed at devising, developing and validating an innovative knowledge based platform of services, able to improve early diagnosis and to make more effective the medical-clinical management of heart diseases within the elderly population. Chronic Heart Failure is one of the most notable health problems in terms of prevalence and morbidity, especially in the developed countries. As a result, it has a profound impact on social and economic aspects. The latter are typically emphasized within the elderly population with very frequent hospital admissions and a significant increase of medical costs. Recent studies and experiences have demonstrated that accurate heart failure management programs, based on a suitable integration of inpatient and outpatient clinical procedures, might prevent and reduce hospital admissions, improving clinical status and reducing costs. HEARTFAID aims at defining efficient and effective health care delivery organization and management models for the “optimal” management of the care in the field of cardiovascular diseases. The HEARTFAID innovative computerized system will improve the processes of diagnosis, prognosis and therapy provision, providing the following services:

- Electronic health record for easy and ubiquitous access to heterogeneous patients data
- Integrated services for healthcare professionals, including patient telemonitoring, signal and image processing, alert and alarm systems
- Clinical decision support in the heart failure domain, based on pattern recognition in historical data, knowledge discovery analysis and inferences on patients’ clinical data

The formalization of the pre-existing clinical knowledge and the discovery of new elicited knowledge represent the core of the HEARTFAID platform.

The current document will outline the features and usability highlights of HEARTFAID platform’s Front-End. The latter is reachable at the web-page:

<http://www.staging.gr/heartfaid/>

Throughout the document, we will refer to the doctors registered to use the HEARTFAID platform as the ‘users’.

## Front-End Development Objectives

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.

## **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.

## Description of the Front-End

### *Login Page*

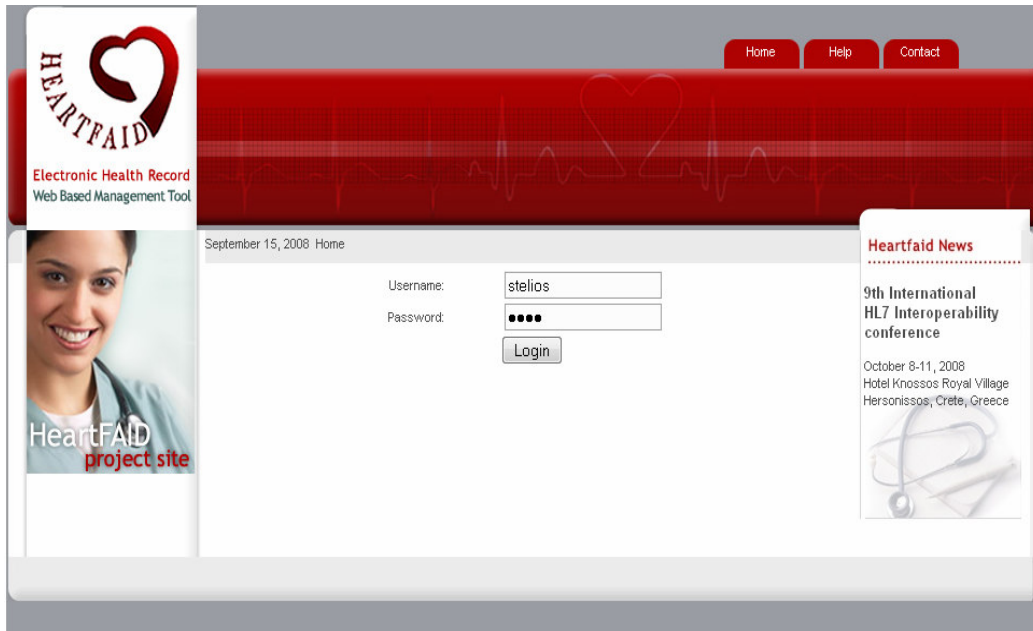


Image 1 – HEARTFAID Login Page

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.

