Development of Online Compendium for Pangasinan State University

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Abstract — **Pangasinan State University is one of the top University in the province of Pangasinan and has 9 different campuses that is located across cities and towns of the province. The university finds research as one way of promoting high quality education. PSU is like any other institution that is finding the task of management, preservation and accessibility of its academic resources, such as its academic researches and papers difficult.**

Therefore, it is vital that the university implements an information system to cater the raised issues on managing its academic researches. The main objective of this study was to design and develop an Online Compendium for Pangasinan State University that will aid in the management of its academic research studies. The Online Compendium of Pangasinan State University is a web based application that provides electronic collection of research studies available to access for students as a fact finding resource and a reference tool.

In order to develop the system, the researchers determined the ICT profile in managing its academic researches in terms of hardware, software, manpower and network infrastructure. The system was developed using Rapid Application Development methodology.

Keywords — compendium; online; development

I. INTRODUCTION

The prevalence of technology drastically affects many areas of society in positive ways, including education. Modern-day students not only have computers to help them with their schoolwork, they also use the Internet for research while teachers use technology to enhance their lessons. With these technologies at hand, information and knowledge are readily available for people to grasp whenever needed.

Education has paved the way to modernization. Traditional education which is a long-term established, teacher-centred and holistic approach is more to be out-shadowed by fast pacing convention and usability of technology [1].

Technology is helping teachers to expand beyond linear, text-based learning and to engage students who learn best in other ways. Its role in schools has evolved from a contained "computer class" into a versatile learning tool that could change how we demonstrate concepts, assign projects and assess progress [2]. Currently educators can use a wide variety of techniques using technology in order to impart knowledge to the learners.

The Pangasinan State University (PSU) is not exempted from this, taken as a prime research and learning institution in the province of Pangasinan. It aims to achieve 'global prominence, self-sufficiency, greater excellence and productivity' using technology. This involves utilization and application of IT to widen effectiveness and efficiency of the University as a whole, and provide higher quality of academic and research standards.

As a research-oriented institution, the University generates wide array of research documents both from student and faculty researches. The need arises now that these research documents must be compiled and preserved for easier retrieval and use. Normally, research documents are stored on bookshelves in every PSU Campus Library; which in effect, limits the opportunity that each of these research materials be further utilized, cross-referenced, and improved for other researches in the easiest manner and shortest time possible for each student and faculty proponents.

In order to successfully attain the Vision of the University to be a Premier State University by 2020, an integrated and holistic review of the existing situation regarding the compiling and safe keeping of researches is required. What was required is an improved information system, which allows research documents to be accessed, integrated and analysed in combination.

The developed Online Compendium for Pangasinan State University in this research purportedly aimed to provide the University a key to be able to store and retrieve research documents easily. In simplest terms, the developed online compendium is where content and documents are stored that can be searched and retrieved for later use. The contents of the online compendium may include research outputs, journal articles, and other research data normally delivered in physical document form.

Thus, it is vital the Pangasinan State University implement an information system to cater the raised opportunities on managing and utilizing its academic researches, for the University's achievement of its vision of becoming a national and global research university.

The Online Compendium for PSU will provide several coaching opportunities to advance learning. In research methods courses, students or proponents can easily examine examples of investigatory papers as a guide to their study. In addition, introducing students and other proponents to electronic source provides educational value that contributes in analysis, judgment and discoveries.

The primary objective of this study was to design and develop an Online Compendium for PSU that would manage its academic research studies.

Specifically, this study aimed to accomplish the following:
1. To determine the ICT Profile of PSU in terms of:
    a.) Hardware,
    b.) Software,
    c.) Manpower, and
    d.) Network Infrastructure;
2. To determine the user requirements for the Online Compendium for PSU; and
3. To develop the Online Compendium for PSU using the Rapid Application Development.

II. METHODOLOGY

The proponents used the Rapid Application Development (RAD) as their methodology to design and develop the Online Compendium for Pangasinan State University. The reasons for using this methodology are the following: a) converge early toward design acceptable to the customer and feasible for the developers; b) limit a project's exposure to the forces of change and save development time, and c) possibly at the expense of economy or product quality [3].

Rapid Application Development (RAD) refers to a development life cycle designed to give much faster development and higher quality systems than the traditional life cycle. RAD is a people-centred and incremental development approach. Active user involvement as well as collaboration and cooperation between all stakeholders are imperative. Testing is integrated throughout the development life cycle so that the system is tested are reviewed by both developers and users incrementally.
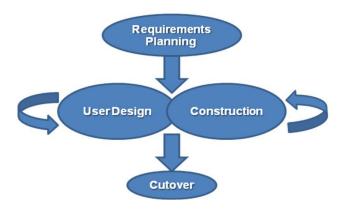

Figure 1. The Rapid Application Model

The RAD life cycle is composed of four stages namely Requirements Planning, User Design, Rapid Construction and Transition. Figure 2 shows the Rapid Application Development (RAD) model.

