Online Informing and Self-Appointment of Population – A Method to Improve Patient's Access to Health Services

LIVIA SANGEORZAN[1], MIHAI VARCIU[2], RAZVAN PESTE[1],
ROXANA MICLAUS[2], DANA SORINA ALEXANDRESCU[2]
[1]Department of Computer Science, [2]Department of Medicine
Transilvania University of Brasov
25, Eroilor, blvd, 500030, Brasov
ROMANIA
sangeorzan@unitbv.ro, http://www.unitbv.ro

Abstract: The public health sector is no longer able to cope population requirements so that the private health sector is facing these requirements and is forced to offer high quality services to the population, including providing new treatments and new medical technology and also to find a faster way to communicate with potential patients. Computers are used in Medicine not only to provide direct health care services for the patients but also to obtain some important information regarding the possibility to schedule to a specifically wanted a doctor. The paper presents a structure of a site, using Web 2.0 technologies, which permits to make an appointment online, to a doctor in a private clinic. Through this application the patient is able to schedule by himself to the doctor he requests and especially at a convenient time for him, according to his schedule and to the doctor's agenda. Additionally, the patient will be reminded by email the chosen appointment, 24 hours before presenting to the doctor.

Key Words: HTML,PHP, jQuery, JavaScript, Database, Health

1. Introduction

The health sector, in the century of speed and information, must find an answer for everybody who wants to solve their own health problems as quickly as possible, if possible by just giving a mouse click [4, 5, 9, 11].

The Internet is providing a range of solutions and useful information in all fields, including the health's domains. On the Internet there are listed some private clinics and these can be easily accessed by every patient. When patient's desire is to schedule to a specific doctor in his free time he is has the choice to access the web application called "Our Doctor" ("Medicul Nostru") (fig.2).

This application supports patient in order to be able to make or to cancel an online appointment to a private clinic. The proposed site is based on a simple web design and also meaningful to make it more attractive and easy to use.

The basic idea is that this site can be accessed by users with not much experience in using the Internet.

The server application PHP is used at the implementation level. The language PHP has a special flexibility allowing to be used with other technologies and also using these languages /technologies makes possible the obtaining of remarkable results. The written application in PHP will be posted on a Web server and will be accessible to any user after authentication.

2. Theoretical aspects

WEB 2.0 is a term describing the trend in the use of word wide Web technology and Web design that aims at enhancing creativity, information sharing and communication among users [6]. This technology uses the Internet / Intranet as a platform and includes some of the following techniques: Cascading Style Sheets, AJAX, Flex, HTML, JavaScript, PHP [3, 10] and so many others.

2.1 Technologies

2.1.1 JavaScript

JavaScript can function both as a procedural and as an object oriented language. Objects are created programmatically in JavaScript, by attaching methods and properties to otherwise empty objects at run time. Once an object has been constructed, it can be used as a blueprint (or prototype) for creating similar objects. JavaScript language has a great advantage; it is a dynamic, interpreted, prototype-based language making it easy to use and flexible [8].

2.1.2. PHP

PHP (Personal Home Page and know PHP Hypertext Preprocessor) is a server-side scripting languages and uses clear, simple syntax; that makes it easy to read and understand, and encourages rapid web application development. PHP can be used on all major operating

systems and has also support for most of the web servers [2, 12].

2.1.3. HTML

HTML (Hypertext Markup Language) is designed for delivering a document on the Web. It is the predominant markup language for the web and includes formatting control and syntax to include objects and any type of external element. HTML is compatible with all major operating systems and software [12].

2.1.4. Database

A database is a collection of data arranged for ease and speed the search and retrieval (American Heritage Dictionary of the English Language).

It is a difference between a database and a database management system (DBMS).

A DBMS is a special program for storing and retrieving data, such as Microsoft Access, witch requires more training than using a spreadsheet or word processor.

SQL is a database computer language designed for the retrieval and management of data in relational database management systems (RDBMS), database schema creation and modification, and database object access control management. Many database products support SQL with proprietary extensions to the standard language. The core of SQL is formed by a command language that allows the retrieval, insertion, updating, and deletion of data, and performing management and administrative functions. SQL also includes a Call Level Interface (SQL/CLI) for accessing and managing data and databases remotely. MySQL is a relational database management system (RDBMS) which has more than 11 million installations. The program runs as a server providing multi-user's access to a number of databases [11].

