HEARTFAID

D 25 – 7th Quarterly Managerial Report

(MB and STAB meeting minutes)
Submission date: 14/12/2007
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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 – 31/01/2009
Project Co-ordinator Name:	Domenico Conforti
Project Co-ordinator Organisation:	UNICAL University of Calabria (Italy)
Thematic Priority:	Information Society Technology-ICT for Health
Instrument:	Specific Targeted Research 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)

D25 – 7th Quarterly Managerial Report
MB and STAB meeting minutes

Document summary	
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Work package:	WP0 – Management
Report Version:	2.0

Short Description
This document describes the activities of the Consortium during the seventh quarterly of HEARTFAID project and its future activities.

Change Record		
Version Number	Changes	Release date
1.0	First draft of the Document	21/11/2007
1.1	Contributions from Partners	31/11/2007
2.0	Final version	14/12/2007

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Executive Summary

The seventh Quarterly Managerial Report describes the activities and the objectives achieved by HEARTFAID Consortium during the period August 1 2007- October 30, 2007.

The following WPs have been involved :

- WP0: Management
- WP2: Biomedical Data Identification and Collection
- WP3: Middleware, Interoperability and Integration
- WP4: Knowledge, Representation, Discovery and Management
- WP5: Data processing and Decision Support Services
- WP6: End-User Application and Services
- WP8: Dissemination and Exploitation

The following deliverables have been finalised in due time during this quarter:

- D20:WP4
- D21:WP4
- D22:WP2
- D24:WP0,

while D20:WP3 and D23:WP6 have been delayed, in details in the description of the WPs.

The subsequent interim period will be particularly devoted towards the second review, with the release of the following deliverables and the following milestones:

- WP0:
  - MS 0.2: 2nd Periodic Report.
  - Deliverables D26, D27 and D33.
- WP3:
  - MS 3.3: Heartfaid Middleware Prototype.
  - Deliverable D28.
- WP4:
  - MS 4.2: Knowledge Discovery in Databases.
  - Deliverable D29.
- WP5:
  - Deliverable D30.
- WP6:
  - MS 6.1: Early Mock-up prototype of the Heartfaid web-based platform of services.
  - Deliverable D31.
- WP8:
  - Deliverable D32.

At the end of the description of each WP, the objectives and the future foreseen activities for the subsequent quarter have been set and can be summarised as follows:

- WP0: monitoring of the overall technical and management activities, coordination and support for the next steering meeting in Milan (hosted by UNIMIB and AUXOL), coordination and support for the second review meeting and developing of all the related activities.
- WP2: further development and testing of the data acquisition and transmission infrastructure and further development of the clinical data collection.
- WP3: final development of the prototype of the middleware infrastructure.
- WP4: further development of the knowledge discovery activity.
- WP5: development and implementation of data processing functionalities and decision support services.
- WP6: development of end-user applications and services.
- WP8: further dissemination activities according to the early plan.

Consortium Management: WP0

WORK PACKAGE: 0
TITLE: MANAGEMENT
START DATE: MONTH 1
WORK PACKAGE LEADER:UNICAL
PARTNERS INVOLVED:UNICZ, UNIMIB, VMWS , FORTHNET, SYNAPSIS, CNR, RBI

STATUS OF DELIVERABLES DUE IN THIS PERIOD

		DATE DUE	COMMENTS
DELIVERABLE	N°		
7th Quarterly Managerial Report	D 25	31/10/07	The Deliverable has been completed on time with the contribution of all HEARTFAID partners

FORECAST STATUS OF DELIVERABLES DUE IN THE NEXT 3 MONTHS

		DATE DUE	COMMENTS
DELIVERABLE	N°		
2nd Periodic Report	D 26	31/01/08	Foreseen to be completed on time
2nd Periodic Report on the Distribution of the Community Contribution among the Contractors	D 27	31/01/08	Foreseen to be completed on time
8th Quarterly Managerial Report	D 33	31/01/08	Foreseen to be completed on time

MEETINGS OF THE PERIOD AND FORECASTED WP0- MB & STAB MEETINGS

	COMMENT	DATE/PLACE
CNR/FORTH/ UNICAL	Combined with Technical meeting	Pisa 26 September 2007
SYNAP/FORTHNET/UNICAL	Combined with Technical meeting	Livorno 27 September 2007
UNICAL	ICT FP6 Financial Statement Coaching Workshop	Brussels 10 October 2007
UNICAL/CNR/FORTH/FORTHNET/ RBI	Combined with Technical meeting	Cosenza 23 October 2007
MB & STAB Meeting	Hosting: JUMC Attendants: MB & STAB	Cracow 8/9 November 2007
MB & STAB Meeting	Organiser UNIMIB/AUXOL/UNICAL	Milan 18/19 February 2008
2nd Review meeting	Organiser UNIMIB/AUXOL/UNICAL	Milan April 2008

Description of the activities

During this quarter the management of the Consortium has focused on the coordination of the overall activities of the project in view of the second review meeting.
The deliverable produced in this quarter has been the following:

- D24: 6th Quarterly reporting period.

