HEARTFAID

D17 – 4th Quarterly Managerial Report

(MB and STAB meeting minutes)
Submission date: 09/03/07
Due date of document: 31/01/07

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)

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MB and STAB meeting minutes

Document summary	
Document Title:	4th Quarterly Managerial Report
Document Classification:	Deliverable D17
Dissemination level:	CO
Period covered:	From 1 November 2006 to 31 January 2007
Submission date:	9 March 2007
Due date:	31 January 2007
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Work package:	WP0 – Management
Report Version:	1.3

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

Change Record		
Version Number	Changes	Release date
1.0	First draft of the Document	22/01/07
1.1	Contribution from WPs	16/02/07
1.2	Minor changes	02/03/07
1.3	Final draft	09/03/07

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EU STREP – Specific Targeted Research or Innovation Project

Executive Summary

The fourth Quarterly Managerial Report describes the activities and the objectives reached by Heartfaid Consortium during the period November 1 2006- January 31 2007.
In short the following WPs have been involved in the work:

- 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 devices
- WP6: End-User application and Services
- WP8: Dissemination and Exploitation

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

- WP0: Final tuning and consolidation of the overall management activities of the consortium. Better definition of the coordination procedures of the consortium technical activities. Further improvement of the internal communication infrastructure.

- WP2: The specifications of the data acquisition and transmission infrastructure have been defined. The set of sensors which will be integrated into HEARTFAID is close to its final definition. The first stage of integration of some medical devices into the HEARTFAID platform has started and some mock-ups have already been developed.

- WP3: The functional specifications of the middleware and the clinical standards available on the market have been evaluated against the need of the HEARTFAID project and the goals to be achieved. Preliminary design models have been proposed for the future development of the HEARTFAID Middleware.

- WP4: Ontological definition of the Case report form in the Protégé Frames form. Testing the available data transformation and data cleansing methodology on the historical data. Experiments with contrast set mining and descriptive induction methods for insightful data analysis in the brain stroke domain. HF ontology set on-line on http://lis.irb.hr/heartfaid/ontology/ and prepared in the OWL form.

- WP5: The functional specifications of data processing and decision support services have been defined.

- WP6: The analysis of the requirements for the design of the end-user services interaction functionalities and the knowledge discovery system for web-based data extraction and analysis has been started just in this quarter.

- WP8: several dissemination activities have been carried out: internal dissemination, submission and publication of scientific papers to conferences and scientific journals, interactions with health care professional associations.

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

DELIVERABLE	N°	DATE DUE	COMMENTS
1st Periodic Report on the Distribution of the Community contribution among contractors	D12	31/01/07	The deliverable has been completed by UNICAL according to financial records
1st Periodic Report (activity and management)	D13	31/01/07	The deliverable has been completed following the structure of the guidelines thanks to the contribution of each partner
4th Quarterly Managerial Report	D17	31/01/07	The deliverable has been completed following the template already established with WP leaders contribution

STATUS OF MILESTONES DUE IN THIS PERIOD

Milestone	TITLE	COMMENTS
M.S.0.1	1st Periodic Report	The milestone ,including reporting aspects and review issues, has been achieved and evaluated with the active interaction of all members. Deliverable D13 of this periodic report defines and reports all details and aspects .

FORECAST STATUS OF DELIVERABLES DUE IN THE NEXT 3 MONTHS

DELIVERABLE	N°	DATE DUE	COMMENTS
5th Quarterly Managerial Report	D18	30/04/07	The deliverable will be organised by UNICAL, completed and reviewed with the contribution of all WP leaders and partners with regards to Consortium activities from February 1st to April 30th 2007

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

ACTIVITY	Attendants	DATE/PLACE
MB & STAB Meeting	Hosting:SYNAP/CNR Attendants MB &STAB	Pisa 7/10 November 2006
IST Coordinators Day on Project Management	UNICAL	Brussels, 28 November 2006
WP 0 Meeting	UNICAL/CNR/ SYNAPSIS	Pisa, 23 January 2007
WP 0 Meeting	UNICAL/FORTHNET	Brussels 12 February 2007
WP 0 Meeting	UNICAL/UNIMIB/AUXOL	Milan 19 February 2007
MB & STAB Meeting	Hosting:UNIMIB/AUXOL Attendants MB & STAB	Milan 20/21 February 2007
Revision Meeting	Coordinator:UNICAL Attendants:Representatives of MB	Brussels 27/28 March 2007

