International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 04 Issue: 10 | Oct -2017 www.irjet.net p-ISSN: 2395-0072

Development of Southern Luzon State University Digital Library of Theses and Dissertation

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Abstract: *The project developed a digital library of theses and dissertations that would help students, faculty, and researchers of Southern Luzon State University in doing their library work without going to the physical location. Agile Model, a practice-based methodology for effective modeling and documentation of software-based systems was utilized in developing the system. MARC is used in proper cataloguing and XML for sharing information in some catalogues of the theses and dissertations. After project development, it was evaluated and tested by different users – the librarian, researchers and students – based on ISO 25010 software quality standards. The evaluation showed that the users strongly agreed on the system's usability. However, it is recommended that for hosting a better hardware specification, two (2) CPUs with the speed of 3.8GHz and a minimum of 2048MB of Random Access Memory based on numbers of 8,000 accounts equivalent to 17,000 articles with one terabyte of hard disk drive capacity for storing the database and the theses and dissertation must be used.*

Key Words: Digital library, Agile Model, ISO 25010, MARC, XML

1.INTRODUCTION

Project Context

The project focused on developing the Digital Library of Theses and Dissertations of the Southern Luzon State University. The project was developed using a Machine-Readable Cataloging (MARC) Standard for metadata creation, Native code for the web interface and Open Archives Initiative Metadata Harvesting Protocol (OAIMHP). The metadata, harvesting and internet service is a current trend in information development and software application indexed by Google by applying the guidelines of indexing for the webmasters to index all journals.

Knowing the credibility of the digitization project, services of the SLSU library can be expanded in terms of the services and information sources as added complement to the existing services of the university as this will also increase and expand resources for new services. Therefore, this project proposal does not only concern the professional growth of the proponent but also of the SLSU community.

Project Rationale

According to Subrata (2006), the internet technology has brought the world closer to form a global village where everybody is a stakeholder. With a few clicks, one can access all the resources available. "Information" is the buzzword for all developed nations and the information-rich are ruling the world. Everybody is trying to communicate or disseminate or learn something and gain knowledge and the library is the right place to draw out information. Internet technology has made it possible to search, read and disseminate information and collection beyond the library walls just by sitting in front of a computer without physically visiting its physical spaces.

Internet technology is being tapped or used by all libraries to offer a new venue of researching or conducting a research study. In the traditional library, the researcher must go to the library to get a journal for his research as additional reference. But now, with the use of internet technology, the journals can be seen without going to the library personally.

Sulleman and Fox (2011) added that at the beginning of digital library development, the system tended to go its own because of the needs of a particular community. Intended to be a quick solution to urgent community needs, variation of the retrieval interface, system structure, and the management policy all emerged. In order to vertically integrate or horizontally link related documents and content with digital archives, it is necessary to provide the function of union cataloging to operate alongside the archives. Thus, there are three basic differences between library automation and digital archives system: the documents must simultaneously contain both of the description data (metadata) and digital object (multimedia); the demand of data structure for digital archives; and the mechanism of interoperability among system or content (Yu, 2005).

A number of specific requirements should be taken into consideration for the development of a web-based digital library of university data. Like any application that employs web technologies, such an effort must follow certain fundamental design principles. Thus, implementation should be based on protocols and software tools that are well accepted by the web community in order to maintain interoperability between various components of the digital library.

The study focused on developing a digital library to improve library services or expand its services to the satellite campuses without the burden of travelling from the hometown to the main campus.

The conceptual paradigm illustrates the existing problems in the traditional library services, the process involved in developing the digital library, and the advantages of using the proposed system.

Figure 1. Paradigm of the need to develop the system.

Figure 1 shows the methodology for the realization of the project Development of SLSU Digital Library of Theses and Dissertations. The development project begins with the gathering of requirements and analyzing the risks. In this regard, the collaboration of the proponent and stakeholders are a big factor in the success of the system.

