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Design and Implementation of a Learning Content Management System (LCMS): A Case Study of the Department of Computer Engineering, Faculty of Engineering, University of Benin, Benin City, Nigeria

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ABSTRACT

The learning content management system designed encompasses the capacity for archiving student's projects, the capability for improving the learning methods in the department of computer engineering and facilitating the students' communication with the lecturers in the department. This work was implemented using a web engineering technique called evolution web-based development process which involves sub-processes such as context analysis, designing system architecture, project plan down to the actual development of various web pages. The result is a fully functional website integrated with the learning content management system.

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1. INTRODUCTION

A learning content management system (LCMS) is a software application or set of related programs that are used to create and manage website content (Leach and Vogel, 2006; Rouse, 2016). Hitherto, document sharing platform has been used for sharing information between two ends. In addition, media such as google drive and drop box are also document sharing platform. Some other LCMS such as Moodle, Sakai, Atutor, etc. have also been used for administering courses in universities and other institution of learning (Foster, 2014).

Some of the problems inherent in those aforementioned systems include limited scope and functionality of the document sharing system, complexity of the interface of some well-known LMS, limited space available for upload in platforms like google drive and drop box and cost of using a proprietary software (France, 2012).

Apart from proffering solution to the problem above, the new things provided by this work are forum for communication by both lecturers, students and graduates from the department, means of sending Lecturers

personal messages by students, and an archive containing outstanding project works done by graduates from the department.

The aim of this work is to design and develop a fully functional LCMS and a well-structured website interface.

2. METHODOLOGY

2.1. Evolutionary Web-based Development Process

The LCMS was developed out using a web engineering process called evolutionary web development process which involves sub-processes such as Context Analysis, Architectural Design, Project Plan, Process Model, etc (Bjorner, 2006). The web development process was used to break the web development efforts into manageable chunks and offers techniques to help in successfully managing and completing the LCMS. These various manageable chunks or parts are shown in Figure 1 (Dingle, 2014).



Figure 1: Evolution development process

2.1.1. Context analysis

The first essential procedure that was used in developing the LCMS is context analysis. In this step, elicitation was carried out and thereafter an understanding of the system's core objectives and requirements, gathering information about the operational and application environment, and identification of the system's primary stakeholders which in this case was the project supervisor, some departmental lecturers and some classmates (Guckenheimer et al., 2012). Figures 2 to 4 show the context analysis for the LCMS with the various requirements or functionalities that were needed or provided for the administrator, Lecturers and Front-end users respectively by the system.



Figure 2: Administrator system requirements



Figure 3: Lecturer system requirements



Figure 4: Website users system requirements

2.1.2. System architectural design

The system architectural design of the LCMS was designed using Microsoft Visio in order to indicate the various components (i.e. Web pages) of the LCMS and how they are linked. Thus, suitable system architectural designs for the LCMS were developed based on the system's requirements which were derived from context analysis. These system architectural designs are shown in Figures 5 and 6. These two figures were combined to form Figure 7 which represents the whole system activity diagram. Figure 8 shows the entity relational diagram for the database structure.



Figure 5: Activity diagram showing the methodology of the front end



Figure 6: Activity diagram showing the back-end methodology

Figure 5 shows functionality like forum interaction, contacting the department, downloading materials, etc. that the main website interface (Front End) will provide for the website visitors. Figure 6 shows functionality such as Course Editing, Project File Editing, Messaging, etc. that the back end can provide for the Administrator and/or Lecturers. Finally, Figure 7 shows a combination of the Front End and the Back End which together makes up the whole system structure or architecture while Figure 8 is the entity relational diagram which is the schematic of the database. This database contains a collection of tables such as the Course, Latest News, Login tables, etc.



Figure 8: Entity relational diagram of computer engineering learning content management system schematic

(4,294,967,295)

2.1.3. Process model

A process model was used to specify the set of activities required to be carried out in order to develop and implement the LCMS.



