A Demonstration of 4D Digital Avatar Infrastructure for Access of Complete Patient Information

Project acronym: MyHealthAvatar

Deliverable No. 1.1
Interim Management Report 1

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PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
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ABSTRACT:
This deliverable reports the progress of the project within its first 6 months. The report is organised according to its progress within the 11 work packages.

KEYWORD LIST:
Management, RTD, dissemination, exploitation

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[1] **R**=Report, **P**=Prototype, **D**=Demonstrator, **O**=Other

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1 Executive Summary

This document reports the progress of the project within its first 6 months. The report is organised according to its progress within the 11 work packages.

WP1 Project management

- A detailed administrative management framework has been built.
- The project is placed under constant monitoring of its progress.
- Pre-finance has been distributed.
- Two major meetings have been held and another one is planned in the next month.
- SAP members have been recruited.

WP2 User needs

- User surveys have been done.
- Use cases/scenarios have been collected.

WP3 Architecture and integration

- Architecture Definition Board (ADB) has been formed.
- Intensive discussion on the architecture is held between the ADB members.
- There are delays in identifying user requirement on the system architectures.

WP4 Semantic interoperability

- User requirements on semantics have been identified.

WP5 Models & repositories

- Start to work on the user requirements of model repository.

WP6 Data & repositories

- Synthetic data are created
- An initial data repository is created and is accessible at http://myhealthavatar.ccgv.org.uk/mha/

WP7 Use cases

- We have started to work on final use cases based on the initial collection from WP2.

WP8 Avatar centred visual analytics

- An initial model of the avatar has been built, which is accessible at http://myhealthavatar.ccgv.org.uk/mha/

WP9 Demonstration and evaluation

- We started to consider demonstration in parallel with the decision on the use cases.

WP10 Dissemination and exploitation

- Project website has been built at http://www.myhealthavatar.eu/
- Project has been invited to be presented in many occasions.
- The story of the project has been published in press.

WP11 Ethical and IPR

- An initial legal guidance of the project has been circulated among the consortium.

- Introduction

Owing to the highly fragmented health systems in European countries, gaining access to a consistent record of individual citizens that involves cross-border activities is very difficult. MyHealthAvatar is an attempt at a proof of concept for the digital representation of patient health status. It is designed as a lifetime companion for individual citizens that will facilitate the collection of, and access to, long-term health-status information. This will be extremely valuable for clinical decisions and offer a promising approach to acquire population data to support clinical research, leading to strengthened multidisciplinary research excellence in supporting innovative medical care.

MyHealthAvatar will be built on the latest ICT technology with an aim of engaging public interest to achieve its targeted outcomes. In addition to data access, it is also an interface to access integrative models and analysis tools, utilizing resources already created by the VPH community. Overall, it will contribute to individualized disease prediction and prevention and support healthy lifestyles and independent living. It is expected to exert a major influence on the reshaping of future healthcare in the handling of increased life expectancy and the ageing population in Europe. This complies with the priority and strategy of FP7 ICT for healthcare, and constitutes a preparatory action aiming at the grand challenge on a "Digital Patient", which is currently the subject of a roadmap in the VPH community.[3]

1.1 Project background

The MyHealthAvatar project will focus on research and demonstration actions, through which the achievability of an innovative representation of the health status of citizens, named 4D MyHealthAvatar, will be explored. The 4D Avatar is anticipated as an interface that will allow data access, collection, sharing and analysis by utilizing modern ICT technology. It is expected to become the citizen's lifelong companion, providing long-term and consistent health status information of the individual citizen along a timeline representing the citizen's life, starting from birth. Data sharing will be encouraged, which will potentially provide to an extensive collection of population data to offer extremely valuable support to clinical research. The avatar will be equipped with a toolbox to facilitate clinical data analysis and knowledge discovery.

MyHealthAvatar can be described as a personal bag carried by individual citizens throughout their lifetime. It is a companion that will continually follow the citizen and will empower them to look after their own health records. This fits very well into the recent trend of developing patient-centred healthcare systems.

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[3] MyHealthAvatar project, Description of Work (DoW) document.

2 Work in Progress

This chapter will describe the work progress according to the work packages.

2.1 WP1 Project Management

The objectives of this WP are:

- to ensure that the project attains its goals effectively: on time, to the specifications contained within the contract, and within the budget defined
- to ensure timely submission of all contractual deliverables
- to organise project meetings
- to elaborate and enforce quality procedures

A Project Management Office (PMO) has been established at BED who will monitor the project throughout its duration and be responsible for all non-research activities.