At the same time, the WP0 has coordinated and submitted the following technical deliverables:

- D19
- D20 (submitted with delay)
- D21
- D22
- D23(submitted with delay)

Together with the technical and management supervision of all deliverables, attention in this period has been paid to the cooperation with the hosting partner JUMC for the overall organisation of the MB & STAB meeting held in Cracow on November 8th and 9th.

During this period also the collection of the 6 months const statement has been performed.

The work plan does not currently foresee any deviation and until next interim the overall management will focus on the coordination of the second periodic report and in particular on following tasks:

T 0.1 Overall management of the Consortium

- Handling of Deliverables
- Cooperation with JUMC for the organisation of MB & STAB meeting

T 0.3: Management of contractual, legal, financial and administrative procedure of the consortium

- Handling of financial and administrative procedures of review outcome
- Collection of the second year, 6 months cost statements from all the partners

T 0.2: Co-ordination of the Consortium technical activities

Also during this quarter, the coordination of the scientific and technical activities has been carried out on the basis of a quite effective collaboration among the several partners involved within each WP. In fact, the overall technical activity during the quarter has been mainly characterized by the finalization of the technical deliverables due by the end of the 21th month. To this end, a strong interaction among all the partners has been developed, with particular emphasis to the organization of specific technical meetings.
Finally, each partner has been responsible for all other direct issues with the coordination unit within the deadlines.

T 0.4: Internal Communication infrastructure

The internal communication infrastructure has been mainly realized by the extensive use of e-mails and audio conference services.

Forecasted activities

During next three months management activities will mainly focus on the coordination and the handling of future deliverables and in particular for the coordination of the overall management activities for the second review.

A close cooperation will be performed with all partners and in particular with UNIMIB and AUXOL, who will host the MB & STAB meeting.

Ongoing workpackages progress: WP2

WORK PACKAGE: 2
TITLE: BIOMEDICAL DATA IDENTIFICATION AND COLLECTION
START DATE: MONTH 3
WORK PACKAGE LEADER: VMWS
PARTNERS INVOLVED: UNICAL, UNICZ, UNIMIB, JUMC , FORTHNET, SYNAP, AUXOL

STATUS OF TASKS DUE IN THIS PERIOD

TASK	TITLE	COMMENTS
T 2.3	Data Collection	The task has started at M18 and the partners are in a good progress towards the collection of the relevant biomedical data, involving both homecare and healthcare data. The progress of the task is under control.

FORECAST STATUS OF TASKS DUE IN THE NEXT 3 MONTHS

TASK	N°		COMMENTS
Data Collection	T 2.3		In the next 3 months, the activities releted to collection of the data will be amplified, and new patients will be enrolled in heartfaid project.

Description of the activities

According to the HEARTFAID DoW, Task 2.3 started in M18 and by the end of this reporting period the task has been running for 3 months. The activities in this period are related to the collection of the relevant biomedical data in all the identified environments. According to the DoW the task was split in two sub-tasks, T2.3.1 and T2.3.2. The activities of the partners in these tasks are reported in the following paragraphs.

T2.3.1 Homecare data collection

This subtask is related to the collection of biomedical data in a sample of home environments utilising the data acquisition and transmission infrastructure developed in T2.2. Initially, there has been a collaboration between the partners involved in the development of the homecare applications (VMWS, FORTHNET) with the clinical partners of the project (UNIMIB, AUXOL, UNICZ and JUMC) in order to assess, at a first stage, the usability of the homecare applications and identify mechanisms in order to realise the data collection in an efficient and consistent way.
During the reporting period the data collection from the home environment has started and UNICZ are collecting, every two weeks, in a small group of patients the following parameters: systolic blood pressure, heart rate, respiratory rate, % of body water, body temperature, in order to achieve an early diagnosis of heart failure decompensation, so as indicated in deliverable D5.
Also, UNIMIB and AUXOL have continued the collection of from CHF patients monitored at home through internet. Via this procedure, the data collection of 30 patients has been completed on a nearly daily basis over a follow-up period of several months. The data obtained are the following: SBP, DBP, HR, Urine output, Water intake, body weight and selected symptoms.
Finally, in JUMC data collection in CHF patients in their home setting takes place on a daily basis and includes change in CHF symptoms (fatigue, dyspnea, orthopnea,

nocturnal dyspnea, peripheral oedema), systolic blood pressure, heart rate, respiration rate, body weight, change in the pharmacological treatment.

T2.3.2 Healthcare Data Collection

Regarding healthcare data collection, a total of 91 patients with chronic heart failure were enlisted in the HEARTFAID project by UNICZ (historical and newly diagnosed cases). The data of this population have been introduced in a database that contains all the heart failure related list of biomedical signs, symptoms and parameters of selected tests (e.g. Electrocardiogram, Holter electrocardiography, Chest X-ray, Echocardiography, Clinical chemistry etc). These data have been filled also in electronic CRF (basal assessments and further clinical evaluations). The clinical assessment in these patients is regularly scheduled every one-two months (and also earlier if clinical conditions are worsening).
Also, UNIMIB and AUXOL recovered from the digital chart of the patients monitored at home additional clinical data recorded in the hospital environment, such as Electrocardiogram, Holter electrocardiography, Chest X-ray, Echocardiography, Clinical chemistry, cardiopulmonary stress testing or 6 min walking test. These clinical data have been collected over repeated visits during patients' follow-up.
Finally, healthcare data collection in CHF patients took place in JUMC according to the eCRF (clinical data from anamnesis, physical examination, laboratory tests, ECG, echocardiography, 24h ECG monitoring, chest X-ray, cardiopulmonary exercise testing, quality of life questionnaire, beat-to-beat blood pressure monitoring).