Information System Development Methodology

This part discusses the type of system development methodology paradigm that the proponent used in the development of the system. After the proponent analyzed the current situation, he decided to choose the appropriate methodology in development of the project. The proponent chose Agile Development that can be incorporated to a project during the requirement gathering and design phases. As requirements are gathered, the models need to be updated to incorporate the new project details. Additionally, the Agile Models created during the requirement phase can be the bases for the models created during the design phase. It is important to only add to the model the changes made to fit the Agile model characteristics and not to overly complicate the design. (https://dzone.com/articles/what-agile-modeling-and-why-do)

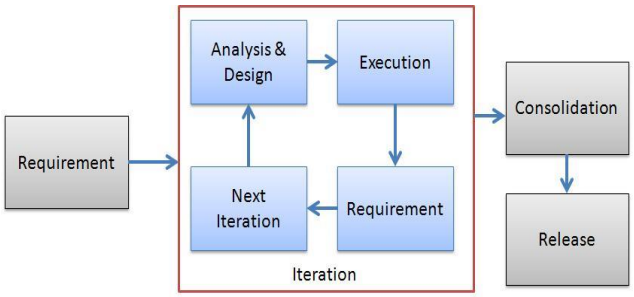

Figure 2. Agile modeling of SLSU digital library of theses and dissertations.

2. REVIEW OF RELATED LITERATURE, STUDIES, AND SYSTEMS

Internet and Research

Kubly (1997) stated that the rise in popularity of the Internet has had an enormous impact on scholarly communication, especially with the development of the electronic journal. There are a number of advantages to reading and publishing scholarly articles in electronic form: World Wide Web publications have a simple interface, easy-to-read typefaces, and hypertext links; publishing on the World Wide Web can be learned fairly quickly and makes information available to the masses; increased availability of new technologies and relatively low cost of electronic distribution are valuable in the face of reduced budgets in academic libraries and universities; primary materials can be made more accessible to a broader audience; electronic journals can also be printed; electronic journals accommodate keyword searching; they are available to many people at the same time and from remote locations; they are self-indexing.

On the other hand, issues of credibility, accessibility, and permanence of electronic journals have to be solved before electronic publication becomes widespread. Some organizations and publishers are trying to find a compromise between traditional print journals and their electronic counterparts. There will likely be a lengthy period of transition as academics begin to see the advantages of mounting their research on the Internet.

Theses and dissertations are considered an important part of information resources in any institution. They are often the only source of research work. Unfortunately, access to these valuable unpublished resources is often restricted to parent institution only. ETD repositories are addressing this problem by making institutional knowledge available online and thereby not only increasing its visibility and use, but also making them

contribute to the impact and ranking of their institutions. (Ahmed, 2014)

Machine Readable Catalogue

MARC records and online policy documents of selected libraries were reviewed to study the approaches taken by libraries worldwide to catalogue electronic journals. In general, libraries catalogue electronic journals that are subscribed on priority basis. Most of them annotate the e-journal to the print record; some prefer to catalogue them separately, while the majority of the libraries adopt both approaches. While most of the libraries studied prefer full record, cataloguing e-journals separately with a brief record (at least containing MARC fields 245, 500, and 856) that identifies and locates the resource seems to be the best practice. (Chaudhry, 2001)

The proposed system is related to some researches and projects that gave the developer knowledge in developing a digital library. Some of these are how to integrate library and digital archives systems, the need of the library systems to revolve around XML for the standard of cataloguing markup, how to store diverse documents in distributed repository structure in a scalable and efficient way and how to share technology for export files and provide a simple way to establish a method for communicating, sharing and delivering data among systems.

Many universities have their own infrastructure for their digital library and how to collaborate or connect their digital library to other universities for additional sources of journals or researches. Some of them use the harvesting technology to gather additional journal for their university for the benefit of the students.

The Networked Digital Library of Theses and Dissertations (NDLTD) (Powel & Fox, 1998; Fox et al., 1997) in the USA is an inter-university digital library based on the SGML-XML and Z39.50 standards. In this work, an argument in favor of XML is presented, claiming that it offers a great deal of flexibility compared with other alternatives such as storing document description in relational database.

This is related to the proposed system SLSU Digital Library because of similarity of features like XML for the format of the documents to be used in the proposed system.

