# A user interface design for a patient oriented digital patient

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*Abstract*—**MyHealthAvatar is designed to provide a digital representation of patient health status. It aims to become a 'lifetime companion' for individual citizens that will facilitate the collection of, and access to, long term health-status information. This avatar is not only extremely valuable for clinical decision-making, but it will generate data to support clinical investigation, thereby leading to strengthened multidisciplinary research and excellence in supporting innovative medical care across the population.**

**My Health Avatar platform is currently under development. The purpose of this paper is to present the scope, the provided service and the future plans of the platform as well as a detailed description of the visual representation of the MyHealthAvatar platform.**

*Keywords*—**Digital patient, silicon environment, ICT architecture**

## I. INTRODUCTION

THE progress and treatment of several major diseases, such as cancer, neurological and cardiovascular disorders, are affected or even determined by numerous factors such as genetics, age, environment and lifestyle, i.e. diet, smoking and alcohol consumption. Since each person's life circumstances and health conditions constantly change over time, effectively recording and using historical data of the above parameters can significantly improve the diagnosis, decision on treatment and life-expectancy.

Collecting and maintaining accurate and consistent data for the afore-mentioned factors cannot be achieved without medical platforms' networking. Given the high fragmentation of the health systems among European countries, gaining access and maintaining a consistent health record of individual citizens involves cross-border activities thus can be considered as an especially complex and challenging task.

Furthermore, following diagnosis of a disease, it is difficult for a patient to collect scientific information related to his disease such as specific symptoms, conditions, medical standard or experimental, treatments. Gaining access to a certified and reliable database would increase a patient's awareness on his disease resulting in better self-care. Furthermore, as mentioned in psycho-oncology science [1], patients who are diagnosed with terminal illnesses are usually supported by, and within, their families and not by disease-specific patient communities; giving access to such a community should have been taken into account when creating a system of care that aims to advance health by taking into account reducing psychological distress and feelings of being alone, among other parameters.

MyHealthAvatar aims to tackle all the afore-mentioned challenges. It aims to facilitate the collection of lifetime health-status information for individual citizens. It will be extremely valuable for clinical decisions as will give access and digitally represent historical data of users' medical parameters, health conditions, life style criteria all of which can be digitally represented Furthermore, it will enable data access, sharing and analysis by utilizing modern ICT technology, overcoming the shortcomings of the existing resources in Europe, which is highly fragmented. Finally it will offer a promising approach to acquire population data to support clinical research, leading to strengthened multidisciplinary research excellence in supporting innovative medical care.

Moreover, MyHealthAvatar is designed to give access to the databases created by the VPH (Virtual Physiological Human) community to enable patients search for valid information and get aligned with the recent advances related to their disease. Additionally, it will promote networking of the patients with people who share the same experiences with them through forum network and interpersonal communication. Finally, this web platform also aims to advance health through prevention, by providing information to a healthy individual regarding the right lifestyle choices, appropriate exercises and early warning of suspicious symptoms, together with several other services, such as a digital representation of a person's health status by way of a statistical timeline from his/her date of registration, free interaction with the databases created by the VPH community.

Last but not least, MyHealthAvatar will provide a 4D avatar which will facilitate a clinical analysis of every part of the body using knowledge discovery tools. A 4D body is available to depict the health status of the user, provide information of the human anatomy and functions and to highlight the anatomical parts that are mainly concerned by his health condition.

From the design point of view it is designed to attract all users, irrespective of age, educational background or web navigation experience. The web interface will be divided into the four sections as shown in Fig. 1.

Dividing the page of the web interface to four sections is expected to implement the simplest possible navigation approach, where all the services are included in one web

interface page. Further details and analysis of each area is provided in sections III and IV.

The paper is structured as follows: Section II provides a survey of some important approaches adopted by previous and current web platforms offering similar services, together with their major limitations.



Fig. 1. MyHealthAvatar web platform interface. Sections 1,2,3,4 are indicated in red.

Section III shows the MyHealthAvatar's main menu categories related to the personal patient medical profile and to the medical database which includes scientific papers and labs.

Section IV focuses on the 4D Avatar design, model and related tools.

This paper concludes in section V, by discussing the advantages and limitations of the MyHealthAvatar technique, together with some proposals for future research.

## II. PREVIOUS WORK

The "Digital Patient" initiative, which has influenced the Virtual Physiological Human (VPH) community, has been involved in several projects contributing to a "digital patient road map" by supporting data sharing infrastructures. The most relevant of these include Discipulus [2]– a support action for producing a roadmap for the future of Digital Patient; VPH Share [3]; P-Medicine [4]; ACGT [5] and Tumor [6], all of which have been very interested in data sharing, emphasising the importance of data in VPH research. However, the research involved in these projects did not focus on the collection of, and access to, long-term, specific information from the patients' perspective in support of individualized healthcare.

