MyHealthAvatar

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

Project acronym: MyHealthAvatar

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Interim Management Report 2

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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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List of contributors
- Feng Dong, University of Bedfordshire

Contents

1 Executive Summary

This document reports the progress of the project between month 12-18. The report is organised according to its progress within the 11 work packages. Here is a summary of the major events:

1) the project has been through the first annual review as "in good progress".

2) We have started the evaluation of the platform at http://myhealthavatar.org/mha/.

3) We are focusing on the selection and refinement of the use cases in D7.1 and D9.1.

4) Technically we are working on the integration of the platform. We are also increasing the range of data collections to the avatar. The availability of the new data will lead to more tasks in data repository, data reasoning and visualization.

5) We are continuing our effort in the project dissemination and we have just started the project exploitation.

6) The legal partner LUH is involved in all the technical meetings and discussion of the project. They will ensure that the ethical and security aspects of the project will fully comply with the legislation.

2 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]

2.1 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.

3 Work in Progress

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

3.1 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

The Project Management Office (PMO) established at BED is continuously monitoring the project throughout its duration for all research and non-research activities.

3.1.1 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 maintains 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 is concerned with quality management.

The PMO is following a detailed administrative management framework, in conjunction with other partners; this includes templates for reports, deliverables, etc. Redmine is continuously used as the management software to conduct consortium management.

3.1.2 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 the meetings have been held:

- Kick off meeting, 27-28th March, 2013, Windsor, UK

- Technical Meeting, 1st – 2nd August, 2013, Crete, Greece

- 1st progress meeting, 12th September, 2013, Budapest, Hungary.

- 2nd progress meeting, 18-19th Feb, 2014, Luton, UK

- 1st annual review preparation meeting, 12th May, 2014, Brussels

In addition, the next global meeting has been planned on 18-19th September at Homburg, Germany.

Notably, the first annual review meeting took place at the EC office in Brussels on 13th May. The outcome is "Good progress" together with constructive comments and suggestions from the reviewers. All the deliverables from the previous year are accepted.

An Architecture Definition Board (ADB) which was originally formed between BED, FORTH, ICCS and LUH has now become a bi-weekly Skype meeting involving all the consortium members to discuss all the project related issues.

Relevant deliverables

D1.1) Interim management report I: [month 6] – completed

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

D1.3) Interim management report II: [month 18] – submitted on time

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.

3.2   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

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

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

3.2.3   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)

This WP has been completed in Year 1. All the deliverables are accepted with a minor revision to D2.2 after the first annual review.

Relevant deliverables

D2.1) State of the art review related to the MyHealthAvatar environment: [month 9] – completed

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

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

Relevant milestones

MS021 Scenario based user needs and requirements - achieved

3.3 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

3.3.1 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.

This task is completed with D3.1 accepted.

3.3.2 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.

D3.2 has been submitted and accepted. After the discussion during the first annual review meeting FORTH has promised an update of D3.2 at month 24 due to the dynamic nature of the project.

3.3.3 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.

The technical integration issues have been another focus of discussion in the recent Skype meetings within the consortium. We have agreed the approach how to experiment the integrated platform with cloudifiable and scalable features under both private and public cloud settings. Especially, we

have outlined three options for the integration between the WP5 and WP6, namely via Message Queue, via APIs, and via iFrames. This investigation will be continued.

Notably, the data repositories in WP5 and WP6 serve different purposes. The WP6 repository is the central repository of the project and the repository in WP5 will be used to support the execution of the simulation models of the project. We will explore the possibility and necessity to build some synchronization functionality between the repositories.

We will continue the investigation and discussion of the system architecture.

3.3.4 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 looks 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.

Linking with Twitter has been completed in one way (Twitter -> MHA). We will do the other way (MHA->Twitter).

Meanwhile, we are working on the others.

3.3.5 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.

Based on the joint work between BED and FORTH, we have investigated different technical approaches for the local cloud. Since more focus has been placed on the use cases following the first annual review, this task and its associated deliverable will need an extension. The update of the use case definition will help us finalise the user requirements to the platform, based on which we shall be able to draw final conclusions on this task.

3.3.6 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. The first version of the APIs is deployed at: http://myhealthavatar.org/mhaapi

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

This task addresses the integration of tools and services that support the 4D digital avatar. The first version of the platform is available at http://myhealthavatar.org/mha/

Relevant deliverables

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

D3.2) Architecture design: [month 6] – partially completed with a promised update at month 24.

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] – to be delayed

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

3.4   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

3.4.1   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.

3.4.2   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.

3.4.3   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.

D4.1 has been submitted and accepted.

3.4.4   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.

3.4.5   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] – completed

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 [month 8] - achieved.