Ongoing workpackages progress: WP3

WORK PACKAGE: 3
TITLE: MIDDLEWARE,INTEROPERABILITY AND INTEGRATION
START DATE: MONTH 2
WORK PACKAGE LEADER: SYNAPSIS
PARTNERS INVOLVED: VMWS, FORTHNET, CNR, FORTH

STATUS OF TASKS DUE IN THIS PERIOD

TASK	TITLE	COMMENTS
T 3.3.1	Early mock up prototype implementation	The activities of subtask T3.3.1, started at month M6, are about to be concluded with a slight delay of one month with respect to the project Gantt. During the reporting period, the open source frameworks related to SOA and ESB, investigated during the previous RP, have been selected among the available technologies and the most suitable solutions for the purposes of the HF project have been adopted for the implementation of the early mock up prototype of the integration middleware. This preliminary prototype was presented during the General Assembly Meeting held in Zagreb on June 2007.
T 3.4	Interoperability Middleware	The activities of Task T3.4, started at month M8, have been carried out during the reporting period as expected from the Gantt of the Project. According and in strict correlation with the studies performed in Task T3.3.1, the technologies investigated during the previous RP have been adopted to implement a first part of the Interoperability Middleware architecture.

STATUS OF MILESTONES OF THE PERIOD

MS	TITLE	COMMENTS
MS 3.2	Early mock-up prototype implementation of the Data Management and Exchange System	A preliminary prototype of the Data Management and Exchange System able to interact with external devices for data measurements and with an alarm/notification system, was presented at the General Assembly Meeting held in Zagreb in June 2007.

STATUS OF DELIVERABLES DUE IN THE PERIOD

		DATE	COMMENTS
DELIVERABLE	N°		
Clinical standards and first middleware prototype	D 20	31/07/07	The deliverable D20 will be delivered with a delay of almost two months with respect to the due deadline.

FORECAST STATUS OF TASKS DUE IN THE NEXT 3 MONTHS

TASK	N°		COMMENTS
Prototype refinement	T 3.3.2		The activities of subtask T3.3.2 will be stated at month M19, in accordance with the Gantt of the Project
Interoperability Middleware	T 3.4		The activities of task T3.4 will be continued during the forthcoming reporting period, in accordance with the Gantt of the Project.

Description of the activities

During the reporting period, the activities of tasks T3.3.1 and T3.4, started at month M6 and M8 respectively, have been continued. The progress of the work carried out is described in the following paragraphs.

T3.3: Integration Middleware

T3.3.1: Early mock up prototype implementation

This Task, has the goal to design and develop a Data Management System that is responsible to guarantee the following features:

- all the data flowing within the entire platform is compliant with the standards identified in Task 3.2
- management of the heterogeneous repository allowing the organization of raw data, laboratory data, structured information (EPR, data entry services, and so on), multimedia/other data (reports, images, ultrasound signals, and so on).

The early prototype developed during the previous RP has been further refined. In this reporting period we consolidated the adoption of Service Oriented Architectures (SOA), Enterprise Service Bus (ESB) architecture, and Open Geospatial Consortium specifications as reference information model, for the implementation of the Integration Middleware.
Concerning the web services architectures, we implemented both the two open source framework experimented in the previous RP, that is Axis2 and XFire, which have been adopted in the prototype.
As far as the ESB is concerned, we adopted both the two implementations of messaging bus experimented in the previous RP: OpenJMS and JBoss Messaging, both compliant with Java Message Service (JMS) specification.

This preliminary prototype developed, provides the external systems with a communication protocol that is flexible and based on the XML standard. The developed protocol allows these external systems to be easily integrated into the HF platform as well as to interact each with the other through the platform itself.
In particular, we have integrated the prototype with some devices that have been selected in the context of WP2 as suitable for the purposes of the HF project, as well as with a notification system able to rise an alert message that can be sent to a set of recipients using different mechanisms (such as e-mail or SMS).
In other words, this prototype is able to acquire and store the real time measurements provided by the medical devices, to process the received data and, if it is the case, to generate an alarm by sending a message to a set of recipients using the notification system.
All the interactions with this Data Management prototype are web based and, therefore, both the set of devices for data acquisition and the notification system can be located anywhere, assuming that an Internet connection is available.

The prototype was shown in a demo session at the General Assembly Meeting held in Zagreb on June 2007.

T3.4: Interoperability Middleware

As reported in the DoW, the Interoperability Middleware will be responsible of guaranteeing a seamless integration among the end-user services of the HEARTFAID Platform. The activities of this task, started at month M8, have been continued during the reporting period.

By implementing the technologies investigated in the previous RPs, a first kernel of the prototype has already been developed as well a mock-up of the Interoperability middleware general architecture. In addition, a first integration with an existing commercial EPR was implemented.