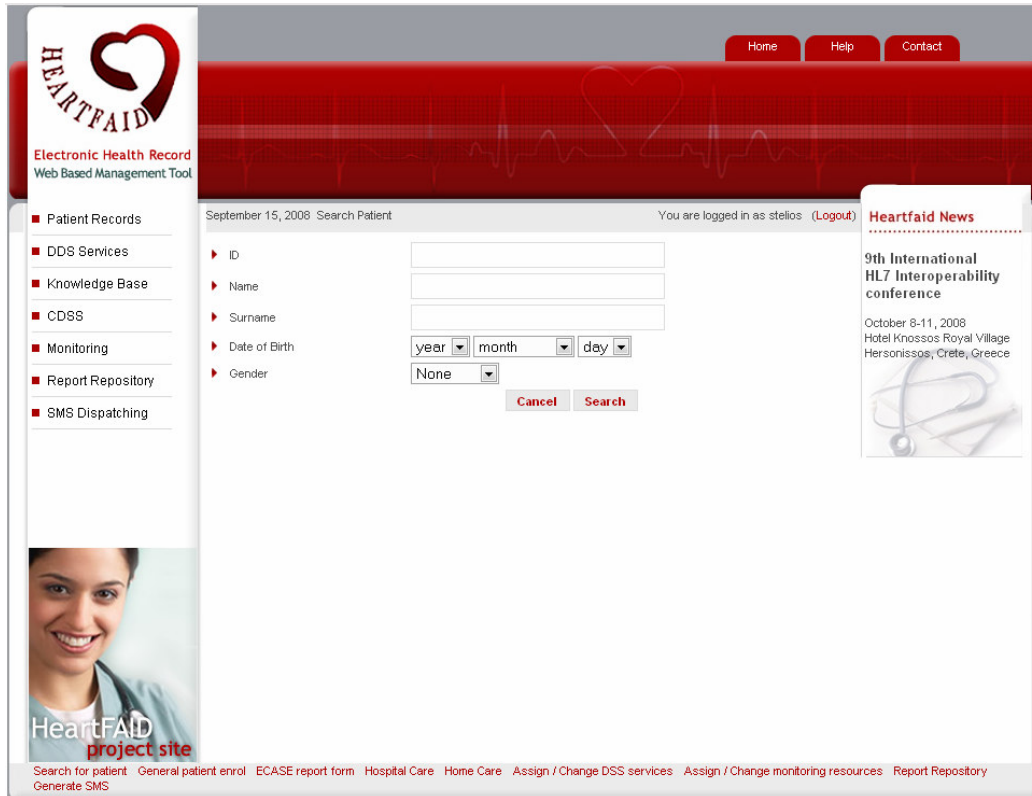
The platform provides a single login access to all services within the HEARTFAID project's scope. Two user attributes have been considered for accessing the platform. On the one hand there will be the fully authorized user who will have access to all platform services and on the other, there will be 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.



### *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.



**Image 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.

## *Menu Options*

### **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 (Image 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.



Image 3 – 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.