MS042 Definition of the mapping formalism [month 12] - achieved

MS043 Query rewriting and data translation [month 12]– achieved

MS044 Ontology evolution & summarization (Initial version & evaluation) [month 19]

MS045 Semantic reasoning utilities for decision support (initial version) [month 15] – achieved

3.5   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.

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

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

The task leader has performed:

- Gathering and analysis of the technical requirements of the tools/model repository and the engine that will be used for the execution of the tools/models.
- Design of the schema of the EU tools/models repository.
- Implementation of the initial version of the tools/models repository.
- Review of the technologies to be used in the engine that will run the tools/models.
- Initiation of the tools/models engine implementation.
- Preparation of deliverable D5.1

The task is on-going.

D5.1 is submitted and accepted.

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

A data repository is 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.

ICCS has carried out an initial analysis of the integration of MyHealthAvatar with a clinical trial support system (OBTIMA). It has also carried out gathering and analysis of the technical requirements of the repository that will store the results of the tools execution.

The task is on-going

3.5.3 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 task leader ICCS has participated in the discussions related to the security framework. The OAuth 2.0 standard for authorization of users will be used and initial actions toward implementing the corresponding service provider and service client were taken. It has also participated in the identification of the different users of the MyHealthAvatar platform (citizens, clinicians etc.)

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

We have outlined three options for the integration between the WP5 and WP6, namely via Message Queue, via APIs, and via iFrames. This investigation will be continued.

Notably, the data repositories in WP5 and WP6 serve different purposes. The WP6 repository is the central repository of the project and the repository in WP5 will be used to support the execution of the simulation models of the project. We will explore the possibility and necessity to build some synchronization functionality between the repositories.

This task is on-going

Relevant deliverables

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

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

Relevant milestones

MS051 Model and clinical data repository schema [month 12] – achieved.

MS052 Web services for the model and the clinical data repositories [month 24]

MS053 Security of the model and the clinical data repositories [month 30]

MS054 Final integration of the model and the clinical data repositories [month 32]

3.6 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.

3.6.1   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.

D6.1 has been submitted and accepted.

Notably, we currently have integrated Fitbti and Moves into the avatar platform. This task continues as we are in the progress of integrate Withings, iHealth and probably other sensors such as Medisana.

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

This task collects data from online patient diary. We (BED) are currently working on Intelligent Textbox which will allow smart data input with minimal efforts from the users.

3.6.3   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 task is still on-going and its current outcome has been described in the submitted D6.2. 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.

The data repository is already in function to support the current version of the platform. This will be continuously upgraded & improved in the project.

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

In this task we 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.

D6.2 has been submitted and accepted.

3.6.5   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 is on-going based on linking ontologies and terminologies (e.g. Health Event Detection ontology). BED is also working on data reasoning rules by building up an event detection engine.

While the initial design of the data reasoning tool is completed, we have yet to implement the initial version of the data reasoning tool. The current platform only has the function of data input and display. The data reasoning and query functions will be ready in the next release of the platform in a few weeks time.

3.6.6   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. We have investigated API Security with OAuth 2.0 using different approaches for access grant, such as resource owner password grant; used by demo platform user authentication; implicit grant (Used by demo platform JavaScript request); Authorization Code Grant (Under implementation & testing used by 3rd server-side request0

3.6.7   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.

D6.5 has been submitted and accepted. However, D6.6 will have a delay and the relevant partner (FORTH) is currently working with its clinical contact to update the plan. More news on D6.6 will be ready soon.

Relevant deliverables

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

D6.2) Design for data and RDF repositories: submitted [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] – submitted.

D6.6) Final comprehensive datasets: [month 18] – to be delayed

Relevant milestones

MS061 Initial collection of data [month 9] – achieved

MS062 data & RDF repository schema [month 12]– achieved

MS063 Data reasoning utilities for decision support(initial version) [month 15] – is delayed

MS064 Web services for data & RDF repositories [month 24]

MS065 Security of the data repository [month 30]

MS066 Final integration of the data repository [month 32]

3.7 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

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

This task describes 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 deliverable D7.1, named "Scenarios and use cases for MyHealthAvatar", which will describes the final Scenarios / Use Cases that are relevant for MyHealthAvatar (MHA). As scenarios are based on the results of WP2, the work on this document has started at month 10, after the finalization of WP2. According to the different stakeholders (citizens, clinicians, researchers and IT people) the final set Scenarios / Use Cases have been updated, ranked, clustered and provided. MHA high-end Scenarios / Use Cases have been defined and predictably divided in two major groups:

- Scenarios / Use Cases for Clinicians and Researchers
- Scenarios / Use Cases for Citizens and Patients

All Scenarios / Use Cases are being developed in an interactive process between all beneficiaries of the project and described in a standardized way by using the updated template from WP2. Interoperability issues are taken into account to allow a seamless interaction between different scenarios and to guarantee data sharing. Tools that need to be developed in those scenarios are prioritized according to the user needs and requirements under a clinical perspective. Criteria for prioritization are given via Scenarios / Use Cases clustering approach and it could serve as a background for the required timeframes for realization of selected scenarios within MHA.