2.1.5. AJAX and jQuery

AJAX (asynchronous JavaScript and XML), is a group of interrelated Web development techniques used for creating interactive Web applications. A primary characteristic is the increased responsiveness of the Web pages achieved by exchanging small amounts of data with the server behind the scenes so that the entire Web pages do not have to be reloaded every time that fetching data from the server is needed. This is intended to increase the interactivity, speed, functionality and usability of the Web page [12]. Figure 1 shows a comparison between the traditional Web application model and the AJAX model [7, 8].

Ajax is based on open standards, a cross-platform technique usable on many different operating systems, computer architectures, and Web browsers. There are free and open source implementations of suitable frameworks and libraries. Ajax allows the creation of better, faster and more user-friendly Web applications. JQuery is a JavaScript library. It allows the creation of animations, communications to server requests, document transversing and event handling

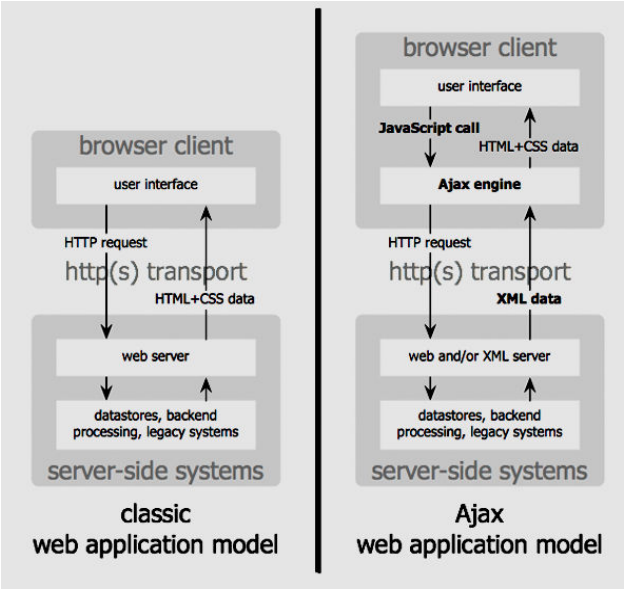

Fig.1 Comparison between the traditional Web model and the AJAX model [3]

2.1.6. Advantages of Web applications

Web applications have certain advantages over classic desktop applications: they are easily accessible from anywhere in the world using a computer with an Internet connection, they can be compatible with any client operating system and browser so that anyone can use the same application and there is no need to install anything on the client computer to make the application work because the application is running directly from the server with the application interface supplied through a Web browser like any other Web page. The classic Web application model works as follows: most user actions in the interface trigger an HTTP requesting a Web server. The server performs some processing – retrieving data, talking to various legacy systems – and then returns an HTML page to the client. It is a model adapted from the Web's original use as a hypertext medium, but what makes the Web good for hypertext does not necessarily make it good for software applications. By contrast, an AJAX application eliminates the start-stop-start-stop nature of interaction on the Web by introducing an intermediary — an Ajax engine — between the user and the server. Instead of loading a webpage, at the start of the session, the browser loads an AJAX engine written in JavaScript. This engine is responsible for both rendering the interface the user sees and communicating with the server on the user's behalf. The AJAX engine allows the user's interaction with the application to

happen asynchronously — independent of communication with the server.

3. Design and Implementation Aspects

The suggested software is a WEB application uses JavaScript and jQuery as the programming language. The server side scripting language chosen is PHP. The database is created using SQL and MySql. The application is granted for two categories of users: the administrator and the user (patient).

The administrator is the person which has access to all parts of the application allowing him to manage the database information.

The user is a patient, which has access to certain parts of the application, after authentication.

While creating the software system "Our Doctor" (Fig.2), we take into consideration the following characteristics:

- Modular construction, apt to be easily extended and also used in other private clinics;
- Dividing the application in windows based on the required functionality. Each window is loaded into the application interface independent of each other.