2.1.1 T1.1 Administrative and Financial Management: PM1=>PM36 (Task Leader: BED)

The PMO continuously monitors project activities in relation to the contractual work plan. The PMO will maintain the project Gantt chart, the risk analysis tool and other instruments that are necessary to ensure this level of monitoring, and update them, as required. The project status is constantly reviewed at meetings of the Steering Committee (SC). The SC will also be concerned with quality management.

The PMO has established a detailed administrative management framework, in conjunction with other partners; this includes templates for reports, deliverables, etc. Redmine has been selected as the management software to conduct consortium management.

Notably, pre-finance has been distributed to all the partners according to the proportion of their budgets.

2.1.2 T1.2 Consortium Management: PM1 => PM36 (Task Leader: BED)

Descriptions of the procedures to be followed for reporting, dissemination have been provided and all partners have gained a common perspective and develop a common practice.

All these activities are coordinated by a project management software called Redmine, which is currently available at BED. Redmine is a flexible project management web application to allow multiple projects support, flexible role based access control, flexible issue tracking system, Gantt chart and calendar, news, documents & files management, feeds & email notifications, per project wiki, per project forums, time tracking.

By using Redmine, all the project tasks are recorded in Gantt Chart and are assigned to individuals. These tasks are subsequently tracked and watched by all the other partners. All the updates of the issues are closely monitored by the relevant partners by using automatic email notification and by using the project Gantt Chart. Other features such as document repository, news announcement, wiki page are also used to ensure the consistent communication within the consortium and make

sure everybody stays on the same page. By doing so, the individual tasks of the project fit well into the overall picture of the project.

Consortium management includes the organisation of consortium meetings, including preparation of agendas, meeting chair, elaboration of meeting minutes, etc. So far two meetings have been held:

- Kick off meeting, 27-28th March, 2013, Windsor, UK
- Technical Meeting, 1st – 2nd August, 2013, Crete, Greece

In addition, the second global meeting has been planned on 12th September at Budapest, Hungary.

A document repository has been built at Redmine, which contains all the templates for project deliverables, presentations etc.

We have also successfully recruited members for specialist advisory panels (SAP). This activity continues in order to receive specialist advices from a wide range of perspectives.

We have also started to organise focus groups within the consortium in order to tackle different issues within the project. An Architecture Definition Board is currently formed between BED, FORTH and ICCS.

Relevant deliverables

D1.1) Interim management report I: [month 6] – submitted on time

D1.2) Periodic report I: [month 12]

D1.3) Interim management report II: [month 18]

D1.4) Periodic report II: [month 24]

D1.5) Interim management report III: [month 30]

D1.6) Periodic report III: [month 36]

Relevant milestones

MS011 Kick off meeting - achieved.

2.2   WP2 User needs (1-9)

WP2 elaborates on the user needs and requirements for the proposed technological and clinical research infrastructure to develop the 4D Digital Avatar. The specific objectives include:

- Understand the state of the art
- Understand the user requirements
- Investigate the linkages to external sources

2.2.1   T2.1: State of the art review: PM1=>PM9 (Task Leader: USAAR)

We have started a review of existing frameworks, their interoperability and re-usage. It will provide the clinical perspective of the project and will take into account the state of the art, the state of research and the state of practice in the healthcare domains addressed by reviewing current infrastructure systems, tools and software for the seamless integration of clinical care and basic research data, clinical trial guidelines, repositories of clinical, bio-molecular, and medication information, etc. under a legal and ethical framework that are able to be linked to a digital Avatar.

2.2.2 T2.2: User needs and requirements: PM1=>PM6 (Task Leader: USAAR)

The main topic that has been in details investigated and described is the scenario based end-user's needs and requirements applicable for:

- citizens to accept the 'Avatar' from MyHealthAvatar (MHA) platform
- clinicians to show the benefits of such an Avatar in routine clinical practice
- IT people to develop the 4D Avatar and the legal and ethical environment
- basic researchers to strengthen VPH research

The techniques used during the end-user's needs and requirements elicitation phase of the project included small and large scale **Surveys**, questionnaires, meetings, interviews, stakeholder focus groups, previous experience, and the results from other research projects. Of special focus and interest were the elaboration of the detailed and comprehensive **Scenarios / Use Cases**, the related activities here have been implemented in a robust linkage of the end users with developers. The complexity of the domain, which is addressed by the project required that a spiral process of requirements analysis, elicitation, documentation and validation to be adopted. Specific techniques have also been selected for the elicitation, negotiation and agreement of requirements as well as their validation. These techniques are Scenarios combined with Use Cases and prototyping (prototyping activities are expected for latter stages). The related deliverable (D2.2) that describes the use case collection and the survey will be submitted on time.