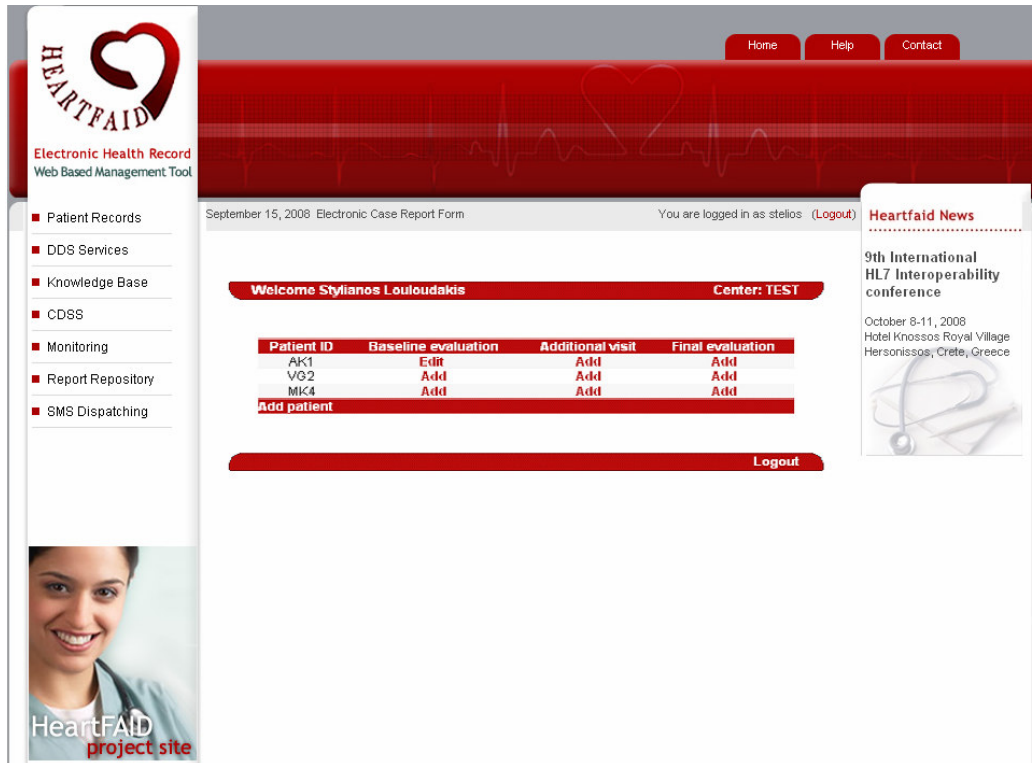


Image 4 – HEARTFAID eCase Report Form

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).

## 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



Image 5 – 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.



HEARTFAID  
Electronic Health Record  
Web Based Management Tool

Home Help Contact

September 15, 2008 Home Care You are logged in as stelios (Logout)

■ Patient Records  
■ DDS Services  
■ Knowledge Base  
■ CDSS  
■ Monitoring  
■ Report Repository  
■ SMS Dispatching

**DATE: 5-4-2008**

SBP	7:55	114.36465418	<input type="checkbox"/>
BW	8:19	85.1848754704	<input type="checkbox"/>
HR	7:59	128.631335589	<input type="checkbox"/>
Body Temperature	8:9	39.956077807	<input type="checkbox"/>
RR	8:19	24.7048382875	<input type="checkbox"/>

**DATE: 6-4-2008**

SBP	8:32	108.074108605	<input type="checkbox"/>
BW	7:59	81.3284102959	<input type="checkbox"/>
HR	8:9	129.760572124	<input type="checkbox"/>
Body Temperature	8:32	31.7369093711	<input type="checkbox"/>
RR	7:59	21.5687343712	<input type="checkbox"/>

Heartfaid News  
**9th International HL7 Interoperability conference**  
October 8-11, 2008  
Hotel Knossos Royal Village  
Hersonissos, Crete, Greece

HeartFAID project site

Search for patient General patient enrol ECASE report form Hospital Care Home Care Assign / Change DSS services Assign / Change monitoring resources Report Repository

Image 6 – HEARTFAID Home Care



## 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.



Image 7 – HEARTFAID Assign / Change DSS Service

## 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 Image 6).

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:





The screenshot shows the HEARTFAID web application interface. At the top, there are navigation buttons for Home, Help, and Contact. The main header area is red with a heart and ECG graphic. Below the header, the date is September 15, 2008, and the page title is Selection of Devices. The user is logged in as stelos. A sidebar on the left contains a navigation menu with options: Patient Records, DDS Services, Knowledge Base, CDSS, Monitoring, Report Repository, and SMS Dispatching. The main content area displays a list of monitoring resources, each with a checkbox for selection. The resources listed are:

Blood Pressure Oscillometric blood pressure (A)	<input type="checkbox"/>
24H Blood Pressure 24H Ambulatory blood pressure monitor (A)	<input type="checkbox"/>
24H Blood Pressure 24H Ambulatory blood pressure monitor (Spacelabs)	<input type="checkbox"/>
24H Blood Pressure 24H Ambulatory blood pressure monitor (Spacelabs)	<input type="checkbox"/>
Resting ECG Ambulatory Resting ECG (ArchMed)	<input type="checkbox"/>
24H Holter ECG Ambulatory Holter ECG (CardioScan/Premier)	<input type="checkbox"/>
Blood Pressure Non-invasive beat-to-beat blood pressure monitoring (Finometer Pro)	<input type="checkbox"/>
Pulse Oximeter Nellcor Pulse Oximeter	<input type="checkbox"/>
Oxycon Mobile Cardiopulmonary test Oxycon Mobile Cardiopulmonary test device	<input type="checkbox"/>
Y Max 229 Cardiopulmonary test Y Max 229 Cardiopulmonary test device	<input type="checkbox"/>
Cardiopulmonary test Y Max 229c Cardiopulmonary test device	<input type="checkbox"/>
Resting ECG Nihon Kohden Resting ECG	<input type="checkbox"/>
Spirometer SPIROBANK-COSMED spirometer	<input type="checkbox"/>
Cardiopulmonary CASE 601 Cardiopulmonary	<input type="checkbox"/>
Plethysmograph EC 5R Plethysmograph	<input type="checkbox"/>

