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A Web-Based Tool for Cooperating Behaviors in Eating and Physical Activity Control

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Abstract. The field of information technology and the Internet for health care has developed rapidly in the last few years. Furthermore, new services devoted to improve personalized healthcare are emerging from current web-orientated research. Control of eating and physical activity behaviors can be performed in a computer mediated way as a social networking application. To this purpose, we designed and implemented a web application based on the cooperation between two communities: Patients and Nutritionists. The patients are able to cooperate as within a self-help group, while nutritionists can guide patients struggling with incorrect lifestyle and its consequences.

Keywords. Internet, social networking, software development

Introduction

The field of information technology and the Internet for health care has developed rapidly in the last few years. Recently patient-centered and consumer-centered healthcare systems have been developed [1,2,3]. Those systems allow the patient to participate in his healthcare process with an active role by collecting and managing his or her digital health documents and information. Moreover, new services devoted to improve personalized healthcare are emerging from current web-orientated research [4]. Among them social networking, which is based on relationships between actors [4], can represent a key to enhance changing weight behavior programs involving the web-technology and surmount the evidenced barriers. The delivery of structured behavioral weight loss programs can be feasible by Internet [5] and can potentially reach greater numbers of people maintaining the weight loss achieved [6], although participant abandon occurred and motivating on-line weight loss participants remains to explore [6,7]. Then, previous studies also showed that some online healthcare devoted applications had a high abandon rate after some time [8], however an approach based on social networking, e.g. membership to a community, could improve motivation in
performing tasks [4]. Therefore, we designed and implemented a dynamic web application for controlling eating and physical activity behaviors based on the cooperation between two communities: the Patient community, i.e. people who decided to follow a healthy lifestyle to lose weight and the Nutritionist community, i.e. professionals who guide patients to reach a healthy lifestyle.

1. Methods

1.1. Modeling the Communities and Their Interactions

In this paragraph, we explained how we modeled the two communities and the cooperation between them. People who decided to follow a healthy lifestyle to lose weight formed the Patient community. This was a virtual community, i.e. patient did not meet each other physically, but they interacted online in a computer mediated way. They agreed to share information related to eating and physical activity behaviors with the other members of the community. In such a way, they could motivate and sustain each other in reaching the objective. We represented the Patient community with a circle (Figure 1). The circle belongs to a plane, meaning that there were not hierarchies in the patient group. The bold arrow contouring the circle means that everyone was able to communicate with each other, in a computer mediated way.

Professionals who guide patients to reach a healthy lifestyle formed the Nutritionist community. This was a virtual community too. They agreed to share their knowledge and experience to help patients. In such a way, the individual experience gap among nutritionists has been filled, and the patient does not perceive it. We represented the Nutritionist community with a circle (Figure 1). The circle belongs to a plane, meaning that there were not skill or experience differences in the nutritionist group. The bold arrow contouring the circle means that everyone communicates with each other, in a computer mediated way. An example of communication is the request of a nutritionist for an advice to another one to better treat a patient. Then, the two communities can communicate to each other by a bidirectional “communication bus,” represented with the two vertical arrows (Figure 1). Patients share information relates to eating and physical activity behaviors with the Nutritionist community and nutritionist give them advices on their behavior.

1.2. Designing the Web Application

A Web application is composed by a data layer, usually a database or a file system structure, and uses a website as the front end. We designed the database to store data and information regarding the two cooperating communities. For the patients, in addition to demographical data, we considered height, weight, body mass index, daily physical activity, daily meals, and messages to other patients, interacting as in a self-help group, or nutritionists. For the nutritionists, we considered advices to patients or other nutritionists. Moreover, a file system structure collects digital pictures of patient meals, taken by the patient using a digital camera. In order to manage this Web application, we also defined the Administrator and the Manager roles. Managers register Patient users, or temporarily disable their access to the system, while Administrators can manage website contents, register both Manager and Nutritionist users.
The Web application has been implemented using Microsoft Active Server Pages technology, together with JavaScript scripting language. Active Data Objects technology has been used to retrieve web page content from the database developed using Microsoft Access®. Microsoft Internet Information Server has been used to perform connections between clients, which use a Web browser to request files, data, and services, and the Web server, which satisfies the client’s requests. The data storage structures contain patient’s data that require ensuring confidentiality and protection against unauthorized access and use. Those security features have been developed by a registration procedure of users, who have their own login and password.