Description of the activities

During this quarter (1st November 2006-31st January 2007) the management of the Consortium has focused on the following tasks:

T 0.1 Overall management of the Consortium
T 0.3: Management of contractual, legal, financial and administrative procedure of the consortium

- Preparation for the reporting period in terms of practical aspects, collection of contribution, financial information for the 1st periodic management report, filtering information between the Consortium and the Commission
- Project meetings and internal WP0 meetings: A face to face interaction has been essential for the management during this quarterly in order to clarify key issues and collect suggestions and feedbacks from all partners, a joint coordination with hosting partners for MB & STAB meetings has also been established
- Continuous interaction and communication with the Consortium
- Overall management of Deliverables of all WPs, collection of all related material with the contribution of all WPs and of the entire Consortium
- IST Coordinators day on project management
- Procedure of amendment clause 9.2 to remove the clause for the contractor Synapsis; the foreseen procedure has been carried out by the coordinator with the signed agreement of all Consortium and approved by the Commission

T 0.2: Co-ordination of the Consortium technical activities

The coordination of the scientific and technical activities has been further consolidated, by the definition and tuning of the procedures for the effective collaboration among the several partners involved within each WP.
In particular, each WP Leader is responsible to:
- plan and organise the overall internal work;
- coordinate the contribution from the relevant partners;
- define the roadmap for the development of the deliverables;
- collect feedbacks from the WP group as far as Quarterly Reports are concerned.

Finally, each partner will be 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 realized by the services and functionalities provided by the Internal side of the Project Web Site.
Further support has been realized by audio conference services.

Forecasted activities

During next three months management activities will mainly focus on the coordination of the different issues related to the first periodic report and to the management aspects of future Consortium Meetings.
Frequent communication with the Consortium and the Commission if necessary is foreseen at this stage of the Project through direct meetings and update information.
The cooperative support and contribution of the Consortium will represent the "heart" of WP 0.

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 2.2	Design and Development of the Data Acquisition and Transmission Infrastructure	The specifications of the data acquisition and transmission infrastructure have been defined and they are reported into D14, which will be submitted at the end of this reporting period. The set of sensors which will be integrated into HEARTFAID is close to its final definition Furthermore, the first stage of integration of some medical devices into the HEARTFAID platform has started and some mock-ups have already been developed

STATUS OF MILESTONES DUE IN THIS PERIOD

		COMMENTS
M.S.2.1	Functional Specifications of the Data acquisition and transmission infrastructure	The functional specifications of the data acquisition and transmission infrastructure have been defined and they are reported into deliverable D14, which will be submitted at the end of this reporting period.

STATUS OF DELIVERABLES DUE IN THIS PERIOD

		DATE	COMMENTS
DELIVERABLE	N°		
Specifications of Data acquisition and transmission infrastructure	D 14	31/01/07	Deliverable D14 describes the requirements and specifications of the infrastructure which will be responsible to gather biomedical data from sensors in all the relevant healthcare environments and transmit these data to the HEARTFAID platform. D14 is jointly prepared by the technological partners involved in WP2 and will be submitted at the end of this reporting period.

FORECAST STATUS OF TASKS DUE IN THE NEXT 3 MONTHS

TASK	N°		COMMENTS
Design and Development of the Data Acquisition and Transmission Infrastructure	T 2.2		In the next 3 months it is expected that the partners, based on the definition of the specifications of the data acquisition and transmission infrastructure, will continue with the development of the various modules of the infrastructure, and standalone tests will start being performed in order to verify the desired operation of the modules.

Description of the activities

In the current reporting period, the activities of WP2 are related to Task 2.2, Design and Development of the Data Acquisition and Transmission infrastructure. These activities were carried out by VMWS, FORTHNET and SYNAP. In the following paragraphs, a more detailed description of these activities is given:

a) **Definition of the specifications of the data acquisition and transmission infrastructure**

This activity was carried out jointly by VMWS, FORTHNET and SYNAP, aiming to define the requirements and specifications of the data acquisition and transmission infrastructure. The results of this activity are reported into deliverable D14, which will be submitted at the end of this reporting period. In D14, the partners identified three major healthcare environments (hospital, home and outdoors) and based on these environments the specifications of the data acquisition infrastructure were defined, which comprise amongst others, specifications for

