User experience integrated life-style cloud-based medical application

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Abstract. Having a modern application capable to automatically collect and process data from users, based on information and lifestyle answers is one of current challenges for researchers and medical science. The purpose of the current study is to integrate user experience design (UXD) in a cloud-based medical application to improve patient safety, quality of care and organizational efficiency. The process consists of collecting traditional and new data from patients and users using online questionnaires. A questionnaire dynamically asks questions about the user’s current diet and lifestyle. After the user will introduce the data, the application will formulate a presumptive nutritional plan and will suggest different medical recommendations regarding a healthy lifestyle, and calculates a risk factor for diseases. This software application, by design and usability will be an efficient tool dedicated for fitness, nutrition and health professionals.

Keywords. User-computer interface, Cloud-computing, Healthcare sector, Internet, Information Storage and Retrieval

Introduction

The increasing use of electronic devices such as computers, touch-screen laptops, and smartphones has improved globally the quality of communication. Numerous social websites have a remarkable influence and might determine the behaviour of users. Therefore, website-related happiness is a new concept associated with emotions and satisfactions of navigating users [1].

Cloud computing is presently appearing as a constantly changing, developing paradigm that designs "everything-as-a-service" [2] used in medical imaging [3], analysis of genomic datasets, dentistry, 3D protein structure similarity searching [4] or for discovering the correlations of gene expressions within biological pathways. Cloud applications have various configurations to satisfy all the user requirements [5]. On user’s side there are two different models of cloud computing: single-tenant and multi-tenant. In a single-tenant model, every buyer purchases a distinct model of a software program that operates on a rationally separated hardware environment. In a multi-tenant model, everyone use the identical model of the software program and hardware system [6]. Moreover, cloud-based applications facilitate a novel approach to user-centred design, user-acceptable models, and user-hedonic aspects. The usage of revolutionary dietary evaluation tools such as EPIC soft, Diet Day, NINA-DISH or

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personal digital assistant tools is considered to increase the accuracy of dietary evaluation in different epidemiological research studies. Therefore, a cloud-based interview application can be a solution for nutritional epidemiological research.

The aim of this study was to develop a new cloud-based interview application based on physical activities and dietary habits for conducting lifestyle assessment and for evaluating its practical utilization among users.

1. Materials and methods

This paper describes a model of a new online nutritional cloud-based application useful for different users and patients. The users may access this application via a free registered account. A large database is created resulting from interview answers related to: age, gender, race, ethnicity, socio-economic status, anthropometric parameters, leisure-time physical activity, cigarettes-smoking, and alcohol and caffeine consumption behavior, internet addiction and food diet. The application creates a complete profile of the user, from healthcare and lifestyle point of view. The data collection is realized through a questionnaire with questions. The application processes the data: validation (ensuring that supplied data is "clean, correct and useful), summarization (reducing detail data to its main points), Classifying (separates data into multiple categories) and reporting (Data list computed information). Based on the entered data, the online tool determines and suggests a nutritional plan and advises such as how to reduce the risk of medical conditions and the possibilities of statistical processing regarding user’s or patient’s lifestyle behavior. This cloud-based interview application comprises a monitoring system for the user and investigator, a data-input program through the interview, a computation system for calculating food and nutrient intake, a data-output system for delivering the results, and an analysis system for determining the adequacy of nutrient and food intake.

The application has three sets of questions. The first set of data includes age, gender, ethnicity, location, height and weight. Based on this first set of data, the application calculates the body mass index. The second set of questions contains information regarding lifestyle habits, addiction pattern of internet use, internet gaming disorder, Smartphone overuse, consumption of alcohol, cigarettes, coffee and energy drinks. The data are input for the algorithm that yields the behavioral categories in terms of addiction and habits. The last set of questions will refer strictly to the daily diet, favorite types of food, mealtimes. Based on the last two sets of questionnaires, the application will process and calculate a nutritional plan and risks of diseases that predispose the user, based on the data entered in questionnaires. The user informed how to reduce risks through diet and lifestyle changes. All information will be automatically being saved in a database that provides tools for generating statistics and comparisons between certain dietary behaviors depending on user’s data input.

2. The structure of the application

Since the application is based on cloud computing technology, it can be accessed via Internet from computers, laptops, mobile phones or tablets. The tool uses the latest trends in user experience design (UXD). It has a responsive design, based on a web design approach. It provides an optimal viewing experience, simple looking at and
visitor navigation with a regular scrolling, resizing and panning. The scroll is accessible on a variety of equipments, from mobile phones to desktop computer monitors. This feature will allow adapting the design and resolution to any different device accessed. The online tool has many integrated multimedia elements, allowing the interaction between user and application, increasing the grade of user experience.