2. Results

The developed Web system contains four sections giving every role, i.e. Administrator, Manager, Nutritionist and Patient, the specific required functions (see Table 1). The functions are presented as a menu in the left side of the screen (see Figure 2). The Web system graphical user interface was designed and implemented to ease filling data forms and better comprehension of displayed information. For a patient, the required information on eaten meals are limited to description and quantity, kind of meal, picture of the meal, and entered filling a three-field form. For a nutritionist, the meal picture supports the calculation of the in-taken calories (Figure 2).

Up to now, we made some preliminary informal experiments building Patients and Nutritionists communities, with a limited number of members, and performing the available functions to verify the correctness of communication workflow represented in Figure 1.

<table>
<thead>
<tr>
<th>User role</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrator</td>
<td>a) Managing website page contents; b) Registering and managing Manager user role; c) Registering and managing Nutritionist user role;</td>
</tr>
<tr>
<td>Manager</td>
<td>a) Registering and managing Patient user role; b) Performing statistics about web site usage.</td>
</tr>
</tbody>
</table>
### User role

#### Nutritionist

<table>
<thead>
<tr>
<th>Functions</th>
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</thead>
<tbody>
<tr>
<td>a) For each considered patient: a1) Reading information about eaten meals, seeing meal pictures, calculate and store in-taken calories, a2) Reading information about performed physical activity and calculate and store calorie’s consumption; a3) Sending advices about of correctness of the followed lifestyle; b) Inserting the value of calories for 100 grams of a food or ingredient; c) Sending a message to Patient community; d) Sending a message to Nutritionist community; e) Reading received messages from patients; f) Reading received messages from patients or nutritionists.</td>
</tr>
</tbody>
</table>

#### Patient

<table>
<thead>
<tr>
<th>Functions</th>
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<tbody>
<tr>
<td>a) Sending a message to a patient; b) Sending a message to Patient community; c) Send a message to Nutritionist community; d) Reading the received messages from Patient community; e) Reading the received messages and reports from Nutritionist community; f) Sending information about eaten meals: description and quantity, kind of meal (breakfast, lunch, brunch, snack, dinner), picture of the meal; g) Sending information about performed physical activity: kind (i.e. footing, swimming, playing tennis, walking, riding bicycle), duration.</td>
</tr>
</tbody>
</table>

### Figure 2.

A breakfast picture sent a nutritionist to evaluate in-taken calories.

### 3. Discussion

The developed Web application involved the modeling of relationship between Patient and Nutritionist communities to cooperate for controlling eating and physical activity behaviors. We designed a web application and implemented it using the MS
Access®, however the design performed can be the base for implementations using other software tools - database management systems and web development environments - as we can consider the application a module to new generation personal health records [4].

The Web system graphical user interface was designed and implemented to ease filling data forms and better comprehension of displayed information, satisfying a requirement for reducing attrition towards the use of some online healthcare devoted applications [8].

In the developed web application, patients upload meal’s pictures and nutritionists manually perform the calculation of the in-taken calories. In a near future, we can imagine that restaurants will make available online information about the food menu, so we will be able to include “mashups” [8,9], i.e. applications that can gather web site content automatically and to facilitate nutritionist tasks.

4. Conclusions

The developed Web-based tool allows collecting the all-eating and activity data of a community of patients and the patient-patient, patient-nutritionist, and nutritionist-nutritionist interactions. The patient can cooperate as in a self-help group, while nutritionists can guide patients struggling with incorrect lifestyle and its consequences.

References