In more details, the interoperability middleware will split to two different modules the responsibility related to the management of raw data (both simple and structured data) and the management of documents (e.g. medical reports). In the first case the data will be stored in a database whose structure will be accurately defined according to the characteristics of the data that will be acquired by the medical devices. In the second case we will refer to a documental repository able to provide advanced services for storing and recovering clinical documents.

The preliminary prototype developed is composed of the following modules:

- a module to access an external archive of demographic data (typically belonging to the Health Information System of a clinical structure) in order to univocally identify the patient who is being enrolled in the HF study or whose physiological data is being acquired within a monitoring context;
- a module to interact with the documental repository to store and recover clinical reports/documents, which is able to rebuild the clinical history of a patient;
- a module, fully configurable, that upon an external request to recover a complex set of information, is able to identify and recover the necessary data both from the HF internal repositories (i.e. either the internal database or the documental repository) and from an external Health Information System, to combine the available information and finally report the answer.

This prototype represents a first step toward the definition of the HF Electronic Health Record that will be accessed using the functionalities that are being defined in the context of WP6.

Ongoing workpackages progress: WP4

WORK PACKAGE: 4
TITLE: KNOWLEDGE REPRESENTATION, DISCOVERY AND MANAGEMENT
START DATE: Month 8
WORK PACKAGE LEADER: RBI
PARTNERS INVOLVED: UNICAL, SYNAP, CNR, FORTH

STATUS OF TASKS DUE IN THIS PERIOD

TASK	TITLE	COMMENTS
T 4.2	Data understanding and preparation	We have finished the work on data understanding of short and long data sequences. Data preparation for continuously measured patient data has been done
T 4.3	Implementation of Knowledge Discovery in Database Processes	Methodological work on the random forest algorithm and SVM methodology has finished. These methods, together with some others have been tested on the available ANMCO data set and the collected dataset with continuously measured patient data. Research in the field of the application of survival analysis in the HF domain has started.

STATUS OF MILESTONES OF CURRENT PERIOD AND NEXT REPORTING PERIOD

MS	TITLE	COMMENTS
MS 4.2	Knowledge discovery in database turning	The work is going according to the plans and we expect the milestone will be achieved on time.

STATUS OF DELIVERABLES DUE IN THE PERIOD and IN NEXT REPORTING PERIOD

		DATE	COMMENTS
DELIVERABLE	N°		
Models and Methods for knowledge discovery	D 29	31/01/08	The work is going according to the plans. The most of the work on the methodology itself has finished and now we do experiments on available datasets. Preliminary table of contents will be prepared soon.

FORECAST STATUS OF TASKS DUE IN THE NEXT 3 MONTHS

TASK	N°	COMMENTS
Implementation of knowledge discovery in database process	T 4.3	We will define medical goals for the KD process that can be achieved from the available datasets. For each of these goals we will use all the available methodology in order to extract most relevant relations that can be useful either for inclusion into the HF knowledge base or as novel medical knowledge. The work on D29 will start soon.

Description of the activities

The work on WP4 included tasks T4.2 and T4.3 in parallel with special attention to data understanding and preparation task which finished in this period.
There have been continuous communication and discussion between RBI and UNICAL on data preparation of the retrospective data sets and organization of the work on KD methodology.
In this period we intensively worked also on the dissemination of the results obtained in T4.4 Ontologies and medical knowledge representation in the domain

in the previous period and integration of the obtained results into decision support system. The work was done by RBI.

T4.2 – Data understanding and preparation

We have finished data understanding for long numerical sequences simulating continuous patient monitoring. The data have been collected by UNICZ and data understanding and data preparation has been done by UNICAL. The data have been prepared for the KD process and the first results of the process have been presented at the STAB meeting in Cracow.
RBI in its work concentrated on the data preparation of short data sequences collected in the patient follow-up period. There have been defined two data table templates. The templates include static patient data, patient data collected during the last visit to the medical institution, flattened patient data from all previous visits, and patient property of interest. The template can potentially include also flattened continuously monitored data, both in the period just before the last visit and for the complete period of interest. These results plus the presentation of how flattening computation is actually performed for numerical and categorical attributes is already included in D21. Additionally, we have worked on the definition of relevant events that will be used as potentially interesting target attributes for KD tasks within Web based KD service. Selected tasks include HF severity modeling, analysis of responses to medication, and prognostic modeling.

T4.3 – Implementation of knowledge discovery in database process

We have worked on new and advanced strategies for the optimal selection of the best performing kernel functions. Specifically we have tested the use of semi-definite programming. The applicability and properties of the support vector machines have been tested in a few different knowledge discovery problems constructed from ANMCO dataset. The work has been done by UNICAL.
We have tested decision tree and rule learning algorithms on continuously measured patient data. The first results seem promising and potentially relevant for inclusion into the knowledge base for decision support purposes. The work has been done by UNICAL.
Independently, the ANMCO dataset have been transformed into a series of 106 different classification problems that will be a basis for extensive experiments with different machine learning tools including random forest methodology, decision trees, and subgroup discovery. The first experiments demonstrate relative low connection between available descriptors and defined medical goals. A real challenge seems extraction of some relevant medical knowledge. The work has been done by UNICAL and RBI.
The work on the implementation of random forest methodology has finished. Now we test the methodology on different datasets, primarily for the selection of a small set of most relevant descriptors. We prepare the methodology for inclusion into the web service. Additionally, research in the field of the application of survival analysis in the HF domain has started, specifically related to using the random forest methodology for modeling purposes. The work has been done by RBI.