2.2.3 T2.3: User requirements and specifications for the linkage to external sources such as social networks and for the collaboration with other existing research projects: PM1=>PM9 (Task Leader: FORTH)

Special care needs to be taken in order to ensure that progress and achievements from previous and running EU funded projects will be incorporated if possible. The VPH Toolkit and possible interactions with the P-Medicine environment and other research infrastructure projects and European networks is currently being addressed in this task. User needs and requirements for the linkage to social networks is analysed and respective networks is contacted and possible interactions defined and established.

Relevant deliverables

D2.1) State of the art review related to the MyHealthAvatar environment: [month 9] – to be submitted on time.

D2.2) Scenario based user needs and requirements: [month 6] – submitted on time.

D2.3) Specification of the linkage to external sources and research projects: [month 9] – to be submitted on time.

Relevant milestones

MS021 Scenario based user needs and requirements - achieved

2.3 WP3 Architecture and Integration (2-36)

The objective of this work package is to
- define the system's architecture and monitor its realization in the course of the project

- provide methodology for the integration with external sources such as hospital records, existing data and model warehouse, social network
- provide standards, guidelines and techniques in order to achieve the system integration
- investigate techniques to build a local cloud infrastructure to support data processing by utilizing resources within individual institutions.
- present a market review of open source APIs for MyHealthAvatar

2.3.1 T3.1 User requirement analysis :PM2=>PM4(Task Leader: FORTH)

This task reviews existing and emerging standards that are pertinent to the definition and building of the project's technological platform. The aim of this work is to feed the subsequent tasks and the building of the system by providing a range of important technologies, standards, etc with their evaluation as enabling blocks of the MyHealthAvatar's architecture.

2.3.2 T3.2 Architecture definition and design: PM2=>PM6(Task Leader: FORTH)

This task provides the architecture's blueprint and will continually monitor its implementation, with emphasis put, on the one hand, on the adherence to the standards and the technologies chosen, and on the objectives of the system.

2.3.3 T3.3 Architecture platform build, maintenance and security: PM2=>PM36(Task Leader: FORTH)

This task builds and maintains the structure of the architecture platform by investigating a number of key issues in infrastructure, resource management, data access and federation, computing resource. It will deal with all the security aspects of the technological platform, ranging from user authentication, authorization, and auditing, to data integrity and privacy, to pseudo anonymization and re identification of patient data.

Notably, T3.1 to T3.3, especially T3.1 has turned out to take longer time than the previous expectation. This is mainly because of two contradicting requirements of the project. Firstly, the nature of MyHealthAvatar implies that the avatar system needs to cover a wide range of all health aspects, and hence the architecture needs to support a very broad scope of use scenarios and use cases over **lifetime durations** of the users. Secondly, the project will need to provide specific demos within the **limited project duration**. Consequently, WP2 has carried out a survey and collected a very wide collection of use cases and scenarios, which will need to be further tuned and finalised in the next stage of the project. This influences T3.1 on the user requirement analysis of the system architecture and hence causes the delay of D3.1 and D3.2. This is currently under urgent discussion within the consortium, especially within the architecture definition board that is formed by the key technical partners FORTH, BED and ICCS in WP4,5,6,8. However, we are confident that a solution will soon be provided.

2.3.4 T3.4 Methodologies to support link with external data sources: PM2=>PM33(Task Leader: FORTH)

This task considers the architecture to support the link of the 4D avatar with the external sources as an interface to extract data and information. These will include

1) Social network.

2) External data warehouse.

3) Hospital records. This lookss into the feasibility of the links to the hospital systems to allow the exportation of the health related data of the patients from the linked hospital systems.

2.3.5 T3.5 Investigation of local cloud PM7=>PM18 (Task Leader: BED)

The main approach is to provide a privately-deployed cloud infrastructure which can cater to the security issues in biomedical research as well as maintain the ability to outsource the infrastructure to commercial cloud computing facilities. BED has already started some investigation on this task.

2.3.6 T3.6 Market review of open source APIs for MyHealthAvatar PM19=>PM24 (Task Leader: BED)

This task will investigate the proof of market of having open source APIs for the MyHealthAvatar. This is not started yet.

2.3.7 T3.7 Platform integration. PM13=>PM33 (Task Leader: FORTH)

This task addresses the integration of tools and services that support the 4D digital avatar. This is not started yet.