The use of a digital avatar as a personal health information centralization service is not revolutionary – it has been proposed in a number of similar systems, including the 3D Avatar from IBM [7], HealthVault from Microsoft [8] and Google Health [9]. However, although the need for health information centralization has been identified, these systems have had a limited impact on healthcare. Hence, Google stopped further development of Google Health on 1st Jan, 2012, which pointed to the following weaknesses and requirements:

1) The failure to share data across institutions, or to make it easy for patients to obtain it.
2) The lack of standardized ways to move data around the health system.
3) Falling short as an "apps" platform. Contrast it with the iPhone platform – the AMA site has some apps available for the Apple iPhone, iPad and iPod Touch on the AMA iTunes store. Patients can store, carry and share their critical medical information – i.e. medications, allergies, emergency contacts, etc. – in one secure place.
4) Patient-centred health information technology will undoubtedly be a pillar in the health system. Also, social components to the user experience may be a key ingredient in the system.

PatientsLikeMe [10] is a web network similar to MyHealthAvatar that allows patients to control their health status; however it has two limitations – firstly, it does not include a 3D avatar with scientific explanations for each anatomical part of the body, and secondly, users cannot visualize their condition or symptoms in a model.

## III. MYHEALTHAVATAR CATEGORIES

MyHealthAvatar will be supported by modern ICT architecture to allow data management, sharing and data security. A 'cloud architecture' is sought to obtain the benefit of the latest ICT technology in order to provide secure data storage and to gain access to powerful computing capability. Data libraries and storage functions are placed in sections 1, 2, 3, and 4, as indicated in Figure 1.

More analytically, sections 1 and 2 (Fig. 1) were designed to provide easy access, navigation and interaction with the patient's personal medical data and also with the medical MyHealthAvatar database, from which users may retrieve information about several conditions, treatments, symptoms, publications and labs.

Section 1 provides the main menu of MyHealthAvatar, which includes the following categories:

1) "Profile" – where users can import information regarding his/her medical background, such as personal facial picture, gender, date of birth, location, ethnicity, race, last hospitalization, its purpose and duration, upload most recent medical exams, etc.
2) "Friends" – where users can invite existing users of MyHealthAvatar to be 'friends', find other users based on criteria, such as similar symptoms, conditions, faith, location, age, treatment, etc; or to invite email contact to join the network. In that section, users can also be informed daily regarding the actions of specific users or forums, or be informed if a particular user is following their profile activities.
3) "My Health Status" – is one of the major MyHealthAvatar categories whereby users can create diaries and add details regarding their diet, medical conditions, symptoms and treatments, etc. They are also able to find scientific information and statistics

regarding their medical conditions, together with possible treatments, experimental research, labs, and to be given the opportunity to communicate with users with similar medical backgrounds in order to share knowledge and experiences. Also in this section, users can view statistically their medical health status, monitor their progress and print out the information prior to doctors' meetings.

4) "About us" – this category contains information regarding the team that developed the MyHealthAvatar web platform with videos and documentation, including published papers.

In order to contain the above information in the smallest possible space, Section 2 was designed within a fixed size panel 640x400px, where the contents are changed according to the selected category from the 'main menu bar options', whereby each option from the Section 1 main menu bar indicates a specific area of information with which the user is able to interact in Section 2. For this visualization approach 'tabs' were deemed essential with each tab covering a specific area of information (for more details, see below).

The logic behind the adjustable content of Section 2 is to familiarise users with a step-wise approach by providing information about themselves, i.e. their health and their friends' criteria. Users insert their data by choosing one tab each time until all the information is gathered. The benefit, in terms of users' perception and experience, is that they do not get discouraged by being presented with a whole set of requested info to be filled-in.

Technically, the main benefit of a 'tabs' approach is that there is no need for pages to be refreshed after each modification. Each tab in Section Panel 2 includes, where applicable, drop down menus, where users may select specific conditions, symptoms or treatments etc, upload file applications, upload medical data, and press the appropriate buttons to get informed of their daily health status/profile. Moreover each tab includes a SAVE button to enable users save the modifications made on their profiles. Popup windows were found to be essential in order to present large amount of data in one area in cases like personal medical statistics, documentation for specific conditions, treatments, symptoms etc. a 4D Avatar.

The MyHealthAvatar aims to innovate as a research and demonstration action system through a new digital representation format of the health status of citizens based on a 4D Avatar which accurately represents the human body anatomy.

The sections of the web interface that refer to the 4D avatar are Section 3 and Section 4 and are presented below:

As in Section 2, Section 3 (Fig. 2) is a panel with static height and width 640x400px which contains all the tools relevant to the 4D Avatar. Using the tabs approach, the user will be provided with all the controls that activate/deactivate individually parts of the 4D body, control it and find information for each anatomical part that relates to a user's medical condition (Fig. 3).

Several functions, which are still under construction, will allow users of the final version to visualize on the 3D model their medical conditions, to retrieve medical information regarding the disease they are suffering from and also, through a special function, to have a timeline animated representation of their progress following treatment.