- Medical devices
- Communication technologies
- Data acquisition devices (operating systems programming environments APIs and applications)
- Data manipulation and enhancement (available APIs e.g. for XML creation)
- Data transmission technologies (over e.g. fixed or mobile networks)
- Data storage

b) **Definition of the set of sensors to be integrated into HEARTFAID**

This activity was started by VMWS and FORTHNET during the previous reporting period and is currently close to its end. An initial filtering of the suggested sensors took place in the last STAB meeting, held in Pisa. After this meeting, and in order to define in more detail the characteristics of the medical devices, some electronic questionnaires were created by VMWS and distributed to the medical partners. In those questionnaires, the medical partners were asked to give more details relevant to each device's characteristics (e.g. the healthcare environment of use, the connectivity features, the communication protocols, the produced data formats etc, possible standards etc).
The compilation of the medical partners' responses is currently close to its completion.

c) **Development of modules for data acquisition (VMWS, FORTHNET)**
Based on the generalised software modules, which were developed and tested during the previous reporting period, some specific software modules related to the communication with specific medical devices were developed and are currently in the test phase. More specifically, VMWS has developed software modules for communication over Bluetooth with the Nonin Pulse Oximeter as

well as the FRWD Heartstrap. Both of these modules were developed in J2ME and their operation was tested on a Nokia 6630 smart phone.

d) Development of modules for data transmission
During the previous reporting period the software modules and interfaces related to data transmission were almost defined and tested. For this reason, during the current reporting period this activity involves mainly some fine tunning of these modules.

e) Development of EHR (SYNAP)
As already reported in the previous quarterly, preliminary studies have been started aimed at extending an existing general purpose EPR developed by Synapsis towards the following two objectives:
  – Adapt the existing EPR to the needs of the cardiovascular experts in order to become the reference HEARTFAID Electronic Patient Record;
  – Integrate the new HF-EPR with the platform of services; this way it will possible for the medical experts to select from the data acquired by the remote sensor networks, the relevant information that will be automatically stored into the EPR itself.

These studies have been carried on during the reporting period, in collaboration with the clinical partners. In particular, the preliminary results have been presented at the General Assembly Meeting held in Pisa on November 2006 and the next steps towards the definition of a HF-EPR have been established.

After a deep analysis performed with the clinical partners on the requirements and the functional specifications that the HF-EPR should provide, and in line with the mid-term industrial strategies of Synapsis related with the innovation of both products and production processes, a path was defined that will lead to the confluence of the existing EPR with an integrated tool (at the moment under study by Synapsis) designed to interactively and dynamically create Patient Records compliant with a set of specifications defined by the clinicians.

The introduction of this tool and the integration with the existing EPR solution, will be strategic for the successive extension of the HF-EPR towards the HEARTFAID Electronic Health Record, whose main goal will be to reconstruct the entire clinical history of a patient, starting from his first contact with a healthcare structure up to today, and including all the information acquired at each contact with any health structure during his entire life and possibly stored in EPRs.

A first mock-up of the EPR was made available to the Italian clinical partners and a process of internationalisation of the available solution was started. This process will lead to the realisation of an advanced prototype of the HF-EPR which will be used also at international level to acquire data for the HEARTFAID repository.

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 3.1	Middleware requirements and functional specifications	The activities of this Task, stated at M2, were concluded at the end of month M10, in line with the Gantt of the Project. The requirements and functional specification identified represent an important input to the activities of the connected Task T3.3. Meeting with CNR both in Pisa and Livorno supported the identification of critical aspects concerning the distribution of source data, which might arise during the subsequent stages of the project activities. These aspects have been discussed in details during the General Assembly Meeting held in Pisa during month M10 (7th-10th November 2006). The requirements and the functional specification identified, were accurately analysed and presented in Deliverable D11.
T 3.2	Identification of the clinical standards for representation and communication of data	The activities of this task started at month M8 and ended at month M12, as expected from the Gantt of the Project. An accurate analysis of the available standards was performed and the results are presented in Deliverable D11.
T 3.3.1	Early mock up prototype implementation	The subtask 3.3.1 has been started at month M6, inline with the Gantt of the Project. Early results are expected to be achieved in the forthcoming period.
T 3.4	Interoperability Middleware	Task T3.4 started at month M8, as expected from the Gantt of the Project. The activities of this task and the results expected have been discussed during the Assembly Meeting held in Pisa. Early results have been presented to the Consortium and a very early mock-up of the middleware was shown. Further results are expected during the forthcoming period.