Requirements Planning (RP). It is the combination of elements of the system planning and systems analysis phases of the System Development Life Cycle (SDLC). Users, managers, and IT staff members discuss and agree on business needs, project scope, constraints, and system requirements. It ends when the team agrees on the key issues and obtains management authorization to continue. The proponents performed the following procedures in this stage: establish a general understanding of the business problems that surround its development and evaluation operation, get familiar with the existing system and identify the processes that will be supported by the proposed application.

The RP stage started with a series of interviews with the librarian of Pangasinan State University – Urdaneta Campus. These interviews initiated the development process by establishing

mutual understanding of objectives of the project development in general and the system in particular.

It was initiated as a study regarding the current system used and problems encountered by the library of Pangasinan State University – Urdaneta Campus with the management of research documents. The interview was conducted to prepare the requirements definition.

Outlining the system's area model and identifying the scope of the system is undertaken. The functionality of the system is expressed in terms of the business processes and the data that supports the system.

User Design (UD). During this phase, users interacted with systems analysts and develop models and prototypes that represented all system processes, inputs, and outputs. The RAD groups or subgroups typically use a combination of Joint Application Development (JAD) techniques and CASE tools to translate user needs into working models. User Design is a continuous interactive process that allows users to understand, modify, and eventually approve a working model of the system that meets their needs. In this stage the proponents associated the details of the business activities with the system and developed the system infrastructure which includes the system layout, and a work plan defining the steps necessary for the transition of the system.

The detailed system area model, an outline system design, and an implementation plan are produced. The tasks of this stage are:

a) **Outline System Design**. An outline system design is developed using the system area model. Upon completion of the outline design, interactions between procedures (series of functions) and data is identified. The system structures and tentative layouts of critical screens and reports that are supported by the system are designed.

b) **Refine System Design**. The developed design is reviewed. The consistency of the analysis and design is confirmed via interaction analysis and prototyping. By interaction analysis, the interactions between functions and data are analysed to identify the missing functions or data. The completeness of the detailed system area model and outline system design is verified. The prototype of screens are developed and shown to the librarian of PSU-Urdaneta.

Rapid Construction (RC). Rapid construction focuses on program and application development task similar to the SDLC. In RAD, however, users continue to participate and can still suggest changes or improvements as actual screens or reports are developed. Its tasks are programming and application development, coding, unit-integration and system testing. The objective of the Rapid

Construction stage is to: complete the detailed design of the proposed system, create and test the software that implements the system, generate a system that operates at an acceptable level of performance, prepare documentation that is necessary to operate the proposed system and to design, develop, and test the required transition software.

After the design of the system which is performed in the User Design (UD) stage, the proponent performed the Rapid Construction (RC) stage, the tasks of the RC stage are:

a) **Prepare for Rapid Construction.** Development of environment including workstations and workspaces was prepared and finalized by the proponents to start the project. Additionally, the database is designed based on the preliminary data structure that is developed in the UD. In this phase the proponents designed the database of the system that is developed.

b) **Construct System.** After the preparation for the rapid construction, the detailed definition of the design of each function is coded. During this phase the proponents started the coding of the developed system.

Transition (TR)/Cutover. This phase resembles the final tasks in the SDLC implementation phase, including data conversion, testing, changeover to the new system, and user training. Compared with traditional methods, the entire process is compressed. As a result, the new system is built, delivered, and placed in operation much sooner. Its tasks are data conversion, full-scale testing, system changeover, user training. The researcher's main objectives in this stage are: to install the system in production operation with minimal disruption of normal business activity, to maximize the effectiveness of the system in supporting the intended business activities and to identify future enhancements.

Population and Locale of the Study

The study was conducted at Pangasinan State University – Urdaneta City Campus, Urdaneta City, Pangasinan. Information gathered from the librarian in these locale was treated as representative of typical situations in parallel institutions found across the other 8 campuses of Pangasinan State University, especially that the libraries usually utilize a common method of keeping their research documents. The chosen locale was also subsequently treated as the pilot testing site for the proposed Online Compendium.

Data Instrumentation

The proponents used three approaches to arrive at a relatively specific and feasible source of data and these are: structured interview, collaborative

session and prototyping. The aforesaid sets of data were retrieved using three different instruments discussed below.

Structured Interview. It is a fixed format interview in which all questions are prepared beforehand and are put in the same order to each interviewee. With the use of interview guide, the proponents are able to gather data pertaining to the process and problems of managing the research documents. The interview guide also served as a basis for formulating the proposed system.

Librarian Interview Guide (LIG). This is a researcher-developed instrument composed of two parts. This instrument aims to seek information concerning the processes and problems encountered by the librarians in the management of research documents.