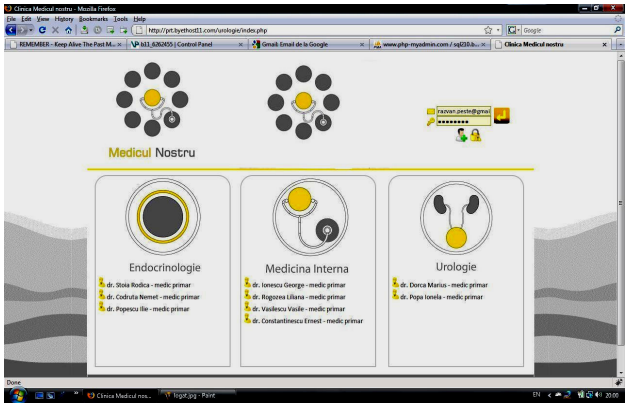

Fig.2. The main Interface of *Our Doctor (Medicul Nostru)*

The main Interface (Fig.2) contains the following links to three medical practices:

- Endocrinologie (Endocrinology);
- Medicina Interna (Internal Medicine);
- Urologie (Urology).

Each of these medical specialties has a suggestive logo, each showed in a panel. The logo is visually suggestive so that the patient can easily access one of these specialties when requests information or specifically, an appointment. During the registration session (fig. 3) every user will receive a user ID and a password. In general, the user ID is the e-mail address of each user.

After authentication, each link allows to choose a specifically requested doctor, according to doctor's schedule, also.

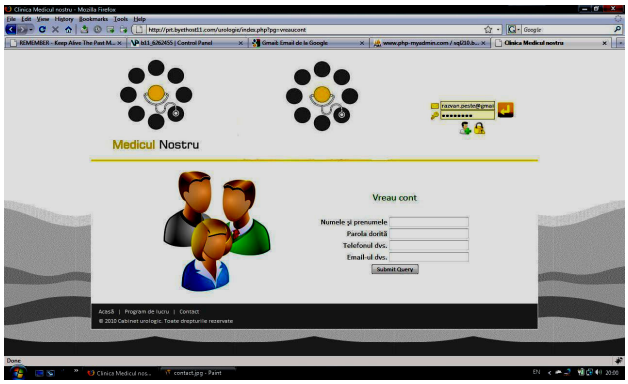

Fig.3. The window with the authentication /registration

Figure 4 show the possibility to choose each specific medical practice and further, to choose an option from a menu list: schedule, schedule cancellation, doctor, contact. If one patient chooses endocrinology for example, it opens a new window, displaying the specialist doctors available. The user can choose one of the doctors according to his resume; the patient has access to the resume of each doctor, so that the patients have the possibility to know each doctor the skills and competences and will make an informed choice, request and consent (Fig. 5).

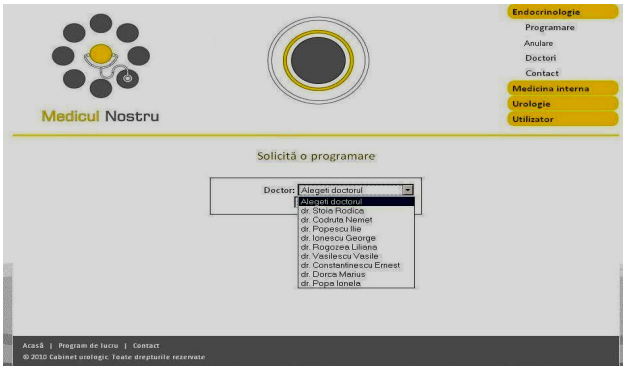

Fig. 4. The window with medical practices *Endocrinology*

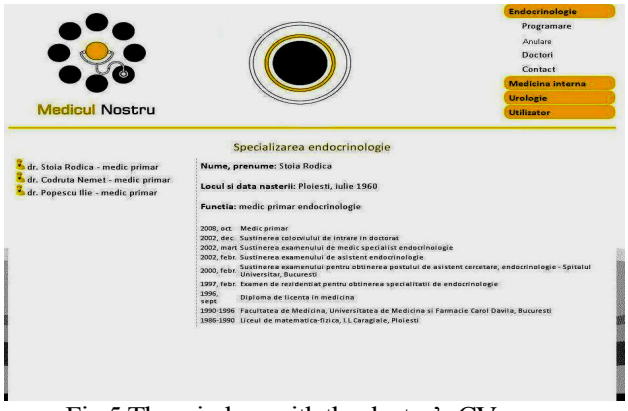

Fig.5 The window with the doctor's CV

Each user (patient) has it's password and if he forgot the password he has the possibility to recover it (Fig.6).