STATUS OF DELIVERABLES DUE IN THIS PERIOD

		DATE	COMMENTS
DELIVERABLE	**N°**		
Functional Specifications of the Middleware	D 11	30/11/07	The deliverable was delivered with a slight delay with respect to the foreseen deadline (22nd January instead of 15th January)

STATUS OF MILESTONES DUE IN THIS PERIOD

		COMMENTS
Milestone	Title	
M.S.3.1	Functional specifications of the Middleware and identification of the clinical standards	The functional specifications of the middleware and the clinical standards available on the market have been examined against the need of the HEARTFAID project and the goals to be achieved. Moreover, preliminary design models have been proposed for the future development of the HEARTFAID Middleware.

Description of the activities

During the reporting period, according to the Technical Annex of the project, Tasks T3.1 and T3.2 have ended, respectively, at months M10 and M12. The activities of tasks T3.3.1 and T3.4, started at month M6 and M8 respectively, continued during this quarterly.

The main results achieved during the reporting period concern the definition of the functional specifications and the requirements of the middleware, as well as the analysis of the available standards for data representation and communication. This activity was carried out in a strong cooperation between SYNAPSIS, VMW, CNR, FORTHNET and FORTH, and the preliminary results obtained were discussed and consolidated during the General Assembly held in Pisa on 7th-10th November 2006.

The progress of the work carried out during the reporting period is described in more details in the following paragraphs.

T3.1: Middleware requirements and functional specifications
In accordance with the goals of Task T3.1, the activities of identifying and formalising the requirements of the core system that guarantees the interaction and interoperability among the software modules of the entire platform have been finalised.

The document on the user scenarios was further extended and refined and it has been considered the reference document for the identification of the functional specifications of the platform of services.

During regular meetings with CNR held in Pisa, some critical points concerning location, safety and accessibility to data repository/repositories have been further examined and shared with the other technical partners of the work-package. These aspects, which might become critical during the subsequent phases of the project lifetime, and the proposed solutions, have been shared and discussed among the other partners of the Consortium, both technical and medical, during the General Assembly Meeting held in Pisa.

The critical aspects discussed during the General Assembly Meeting and the conclusion derived have been formalised in the Deliverable D11 – "Functional Specifications of the middleware" that was delivered with a slight delay with respect to the foreseen deadline (22nd January instead of 15th January, 2007).

T3.2: Identification of the clinical standards for representation and communication of data
This task was started according to the schedule on September 1, 2006 and ended on January 2007 producing together with T3.1 the milestone MS3.1 "Functional specification of the middleware and identification of the clinical standards".

During the reporting period, the study of the state of the art of the most common standards for clinical data encoding and communication was completed. The standards identified as the most adequate for the purpose of the HEARTFAID project have been described in details in Deliverable D11. In particular, the approaches proposed by the IHE (Integrating the Healthcare Enterprise) initiatives and the HL7 (Health Level 7) organisation have bee selected as suitable reference standards for the objectives of HEARTFAID.

T3.3: Integration Middleware

T3.3.1: Early mock up prototype implementation

This Task, started at month M6, 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).

During the studies carried out so far, the following technologies have been adopted for the development of the Integration Middleware (for the description of these technologies please refer to the 3rd Quarterly report):

- Service Oriented Architectures (SOA).
- Enterprise Service Bus (ESB).
- Open Geospatial Consortium specifications as reference information model for data modelling: the Sensor Mark-up Language (SensorML) to model and encode the Remote Data Acquisition (RDA) networks, and the Observation & Measurements specifications to encode the observations produced by RDA, both using the XML standard language.

These technologies have been implemented for the definition of a preliminary demonstrator able to integrate both real and simulated data acquired from two remote data acquisition networks located at VMWS and CNR sites respectively. The demonstrator was presented at the General Assembly Meeting held in Pisa on November 2006.

T3.4: Interoperability Middleware

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.

The functional specifications and the requirements of the Interoperability Middleware have been defined in accordance with the document on the user scenarios that was validated by the medical partners during this quarterly. The specifications and the requirements have been formally described in Deliverable D11 that will be considered as the reference document for the next phases of this task.