From a technical point of view, the application has three main components: **interface** - easy to use even by the users who are not very familiar with the use of modern information systems, a **database** - which stores all the input data and the processed information, and an **e-engine module** - that processes the data into information and displays it to the user. Having modular design, the application can always be developed in the future and enriched with new elements, in terms of architecture and in terms of user-centered experience applications, without an expensive development effort. This online tool engine includes a system of detecting and displaying errors, arising from both technically issues and from the user interaction point of view.

### 3. The architecture of the system

The online cloud-based interview application is in trend with the latest technology in the field of information architecture. It has a dynamically generated interface and content. All the information of the application is stored in a database on an internet server. The application is developed in accordance with the latest trend in **server side**
dynamic pages, where the web page construction is controlled by an application server processing server-side scripts [7]. Figure 1 presents this organization.

In server-side scripting, the parameters determine how the construction of each new web page continues, integrating the arranging of additional client-side developing. This will help users to find the required information more rapidly. It is already known that an advantage of dynamic web pages is that, the server can process large quantity of information to multiple online users in the same time, without any risk of losing the resources of the servers. The main advantage of the dynamic-content is the fasting loading through a web server, because all the information content is stored in a single database instead of multiple files. Because the application has a modular design, every improvement can be quickly performed and without damaging the rest of the modules in the tool. Generated observed errors are reported in an XML file, to be easily identified and corrected, allowing future improvements of the online tool. There are two kinds of errors that can be encountered in such kind of application: Development errors – mostly encountered in the development stage of the application or when is tested, before launching online, and User’s errors – that appears when a user makes a mistake. The application has a special dedicated module for determining the errors encountered when the application is used. The error module saves the errors encountered through the navigation in a XML file on the web server. This file plays a great role in detecting bugs, errors and the deficiencies of the application, allowing easy identifying and solving them. The main advantage of the dynamic-content is the fasting loading through a web server, because all the information content is stored in a single database instead of multiple files. Because the application has a modular design, every improvement can be quickly performed and without damaging the rest of the modules in the tool.

4. Conclusions

The application is currently uploaded online on a web server and is in test with students from University “Politehnica” (UPT) Timisoara and from University of “Medicine and Pharmacy” Timisoara (UMFT) young user groups from a generation using frequently IT tools. In this phase, the online tool has a special feedback questionnaire in order to see the student’s opinion regarding the application in terms of user interface. In this manner, some undiscovered errors or bugs can be reported. After this stage, the application will be improved in accordance with the student’s feedback. In the next phase the results will include a comparison of the lifestyle of the students from both universities. In the test group there are included 5 groups of students from UPT, around 110 students and around 100 from UMFT. They register and use the application. The intention is to compare the feedback of IT and non IT users, and also medical and nonmedical accustomed users. The timeline of the process is: 3 month (October-December 2014) for testing at UPT and UMFT, 2 month processing the data (Jan-Feb 2015), 2 month redesign based on results of processing (Mar-Apr 2015). This will end the stage of design. Based on the new tool the test users group will be diversified and the study of lifestyle behavior reports and statistics will be provided during the second half of the year. Having a dynamic arhitecture and a user-centered design, this online tool is actually a web 2.0 generation application. The modular system allows easy further improvement of the application. The development and integrated multimedia elements will help the user to access information more quickly, in this way increasing
it’s user experience design. Furthermore, the application is based on a optimization system for the most advanced browsers. The novelty for this type of applications is its adaptability on any mobile device connected to the Internet. The development of the application is based on "responsive design" using a CSS3 (cascade style sheet) scripting language, a system that is increasingly used in modern websites, with a fluid layout using a flexible grid, and a range of the website according to browser’s full size and graphics, in a flexible manner. The adjustments for resolution is realised by adding media queries for resolution scale and orientation ranges. The application will effectively adjust automatically the layout and content for the device from which is accessed, ensuring that the user has a richer viewing experience. However, the tools such as paper questionnaires, Diet Day, EPIC soft, NINA-DISH or 24-hour recall tools are difficult to use in large populations due to daily variations in nutrient intakes of users. Considering the fact that there is a high demand by research studies to accurate determines the dietary habits of individuals, this suggested cloud-based application presented in this research could provide a personalized solution for evaluating physical activities and dietary habits assessment among different types of user.

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