Figure 9: LCMS process model

2.2. Testing

Testing was carried out in order to determine if the unit, integrational and whole system was working efficiently (Agarwal et al., 2010).

2.2.1. Unit, integrational and whole system testing

Unit testing was carried out on single page such as the homepage in order to determine if the content and the various page elements were displayed properly (Gilmore et al., 1994). Integrational testing was carried out mostly on the backend in order to determine if a certain collection of pages were working together properly for an operation to be carried out. For instances, to perform the function of editing a course, the Create Course Page, Read Course Page, Update Course Page and the Delete Course Page must be functioning efficiently a certain course to be edited. Lastly, the whole system testing was carried out in order to determine if the modular parts integrate properly to form the LCMS (Wieringa and Persson, 2010).

3. RESULTS AND DISCUSSION

3.1. Results of Unit Testing

Figures 10 to 13 show the result obtained from testing the unit that is responsible for sending a message to a certain lecturer.

Step 1: The lecturer display page where a website user can send a message to a lecturer

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Isidaehomen Arthur Edeoghon	

Figure 10: Lecturer profile page

Step 2: A web form field where the message can be sent

:

Send A Message

Subject:	Subject	
First Name:	First Name	
Last Name:	Last Name	
Email:	Email	
Phone Number:	e.g 08098764531	
Message:	What's on Your Mind	
	, ,	
Attachment: Choose File No file chosen		
Send		



Step 3: Fill in form values

Send A Message

Subject:	Testing		
First Name:	Udomoh		
Last Name:	Ammed		
Email:	festus.udomoh@gmail.com		
Phone Number:	08166671357		
Message:	I am just testing this system to know if it is working fine.		
Attachment:	Choose File Chapter Three.docx		
	Send		

Figure 12: Message sending page with details

Step 4: Send the filled form

Message Submitted Successfully



Figure 13: Successful message submission page

3.2. Results of Integrational Testing

The various results of integrational testing are shown in Table 1.

Table 1: Integrational testing results				
SN	Condition tested	Result		
1	User Login page linked to either the administrator or lecturer panel	Successful		
2	Home page links to 'Search for a Lecturer' Successful			
3	Editing (i.e. Uploading, Viewing, Updating, and Deleting) of course content by lecturers or administrator	Successful		
4	Editing (i.e. Uploading, Viewing, Updating, and Deleting) of news content by administrator	Successful		
5	Editing (i.e. Uploading, Viewing, Updating, and Deleting) of project files by administrator	Successful		
6	Viewing of both personal and departmental messages	Successful		
7	Administrator creating users (which are lecturers)	Successful		
/	Auministrator creating users (which are recturers)	Successiui		

3.3. Results of Functional Testing

Functional testing results are shown in Table 2.

Table 2: Functional testing results				
SN	Condition tested	Result		
1	View Message	Program was error free and messages sent to lecturers was delivered		
2	Upload Course Material	Program was error free and course content upload was successful		
3	Update Course Material	Program was error free and update to course content was successful		
4	Delete Course Material	Program was error free and deleting of course content was successful		
5	Update Current Profile	Program was error free and update to current profile was successful		
6	Delete Account	Program was error free and deleting of user's account was successful		
7	Login	The login page logs a user into the administrator or lecturer dashboard depending on who the user is		
8	Upload Project Files	The project files page successfully uploaded project files into the project archive page in the public area		

4. CONCLUSION

Learning content management systems are at the heart of most foreign university for administering courses. The LCMS implemented in this work can be used to communicate with departmental lectures, for administering courses with ease, for managing final year projects with ease and others purposes. It will be a great step in the right direction if the department of Computer Engineering in the Faculty of Engineering, can bring about its birth in the University of Benin.

5. ACKNOWLEDGMENT

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6. CONFLICT OF INTEREST

There is no conflict of interest associated with this work.

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