Ongoing workpackages progress: WP5

WORK PACKAGE: 5
TITLE: DATA PROCESSING AND DECISION SUPPORT SERVICES
START DATE: MONTH 5
WORK PACKAGE LEADER: CNR
PARTNERS INVOLVED: UNICAL,UNICZ, SYNAPSIS,FORTH, RBI

STATUS OF TASKS DUE IN THIS PERIOD

TASK	TITLE	COMMENTS
T 5.2	Design and development of models and methods for signals and images processing	▪ Refinement of a comprehensive showcase involving ECG processing and echocardiography workflows and preparation of a paper submitted to the HEALTHINF conference ▪ Acquisition of images from clinical partners within the DICOM standard ▪ Preliminary study for the integration of an Image Archive into HEARTFAID platform ▪ Study of available open-source implementation of DICOM standard for the realization of an application for image uploading ▪ Evaluation of software libraries for the realization of signal and image processing application modules (Matlab, ITK, VTK, FLTK, ImageJ) ▪ Refinement of the algorithms for QRS detection and left ventricle segmentation in US apical image sequences for the extraction of geometrical parameters.
T 5.4	Implementation of the Decision Support System	▪ Refinement of the comprehensive showcase that should be finalized at the end of the third year ▪ Study and development of the object level of CDSS Brain, in particular of the domain knowledge base and the inference engine ▪ Design and test of computational models for solving difficult decisional problems ▪ Implementation activity in Protégé, Swoop and Jena ▪ Preparation of a paper submitted to the HEALTHINF conference

STATUS OF MILESTONES DUE IN THE PERIOD

MS	TITLE	COMMENTS
MS 5.1	Early mock-up prototype of data processing and decision support services	The implementation of signal and image processing application modules has started exploiting various libraries, i.e. Matlab, ITK, VTK, FLTK, ImageJ

STATUS OF DELIVERABLES DUE IN THE NEXT REPORTING PERIOD

		DATE	COMMENTS
DELIVERABLE	N°		
Models and Methods for signals and image processing	D 30	31/01/08	Table of contents in preparation

FORECAST STATUS OF TASKS DUE IN THE NEXT 3 MONTHS

TASK	N°		COMMENTS
Design and Development of models and methods for signals and images processing	T 5.2		- Development of ▪ a simple client for image uploading/querying to be added DCM4CHE ▪ first image analysis module integrated with HEARTFAID Image Archive ▪ methods for QRS classification and averaging - Deliverable D30
Implementation of the Decision Support System	T 5.4		▪ Implementation of the required CDSS functionalities ▪ Integration with the other platform components

MEETINGS OF THE PERIOD

PARTNERS	COMMENT	DATE/PLACE
CNR-SYNAP		Pisa, 12 September
CNR-FORTH-UNICAL-SYNAP	WP-5 Technical Meeting	Pisa, 25-27 September
CNR-FORTH-UNICAL-SYNAP-FORTHNET		Livorno, 27 September
CNR-RBI-UNICAL-FORTH-SYNAP		Cosenza, 23 October
CNR-FORTH-UNICZ	Informal tutorial on the use of 1) DICOM network operations and 2) FORTH module for ECG visualization and annotation	Catanzaro, 24 October

Description of activities

Task 5.2 - Design and development of models and methods for signals and images processing

The comprehensive showcase (prepared for the early mock-up of HEARTFAID data processing and decision support services) has been refined to integrate all the modules making up the HEARTFAID *Brain*. A paper has been prepared and submitted to HEALTHINF conference (to be held in Funchal in January 2008).
The HF Image Archive installation at the CNR (powered by DCM4CHEE) has been checked for security issues. Then, access to the HF Image Archive has been given to interested clinical partners. For this reason, a tiny (but expansible according to the users need) user guide was prepared. A freeware DICOM client (namely K-Pacs) was suggested to the interested clinical partners and support was given for its installation, along with some sample images to test DICOM network operations. UNICZ managed to transfer images to the HF Image Archive located in Pisa, during a short meeting held in Catanzaro validation site.
To avoid the use of freeware applications, a simple client for image uploading/querying is in preparation. It will be based on the JAVA implementation of DICOM standard provided by DCM4CHE, possibly integrated as a plugin of ImageJ (for instance by using the Tudor DICOM toolkit).
This simple client will be possibly extended by adding image processing modules for the segmentation of echocardiographic image sequences, by using wrapping of ITK and VTK libraries. Other non-JAVA libraries both for image processing (MATLAB with the included C Compiler) and interfaces (FLTK) are also being considered at this stage.