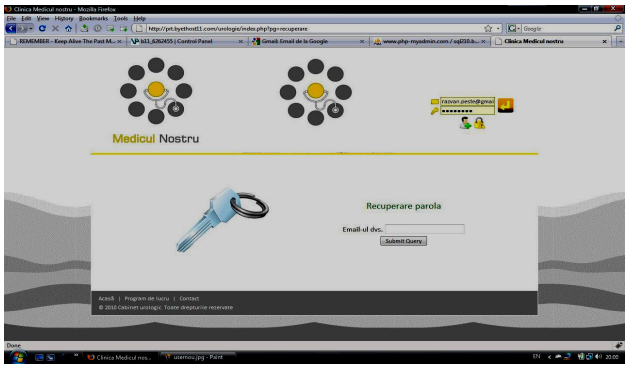

Fig.6. The window showing password's recovery

The user has the possibility to choose one date for one appointment by ticking in a calendar that appears on the screen (Fig.7).

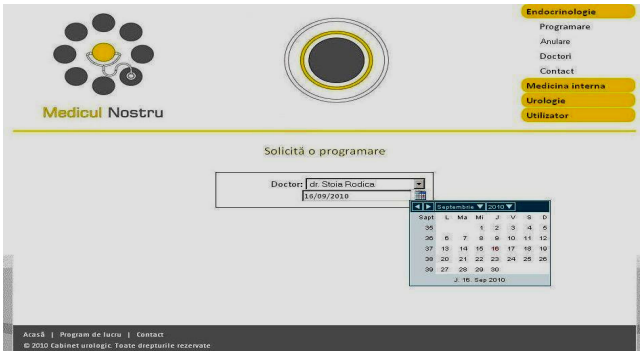

Fig. 7. The window for medical consultation (Endocrinology practices)

The application requires an advanced database management. We have created the model of the database according to the entity relationship method [1, 12]. The information can be found in the database and is stored in tables related to: the three available medical practices (specialities), the doctors and the users (patients). Data base is annually updated by the administrator with new information collected by doctors from their patients during the most recent medical evaluations. For this purpose the software system "OnLine Patient Record" will be used (Fig.8) [13]. The medical professional users (doctors or nurses) are authorised to store the information inside database after authentication, into the fields enclosed in *Fişa de observaţie clinică generală (Patient record)* (Fig.9).

Fig.8. The main Interface of *Online Patient Record* [13]

The information regarding the patient can be print or displayed by request. Using the unique key identification number (CNP), it is possible to access the patients' medical history. Each patient history means the confidential data collected from previous medical consultations and the analysis performed, interpreted and correlated with the clinical evaluation.

It is also possible for a user to check his own previous medical history (consultations and tests) and to recover all data using his password automatically. The system is protected all information according to ethics and confidentiality rules.