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 4.1	Design and development of a suitable data warehouse for knowledge discovery	Search for historical and publicly available data related to HF. Experiments with available brain stroke data. Ontological definition of the Case report form in the Protégé Frames form.
T 4.2	Data understanding and preparation	Testing the available data transformation and data cleansing methodology on the historical data. Experiments with contrast set mining and descriptive induction methods for insightful data analysis in the brain stroke domain.
T 4.4	Ontologies and medical knowledge representation in the domain	HF ontology set on-line on http://lis.irb.hr/heartfaid/ontology/ and prepared in the OWL form. Experiments with JESS based reasoning directly connected with an experimental database and experiments with the rule part of the knowledge base in the SWRL form. Prepared two publications related to ontologies and their application.

FORECAST STATUS OF TASKS DUE IN THE NEXT 3 MONTHS

TASK	N°	COMMENTS
Design and development of a suitable data warehouse for knowledge discovery	T 4.1	Search for available public domain software for data warehousing. Experiments with available historical data and their transformation into form appropriate for knowledge discovery. Detection of relevant data warehouse tasks from the Case report form and D5.
Data understanding and preparation	T 4.2	Application and verification of noise detection algorithms on historical data. Experiments with data preparation and data understanding on the datasets from UNICZ.
Implementation of knowledge discovery in database process	T 4.3	Application and development of the coexisting factor detection methodology for data understanding, modelling, and decision support. Experiments with contrast sets methodology. Experiments with Kernel based Support Vector Machine algorithms will be started on the datasets from UNICZ.
Ontologies and medical knowledge representation in the domain	T 4.4	Experimental integration of ontologies and decision support system. Presentation of procedural HF related medical knowledge in the form of medical plans. Study of existing systems for medical guideline presentation. Rules representation formats and a list of open source technologies will be evaluated.

Description of the activities

The work on WP4 already includes tasks T4.1, T4.2, and T4.4 in parallel. In the next 3 months the work on T4.3 will start as well.

T4.1. – Design and development of a suitable data warehouse for knowledge discovery

The work concentrated around two main tasks: a) search for available historical and publicly available data and experiments with them and b) study of the platform requirements in respect to data warehousing including development of a formal representation of the data that will be available as input.

In respect to the first part of the task we have identified two data historical datasets, both coming form University of Catanzaro. The first is with 126 HF patients described by 30 attributes in which it is relevant to find models for those having some event. The second is with 175 patients described with many relevant attributes including genetic polymorphisms. *It seems relevant the detection of relations among genetic data and ecocardiographic measurement results*. Both datasets will be extensively studied in the next period, including their transformation into appropriate knowledge discovery tasks. In the meantime experiments have been made with available historical data related to brain stroke. For them the complete data preparation process has been implemented and currently available methodology tested.

In respect to the second part of the task ontological representation of the data has been prepared that will present an input for data warehousing. The ontology has been used to build an experimental database that will be useful for experiments, both in respect of data warehousing and decision support. In the next period the task will concentrate on deliverable D5 and on the definition of relevant data warehouse task trying to identify and experiment with publicly available data warehouse software.

T4.2 – Data understanding and preparation

Historical data describing 300 brain stroke patients each with 26 attributes to test existing data preparation methodology have been used. Data preparation started by detection of potentially noisy examples and was followed by different descriptive induction experiments aimed at human understanding of underlying relations. Novel contrast set mining methodology based on subgroup discovery has been tested. The approach was compared with the known STUCCO algorithm. Comparative set of synonyms between rule learning, subgroup discovery, and contrast set mining has been established. Significant effort has been devoted to the visualization of the result that should be very useful for human understanding. Some of the most interesting results have been prepared for a paper accepted for the PAKDD 2007 conference and another submitted to AIME 2007. In the next period the implementation of the same methodology on the data that will be prepared from databases about historical HF patients collected at UNICZ is planned.

T4.4 – Ontologies and medical knowledge representation in the domain

The HF ontology has been continuously upgraded. The latest version has been transformed into the html form and set on-line on the local HEARTFAID server (http://lis.irb.hr/heartfaid/ontology/) for inspection and comments by other project members. The advantages of dividing it into several sub-ontologies (SO) have been analysed in order to improve the performances and to reduce the complexity of the management. Main SO would represent the main application scenarios: diagnosis, prognosis, therapy and early detection decompensation.

