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THEME:

"BENCHMARKING OF WEB METHODOLOGIES"
"DENTAL CONTROL SYSTEM"

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Abstract *The present thesis project is based on the research and comparative study of certain web methodologies, which through a thorough analysis will select the best adaptable methodology in the development of web applications. The development of the present comparative analysis has been classified as follows: **Chapter 1.-** Chapter one presents the introduction, background, current situation, prospective, approach of the problem and the objectives for which it is necessary to develop this research, based on a well-structured scope and justification. **Chapter 2.-** Chapter two establishes the theoretical framework of the main web methodologies that will make this study possible, in turn the basic conceptualization of the tools and technologies that will be used in the development of the dental control application. **Chapter 3.-** Chapter three contains the comparative analysis of the web methodologies studied and their evaluation through the requirements model and the ISO / IEC 9126 standard, thus selecting the most adaptable methodology in the development of web applications. **Chapter 4.-** Chapter four uses the methodology highlighted in the investigation, for the development of the application of dental control. **Chapter 5.-** Chapter five presents the dental software according to the guidelines established in the selected methodology. **Chapter 6.-** Chapter six presents the results generated by the use of the winning methodology in the construction of the dental web application.*

Keywords

Web methodologies, web engineering, study, research, comparative analysis.

Resumen. *El presente proyecto de tesis se basa en la investigación y estudio comparativo de determinadas metodologías web, las cuales mediante un análisis exhaustivo se seleccionará la metodología mejor adaptable en el desarrollo de aplicaciones web. El desarrollo del presente análisis comparativo ha sido clasificado de la siguiente manera: **Capítulo 1.-** El capítulo uno presenta la introducción, antecedentes, situación actual, prospectiva, planteamiento del problema y los objetivos por los cuales es necesario desarrollar esta investigación, en base a un alcance y una justificación bien estructurada. **Capítulo 2.-** El capítulo dos establece el marco teórico de las principales metodologías web que permitirán realizar este estudio, a su vez la conceptualización básica de las herramientas y tecnologías que se utilizarán en el desarrollo de la aplicación de control odontológica. **Capítulo 3.-** El capítulo tres contiene el análisis comparativo de las metodologías*

*web estudiadas y su evaluación mediante el modelo de requisitos y la norma ISO/IEC 9126, seleccionando de esta manera la metodología más adaptable en el desarrollo de aplicaciones web. **Capítulo 4.-** El capítulo cuatro utiliza la metodología destacada en la investigación, para el desarrollo de la aplicación de control odontológica. **Capítulo 5.-** El capítulo cinco presenta el software odontológico según los lineamientos establecidos en la metodología seleccionada. **Capítulo 6.-** El capítulo seis presenta los resultados que generó el uso de la metodología ganadora en la construcción de la aplicación web odontológica*

Palabras Claves

Metodologías web, ingeniería web, estudio, investigación, análisis comparativo.

I. INTRODUCTION

The navigation on the web has become a daily action of the human being, all kinds of users are immersed in the use of sites that are housed in cyberspace, supported by the breakthrough of computer technology, adaptable tools for multiple devices electronic systems that allow an immediate connection to the internet and the constant development of communication networks that grant global and instantaneous access. Whoever accesses the world of the web finds an infinite space of sites that present information, services and applications seeking to satisfy the needs of users, but different concerns are presented such as: What are the guarantees of using these websites? Are web spaces that have reached effectiveness, impact and acceptance in consumers? o Are web applications that have gone through a process of study and structural design? arriving at an unfavorable result that in most of the situations is not established a previous study, a structural design or planning for the development of web applications (Rodriguez, 2010). For this reason it is necessary to make use of specific tools and methodologies that allow the development of computer applications, using formal methods of design and implementation, establishing in this way that computer systems are fully structured and functional. Although at the moment several methodological standards have been defined, be they traditional, agile or hybrid, other types of methodologies that are directly focused on the creation of web applications have not been highlighted, due to the ignorance of the methods and the minimum use of them, They have made these methodological techniques go



unnoticed when creating the software. Due to the existence of an indeterminate number of web methodologies, and the scarce research on the best methodological model, it is necessary to carry out a comparative study of these methods of structuring, planning and controlling the application development process. Dental health care has become an essential service for society, such a need is visible when making use of it. The dental service works with a number of clients that generate large amounts of data, which for better care must be manipulated and assisted by some type of computer application of control, otherwise it will result in a poor service provision due to the control of large volumes of information. Many are the cases of dental care institutions where their information is handled in a personal way through the use of files, folders and physical agendas, in which the information is noticeable that is not supported, with a high risk of being lost, even reaching to cause the fear of being mishandled. One of the cases described above is the Dental Clinic of Dr. Luis Andrango located in the city of Otavalo (Imbabura - Ecuador), which has been providing services for around 25 years. Due to the massive acceptance of the quality of service provided by the Odontologist and the large storage of physical information, it is necessary to implement a web application for dental control that guarantees the quality, backup and safe handling of the information of this center. dental health.