Relevant deliverables

D3.1) User requirements: [month 4] – delayed

D3.2) Architecture design: [month 6] – to be delayed

D3.3) Security measures and guidelines: [month 33]

D3.4) Technical report on the links with external data resources: [month 33]

D3.5) Report on local cloud infrastructure: [month 18]

D3.6) Report on the review of open source APIs for MHA: [month 24]

D3.7) Integrated platform with an evaluation report: [month 33]

Relevant milestones

MS031 First deployment of the architecture platform: to be achieved

MS032 Simulated database to experiment links with hospitals

MS033 Deployment of a local cloud

MS034 Web interface for toolbox

2.4 WP4 Semantic interoperability (2-33)

The objective of WP4 is to establish and formally specify the semantics-based conceptual substrate of the overall information system. More specifically the objectives of this work package are the following:

- Specification of a core Ontology describing multi-scale medical data, social activity and models.
- Specification of a mapping formalism to allow data extraction and integration.
- Specification of the algorithms & methodology for data and query translation.
- Ontology summarization and evolution
- Semantic Reasoning for Decision Supports

2.4.1   T4.1: Semantic Core Ontology PM2=>PM24(Task Leader FORTH)

In this task, we extract for each domain of focus a well defined set of domain concepts that sufficiently describe the semantics of a) the chosen clinical domain; b) the social activity of the users and that c) will allow the semantic enrichment of the models.

2.4.2   T4.2: Mapping formalism PM2=>PM24(Task Leader FORTH)

In this task, we intend to identify the requirements for mappings that bridge the Semantic Core Ontology with the information models representing the external information sources.

2.4.3   T4.3: Semantic Integration Methodology PM2=>PM24(Task Leader FORTH)

This task takes as input the mapping format and methodology established in task T4.2 and will define the necessary algorithms for data translation or query rewriting. These algorithms and the proof-of-concept modules will be implemented.

Led by FORTH, we have started to investigate the above tasks. A user requirement analysis (D4.1) has been submitted with some delays. The delay was caused by the fact that it takes longer time to analyse the user requirement of the 4D avatar system due to its more complex nature.

2.4.4   T4.4: Ontology Evolution and Semantic Summarization PM13=>PM33(Task Leader FORTH)

This task will produce semantic summaries that will constitute such adequate representations and will include anchors to complete ontological descriptions. This task has not started yet.

2.4.5   T4.5: Semantic Reasoning for Decision Support PM13=>PM33(Task Leader FORTH)

The task will produce the reasoning mechanisms that will enable semantic-based decision support. This task has not started yet.

Relevant deliverables

D4.1) Requirements analysis for semantic core ontology: [month 4] – submitted with delay

D4.2) Extension of the semantic core ontology: [month 24]

D4.3) Technical evaluation report of ontology including ontology evolution and summarization: [month 33]

D4.4) Semantic reasoning utilities for decision support: [month 33]

Relevant milestones

MS041 Initial proposal for the semantic core ontology - expected to achieve at month 8.

MS042 Definition of the mapping formalism

MS043 Query rewriting and data translation

MS044 Ontology evolution & summarization (Initial version & evaluation)

MS045 Semantic reasoning utilities for decision support (initial version)

2.5   WP5 Models and repositories (3-36)

This work package focuses on the development of clinical oriented repositories that will cover the needs of the MyHealthAvatar project. This involves the development of:

- a repository of models of special biomechanics and tumour growth and response to treatment including the dynamics of specific affected and/or critical organs.
- a data repository of multiscale data exploitable by the models. The aforementioned repositories will be tailored to the needs of the project. At the same time they will be generic enough to be usable by several different medical scenarios.

2.5.1   T5.1 Development of the models repository: PM3=>PM36 (Task Leader: ICCS)

The MyHealthAvatar models repository will be built based on the experience already accumulated during the implementation of the Tumor (Transatlantic TUmour MOdel Repositories) project.

2.5.2   T5.2 A data repository for models: PM3=>PM36 (Task Leader: ICCS)

A data repository will be built to support the model repository based on the experience already accumulated during the implementation of other data repositories such as the ones developed within the framework of p-Medicine and ContraCancrum.

2.5.3   T5.3 Integration with the security framework: PM7=>PM36 (Task Leader: ICCS)

In order to ensure that only authorized persons have access to the content of the data and the models repositories, appropriate authentication and authorisation mechanisms will be implemented, according to the directives of WP3. This task has not started yet.

The project members at ICCS are working closely with FORTH and BED for the definition and the system architecture to ensure the integrity of the system.

Relevant deliverables

D5.1) Model and clinical data repositories design: [month 12]

D5.2) Model and clinical data repositories interfaces & evaluation report: [month 36]

Relevant milestones

MS051 Model and clinical data repository schema

MS052 Web services for the model and the clinical data repositories

MS053 Security of the model and the clinical data repositories

MS054 Final integration of the model and the clinical data repositories

2.6   WP6 Data and repositories (2-36)

The main objectives in WP6 are:

- to develop data collection utilities for support data contribution from users with minimal input
- to build a data repository to store health related data of individual citizens collected from the web and mobile apps.
- to experiment the Linked Data approach to facilitate the flourish and reuse of data, including data search and reasoning.