At the bottom of the page, there is a search bar and a navigation menu with options: Search for patient, General patient enrol, ECASE report form, Hospital Care, Home Care, Assign / Change DSS services, Assign / Change monitoring resources, and Report Repository. On the right side, there is a 'Heartfaid News' section with a link to the '9th International HL7 Interoperability conference' held from October 8-11, 2008, at Hotel Knossos Royal Village, Hersonissos, Crete, Greece.

Image 8 – HEARTFAID Assign/Change Monitoring Resources

## Report Repository

To be completed when the development of the platform proceeds a bit further.

## 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:



Image 9 – 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™ 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.

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**Accompanied document**



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.

## 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

## 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:

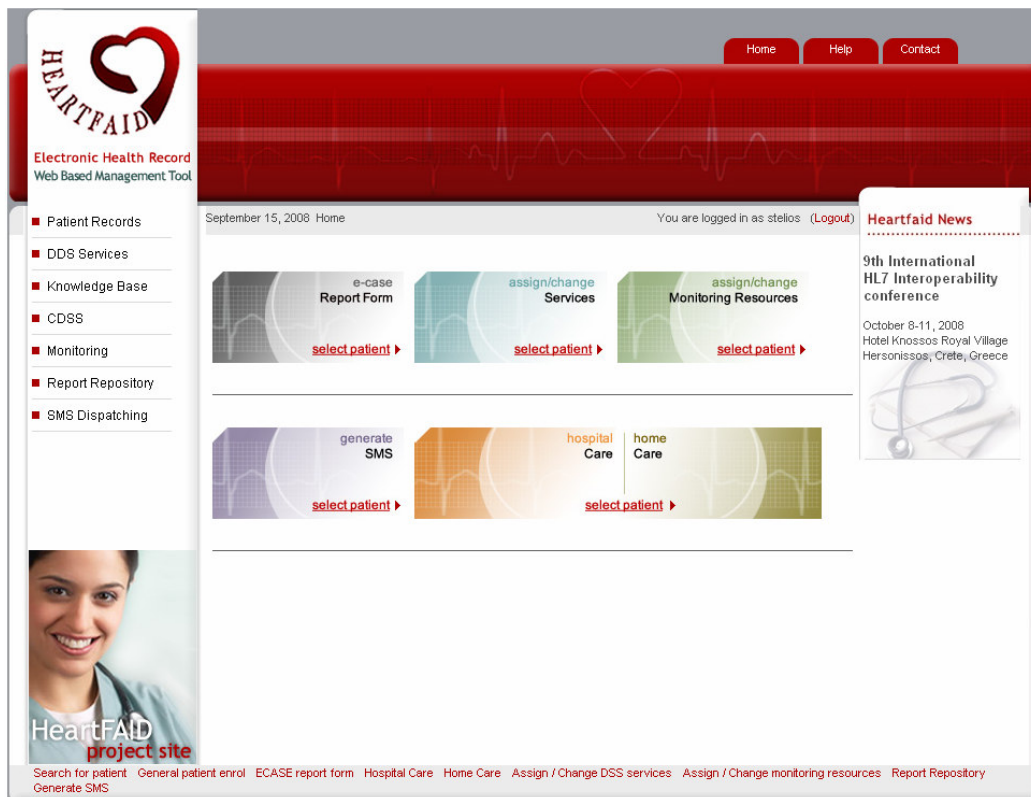


Image 10 – HEARTFAID Home Tab

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.