II. PROBLEM

How will the use of an appropriate web methodology influence the development of computer applications?

By means of the comparative analysis of methodologies, the most appropriate methodological tool for the control of the development of web applications will be selected, which will allow the construction of quality software, because the aforementioned models make a detailed approach in the analysis of requirements and in the processes of conceptual and navigational modeling, mainly analyzing the abstract interface of the developed software, guaranteeing in this way the formal structuring and the correct implementation of the computer application.

How will the selection of an appropriate web methodology help in the development of the dental application?

The use of an adequate methodology will help in the construction of a good web application, complying with the detailed requirements in the previous analysis phase, performing in the same way the analysis of the conceptual, navigational and abstract interface modeling, presenting an efficient, robust and with a very visual and acceptable interface by the end user, thus delivering a very useful and functional computer tool, which will be very useful for the dental medical sector.

III. JUSTIFICATION

Social impact

When executing this comparison, we want to introduce the software development environment, the need to use a certain web methodology to develop the applications, discarding the use of any other methodologies, be they traditional, agile or hybrid.

In this way, the use of a methodological standard will help in the development process of the dental application, encouraging the entire group of dentists to use the computer application, being a software intended by the doctors of the dental area.

By implementing the dental web application, the aim is to modernize the control of information in the health center, through the use of information technologies, promoting the improvement of quality in the provision of services and positively impacting the population. this way to the guidelines of objective 3 presented in the National Regime of Electronic Government and the National Plan of Good Living (National Secretariat of the Public Administration, 2017).

Technological Impact

The comparison between web methodologies is carried out because the result of the study will contribute in the development of computer applications with quality methodological standards, presenting an effective web method that helps control the analysis, design and implementation of a computer application.

The use of the preponderant methodology will help in the process of developing a web application for the dental sector, where the control processes will be automated and in this way the dental environment will be innovated based on computer technology.

Economic impact

When comparing and finding an adequate methodology, it is planned to reduce the time of development and cost of the application, this will help efficiently the construction of web applications.

Environmental impact

By making use of the dental clinical system, the use of paper and physical material will be reduced since all the data and information generated in the dental offices will be stored in computer media, thus reducing the consumption of physical documents and thus contributing to the environment.

IV. GENERAL PURPOSE

Analyze the benchmarking of web methodologies for the development of computer applications.

V. REACH

The comparison made analyzes the use of methodologies, selecting from the broad field of web engineering three methodological tools of which the most convenient will be selected in concepts of:

- Characteristics,
- Advantage,
- Disadvantages

For the development of the research, three methodologies will be selected that will enter into the comparison process. After the analysis and study of web methodologies, the dental control system will be developed where the most appropriate web model will be used according to the results obtained in the research.

Functionality and modules to be developed

The dental control system will be an application that will be hosted on a server on the web, the application will be developed in free software tools such as:

- PostgreSQL Database 9.3
- JavaServer Faces (JSF)
- PrimeFaces
- JasperReports

Next, in Figure 1. The scheme of the operation of the dental application is identified.

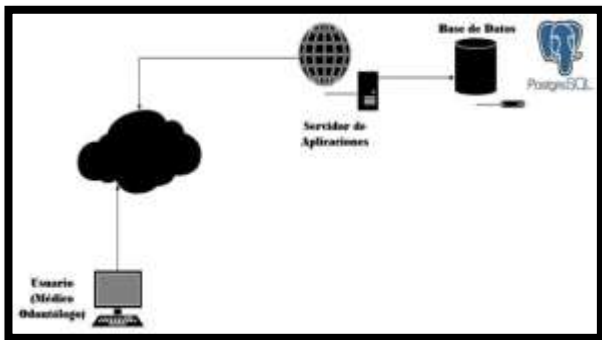


Fig. 1: Esquema de funcionamiento de la aplicación.

Fuente: Propia

The dental control system will efficiently help to optimize the processes of:

- Control of information and access of system users.
- Control of information of patients and doctors.
- Control of procedures.
- Dental control.

The application of dental control will be structured according to the modules presented in Figure 2.