The dLOC (Digital Library of the Caribbean) is collaborative digitization project from and about the Caribbean. It was established by the committee of librarians, scholars, and archivists at a meeting in San Juan, Puerto Rico in July, 2004. This is a joint project of the University of Florida, University of Virgin Islands and Florida International University in partnership with institutions in the Caribbean and circum-Caribbean. A digital library allows the users to browse materials or searches the text through multilingual interfaces. Each item is generated and distributed by each partner, and then submitted to the central server (Sullivan & Ochoa, 2009). This is related to the proposed SLSU digital Library because it allows the users to browse materials or search text in distributed manner.

The North Carolina State University a digital library framework and toolkit is called MyLibrary. At its heart, MyLibrary is designed to create relationships between information resources and people. To this end, MyLibrary is made up of essentially four parts: (1) information resources, (2) patrons, (3) librarians, and (4) a set of locally defined, institution-specific facet/term combinations interconnecting the first three. On another level, MyLibrary is a set of object-oriented Perl modules intended to read and write to a specifically shaped relational database. Used in conjunction with other computer applications and tools, MyLibrary provides a way to create and support digital library collections and services. Librarians and developers can use MyLibrary to create any number of digital library applications: full-text indexes to journal literature, a traditional library catalog complete with circulation, a database-driven website, an institutional repository, an image database, etc. (Morgan, 2008)

This is related to the proposed system because of similarity in features like a database-driven website, an institutional repository and full-text indexes to journal.

The China Networked Digital Library of Theses and Dissertations has been widely realized by Chinese academic libraries in recent years. The China Networked Digital Library of Theses and Dissertations project was initiated by the China Academic Library and Information System and current research into related technologies, including metadata standards, OAI metadata harvesting protocol, standard document format and intellectual property protection. Research work on multilingual and cross lingual searching, personalization and knowledge organization is also described. The goals of the China Networked Digital Library of Theses and Dissertations are to establish electronic theses and dissertations collection for Chinese academic library universities, to provide services to access them efficiently, and to ensure the seamless organization of distributed electronic theses and dissertations collections (Yi Fin, 2004).

3. SYSTEM/SOFTWARE PROJECT METHODOLOGY

System/Software Development Method Used

The study used the Agile Model, a combination of iterative and incremental process models with focus on process adaptability and customer satisfaction by rapid delivery of working software product.

Agile Modeling (AM) is a practice-based methodology for effective modeling and documentation of software-based systems. At a high level, AM is a collection of best practices, depicted in the pattern language map below. At a more detailed level, AM is a collection of values, principles, and practices for modeling software that can be applied on a software development project in an effective and light-weight manner. (http://www.agilemodeling.com/)

Models, Technologies, Tools and Techniques

Models

In order to come up with acceptable solutions to the problems encountered by front-end and back-end users, the proponent decided to use modeling. In this way, the proponent got a picture of what needed to be built before the actual development took place. This enabled a scientific approach in software analysis and development.

The Unified Modeling Language (UML), according to Rouse (2010) is a standard notation for the modeling of real-world objects as a first step in developing an object-oriented design methodology. It focuses on the standard modeling and is not a standard or basic process. UML provides a consistent and reliable language for visualizing, documenting and identifying object oriented software. The diagrams function to depict real world objects that interact in the web application. It also serves as a tool to visualize the tasks at hand without thinking of any programming languages to use in modeling.

Technologies

Open source technologies such PHP, MySQL, and CodeIgniter were used for the web application and database. They provided good performance and are free for use.

PHP is used for designing the web application of the proposed project and for indexing Google.

MySQL used in storing or housing database of the proposed project and accessing and processing data contained in databases.

XML used in the proposed project for sharing information in some catalogues of the theses and dissertations.

MARC 21 was used in the proposed project for the cataloguing of the theses and dissertations to hold or define the content designation or group of the data.

Ajax used in the web applications for transmitting information to and from the server using synchronous requests. It means filling out a form, hitting the submit, and getting directed to a new page with new information from the server.

Bootstrap was utilized in the project front-end framework, an interface for the user, unlike the server-side code which resides on the "back end" or server.

HTML5 was used in the proposed project to make things easier and more cross browser friendly.

CSS is utilized in the project to control the pages displayed and to avoid duplication and to link an external style sheet to document.