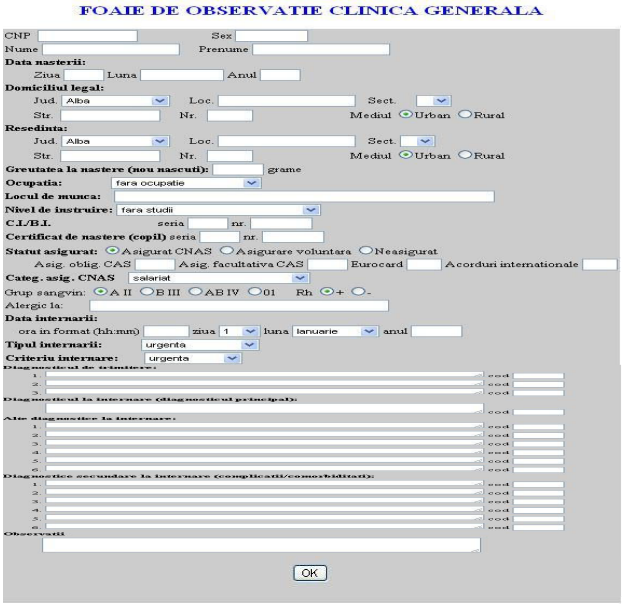

Fig. 9. The window with the patient's information (individualized) [13]

4. Conclusion

This software application has been created to be easily scalable and adaptable (on request) to other medical practices, offices or clinics. The application uses PHP server-side scripting language, MySQL database, all of these technologies are open sources, and allow easy implementation on any server with any operating system. The application is very dynamic and allows obtaining the information about the schedule of a certain doctor in real time. Each patient will be warned 24 hours before, about his clinic schedule, with an email automatically sent by the server, informing each patient 24 hours before about his medical appointment, documents he should bring with him or other information. On line cancellation is possible making easier any contact patient-doctor-health system. In the same time, each doctor can check each patient full medical history and consequently to think and decide a specific treatment, to integrate new data when patient follow up, meaning a permanent medical updating.

Acknowledgements

Many thanks to Mr. George G. Sangeorzan from Hillside Product Design Lmited, Teignmouth, U.K, Product Designer, for creating the logos of the site.

References:

[1]. Eessaar E., SQL or Third Manifesto Compliant Object-Relational Database Management Systems as the Platforms for Maintaining the Whole-Part Relationships in a Database, WSEAS TRANSACTIONS on COMPUTERS, ISSN 1109-2750 Issue 10, Volume 5, Oct. 2006, pg.2240-2448.

[2]. Greenspan J., Bulger B. – MySQL/PHP Database Applications ISBN 0-7645-3537-4; M&T Books

[3]. http://www.adaptivepath.com

[4]. Moisil, I; Domnariu, C; Rogozea, L., Web-based Citizens Education for a Healthy Life-Style, 8th WSEAS International Conference on Artificial Intelligence, Knowledge Engineering and Data Bases, Date: FEB 21-23, 2009

[5]. Moisil, I; Jitaru, E. E-health progresses in Romania, International Journal of Medical Informatics, vol: 75 Issue: 3-4 pg: 315-321, 2006

[6]. O'Reilly Tim (2006–12–10), Web 2.0 Compact Definition: Trying Again. Retrieved on 2007-01-20.

[7]. Pop I., Popa E. M., Algebraic Modelling for Web Mining Applications and for Component Based-Web Design

[8]. Sângeorzan L., Aldea C. L., Tehnologii internet, Ed. Univ. Transilvania din Braşov, pg. 160, 2003, ISBN 973-635-176-9.

[9]. Sângeorzan L., Florin T., Rogozea L., Miclăuş R., Summary statistics for Training Medical Students, 29th International Conference of the Romanian Medical Informatics Society, MEDINF 2007, e_Health Days in Sibiu, pg. 299-304, 8-11 Nov. 2007, ISSN 1843-651X

[10]. Sangeorzan L., Tehnologii Web si Web Design, Ed. Universitatii Transilvania din Brasov, ISBN 978-973-598-523-3.

[11]. Sângeorzan L., The Bearing Quality Inspected with a Software Based on Web Technologies, 6th International DAAAM Baltic Conference Industrial Engineering, 24-26 April 2008, Tallin, Estonia, pg. 171-182, ISBN 978-9985-59-783-5.

[12]. Welling L., Thomson L. - PHP and MySQL Web Development, 2001 Sams Publishing, USA, ISBN 0-672-31784-2.

[13]. Livia Sangeorzan, Anisor Nedelcu, Camelia Mazgaciu, Liliana Rogozea, Cezar Podasca Online Patient Record in an Emergency Room Based on WEB 2.0 Technologies, WSEAS, APPLIED COMPUTING CONFERENCE (ACC '09), Date: September 28-30, 2009