## Help

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

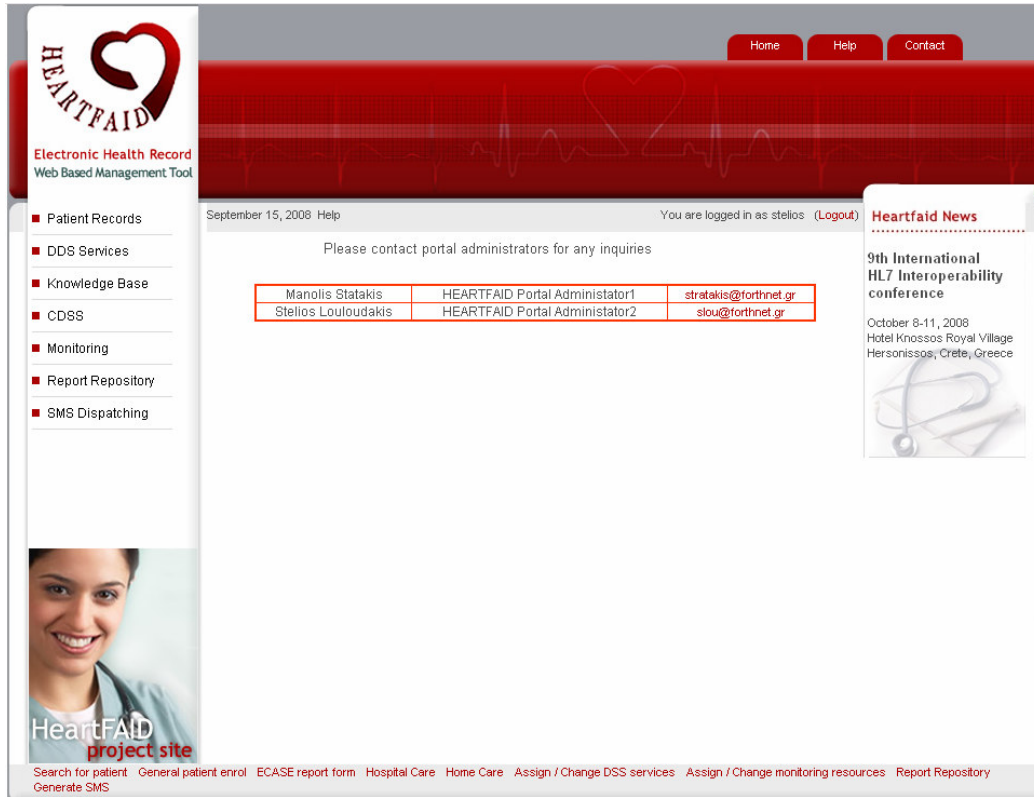


Image 11 – HEARTFAID Help

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.

### 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.



The screenshot shows the HEARTFAID web application interface. On the left is a navigation menu with items like Patient Records, DDS Services, Knowledge Base, CDSS, Monitoring, Report Repository, and SMS Dispatching. Below the menu is a photo of a smiling woman and the text 'HeartFAID project site'. The main content area has a red header with 'Home', 'Help', and 'Contact' buttons. Below the header, it shows the date 'September 15, 2008' and the user 'stellos'. A table lists contact details for three individuals. To the right, there is a 'Heartfaid News' section with a link to a conference. At the bottom, there is a footer with various navigation links.

Name	Position	Contact Details
Domenico Conforti	HEARTFAID project Co-ordinator	<a href="mailto:mimmo.conforti@unical.it">mimmo.conforti@unical.it</a>
Manolis Statakis	HEARTFAID Portal Administrator1	<a href="mailto:statakis@forthnet.gr">statakis@forthnet.gr</a>
Stellos Louloudakis	HEARTFAID Portal Administrator2	<a href="mailto:slou@forthnet.gr">slou@forthnet.gr</a>

**Heartfaid News**  
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Search for patient   General patient enrol   ECASE report form   Hospital Care   Home Care   Assign / Change DSS services   Assign / Change monitoring resources   Report Repository   Generate SMS

Image 12 – HEARTFAID Contact Details

## **General 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.