Tools

In this study, XAMPPSERVER and Sublime were the tools used to develop the system. XAMPPSERVER including the Apache was used as web server and MySQL as database. Sublime was used as text editor and HTML5 because of its complexity and ease of manipulation of application. All tools used in the system were all open source software used to host a PHP program. phpMyAdmin is a PHP program included in Apache webserver to manipulate the database to create a database.

Techniques

In software development, a prototype is a rudimentary working model of a product or information system, usually built for demonstration purposes or as part of the development process. Prototyping Model, a basic version of the system is built, tested, and then reworked as necessary until an accepted prototype is finally achieved from which the complete system or product can now be developed. (http://searchcio-midmarket.techtarget.com/definition/prototype)

Prototyping is an attractive idea for complicated and large systems for which there is no manual process or existing system to help determining the requirements. In such situations letting the client "plan" with the prototype provides invaluable and intangible inputs which helps in determining the requirements for the system. It is also an effective method to demonstrate the feasibility of a certain approach. This might be needed for novel systems where it is not clear that constraint can be met or that algorithms can be developed to implement the requirements (http://www.freetutes.com/systemanalysis/sa2-prototyping-model.html).

System/Software Evaluation Plan

The completed web application was subjected to various tests and evaluations to find logical, syntax, and runtime errors. This is vital since in software engineering, errors and bugs should be eliminated before the installation

and implementation of the final program. This standard determines the quality of a software product through the ISO 25010 eight internal/external quality model characteristics: functional suitability, performance efficiency, compatibility, usability, reliability, security and portability. (http://iso25000.com/index.php/en/iso-25000-standards/iso-25010?limit=3&start=6).

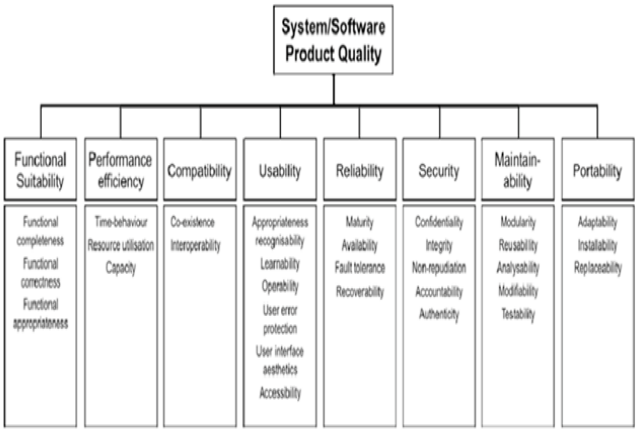

Figure 3. ISO 25010 internal/external quality model characteristics.

This standard provides the definition of the characteristics and associated quality evaluation process when specifying the requirements for and evaluating the quality of software products throughout their life cycle. The intent of this evaluation plan was to provide systematic and reliable data to use for decisions related to the continued development and future use of the system. It addressed issues of usability of the system by back-end and front-end users and the acceptability of its use in mobile environment. The evaluation was conducted by sending the evaluation form personally to varied stakeholders and IT experts. The evaluation form contained questions stated in a simple manner so that users would find it easy to accomplish. The gathered data were tallied, analyzed, and subjected to statistical treatment. Based on the results of the evaluation, the mobile application was improved and enhanced to meet user satisfaction. Responses were based on a Likert scale.

4. SYSTEM/SOFTWARE DEVELOPMENT

System/Software Environment and Description

The Southern Luzon State University Digital Library of Theses and Dissertations would serve as an alternative way of undertaking research without going to physical library. This web application takes advantage of the latest technologies and can take the researcher to another level of researching and library work without boundaries. The system was developed in PHP (Hypertext Pre-Processor) that could run in an Apache web server. MySql was used in creating the database of the system. To use this web application, a web browser is needed that could run in different types of web browser (Internet Explorer, Opera, Safari and Google Chrome web browser). The Southern Luzon State University Digital Library has two (2) main functions: (1) dashboard for creating a catalogue, uploading journals, editing catalogue, deleting and viewing the catalogue; (2) setting which consists of three sub-categories category management, marc management and user account management.