Different levels, from general to specific concepts, would improve the
quality of the ontology. A further improvement would be the introduction of typed
information in order to improve rules and to foster uncertainty reasoning.
Also, the ontology has been transformed into the OWL form in order to enable
experiments on connecting the ontology with the SWRL form of rules and Pellet
reasoner. Much more flexible seem JESS type rules but JESS reasoner is a
commercial product. JESS has been connected directly with an experimental
database simulating the platform environment in order to test this option. Most
significant results in respect to ontology construction and ontology based
reasoning were prepared as two scientific papers have been submitted to a local
Croatian information technology conferences.

In the next period WP4 plans experimental integration of ontologies and a
decision support system by transformation of relevant database data into
ontological factual knowledge. In parallel we will try to define the semi-formal
form of plans for presentation of operational knowledge. This form could then
serve to present operational HF knowledge that will be transformed into a form
appropriate for the platform decision making. The study of existing systems for
medical guideline presentation will be continued as possible knowledge
representation forms.

Ongoing workpackages progress: WP5

WORK PACKAGE: 5
TITLE: DATA PROCESSING AND DECISION SUPPORT DEVICES
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 5.1	Identification of representation features for signals and images processing	Preparation of the deliverable D15. Critical analysis of the characteristics of the devices useful for data acquisition. Improvement of the analysis of the representation features for the signals and images.
T 5.3	Requirements and functional specifications of the Decision Support System	Comprehensive definition of the HF CDSS requirements has been debated. The functional specifications, which the DSS should supply to fulfil the requirements, have been detailed also according to the suitable design methodologies. HF CDSS success factors have been deeply investigated. A logical-functional HF CDSS architecture (core components and interrelations with the other HF platform modules) has been defined. Preparation and drafting of the deliverable D15.

STATUS OF DELIVERABLES DUE IN THIS PERIOD

		DATE	COMMENTS
DELIVERABLE	N°		
Functional Specifications of Data Processing and Decision Support Services	D 15	31/01/07	The functional specifications of data processing and decision support services have been defined and they are reported into deliverable D15, which will be submitted at the end of this reporting period.

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		In the next three months, FORTH (and till the end of T 5.2) will almost complete the design of algorithms for ECG filtering and QRS detection and start studying the algorithms for QRS classification. CNR will carry on the implementation and testing activities on LV segmentation in echocardiographic image sequences (apical 2C/4C, short axis mid-papillary); the quantification of chamber size and shape; segmental wall motion and thicknening analysis.
Implementation of the Decision Support System	T 5.4		After the delivery of D15, the aspects related to the HF CDSS will be detailed, giving specific attention to telemonitoring and the user's interface

Description of the activities

T5.1 – Identification of representation features for signals and images processing

The state of the art for the representation and characterisation of features extracted from signals and images has been analysed, both in general and in the specific cardiovascular field under investigation.

In these three months of activity, FORTH has been involved in the analysis of the representation features for the signals acquired by the medical sensors (non-imaging devices) identified in WP2 and WP1. For each type of medical sensor candidate to be used in the HEARTFAID platform, the relevant features (parameters) were identified. Still a complete evaluation of the capability of such sensors to transfer information (in a structured format or as raw data) to the HEARTFAID platform is not available, but an inventory of all devices theoretically suitable for the HEARTFAID project and present in the validation sites has been done in all validation sites. This inventory should clarify the level of integrability of each device in the HEARTFAID platform. This task related to WP2 in some way has delayed the identification of the signal processing suitable for the medical devices and convinced to identify some multipurpose basic algorithms like QRS detection in ECG and QRS classification in ECG that are basic for any further processing applied to the ECG. The work on QRS detection has been already started in MATLAB and at the same time a significant contribution has been provided for deliverable D15.

Regarding imaging features, the activity concentrated on identifying (i) image processing tools, useful in routine clinical environment; (ii) *innovative representing features*, promising to extend heart failure domain knowledge.

In relation to the first point, classical cardiac parameters which are more prone to intra- and inter- observer variability have been identified. In this direction, we have developed an algorithm for left ventricle end-systolic and end-diastolic volume quantification in ultrasound images. During the last months, a testing activity has been started on left ventricle segmentation from echocardiographic image sequences (4 and 2 chambers apical views and short axis mid-papillary).

In relation to the second point, tools for the analysis and fast visualization of segmental timing mechanics have been developed and tested. They may be useful in the assessment of cardiac dyssynchrony in heart failure patient and to foresee the outcome of cardiac resynchronization therapy. Innovative representing features extracted by this kind of analysis could constitute an input data for the HF CDSS, allowing for left ventricle deformation pattern categorization.