The method for QRS detection (presented at Computers in Cardiology 2007 (Durham, NC, USA)), currently implemented in MATLAB, has been initially partially ported in C for better performance. However, a further check on a subset of a first data set (74 ECG files in all) provided by the hospital of Catanzaro has revealed very satisfactory performances (sensitivity, PPV and execution time) specially considering that the ECG duration is only 10 seconds compared to about 30 minutes of the MIT-BIH database on which the algorithm was implemented and tested (there is an average scale factor of about 180 on the total number of QRSs present in the record). For that reason we concluded that very likely the porting in C is not anymore necessary and the Matlab compiled version (MATLAB with the included C Compiler) should properly satisfy all the time requirements. Moreover, FORTH is further adapting the QRS detection method to process the ECG data acquired at the HEARTFAID validation site in Catanzaro. Such data consist of short-time 12 leads recordings with 500 Hz sampling rate, instead of 30min and 2 leads recordings with 360 Hz sampling rate available in MIT-BIH database. Future research activity in signal processing will focus on QRS classification and averaging still using the MIT-BIH annotated database and also the Catanzaro database adequately annotated.

Task 5.4 - Implementation of the Decision Support System

The showcase, defined and detailed with UNICZ, was further refined for considering a complete and realistic scenario within the hospital environment, also touching aspects of telemonitoring and signals and images interpretation. Minor corrections and additions were made to the first version. A strict interaction with the clinical partners was aimed at defining all the data and information necessary to implement the showcase. In particular, the ontology developed within the WP4 was deeply analyzed for identifying missing terms and a preliminary set of rules was defined together with clinicians.
At the end of September, a WP5 Technical Meeting was held in Pisa involving CNR, UNICAL, FORTH and SYNAP and aiming at the assessment and discussion of CDSS development activity. In particular, UNICAL presented the current results of the computational models which are under development for prognosis, based on the ANMCO dataset, and early detection of patient decompensation, based on the data acquired at UNICZ.
Soon afterwards, another meeting was held in Livorno and resulted in the definition of CDSS involvement within another showcase that should be realized at the beginning of next year and is strictly related to the telemonitoring functionality of HEARTFAID platform.
CNR and UNICAL performed preliminary implementation tests on the complete showcase, which highlighted the importance of extending and re-organizing the tassonomical ontology developed within WP4. Moreover, for pursuing inference efficiency, it was decided to arrange several core ontologies, integrated by means of upper ontologies; this way, it would be not necessary to transfer to the inference engine all the ontological data but only those involved in the context under processing. Reachability analysis of the rules in the knowledge base was considered useful for identifying these subsets of data.
A careful planning activity was performed for assessing all the necessary functionalities involved in the showcase and related not only to CDSS but to the entire platform, e.g. knowledge base, computational models, web interfaces and controller, platform event controller, data mappers, repository. A preliminary

implementation demo was prepared for testing purposes, by using Protégé, Swoop and Jena, and included pieces of core ontologies equipped with data types (patients, diagnostic procedures, …), some rules, the inference engine, and a tiny user interface for the Minnesota Questionnaire form and for patients' management (in XHTML/JSP and servlet).

Ongoing workpackages progress: WP6

WORK PACKAGE: 6
TITLE: END-USER APPLICATION AND SERVICES
START DATE: MONTH 10
WORK PACKAGE LEADER: FORTHNET
PARTNERS INVOLVED: UNICAL,UNIMIB, JUMC, CNR,FORTH,RBI

STATUS OF TASKS DUE IN THIS PERIOD

TASK	TITLE	COMMENTS
T 6.2	Development of end user applications and services	Within Task 6.2, more tests have been performed, in order to test the applications and services, regarding their functionality and interoperability. Emphasis has been given on the Alert & Notification system, where testing has been successful by delivering important information through SMS messages to certified mobile phones of end users.
T 6.3	Knowledge discovery system for web-based data extraction and analysis	We performed first experiments for testing on-line web based applicability of the random forest engine for knowledge discovery tasks. A simple task scheduler has been designed for these experiments.
T 6.4	Integration of services	The aim of this Task, which started on month 19, is to test and guarantee the integration and interoperability among the various services provided by the middleware platform. As soon as all the services are successfully developed, a number of tests have to be performed in order to check important parameters ranging from integration to the usability of the available services.

STATUS OF DELIVERABLES DUE IN THE NEXT REPORTING PERIOD

		DATE	COMMENTS
DELIVERABLE	N°		
User needs analysis and functional specifications of the Heartfaid platform services	D 23	31/07/07	The deliverable has been completed successfully, but submitted with two months of delay. We have analyzed all user needs, depending on the attributes of the users that are going to use the services of the platform. Furthermore, a large number of functional specifications have been described in detail, regarding the functionalities and interoperability of the Front End of the HEARTFAID platform.
Knowledge discovery systems	D 31	31/01/08	The content that will be included in this Deliverable is currently being defined and the distribution of work among the participating partners will start in the following weeks.

FORECAST STATUS OF TASKS DUE IN THE NEXT 3 MONTHS

TASK	N°	COMMENTS

Development of end user applications and services	T 6.2	Finalize the Alert & Notification system, regarding its usability, functionalities and interoperability.
Knowledge discovery system for web-based data extraction and analysis	T 6.3	In the next period the project partners will cooperate in order to define the exact web services, regarding Knowledge Discovery that will be available through the front-end.
Integration of services	T 6.4	Perform tests, in order to analyze and develop the most proper interoperability and integration aspects of the services provided by the HEARTFAID platform.