2.6.1   T6.1 Data collection utilities PM2=>PM12 (Task Leader: BED)

This task will investigate a number of data collection utilities which will collect information of individual patients without requiring a major effort from the patients themselves. This includes information extraction from social network, which falls in the category of information extraction;

Mobile apps with wearable sensors will also be developed by ANS to support the collection of health data such as blood pressure, body temperature, etc. and a unified user friendly web portal (e.g. in a style of web forum) will be built as part of the integrated system for users to input these data, and the same interface will also be used for users to manage the data and also used as a forum.

BED and ANS are currently working together to investigate the state of the art of data collection technologies and to make a plan of utilising and developing data collection utilities for the project.

2.6.2   T6.2 Data collection from online patient diary PM13=>PM33 (Task Leader: BED)

This task will collect data from online patient diary using the utilities provided by T6.1. This task has not started yet, but we have started preparation (e.g. legal clearance) to get participants of the MyHealthAvtar system.

2.6.3   T6.3 Data repository for health information PM7=>PM36 (Task Leader: BED)

This task builds a data repository to hold health related information of individual citizens collected from T6.3, including their environmental data(life style, diet, geography environment, etc.), activities, family histories and other risk factors, which may hold the key to the development and treatment to a lot of disease and thus highly valuable to the clinics.

This project considers user avatars at the scale of big data, so the work on data repository has been focusing on investigation of NoSQL rather than traditional RDBMS.

There are a number of NoSQL implementations on the market, among which three popular ones are selected for initial testing. All tests were set up at the minimal level and performed on a single machine.

Our development is mainly based on Java. The Cassandra Java client library Astyanax[4] is used for writing and reading with Cassandra data store.

Cassandra[5] is a key-value store, where data are stored in KeySpaces. One KeySpace can match to multiple Column Families, each Column Family may have multiple columns and each record is referenced by its row key. Once a data store is set up, the KeySpace and the Column Families are typically fixed, but the columns can be added into the column list any time. Cassandra supports RowKey based query, All Row query and range query.

Cassandra is compatible with Hadoop and can run MapReduce. The typical combination with Hive is normally considered for real-time data analysis.

Cassandra has been used widely (http://en.wikipedia.org/wiki/Apache_Cassandra) and been considered with good performance, availability and scalability.

A set of Java applications is implemented, which generate web users and import synthetic avatars. We are still working on collecting and importing data. We have around 1 million synthetic avatars at

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[4] https://github.com/Netflix/astyanax/
[5] http://cassandra.apache.org/

the moment. We start with importing a small number of avatars and will look into import the whole data file into Cassandra later.

100 Web user accounts are generated according to the synthetic data (e.g. the user id and the gender). The usernames are "demo" followed by an id (e.g. demo1, demo2 ~ demo100). All user accounts use the same password "demo".

In the current implementation, we can import the following data:

- Gender
- Ethnicity
- Qualification
- Medical conditions
- Symptoms
- Treatments
- Diary: activity, physical, mental, social, infection and dysplasia

A demo is now deployed on the server at http://myhealthavatar.ccgv.org.uk/mha/, which combines 3D avatar visualisation and data management.
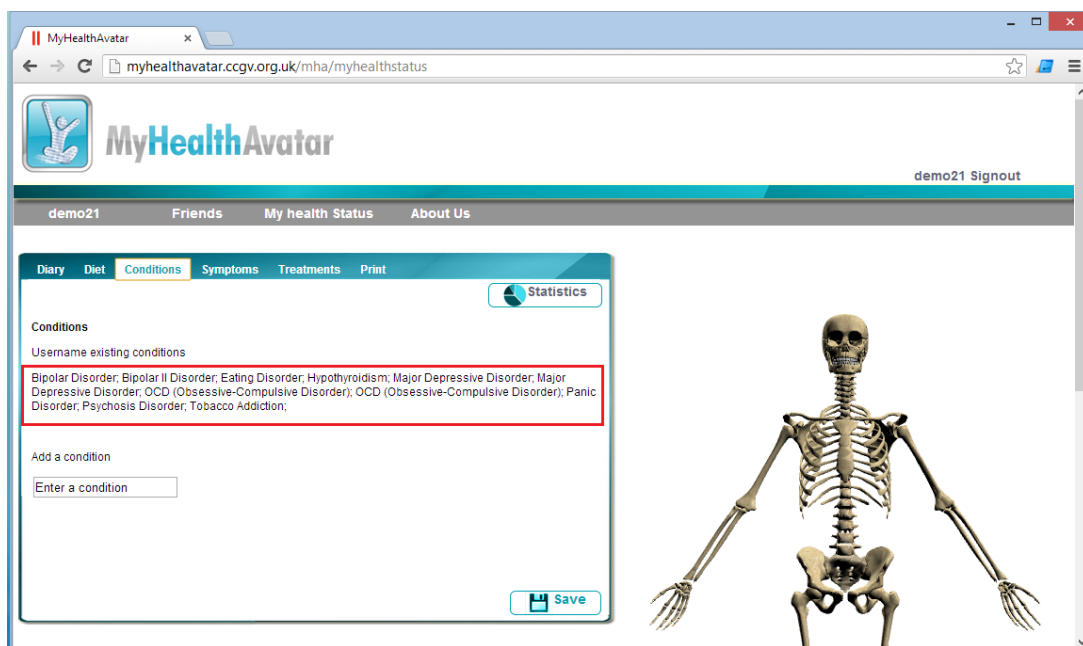