As a further topic we planned to address the problem of detection, treatment and interpolation of ectopic beats to achieve accurate estimations of heart rate variability (HRV).

T5.3 – Requirements and functional specification of the Decision Support System

The HF CDSS requirements have been discussed and agreed in accordance with (i) the medical-clinical requirements and the relevant decision making problems formulated in the D5; (ii) the users' scenarios; (iii) the project and design requisites that have been agreed among partners (e.g., standard implementation, robustness, portability,…). The HF CDSS should be designed to face four main application scenarios, namely heart failure diagnosis, prognosis, therapy and early detection of patient's decompensation. For each of them, more detailed problems,

as stated in the deliverable D5, have been translated into requirements of the system. Plus, important success factors of the HF CDSS have been highlighted: completeness on important issues, and ability to show and let the users explore the whole space of possibilities; representation aiding; capability of explaining the suggested decisions; adaptability to changes, also in accordance with the end-users applications, and ability to check the correctness and consistency of the knowledge base; capability of dealing with uncertainty. Other important system features related to the system implementation have been affirmed, e.g., robustness, computational optimization, portability, open-source, and so on. The important question of system proactivity vs. reactivity has been considered and the accomplishment of both features has been evaluated.

Starting from the requirements, the functionalities that HF CDSS should provide have been specified, and, as a result, a logical architecture of the system has been designed. The core components have been identified as:

- the knowledge base, consisting in
  - the ontology – organized in separate parts and at different levels, according to the specific aspects to face, i.e. a general descriptive ontology, a diagnosis ontology, a prognosis ontology, a treatment ontology, a measurements ontology,…;
  - the inferencing rules – extracted from the guidelines, deliverable D5, and from the knowledge conceptualization process;
- the model base – containing all the *computational* decision models, included the ones extracted from the KDD processes;
- a local database – containing all the instances the DSS needs to work with;
- the *Brain* – the intelligent part of the system, which includes the inference engine and is able to manage and support the high level decision requests exploiting the knowledge and model bases.

Guidelines for the implementation the HF CDSS and its interactions with the other components of the HF platform have been defined.

All the above mentioned issues have been discussed and detailed in the deliverable D15.

A meeting has been held between CNR and SYNAPSIS in order to define the functional specifications and integration of the decision support tools.

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 6.1	Design end-User Services Interaction Functionalities	The activities of Task 6.1 started at M10 and will be completed at M16, inline with the Gantt Chart of the project. The goal of this Task is to design a set of high level services necessary for the users to interact with the HeartFAID platform and its functionalities, namely, the clinical decision support system, the knowledge base and the patient data, in a user-oriented and user-friendly fashion. Furthermore, the requirements for the integration of the developed services are also included in this Task.
T 6.3	Knowledge discovery system for web-based data extraction and analysis	The activities of Task 6.3 started at M10 and will be completed at M22. This Task refers to the development and provision of an on-line platform that supports the analysis of the available data, using suitable tools in order to implement processes for knowledge discovery in the databases of the HeartFAID platform. These tools will also provide the final users (expert users only) with the possibility of performing statistical analysis and implementing complete processes using a range of both traditional and innovative data-mining algorithms.

FORECAST STATUS OF TASKS DUE IN THE NEXT 3 MONTHS

TASK	N°	COMMENTS
Design end-User Services Interaction Functionalities	T 6.1	Task 6.1 will end on Month 16, where the Front-End of the HeartFAID platform shall be available for the end-users, as soon as all the functionalities and services that will be provided through the Front-End will have been identified and developed. Different access levels will be included, according to users' attributes, in order to access the various proposed functionalities.
Knowledge discovery system for web-based data extraction and analysis	T 6.3	Task 6.3 will end on Month 22, according to the Gantt chart of the project. Contrast set mining experiments will take place in the following months.

Description of the activities

According to the Technical Annex of the project, both Tasks T6.1 and T6.3 started on month M10.

In general, the "End User Application and Services" work package is characterized by implementation-oriented activities and customization of advanced and well established technologies. Risk issues are considered an important aspect of this WP and are basically related to the proper definition of end-user requirements and the development of effective and user-friendly interfaces and functionalities.

T6.1: Design of End-User services Interaction Functionalities.

The "end-user" level constitutes the front-end layer of the HeartFAID platform and provides the means for every interaction between external users and the system. In particular, the main goal of the Task is to design and implement an interface, with the dual purpose of facilitating access to the functionalities of the platform, as well as managing the know-how that is formalized in the platform's database.

