CHAPTER 5

A DEVELOPMENTAL PROCESS OF A REAL TIME WEB-CENTRIC DIABETES DIAGNOSIS TELEMEDICINE SYSTEM

5.1 INTRODUCTION

This chapter presents a development process of real time Web-centric intelligent health care diagnosis system to support the diabetes diagnosis and particularly focuses on the development process of its corresponding Web applications. As a case study, the Web based diabetes expert system WEBDIACIN is presented. We propose a medical network based on state-of-the-art medical kiosk that addresses the problems of providing preventive and diagnostic health care. The combination of the expert system with the benefits of Web technology allows that several doctors and patients use the benefits of the system for support the detection of diabetes. The rules of the expert system are applied to diabetes, and the related diseases that puzzle the doctor in the diabetes evaluation, of diabetes.

In a few years time, Internet and especially worldwide Web
developed quickly from a media of information sharing to a ubiquitous platform of several applications like online banking, e-governance, e-commerce, digital libraries etc. Today, the developers of expert systems have the good chance to share their applications via the Web also.

The promotion of an expert system includes a number of challenges that must be surmounted like: domain experts’ identification and persuasion for collaboration, knowledge acquisition and knowledge representation, coding, validation, verification etc. Since there is a frantic rush to be on the Web, the number of expert system is expected to grow, which is a reason for some of the current problems surrounding Web based systems development.

The ultimate aim of this research is to clarify that Web centric diabetes expert system can be developed by merging an expert system and a Web application developing sub projects. The Web application we are referring to is a Web centric diabetes expert system.

5.2 DEVELOPING PROCESS WEB-CENTRIC EXPERT SYSTEM

This thesis focuses on a Web centric diabetes expert system development process that can be considered as an attempt to combine two subprojects, a diabetes expert system and a Web application.

The Expert system became a commercially viable solution to real life problems at the beginning of 1980’s. Recent advances in the field of
artificial intelligence have led to the emergence of expert systems, computational tools designed to capture and make available the knowledge of experts in a field. Although much of the underlying technology available today is derived from basic research on biomedical advice systems during the 1970s, medical application packages are thus far generally unavailable from the young artificial intelligence industry.

Medical expert systems will begin to appear, however, as researchers in medical artificial intelligence continue to make progress in key areas such as knowledge acquisition, model-based reasoning and system integration for clinical environments. It is accordingly important for physicians to understand the current state of such research and the theoretic and logistic barriers that remain before useful systems can be made available. Our experimental system, Webdiacin, provides a glimpse of the kinds of Web based intelligent knowledge-based tools that will someday be available to physicians.

5.2.1 Diabetes expert system development

The process of diabetes expert system development

- Diabetes domain experts identification
- Diabetes knowledge acquisition
- Diabetes knowledge representation
- Design of the diabetes knowledge base,
- Design of the expert system architecture
- Prototype development
- Refinement of design
- Development of the diabetes expert system
- Verification and testing
Figure 5.1 shows the developing process of the diabetes expert system.

Figure 5.1 – Expert system development process
5.2.2 Web application development subprojects

Figure 5.2 shows the Web application development process of a diabetes expert system. Today, Web application developers are using a mix of concepts, tools, methods and best practices from several scientific fields like software engineering and information systems to address the specificity of the Web.

The essence of Web engineering is to successfully manage the diversity and complexity of the Web applications development, and hence, to avoid potential failures that can have serious implications. The Web application for the diabetes expert system during its development and based on Web engineering principles, must accomplish the following activities.

**Major activities of Web application development:**

- Identification of user requirements and specification: The requirements for the system as a whole are established and written to be understandable to all stakeholders. The entire system requirements are analyzed based on functional and non-functional, and personalization requirements and specifications are identified.
  - The pages to be created to interact with the users and administrator are listed out.
  - The proper tool for developing Web application is identified.
  - Design database: Important Web application notions and sub notions that must be displayed to Web users into implemental data structures are identified, analyzed and described. Their hierarchy, relations and the set of data that will change often are specified.
Requirement Definition

Analyse Requirement

Develop Prototype

Is Design Satisfactory?

Yes

Template / Tool Selection

Design / Develop Web Pages

Is Design Satisfactory?

No

No

Refine Design

Yes

Implementation and Maintenance

Figure 5.2. Web application development process
- Web page template creation and Web page designing: The basic objects that constitute the Web pages (tables, frames, layers, images etc.) to deliver a specific set of information or data to the user by taking into consideration like data entities mapping and Web page linking are identified. The HTML code by considering color, fonts, tables and images are written. The parts of the pages like logo, navigation bar, links that are common to several html pages used within the templates are identified.
- Designing the architecture of the Web application: The hardware and software that must be used (databases, servers, firewalls, routers, etc) are identified. The method of connecting these components in order to deliver the use of Web application is identified.
- Security checks are applied.
- Testing and evaluation: The degrees to which the requirements have to be fulfilled are identified.
- Launch application- all the above processes are combined into a real physical system for implementation.
- Finally, the physical system implemented is maintained.

5.2.3 Combined Web centric expert system

Combining the developmental process of both the expert system and the Web application, we have developed Web centric diabetes expert systems WEBDIACIN. The subprojects can be merged in a manner that activities of the expert system development can be performed in parallel with activities of the Web application development and the activities of the second can provide
feedback and crucial information for activities of the first and vice versa.

WEBDIACIN’s Web based expert system subprojects merging process is briefly displayed in Figure 5.3.

5.3 DISCUSSIONS

Many expert systems have been developed since the mid of 1960’s and numerous experiences are available on their development. In that case it is necessary to have suitable engineering methods and processes in order to design and develop a Web centric expert system that is something more than just a conventional expert system. Web based expert system development processes requires the use of several scientific principles like knowledge engineering, expert system programming, Web designing and programming, data base design and management, network security etc which have been applied in our WEBDIACIN- Web centric expert system.
Figure 5.3. Web centric expert system (combined subprojects)
5.4 CONCLUSIONS

This chapter presents the developing process of Web centric expert system- WEBDIACIN. This developing process has been followed for Web diacin. As a case study, the architecture of Web diacin, as well as its developing steps were presented. The real-time Web centric intelligent health care diagnosis system supplies (via usage of Web-centric technology) the ability to access the diabetes expert system from any part of the world. It has a Web based user interface to the diagnostic system that enables access from any part of the world. Telehealth care solution aims to act as an “intelligent” proactive agent representing and guarding the person’s long term health related interests and concerns, serve as an efficient healthcare information management infrastructure to collect, organize, and distribute relevant knowledge and service information to the individuals, provide remote, Web based health care monitoring and diabetes diagnostic services, accessible from the home, or kiosk. The system includes integrated Web server, secured data storage and transfer, delivering of data. It can be adapted for any E-health System.