Figure 1. A snapshot of showing existing user conditions.

2.6.4 T6.4 RDF data repository PM7=>PM36 (Task Leader: BED)

In this task we will build a semantic data repository based on the Linked Data approach. The existences of the links will help the data searching and processing. The data will be annotated using ontology defined in WP 4. This task is currently under investigation and some initial work has been done by BED.

2.6.5   T6.5 Data reasoning PM7=>PM33 (Task Leader: BED)

This task deals with data reasoning based on the linked data in the RDF data repository. This task has not started yet.

2.6.6   T6.6 Integration with the security framework (PM7-PM36) (Task Leader: BED)

In order to ensure that only authorized persons have access to the content of the data and repositories, appropriate authentication and authorisation mechanisms will be implemented, according to the directives of WP3. This task has not started yet.

2.6.7   T6.7 Collection of multiscale datasets PM3=>PM24(Task Leader: FORTH)

A small but adequate for experimentation number of full scale and comprehensive datasets (images) will be collected, which will cover a range of cancer diseases, such as lung cancer, rectal cancer, endometrial and cervical cancer, etc. We will also look into the possibility of collecting perfusion imaging (T2*/T1) of brain gliomas, as well as the value of diffusion MR imaging in histological classification of soft tissue sarcomas.

We will also carry out genomic analysis of the above patients based both on blood by completing genotyping snp6 (1 million snps) for predisposition and working on targeted genotyping for predisposition re drug metabolism, and on tissues by generating gene expression profiling- afymetrix and cancer molecular mutation profiling.

There have been positive discussions between FORTH and their local clinical collaborators regarding the data collection.

Relevant deliverables

D6.1) A set of data collection utilities & evaluation report: [month 12]

D6.2) Design for data and RDF repositories: [month 12]

D6.3) Data & RDF repository & evaluation report: [month 36]

D6.4) Data reasoning utilities for decision support & evaluation report: [month 33]

D6.5) Initial report on data collection methods and plans: [month 9] – to be submitted on time.

D6.6) Final comprehensive datasets: [month 18]

Relevant milestones

MS061 Initial collection of data – to be achieved at month 9.

MS062 data & RDF repository schema

MS063 Data reasoning utilities for decision support(initial version)

MS064 Web services for data & RDF repositories

MS065 Security of the data repository

MS066 Final integration of the data repository

2.7   WP7 Use cases (Scenarios) (10-18)

The objective of this WP is to build scenarios and use cases based on the user needs identified in WP2

2.7.1 T7.1: Scenarios and use cases for MyHealthAvatar: PM10=>PM18 (Task Leader: USAAR)

This task will describe scenarios and use cases that are relevant for MyHealthAvatar. As scenarios are based on the results of WP2, this task starts at month 10 after the finalization of WP2. According to the different stakeholders (citizens, clinicians, basic researchers and IT people) scenarios and use cases will be provided for each of them.

The project has carried out analysis of detailed end-user requirements and needs by collecting an initial set of Scenarios / Use Cases. These cases were collected by consortium members through interaction with stakeholders of MyHealthAvatar system, including citizens/patients, clinical doctors and clinical and IT researchers. Each of these cases addresses a use scenario from a particular user perspective, either as a patient, or as a doctor, or as a clinical or IT researcher.