System/Software Evaluation Results

After the development stage of the Southern Luzon State University Digital Library of Thesis and Dissertation, a software evaluation tested the system effectiveness and capability. The librarians, researchers and students were asked to participate in the acceptability and evaluation of the system. Convenient sampling method was used in selecting the respondents who were asked to evaluate the developed system. There were thirty respondents who helped in the accomplishment of the evaluation based on functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability and portability of ISO 25010. The average results were presented in graphs on each sub-characteristic of eight categories.

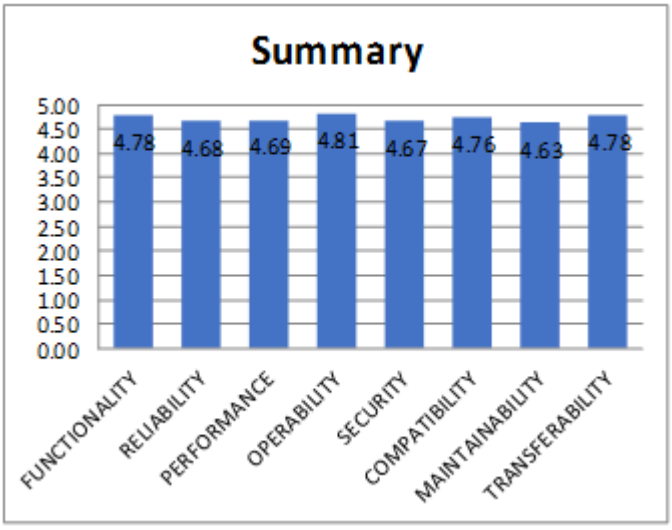

Figure 4. Summary of evaluation of the system.

Figure 4 illustrates the overall evaluation of the end users on the system based on ISO 25010 criteria. The diagram shows that the respondents strongly agreed that the developed system meets the standards of functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability and portability. The result indicates that the system can be functional and useful for the users and implies that the system is highly acceptable to the users.

5. CONCLUSIONS

The developed system entitled Southern Luzon State University Digital Library of Theses and Dissertations was successfully developed utilizing different tools and techniques that satisfied the end users. Based on the data gathered through interviews with students, faculty and researchers and observations, the Southern Luzon State University Library need an alternative way to do research and the developed system that supports a digital library was the response to the identified need. The web application utilized use case diagram, activity diagram, sequence diagram, class diagram, deployment diagram, and database diagram. The developed system also used Unified Modeling Language (UML) as a reliable modeling language in the building of the object-oriented software application development. In Google indexing, the developer used the search engine optimization to index all journals in the digital library. In creating a machine-readable catalogue, the developer used Marc XML Schema. Southern Luzon State University Digital Library of Theses and Dissertations as evaluated based on ISO 25010 software standard is acceptable to the users in terms of functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability and portability. The system can help researchers, librarians and students of the Southern Luzon State University both in the main and extension campuses. The system will serve as a viable alternative to doing electronic research and extension.

ACKNOWLEDGEMENT

The researcher wishes to give his sincerest and warmest gratitude to the following persons for their generous help that inspired him in the completion of this study:

Dr. Jose B. Tan Jr., for his dedication to help the researcher and for his comments and suggestions to make this study more useful not only for the researchers but also for the benefit of the students and the whole university as a whole;

Dean Rodrigo C. Belleza Jr. and Dr. Maria Cecilia G. Cantos, the oral defense panel, for generously giving time, suggestions and opinions;

Dr. Benilda N. Villenas, for giving suggestion which urged the researcher to make this study conform to the generally accepted rules, principles, and conventions of academic writing in English;

Southern Luzon State University, for its earnest desire to develop the abilities of the faculty and for its faith in the potentials of the proponent to express his intellectual capacities in this project;

Dr. Ricaryl Catherine Pornasdoro-Cruz and the late Dr. Ricardo R. Pornasdoro (+) for their support to the researcher to finish his master's degree;

And lastly to all of the researcher's colleagues in the College of Industrial Technology, classmates, friends and specially his wife Sheila P. Danganan who supported him all throughout the study.

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