The Decision Support System (DSS) is an important and complex part of the platform, aiming at providing a certain level of intelligence, with the use of a specifically designed inference engine. This engine is intended to combine the know-how, coded in the knowledge base, as well as the actual data of the patient, in order to provide end-users with feasible and reliable decision support. Furthermore, a set of specific services are also needed, in order to manage the knowledge base of the platform, since it encodes the know-how of the domain that is changing continuously.

The HeartFAID middleware platform supports a multitude of functions to assist data entry and retrieval, and intelligent deduction. It is evident that for these functions to be adequately exploited, an intuitive, inclusive and stable UI should be developed. Up to M12, most of the important functionalities of the middleware, as well as the respective Front-End interfaces, have been identified. The development of the Front-End has already started, but there are still significant changes and updates that have to take place within the next months. It is also intended to receive feedback from the other partners, including comments and ideas, regarding additional functionalities or other interface/interaction-related issues for the Front-End of the platform.

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

Identification of appropriate knowledge discovery tools has been the central task in the previous period. A few and preliminary experiments have already taken place with existing methodology for subgroup discovery (see Task T4.2). In particular, this methodology is currently under evaluation, in order to define and provide a first set of tools suitable for implementing the type of services which will be developed within the present task.

EU STREP – Specific Targeted Research or Innovation Project

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	Specific contribution from: ♦ UNICAL ♦ UNICZ ♦ UNIMIB ♦ JUMC ♦ FORTHNET ♦ CNR ♦ FORTH ♦ RBI ♦ AUXOL

STATUS OF DELIVERABLES DUE IN THIS PERIOD

		DATE	COMMENTS
DELIVERABLE	**N°**		
First Report on Dissemination activities	D16	31/01/07	The overall Dissemination activities carried out during the first reporting period have been detailed, and they are reported into deliverable D16, which will be submitted at the end of this reporting period.

FORECAST STATUS OF TASKS DUE IN THE NEXT 3 MONTHS

TASK	N°		COMMENTS
Dissemination activities	T 8.1		Specific initiatives have been planned, specifically related to the dissemination of the Heartfaid activities to some health care professional associations.

Description of the activities

During the last quarter of the first year of project activities, the dissemination activities have been carried out according to the general plans defined in the Deliverable D6.

In particular, each partner has further improved its own internal dissemination activities, by increasing the awareness of Heartfaid activities and current results within its own institution.

More specifically, UNICAL and UNICZ have started to prepare an agreement with the Regional Administrative responsible of the Calabria's High Schools, in order to promote and organize initiatives addressed to the dissemination of the Heartfaid results to the High School students.

Moreover, the same partners have established contacts with the following health care professional associations with the aim to keep informed about the Heartfaid activities:

- ◆ ANMCO (Italian Association of Hospital Cardiologists)
- ◆ SIC (Italian Society of Cardiology)
- ◆ SIMI (Italian Society of Internal Medicine).

As far as clustering activities are concerned, evaluation of possible co-operation with other projects and programmes will be carried out during the next Personal Health Systems (12 and 13 February 2007) event in Brussels

Finally the abstract of a scientific paper, prepared by UNICZ, UNIMB, JUMC, AUXOL and UNICAL, has been submitted for possible presentation at the next "Heart Failure 2007", the international congress on HF, which will be held in Hamburg (Germany), the next June 2007.
Other two papers have been submitted by RBI to PAKDD 2007 and AIME 2007 events.

ACTIVITY	Partner Responsible	DATE/PLACE	COMMENTS
Paper Publication	FORTH	On-line: IEEE Transactions on Biomedical Engineering	Web-link: http://ieeexplore.ieee.org/iel5/10/26767/101109TBME2007890741.pdf?tp=&arnumber=101109TBME2007890741&isnumber=26767
On-line publication	CNR	On-line 18/11/2006	http://www.ilcittadinooggi.it/L5.cfm?Id=2071
Abstract submission	UNICZ/UNIMB/JUMC /AUXOL/UNICAL	15 January 2007	Submission to HEART FAILURE 2007
Paper submission	RBI		PAKDD 2007 AIME 2007
Personal health Systems event	UNICAL/FORTHNET/ FORTH	Brussels, 12/13 February 2007	Dissemination and Networking activities