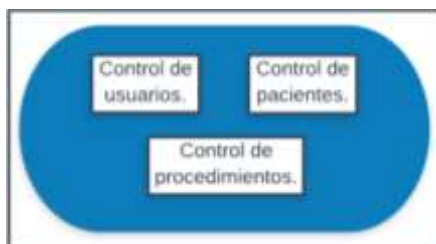


Fig. 2: System modules.

Source: Own

- User control module

It will allow full control of users who will have access to the dental system.

- Patient control module

It will allow to administer the information of the patients and the odontological control of the same ones.

- Procedure control module

It will allow the control of dental procedures provided by the dental entity

Architecture

The dental system has been built using the MVC pattern (Model, View, Controller) thus separating the layers of the software construction, the architecture is detailed in Figure 3.

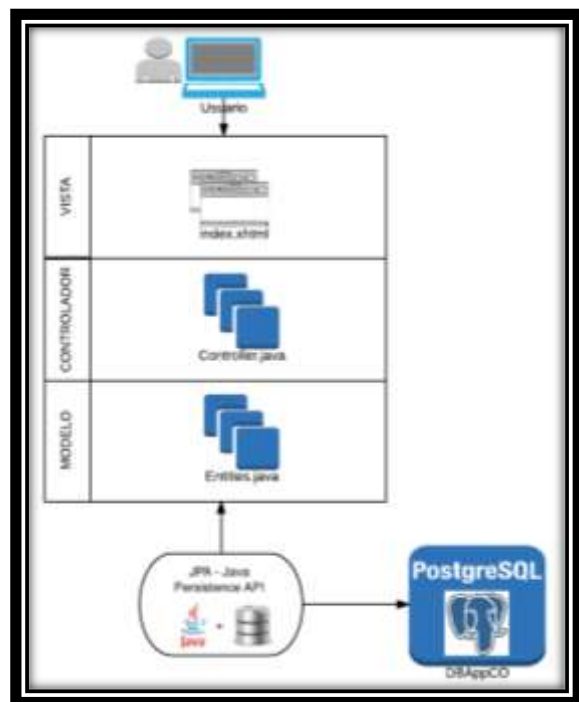


Fig. 3: Arquitectura de software

Fuente: Propia

VI. Comparison of web methodologies

Currently, there are several web-based models that are applied in software development, such as the OOHDM, WSDM, UWE methodologies that are part of the comparative analysis of this research. According to (Calva & Romero, 2010) with the appearance of the object orientation paradigm, other methodologies such as OOHDM, which tries to encompass the development cycle in general, have been widely accepted, due to the new trends that it incorporates. , as the fact of separating the conceptual model, the navigational and the abstract interface independently. The WSDM methodology that focuses on the analysis and study of user groups, while the others focus on making a high-level class model to represent the conceptual model of the system. On the other hand, UWE maintains the object-oriented modeling technique, but introducing a

standard notation based on the use of UML for each stage of the methodological standard

VII. Comparative analysis of parameters

Table 1 presents a comparison of the main quality characteristics of the ISO / IEC 9126 standard, for a later selection of parameters that will help in the comparative analysis of the current research.

Table 1: Comparison of the characteristics of ISO / IEC 9126

NRO.	PARÁMETRO	INDICADOR	APLICA	NO APLICA
1	Funcionalidad	Adecuación	✓	
		Exactitud		x
		Operabilidad		x
		Seguridad de acceso		x
		Cumplimiento de Funcionalidad		x
2	Confiabilidad (Fiabilidad)	Madurez		x
		Tolerancia a fallos		x
		Recuperabilidad		x
		Cumplimiento de Fiabilidad		x
		Capacidad de ser entendido	✓	
3	Factibilidad de uso (Usabilidad)	Capacidad de ser aprendido	✓	
		Capacidad de ser operado	✓	
		Capacidad de atracción	✓	
		Cumplimiento de usabilidad	✓	
		Comportamiento temporal	✓	
4	Eficiencia	Utilización de recursos	✓	
		Cumplimiento de eficiencia	✓	
		Facilidad de análisis		x
5	Mantenibilidad	Estabilidad		x
		Facilidad de prueba		x
		Capacidad de ser cambiado		x
		Adaptabilidad		x
6	Portabilidad	Facilidad de instalación		x
		Coexistencia		x
		Reemplazabilidad	✓	

Source: Own

VIII. Development of the UWE methodology (UML-Based Web Engineering)

It focuses on the creation and implementation of the dental control application through the use of the UWE methodology that turned out to be the best adaptable methodological standard in the development of web applications.

The dental software was developed with the aim of automating the control processes, and in this way guaranteeing the quality and safety of the information in the dental institution.

To meet the requirements, an interview was conducted with the beneficiary of the web application, who explained the needs through the following table.