The first part of the LIG is a 6-item multiple-choice questionnaire. Print copies of the instrument are furnished individually to the respondents on a scheduled appointment with them for the purpose.

The second part of the LIG is composed of a series of questions structured from the responses made by the respondents in the first part. It was administered in a form of a structured oral interview with the same set of respondents. The purpose of this interview is to retrieve more intensive information to qualify the responses made in the multiple-choice questionnaire.

Collaborative Session. This was accomplished by the proponents and respondents. Thru this, the proponents asked suggestions from the respondents regarding the system as their bases for deciding on the software specifications of the system.

Prior to the designing of the system, it is also beneficial in considering judgments of each proponent on the researchers to identify and resolve conflicts regarding on classifying requirements and developing of the system. This would be accomplished having the different proponents of the target organization and the researchers work together to encounter their individual goals. By having this, scope and limitations of the proposed system are clearly defined and they could initially start constructing the system. Concerning the objectives; this tool could help also the researchers to answer the objective no. 2, which is to determine the requirements of the Online Compendium for Pangasinan State University.

Prototyping. Prototyping is a valuable approach used prior to the development of the entire solution, to validate those individual components of

the system operates as expected. Prototyping lets the proponents get valuable feedback from the users in the early stage of the project, until they meet the software specification that both the proponents and respondents agreed upon. After conducting the LIG and collaborative session, prototyping was used as an instrument in the development of the project. Through the use of this, the respondents were enabled to see the tentative features of the final project. Across the processes in developing the system, the prototype underwent necessary modifications until both proponents and respondents were finally satisfied with the results.

Data Analysis

Analysis of data is a process of inspecting, cleaning, transforming, and modelling data with the goal of highlighting useful information, suggesting conclusions, and supporting decision making. Data analysis has multiple facets, approaches and tools, encompassing diverse techniques under a variety of names, in different business, science, and social science domains.

In order to achieve the 1st objective of this research the proponents used frequency count was used for determining whether the existing hardware, software, manpower, and network infrastructure of UCNHS are acceptable and sufficient in the implementation of OCSR.

In order to arrive at the needed information for the 2nd objective of this research, used the data gathered during the interview and collaborative sessions which helped them describe what the proposed system will do and how will the users use it, but not how the system operates internally. It also helped the proponents identify the services and limit that the Online Compendium provides for different users.

In order to achieve the needed information for the 3rd objective the proponents employed Entity-Relationship Diagramming (ERD) and Use Case diagramming and prototyping. An entity-relationship (ER) diagram is a specialized graphic that illustrates the relationships between entities in a database (Chapple, 2014). Use Case is a description of a systems behavior or a particular scenario in which a system responds to an external request that originate, it helps specify and explain the interaction between the actors and the system. Use-case diagrams illustrate and define the context and requirements of either an entire system or the important parts of the system. The use case indicates the role of the students, research personnel, faculty and other staffs.

III. RESULTS AND DISCUSSION

This chapter presents the data and results that were used by the researchers to design and implement the developed system. The gathered data in this study were taken from different respondents through the use of various instruments such as interview, collaborative session and ICT Profile checklist. Data modelling and diagramming tools such as Use Case Model and ERD were also used to give a full view of the processes of the existing and developed system.

ICT Profile of the Libraries of PSU

The researchers identified and assessed the status of the existing ICT profile of the Library of Pangasinan State Univeristy – Urdaneta City Campus in terms of (a) hardware, (b) software, (c) manpower, and (d) network through the ICT profile checklist. Frequency count was used in the analysis of the ICT profile checklist as shown under Table 1.

Table 1: ICT Profile of the Library of Pangasinan State University – Urdaneta City Campus

Hardware Equipment	Quantity	Percentage
Working Computer Unit	9	100%
Specifications		
Processor		
300 megahertz to 1 gigahertz	0	0%
1 to 2 gigahertz	0	0%
Above 2 gigahertz	9	100%
System Type		
32-bit processor	0	0%
64-bit processor	9	100%
Memory(RAM)		
512 to 1 gigabyte		0%
2 gigabyte	9	100%
Printer		
Laser Printer	1	
Scanner		
Flatbed Scanner	1	
Software	Quantity	Percentage
Windows 98	0	0%
Windows 2000	0	0%
Windows ME	0	0%
Windows XP	1	10%
Windows 7 (Ultimate)	8	90%
Manpower	Quantity	
Network Administrator	0	
Computer Technician	2	
ICT Administrator	1	
Database Administrator	0	
Network	Quantity	
Network Computers	9	
Router	1	
Modem		
Switch/Hub	1	
Wireless Routers	0	
Internet Connection	Available	

As seen in the Table 9, PSU has the resources needed to deploy the "Online Compendium of for PSU" in terms of hardware, software, manpower and network as recommended by the researchers for the system's requirements. It is advantageous that the school has an internet connection wherein the personnel in charge of the researches can openly upload a new research, update or delete existing research while the students can go online, log in to the Online Compendium site and browse the compiled researches.