FORTH provided a number of clinical use cases (e.g. genome, drug-to-drug interaction, CHF, etc.), LIN provided the brain trauma case together with BED, BED has also provide the diabetes case. ICCS provided the description of the nephroblastoma biological simulation use case and initiated the adaptation of the corresponding model to the needs of MyHealthAvatar platform.

Following the first annual review, we are reviewing all the cases on a one-by-one basis. Each case is investigated in terms of:

1) Analysis from the perspective of the end-users, namely, who the targeted end-users of the cases are, and what is the added value of the MyHealthAvatar platform to these targeted end-users in these cases.
2) Engagement with the end-users, namely, how we are going to reach the targeted end-users. The project will endeavor to achieve as much direct participation from the end-users (i.e. patients, citizens and doctors) as we can. To achieve this, a number of activities are happening at the moment: BED is speaking to Luton CCG (Clinical Commissioning Group) who is planning to recruit patients and GPs for the diabetes case; USAAR will contact the participants who were involved in the first round of the MyHealthAvatar survey, and we are continuing to communicate with the external projects who will probably use the MyHealthAvatar platform, such as MyLifeHub (an UK EPSRC project) and CARRE (a FP7 project). For cases with no possibility of involving end-users directly in the duration of the project, we will consider to use synthetic data for the demonstration.
3) The data needed for the demonstration of the case. For cases that will be able to directly involve end-users, data will be collected from the participants for the demonstration of the project. Otherwise we will explore the possibility of using synthetic data.
4) Implementation details, namely the implementation of the demonstration apps and services. Our general perception is that the MyHealthAvatar platform is in essence a data and information provider of individual citizens for clinical and health related applications and services. Hence the demonstration will need to involve some demo versions of the applications and services. We need to investigate the feasibility of doing this.

Notably, in our views the content of D7.1 and D9.1 are highly related and we will coordinate these two deliverables together.

Consequently, we propose the delay of D7.1 until at least after the next consortium meeting at Homburg.

Relevant deliverables

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

3.8 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

3.8.1   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. BED has built an initial version of the 3D avatar using WebGL and three.js for interactive rendering, allowing for interactive part selection and highlighting, and interactive part transparency adjusting.

The avatar rendering is available and quite stable as a component in the platform. We will continue to look after this component in the rest of the project.

3.8.2   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, allowing for visualization of data from multiple data sources and heterogeneous data types (e.g. those from WP6). Temporal and spatial visualization techniques have been adapted, such as time sequence visualization and timeline visualization. Special focus has been casted on big data volume for data resides on cloud data repositories, supporting scalable Visualisation techniques based on filtering, clustering and summarisation, multiscale techniques, etc. Uncertainty visualization is also under investigation given the varying data quality and uncertainty.

The specific data visualization that have been implemented include data summarization at dashboard, calendar based diary and timeline.

This part of the work will continue with the availability of more data at different types in the avatar. At the moment, MS082 is only partially achieved due to limited data availability.

3.8.3   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 will progress together in conjunction with Task 8.2.

3.8.4   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. The following image functionalities are under investigation for the avatar:

- Load, browse and save the selected medical images;
- Basic image processing functionalities:
- Brightness/contrast control
- Zoom in/out

- Image filtering/smoothing

- Image enhancement

- Image segmentation (thresholding, level set, etc)

- Measurements and annotations.

Some of the above image functions have been applied to support one of the use cases: the brain trauma case for the detection and segmentation of Haemorrhage in Brain CT images that support Automatic detection and segmentation of haemorrhage; automatic haemorrhage volume calculation; reduce time needed for segmentation and quantification of haemorrhage; and alleviate the variability errors (inter- and intra-) in measurements. Currently, the work is based on finding initial contour using small pixel removal and morphological erosion that is able noise and high intensity regions near the skull. Upon the identification of the initial contours, both shrinking and expansion based level-set evolution are adapted for experiments with some initial results achieved.

We will continue this task to meet the project requirement on image analysis.

Relevant deliverables

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

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) [month 12] – achieved

MS082 Key techniques for visual analytics (initial version) [month 18] – partially achieved

MS083 Visual data analysis suite (initial version) [month 24]

MS084 Key techniques for multi-scale analysis [month 15] – partially achieved

3.9   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

The work has just started and D9.1 is currently prepared together with D7.1.