Description of the activities

T6.2: Development of end-user application and services

The HEARTFAID platform should be able to provide advanced alert and notification communication services through an interface dedicated to mobile devices (mainly mobile phones and PDAs) for both patients and medical staff.

The instant communication method of Short Messaging System (SMS), is being used in order to provide HEARTFAID platform with enhanced one and two-way communication services available over GSM network for mobile users.

The main issues for the alert and alarm service will be the existence of an advanced user profiling and cognitive techniques which should be used, in order to dynamically compose and send alert and notification messages to HEARTFAID users according to their attributes and depending on their particular personal profile.

Depending on the values of the measurements received from the sensors (data acquisition-WP2), several alarms may be raised after the processing of these data by the platform. If an alarm is fired in the middleware, the notification process is triggered. The appropriate message is assembled in the middleware platform, including the measurements that caused the alarm and other assistive data. The message may be sent by SMS or e-mail, depending on the means selected by the patient or the care-taker.

The SMS notification module offers a clear-cut XML-based communication interface, through which authorized clients may submit requests. The whole process is fully automated and commences with the reception of a well-formed XML document, containing the message subject, the message body and the message recipients. The SMS notification module manages the XML unmarshaling, the SMS marshaling and the dispatch and monitoring of the SMS. When the message arrives to its destination, the patient, care-taker or clinician is able to view the informative description on their mobile phone quickly and easily, and proceed to perform the necessary actions.

T6.3: Knowledge discovery system for web-based data extraction and analysis

In the previous period we have concentrated on the problem of testing on-line executability of knowledge discovery algorithms. For this purpose a task scheduler has been designed which combines the tasks of getting requested data from an auxiliary database and starting the knowledge discovery jobs. The distinguishing property is to have more than one knowledge discovery job in parallel, potentially for different users. For the experiments we have used the random forest algorithm with relative primitive report functionality. In the next

period we have to concentrate on improving the report functionality of the random forest algorithm and to prepare some interesting datasets for potential web users.

T6.4: Integration of services

The Middleware is responsible to guarantee the integration and the interoperability among all the modules of the platform, as well as of the services provided to the end-users.

Personalised access technologies to the HEARTFAID platform are currently under the development process, in order to ensure that access to medical data from the end users will be easy and secure.

In order to guarantee the interoperability among the services offered by the HEARTFAID platform, we will rely on the Service-oriented architectures (SOA). SOA is an evolution of distributed computing based on the request/reply design paradigm for synchronous and asynchronous applications. The individual functions of an application in the HF platform will be modularized and presented as services. What's key to these services is their loosely coupled nature; i.e., the service interface is independent of the implementation.

Security is also an important factor throughout the development of the project and must be used in order to provide protection of information systems against unauthorized access to or modification of information, whether in storage, processing, or transit, and against the denial of service to authorized users or the provision of service to unauthorized users, including those measures necessary to detect, document, and counter such threats.

Ongoing workpackages progress: WP8

WORK PACKAGE: 8
TITLE: DISSEMINATION AND EXPLOITATION
START DATE: MONTH 1
WORK PACKAGE LEADER: UNICAL
PARTNERS INVOLVED: ALL

STATUS OF TASKS DUE IN THIS PERIOD

TASK	TITLE	COMMENTS
T 8.1	Dissemination activities	Contributions to the dissemination have been given by the clinical partners, in detail below
T 8.2.1	Investigation of new models for Healthcare processes	The subtask has been just started

STATUS OF DELIVERABLES DUE IN THE NEXT REPORTING PERIOD

		DATE	COMMENTS
DELIVERABLE	N°		
Second Report on Dissemination Activities	D 32	31/01/08	The deliverable will summarize all the dissemination activities of the project second year.

FORECAST STATUS OF TASKS DUE IN THE NEXT 3 MONTHS

TASK	N°		COMMENTS
Dissemination activities	T 8.1		The main initiative will be the organization of the Special Session within the International Conference HEALTHINF 2008, Madeira (Portugal), which will be held on Jan. 28-31, 2008
Exploitation activities Investigation of new models for Healthcare processes	T 8.2.1		The exploitation activities will be developed mainly on the basis of the assessment of the new organization and management model proposed in the deliverable D8.

Description of the activities

UNICAL:
The dissemination activity of UNICAL has focused in this period mainly on the organisation of the joint dissemination activity at HEALTHINF together with ACGT and MyHeart.
In particular a meeting at Philips Research Aachen has been organised on November 16th in order to better define technical and management aspects of this event and of future joint activities.