The use case collection has been an extremely useful exercise in order to allow us to develop concrete understanding of user requirements for the MyHealthAvatar system. Since these cases were collected from the perspectives of individual stakeholders, we are fully aware that there are repetition and inconsistency between them. One of key tasks of the project in the next stage in T7.1 is to reach a final set of refined use cases based on these initial collections. The team of MHA project is continuously working on this. This approach is in line with the project description and the accepted spiral software development process. Close to the fact that elaborated Scenarios / Use Cases are in continuous development a special attention is paid on elaborating new ones

The final set of refined use cases will fit into the next project's task Nr 7.1, named "Scenarios and use cases for MyHealthAvatar: PM10=>PM18 (Task Leader: USAAR)". This task will describe in details the new Scenarios / Use Cases that are relevant for MHA platform. As scenarios are based on the results of Work Package 2 (WP2), this task starts at month 10 after the finalization of WP2. Additionally, all Scenarios / Use Cases will be prioritised and aligned to different stakeholders (citizens, clinicians, basic researchers and IT people).

Relevant deliverables

D7.1) Description of scenarios and use cases for MyHealthAvatar: [month 18]

2.8 WP8 Avatar centred visual analytics (3-33)

The objectives of this WPs are

- To provide a set of visualization tools for model and data analysis
- To provide a set of display functionality for avatar rendering

2.8.1 Task 8.1 Avatar modelling and rendering suite PM3=>PM18 (Task Leader: BED)

This task is to construct a generic avatar. The human geometry model should include a number of layers to portray human anatomy. High-resolution anatomy data from the third party will be used to build the geometric model. Also, a software suite will be provided to change the appearance by users, such as anthropometric scaling of the generic avatar, change of colours, etc.

Notably, an initial version of avatar modelling and rendering is now available at http://myhealthavatar.ccgv.org.uk/mha/

2.8.2   Task 8.2 Key techniques of visual analysis PM4=>PM33 (Task Leader: BED)

We are building a general development environment and developing techniques for the visualization tasks within this project.

2.8.3   Task 8.3 A visual data analysis suite PM19=>PM33 (Task Leader: BED)

This task will focus on the work of building a visual data analysis suite to support data analysis in an avatar centric view around the avatar models. The data analysis suite should support interactive visual data analysis through a number of visualization means. This task has not started yet.

2.8.4   Task 8.4: Multi-scale medical image analysis PM6=>PM27 (Task Leader: LIN)

This task will focus on developing a software toolbox that supports the analysis of multiscale medical images associated with the avatars. This task has just started.

Relevant deliverables

D8.1) Display suite for avatars & evaluation report: [month 18]

D8.2) Avatar-centred visual analytics suite & evaluation report: [month 33]

D8.3) A multi-scale medical image analysis toolbox: [month 27]

Relevant milestones

MS081 Avatar rendering (initial version)

MS082 Key techniques for visual analytics (initial version)

MS083 Visual data analysis suite (initial version)

MS084 Key techniques for multi-scale analysis

2.9   WP9 Demonstration and evaluation (19-36)

This WP will guide the project in a way that the scenarios and use cases specified in WP7 can be demonstrated at the end of the project. This includes the following objectives:

- to describe and to the developmental process
- to test and evaluate demonstrators at each level of the development
- to demonstrate MyHealthAvatar at the end of the project at a conference

No work has started in this WP.

Relevant deliverables

D9.1) Definition of the demos: [month 21]

D9.2) Development of demonstrators: [month 36]

D9.3) Report on the clinical acceptability and evaluation of MyHealthAvatar and future ecommendation: [month 36]

D9.4) Demonstration of MyHealthAvatar: [month 36]

Relevant milestones

MS091 Demo of MyHealthAvatar (initial version)

2.10 WP10 Dissemination and exploitation (1-36)

The objectives of this WP include:

- to inform all internal and external stakeholders about the project results and the implications that these results might have for the research, clinical and industrial users;
- to communicate the availability of the technology to potential users and to import the technology into suitable application domains.

2.10.1 T10.1 MyHealthAvatar Web-site and dissemination materials: PM1=>PM36 (Task Leader: ICCS)

Website has been developed and is currently maintained by ICCS – see http://www.myhealthavatar.eu/. Flyers have been made

2.10.2 T10.2 Publications: PM1=>PM36 (Task Leader: ICCS)

All participants will regularly take part in international scientific discussions. The results will be relevant to technological, scientific and clinical journals and conferences and to trade magazines.

The project has been working on building links with other research projects and research groups. It has been invited for presentation at various locations outside the project, including:

- University of Sheffield
- VPH institute, UK
- Luton CCG
- University of Middlesex

Notably, the story of MyHealthAvatar has been published through various media, such as:

- http://www.isgtw.org/feature/health-avatars-%E2%80%94-your-lifetime-companion
- http://www.ehealthnews.eu
- http://www.ehealthnews.eu/research/3481-myhealthavatar-to-reshape-the-future-of-healthcare
- http://www.ehealthserver.com
- http://www.ehealthserver.com/research-development/1333-myhealthavatar-to-reshape-the-future-of-healthcare
- http://www.pharmanews.eu
- http://www.pharmanews.eu/research-and-development/1263-myhealthavatar-to-reshape-the-future-of-healthcare

2.10.3 T10.3 workshop: PM25=>PM36 (Task Leader: BED)

This task has not started yet.