Table 2: Requirements of the Dental Software

Nombre	Descripción	Prioridad	Nivel de Riesgo
Control de Usuarios	Control de acceso	ALTA	Crítico
	Ingresar, Actualizar, Eliminar, Consultar,		
Control de Pacientes	Ingresar, Actualizar, Eliminar, Consultar,	ALTA	Crítico
	Control odontológico		
CONTROL DE MÉDICOS (OPCIONAL)	Ingresar, Actualizar, Eliminar, Consultar	BAJA	Baja
Control de Procedimientos	Ingresar, Actualizar, Eliminar, Consultar,	ALTA	Crítico
Reportes	Visualizar	BAJA	Baja

Source: Own

IX. RESULTS

Impact analysis

The analysis of impacts is supported by statistical information, changes and improvements in processes, design, times, performance, etc. In addition, it allows to know the benefit obtained by the dental application when using the UWE methodology.

Table 3 shows the results of the analysis of the impacts obtained by using the UWE methodology in the construction of the web application.

Table 3: Results of the impact analysis

Análisis (cambios y mejoras)	Evaluación Anterior	Evaluación actual	Explicación (Evaluación actual)
Procesos	6	10	Se mejoró la comprensión de los procesos detallados en la metodología UWE, ayudando positivamente la construcción de la aplicación web.
Diseño	7	10	Al aplicar la metodología UWE se pudo desarrollar una aplicación que contenga una presentación atractiva al usuario final.
Rendimiento	7	10	Al usar la metodología UWE el sistema funcionará eficazmente.
Tiempos	5	10	La construcción de la aplicación web se desarrollará en menor tiempo gracias al uso de la metodología UWE.

Source: Own

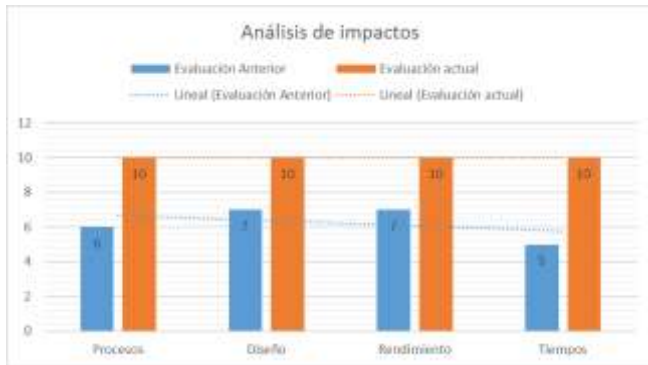


Fig.4: Graphic representation of the impact analysis
Source: Own

By using the UWE web methodology, the development of the dental application was improved, the information is confirmed in Figure 5.

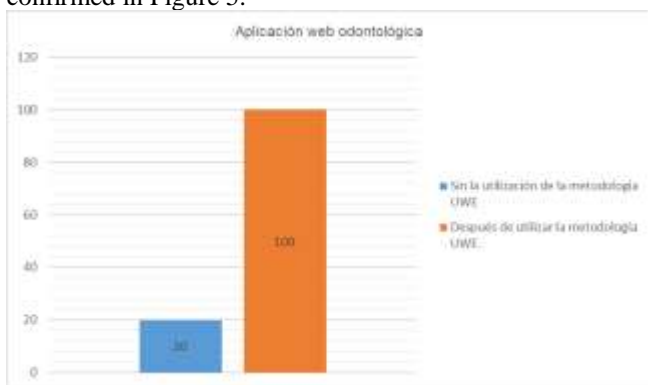


Fig. 5: Graphic representation of the use of web methodology
Source: Own

After the use of UWE (UML-Based Web Engineering) excellent results were obtained, because the applied methodology helped in the construction of a high quality web application, since it considers the detailed analysis of the requirements, clarity in the representation of the conceptual and navigational design, and particularly develops a very attractive graphic interface and accepted by the end user.

According to the results obtained, it is essential to use the UWE methodology (UML-Based Web Engineering) in the development of web-based applications.

X. CONCLUSIONS

You can argue the following:

- The main methodologies were investigated, which allowed to know that OOHDM, WSDM and UWE are the most preponderant models for the development of web applications.
- The comparative analysis of the OOHDM, WSDM and UWE methodologies was carried out through the development of prototypes, evaluation model and several criteria of the software quality standard ISO / IEC 9126.
- Through the results obtained in the comparative study it was determined that, the UWE methodology is the best adaptable model in the development of web applications.

- The dental control software was created by using the UWE methodology, this allowed the development of a good and functional web application.
- It has been concluded that there is no perfect methodology for software development.

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