The Section 4 (Fig. 1) is the occupied by the 3D Avatar, which is placed in an adjustable area according to the screen resolution. For instance, on small screens the avatar will appear small in order to include, in the viewable area, sections 1, 2 and 3 (Fig. 1). The avatar is capable of rotation and zooming in and out.
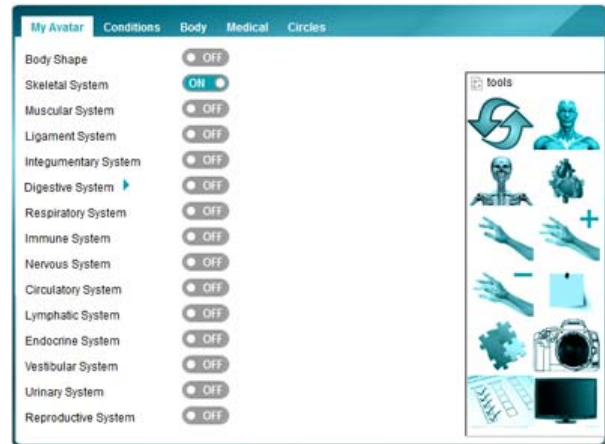


Fig. 2. This panel contains all the tools needed by the user in order to interact with the 4D Avatar model.

Technically, the avatar has a light-weight application so that, each time the page is refreshed or a new page is opened, the data can be uploaded quickly. It is also viewable both in tablets and in several navigation browsers, as it is built on webGL graphics (a JavaScript API for rendering interactive 3D within any compatible web browser without having to use plug-ins) and trhee.js (lightweight cross-browser JavaScript library/API used to create and display animated 3D computer graphics on a Web browser.)
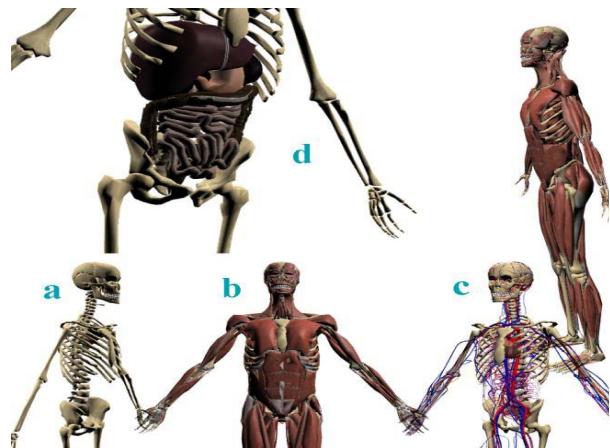


Fig. 3. 3D model. Examples of a) skeletal, b) Muscular, c) Nervous, d) Digestive Systems.

The user can activate/deactivate the 3D Avatar's body shape, its skeleton, muscles, ligaments, integumentary digestive, respiratory, immune, nervous, circulatory, lymphatic, endocrine, vestibular, urinary, and reproductive systems.

Also included in this section are the tools that help users to manipulate the 4D body in order to (a) obtain information about specific anatomical parts, (b) take pictures, (c) share information with others, (d) make the avatar transparent in order to select and view specific parts, (e) separate out a specific part to ascertain where an infection might lie, (f) test their knowledge, (g) run scientific tests, (h) take screen shots, and (i) save recent actions made on the model.

## IV. FUTURE PLANS

In future it is planned to create simulation models whereby the user is able to view the development, or the termination, of a condition, such as a cancer, in correlation with their treatment. Such a simulation will be based on a theoretical timeline, where medical characteristics of a condition can be visually demonstrated.

Alongside this, it will be possible for tele-medicinal facilities to be uploaded in order to help doctors from far afield to have access to the patient's files. Such a facility will help patients when they visit a hospital abroad and it will also inform the doctors concerned regarding the patient's condition, their previous treatments and their reactions to specific medicines, etc.

## V. CONCLUSION

The MyHealthAvatar project is a research and demonstration action system by which, through a new digital representation format, the health status of citizens can be shown and demonstrated. Its web interface provides access to a platform that allows web users to monitor their long-term medical status, to obtain information regarding several medical conditions, symptoms and possible treatments, or physical 'gymnastic' actions and diet plans. Through a 4D avatar model, information referring to its health condition regarding each part of the body can be visualized. It also provides access to appropriate forums where patients can share their experiences and knowledge. Furthermore, MyHealthAvatar features an underlying architecture that supports the access, collection and sharing of a set of long-term records and information about patients, together with an ICT toolbox for simulation and data analysis, designed to support the clinical decisions by medical professionals. This is not provided in any existing healthcare system. The results are also important for the clinical research labs as the MyHealthAvatar can provide consistent long term patients data, important to justify the disease growth criteria and also valuable to discover the final treatment

Therefore, MyHealthAvatar is designed to meet individual citizens' desires for transparency, individualization, recognition, respect, dignity, and the exercise of choice. In addition, the voluntary data exchange and sharing of the avatars will, over time, create a huge resource of population-based information that will greatly support new knowledge and discoveries in biomedical research.

Future plans include the implementation of functionalities that will facilitate telemedicine, communication with doctors and simulation or monitoring of the patients' medical health status in correlation with time, exploiting the capabilities of the representation on a 4D avatar of human body.

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