2.10.4 T10.4 Exploitation: PM19=>PM36 (Task Leader: ASTRID)

This task has not started yet.

Relevant deliverables

D10.1) External project website: [month 3] – completed on time.

D10.2) Dissemination plan: [month 12]

D10.3) Workshop for dissemination: [month 33]

2.11 WP11 Ethical and IPR

The objectives of this WP include:

- Reviewing and analyzing the European and relevant national legislation on data protection, data security and ownership of (personal) data in reference to the data generated and processed within the project;
- Doing a survey on strengths and weaknesses of the European data protection framework in supporting the patient to keep control about their personal medical information in the MyHealthAvatar-scenario;
- Illustrating the impact of intellectual property on ownership of data processed in a 4D-Avatar and its software
- Creating legal and ethical guidelines concerning the use of the final platform; and
- Serving as a legal/ethical helpdesk for the project

2.11.1   Task 11.1 The legal and ethical framework PM1=>PM24 (Task Leader: LUH)

This workpackage starts with a detailed analysis of the existing European and national rules concerning data security and privacy protection as far as they are relevant to MyHealthAvatar. The outcome of this task will be a definition of the legal and ethical framework of the project in concreto. Furthermore it will define the legal and ethical framework and guidelines for patient-specific computer-based models in general. The framework will be revised after year 2 of the project in order to cover modifications necessary in the development of the project.

2.11.2   Task 11.2. Survey on strengths and weaknesses of the European data protection framework in supporting the patient in scenarios like MyHealthAvatar PM13=>PM24 (Task Leader: LUH)

This task will produce a survey among relevant European stakeholders (patient organizations, regulatory authorities, researchers) on the current situation and necessary steps de lege ferenda in order to foster the development of digital avatars in the best interest of the individual patient. This is not started yet.

2.11.3   Task 11. 3. Understanding the Legal and IPR regime in MyHealthAvatars PM25=>PM30 (Task Leader: LUH)

The task will show that data protection is not the only legal framework of relevance but that issues of intellectual property (on data, software, algorithms and concepts) is of equal importance. Some initial work has been carried out to understand the requirements of legal and IPR issues in the project. An internal document has been circulated within the consortium.

2.11.4   Task 11.4 Defining the rules for the exploitation of the platform after the project's end PM25=>PM36 (Task Leader: LUH)

This task will cover the data protection and intellectual property rules that need to be obeyed in the exploitation phase of the project in order to guarantee compliance with the relevant legal regime. This task has not started yet.

2.11.5 Task 11.5 Legal and ethical helpdesk PM1=>PM36 (Task Leader: LUH)

The WP will serve as an internal legal and ethical helpdesk that will support the consortium in all privacy, security and intellectual property related issues upcoming within the project. This task has not started yet.

Currently, LUH is helping in clearing legal requirements

Relevant deliverables

D11.1) The ethical and legal framework of MyHealthAvatar: [month 24]

D11.2) Survey on strengths and weaknesses of related European data protection framework: [month 24]

D11.3) Legal and IPR-related issues in patient centred solutions like MyHealthAvatar: [month 30]

D11.4) Legal framework for the exploitation of MyHealthAvatar: [month 36]

3   Conclusion

The first version of the avatar system is now available at http://myhealthavatar.ccgv.org.uk/mha/.
In conclusion, the project has achieved good progress in many aspects but has encountered some
problems in architecture definition that was previously unseen. More specifically

- Management – a management infrastructure has been successfully established which keeps
  the project well under control.

- Use cases scenarios and survey – use surveys have been carried out and an initial collection
  of use cases have been made.

- Data repository – a pilot version of data repository has been set up, which is currently
  populated with synthetic data of virtual citizens.

- Visualization of 3D avatar – 3D avatar can now be viewed at
  http://myhealthavatar.ccgv.org.uk/mha/.

- Architecture – we have encountered some problems in gathering system requirement for
  the system architecture due to its broad demands of covering a wide range of health
  conditions and use scenarios. The architecture definition board has been formed and we are
  working on a solution as soon as possible.

- Dissemination – the project website is available at http://www.myhealthavatar.eu. The
  project flyers have been made and we have made presentations at various venues. The
  project story has appeared in different media.

- Legal & ethical – an initial legal guidance of the project has been circulated among the
  consortium.