JUMC :
Spreading the knowledge about Heartfaid platform in CHF patients visiting the Cardiology Department

RBI:
The most relevant dissemination result in the previous period has been a request from Stanford University Medical Center for using the heart failure ontology (HF) we have developed in WP4 of the Heartfaid project in their ongoing research projects in the field of congestive heart failure. Based on their written expression

of interest and statement that the ontology will be used only for scientific work in improving the quality of clinical care we have given them access to all details of the developed ontology. This dissemination is important for us because it demonstrates the relevance of our work and opens possibilities for future cooperation with one of the most prestigious research centers in medical informatics. By the way, they have developed and enabled public application of the ontology tool Protégé that we used for the development of the HF ontology. As the result of the cooperation we already received the ontology part on etiology of the heart failure that they have developed.

FORTH

Dissemination activities performed by FORTH in this period were:

- Collaboration in setting up the organization of a special session at HEALTHINF 2008 (Madeira, Portugal), that will be also part of the clustering activities of the project.
- Collaboration in the preparation of two papers for the HEALTHINF 2008 conference. Both papers have been accepted for oral presentation and the oral presentation will be given at the conference time (January 28-31):
    - A. Schlögl, C. Vidaurre**,** E. Hofer, T. Wiener, C. Brunner, R. Scherer**,** F. Chiarugi. "BIOSIG: Standardization and quality control in biomedical signal processing using the BioSig project".
    - S. Colantonio, M. Martinelli, D. Moroni, O. Salvetti, D. Perticone, A. Sciacqua, F. Chiarugi, D. Conforti, A. Gualtieri, V. Lagani. "Decision support and image & signal analysis in heart failure: a comprehensive use case".
- Oral presentation of two papers at Computers in Cardiology 2007 (Durham, North Caroline, USA) (September 30-October 3):
    - F. Chiarugi, V. Sakkalis, D. Emmanoulidou, T. Krontiris, M. Varanini, I. Tollis. "Adaptive Threshold QRS Detector with Best Channel Selection Based on a Noise Rating System".
    - A. Schloegl, F. Chiarugi, E. Cervesato, A. Apostolopoulos, C. E. Chronaki. "Two-Way Converter between the HL7 aECG and SCP-ECG Data Formats Using BioSig".
- Publication of a paper in IEEE Transactions on Biomedical Engineering (issue of August 2007):
    - F. Chiarugi, M. Varanini, F. Cantini, F. Conforti, G. Vrouchos. "Noninvasive ECG as a Tool for Predicting Termination of Paroxysmal Atrial Fibrillation".

Planned activities for the next three months:

- Participation to the special session at HEALTHINF 2008 (Madeira, Portugal), that will be also part of the clustering activities of the project.
- Collaboration to the preparation of the two oral presentations at HEALTHINF 2008 (Madeira, Portugal) (January 28-31, 2008):
    - A. Schlögl, C. Vidaurre**,** E. Hofer, T. Wiener, C. Brunner, R. Scherer**,** F. Chiarugi. "BIOSIG: Standardization and quality control in biomedical signal processing using the BioSig project".
    - S. Colantonio, M. Martinelli, D. Moroni, O. Salvetti, D. Perticone, A. Sciacqua, F. Chiarugi, D. Conforti, A. Gualtieri, V. Lagani.

"Decision support and image & signal analysis in heart failure: a comprehensive use case".

Dissemination activities of the period

Date	Channel	Event	Place/ Country	Partner responsible	Nature and size of audience
3. Aug. 2007.	message to the official web site	Croatian Cardiology Society	Zagreb, Coroatia	RBI	Croatian Cardiology Society
20.-28. Aug. 2007.	poster presentation	ACAI 2007Logic for Artificial Intelligence (summer school)	Leuven, Belgium	RBI	50 participants
4. Oct. 2007.	sharing the results	Stanford University Medical Center	Stanford, California, USA	RBI	Partners on the project of etiology of congestive heart failure
20-23 August 2007	2 Oral presentations	7th Open German-Russian Workshop on Pattern Recognition and Image Understanding	Ettlingen, Germany	CNR	200 participant
17 September 2007	2-hours long seminar	DSP Application Day, University of Milan, Department of Computer Science and Communication. Seminar on "Methods for image processing" featuring the description of the activity carried out within HEARTFAID Project as example	Milan, Italy	CNR	~100 participants (computer science students and researchers)
23-24 October 2007	4-hours long seminar	"HEALTH CARE" module of the Master in Computational Science organized by NEC-CESIC. Seminar on "Biomedical image processing" featuring the description of the activity carried out within HEARTFAID Project as example	Cosenza, Italy	CNR	~20 participants (students)

Future activities and dissemination

Date	Place	Event	Partner responsible	Description
28-31 Jan. 2008	Funchal, Portugal	International Conference on Health Informatics	RBI	Paper presentation
28-31 Jan. 2008	Funchal, Madeira	HEALTHINF		Organization of the special session on "Knowledge Discovery and Decision Support Systems in Health Information Systems" + oral presentations
22-25 Jan. 2008	Funchal, Madeira	IMTA Workshop, VISAPP Conference	CNR	Oral Presentations
13-15 Dec. 2007	Bari, Italy	AITIM 2007	UNICAL	Paper Presentation
18-20 Dec. 2007	Bari, Italy	SWAP	CNR	Paper Presentation
16 Nov. 2007	Aachen, Germany	Joint Dissemination Coordination Meeting with PHILIPS for MyHeart Project	UNICAL	Meeting