This task will define a number of demos that based on the use cases specified in WP7. These demos will need to exhibit the following factors:

1. Display of the Digital Avatar and the information (data) together with the Avatar

2. Building of the legal and ethical environment (based on WP3 and WP11)

a. Including a portal with a roles and rights management
b. Addressing Interoperability issues
c. Taking into account state of the art developments (based on WP2)

3. Realising specific scenarios for data access and collection

a. The use of the data collection utilities (i.e information extraction, mobile apps)
b. Linkage to external data/model repositories
c. Linkage to external hospital systems (e.g. EHRs).
d. Linkage to social network

4. Realising specific scenarios for clinical applications

a. Usage of the web toolbox to carry out simulation via accessing models from the model repository
b. Usage of the web toolbox to perform visual analytics tools to the data in the data repository
c. ... further scenarios defined in WP7

Each demo maybe associated to a specific application or a specific tool. They will be defined within clinical context. The demos will prove the concept of MyHealthAvatar by demonstrating a clear benefits through well-defined the clinical applications.

The task will develop a flow diagram for every tool that is developed along a timeline. This diagram specifies responsibilities and timeframes for each step of development. There will be a close cooperation with task 9.2 to get feedback for the development at each step according to the results of usability and evaluation.

During the Homburg meeting, each use case will be requested to report to answer the following questions
1) Who are the targeted end-users
2) How to engage with the end-users
3) What is the added value of the MyHealthAvatar platform
4) How the data will be collected?
5) Please provide an implementation plan using a flow diagram to show the development and key milestone.

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) [month 30]

3.10 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.

ICCS designed the project dissemination plan (for details see deliverable D10.2) in collaboration with all project partners

The project's Dissemination Committee has been formed, including representatives from all partners.

Interfacing activities with the following relevant projects/initiatives have been strongly pursued by all project partners: p-medicine, CHIC, TUMOR, Discipulus, MD Paedigree, VPH-Share, Rewire, Eureca, MyLifeHub, Dr Inventor, CARRE.

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
- Brunel University
- IDOP – Institute of Diabetes for Older People

3.10.1   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

3.10.2   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 (especially with CARRE and MyLifeHub, which are funded by EC and by UK EPSRC, respectively) 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

A number of conference papers have been already produced by consortium members, and there are also online articles, news releases and other events.

Facebook and twitter accounts for MyHealthAvatar have been set up by BED

We have also organised a special session for MyHealthAvatar in a IEEE conference: IEEE BiBE 2013.

More details of the dissemination activities are presented in D10.1

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

This task has not started yet.

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

This task has not started yet.

Relevant deliverables

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

D10.2) Dissemination plan: [month 12] – completed.

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

D10.4) Exploitation plan: [month 24]

D10.5) Business plan: [month 36]

3.11 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

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

This work package 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.

Sensitive health data will be processed within the MyHealthAvatar project; so will other potentially sensitive personal data (re data subject's lifestyle). **Three phases of MHA project** need to be looked at in turn:

Phase 1: Developing / building the Avatar and its associated infrastructure (during first half of project lifetime)

Phase 2: Validation of the MHA platform (during second half of project lifetime), including issue concerns framework so that personal data will be processed in a data protection-compatible manner

Phase 3: Exploitation of the MHA platform (after project lifetime), here issue concerns legal framework to govern future use of   platform by various envisaged users; data protection issues remain highly pertinent, but also broader liability issues

The issues relevant to the first two phases will be addressed principally by Deliverable D11.1, and those for the third phase by Deliverable 11.4

3.11.2   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 ongoing.

3.11.3   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.

3.11.4   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.

3.11.5   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.

An initial legal guidance of the project has been circulated among the consortium. This includes four legal and ethical briefing documents.

Also, LUH has created consent forms for the participants of the MyHealthAvatar platform. Different forms are used for those within the consortium and those outside the consortium (i.e. from the linked external projects).

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]

4 Conclusion

In conclusion, here are the major events of the projects.

- The project has been through the first annual review as "in good progress".

- We have started the evaluation of the platform at http://myhealthavatar.org/mha/.

- We are focusing on the selection and refinement of the use cases in D7.1 and D9.1.

- Technically we are working on the integration of the platform. We are also increasing the range of data collections to the avatar. The availability of the new data will lead to more tasks in data repository, data reasoning and visualization.

- We are continuing our effort in the project dissemination and we have just started the project exploitation.

- The legal partner LUH is involved in all the technical meetings and discussion of the project. They will ensure that the ethical and security aspects of the project will fully comply with the legislation.