52

Developed Online Compendium for PSU

Through the assessment of the ICT Profile of the Libraries of PSU and with the help of RAD methodology, the researchers developed a system entitled Online Compendium for PSU that would help the University to ease the burden in managing, maintaining, preserving and promoting the researches.

Requirements Planning

The researchers conducted a structured interview and collaborative sessions with the personnel in charge of the research documents to analyse and determine the requirements of the Online Compendium. The results showed that PSU's existing manual management system of scientific researches has constraints. Then, checking of the ICT

Profile was done in terms of hardware, software, manpower, and network infrastructure and the results showed the organization has all the resources needed for deploying the developed system.

User Design

In this phase, the researchers used diagrams such as Use Case diagram and Entity-Relationship Diagram (ERD). Figure 1 and 2 shows the Use Case Diagram of the developed system. This indicates what each actor could do in using the system. There are three actors, the Research Personnel (System Administrator), Registered User, and Guest User. In the form based system the Research Personnel could login and manage and upload research to the website. In the Online Compendium website, registered users and guest users could search and view documents while users could login and bookmark a research.
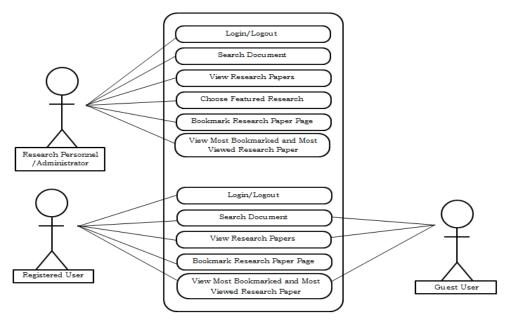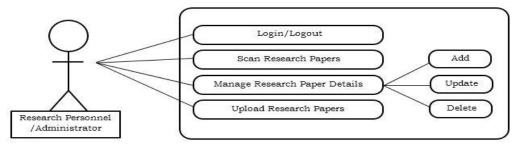

Figure 1. Use Case of Form Based System

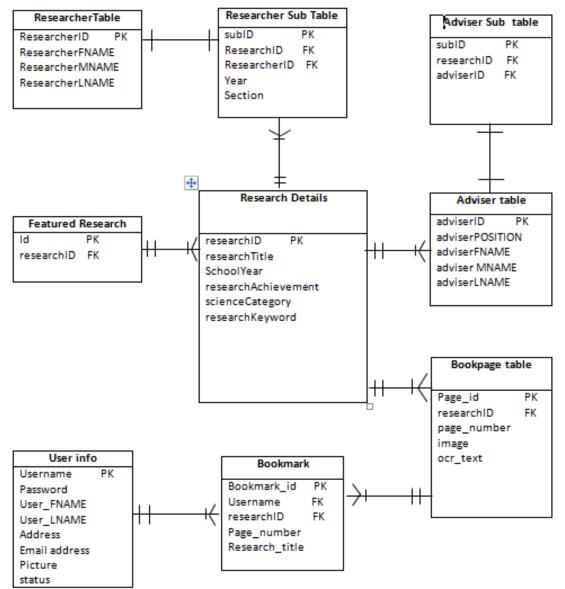Figure 2. Use Case of Web Based System

Figure 3. Entity-Relationship Diagram of the Developed System

The researchers used Entity-Relationship Diagram for the design of the system's database. Entities and their different attributes were shown and the relationships between the different tables in the database are also illustrated above.

Construction

In this phase, the researches built a prototype. This was the developmental stage in which the prototype was used to modify and add necessary functions for the system to work.

For the development of the system, the researchers used Microsoft Visual Studio 2010 as Integrated Development Environment, utilizing .Net

Framework 4 and ASP.NET platform. The Visual Basic.Net was used as programming language for the development of both the WinForm and web-components of the system, and MS SQL Server 2010 for database management system.

IV. SUMMARY, CONLUSIONS & RECOMMENDATIONS

1. The problems raised from the current processes in management of scientific researches must be solved through the implementation of the Online Compendium for Pangasinan State University.

2. Minimum system requirements are recommended to be followed for the full implementation of the developed system.

3. Rapid Application Development (RAD) methodology is recommended for the construction of similar systems that uses the same technology as projected.

4. The researchers recommend that the developed system should be implemented in the University, in order to provide assistance in the management of their students' researches

5. The researchers recommend that a committee in charge of overseeing that the submitted researchers for the compendium is up to par with the University's standard be established

6. The researchers recommend for user's training in using the system.

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