Lab 1 – Research Link Description

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CS411
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October 2, 2016
Version 1
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1 INTRODUCTION

The “Earth” was explored to the human beings approximately 4.5 billion years ago (Windley, 2015); whereas, wheel was invented only 5000 years ago (Ament, 2005). The age of the wheel is too short as compared to the history of the earth. The wheel was used for potters after its invention; however, it took 300 years to make a wheel as a means of transportation (Ament, 2005). Humans thought of the wheel thousands years ago and invented it. They invented unlimited products after doing research on their thoughts and developed great products like computers, airplanes, electricity, ships, satellites, and internet. Hence, the curiosity and struggle of human beings insisted them to explore, experience, and excel in order to meet their needs. The process of exploring more and more lead them towards research which has played a vital role in the progress of mankind through the years. A society cannot ignore the importance of the research. Likewise, Old Dominion University (ODU) addresses student’s necessities and promotes research culture among students.

In ODU, students rarely participate in research activities. One of the major reasons of their rare participation is the old methods of ODU for announcements of research opportunities. For instance, the management posts an opportunity on notice boards. In today’s era of technology, such an obsolete method of announcements does not really work; hence, the students as well as faculty members do not notice such news. Even if they come across with an opportunity; it does not last in their minds for long. The correspondence for an opportunity is usually responded by outdated resources. ODU does not have any notification system to announce deadlines for opportunities. If a student or faculty member conducts a successful
research project, there is no public recognition for that person.

ODU enrolled a total of 24,672 students for 2016; where, undergraduate enrollment was 20,101 and graduate enrollment was 4,571 (University Facts & Figures, 2016). Undergraduate enrollment is 81% of the total enrollment while graduate enrollment is only 19% of the total enrollment. There is a huge gap between undergraduate and graduate enrollment ratio.

There was a study conducted by Council on Undergraduate Research that said, "A substantial body of evidence suggests that students that participate in undergraduate research are more likely to be retained in science majors to graduation" (Vieyra, 2013). Hence, ODU needs to improve its graduate student ratio to enhance the research. ODU can improve distributed opportunities appropriately by giving reminders, use automatic notification system, and recognition of a person who conducts a successful research.

The proposed solution would create a hub which would eliminate the middleman, and it will produce enticement for future undergraduate students. By retaining more graduate students, ODU will improve its ranking and enrollments in graduate as well as undergraduate admissions. The students will have a higher chance of internship and scholarship opportunities and it will increase their skills. Ultimately, ODU will retain and recruit more talented students.

2 RESEARCH LINK PRODUCT DESCRIPTION

A Research Link through a portal will be available for students, faculty, administrators, and research organizations. Research opportunities, co-op, and internships positions would be posted directly on Research Link portal. Students will get up-to-date information. Students, faculty and organizations would be able to make their profile according to their interests. Research organizations will be able to communicate directly with the intuitive students. The
Research Link will increase research program affinity, attract more graduate and undergraduate students, and enhance ratio of enrollment from undergraduate to graduate programs.

2.1 Product Features and Capabilities

In current situation, the research organizations and ODU management contacts the faculty member for a research opportunity. Faculty member disseminates the information to the students via emails, bulletins, verbal communication, or posters. There is no mechanism to remind the interested stakeholders about the opportunity. Consequently, most of the students miss out research opportunity. This process is illustrated in Figure 1.

Figure 1: Current Process Model

Old Dominion University Research Link portal is being proposed as a solution to this problem. Research organization contacts with Old Dominion University management for a research opportunity. Faculty member could post the research opportunity into Research Link. Students and faculty members can make their profiles according to their interests. Faculty
members can filter the results according to their interest. Students could see notifications for a research opportunity with a deadline reminder. The solution is shown in Figure 2.

![Modified Process Model](image)

**Figure 2: Modified Process Model**

The administrators, faculty, and students can create and login to their profiles on ODU Research Link portal with their Monarch Identification and Authorization System (MIDAS) IDs. Faculty will create the opportunity and could see archive of previous opportunities. Faculty may further filter search options according to student qualifications and send emails with respect to the interest of the department. Faculty shall be able to select students according to their interest,
completed courses and Grade Point Average (GPA). Students will receive notifications for their interested research opportunities with deadline reminders. Faculty and students would be acknowledged about the departmental and student success stories for their public recognition. Authorized users could use ODU Research Link portal on web and mobile devices as well.

2.2 Major Components (Hardware/Software)

Two major hardware components will be used - Microsoft SQL Database Server and Web Server. LAMP structure will be used as a software which consists of Linux, Apache, MySQL, and PHP. MySQL will be used as a database that will create and store all users’ information. Apache will be used as web server because of its reliability, speed, and sound security. PHP, a server side scripting language will be implemented. Web server will be responsible for processing the PHP scripts and fetching the required user data.

Major Functional Component Diagram (MFCD) in Figure 3 illustrates the structure of the software. The “users” category includes students, faculty, admin, and research organizations. They will be able to connect ODU Research Link portal through their valid MIDAS IDs. The users would be connected to the MySQL database after authentic credentials. MySQL database will be connected to ODU web servers managed by ODU management. Four algorithms are used to check authenticity of the data - login, create profile, create research opportunity, and search. These algorithms do not process invalid or duplicate data. User can also see the error messages in the presence of inaccurate data.

(This space intentionally left blank.)
ODU Research Link is developed for ODU Computer Science department and research organizations like NASA, NSF etc. In future, ODU and others departments can also use Research Link. In fact, ODU is utilizing conventional communication system which has limited knowledge of opportunities for all stakeholders. Council on Undergraduate Research states that, "Students who did not conduct research and found that many chose not to engage in
undergraduate research due to lack of time, interest, opportunity, or knowledge of opportunities” (Vieyra, 2013). Presently, ODU is lacking of graduate students who could participate in research. Unfortunately, current graduate students are not prepared for research. As a result, ODU is losing number of potential graduate students. Currently, Pivot research portal and Harvard research database has similar systems like ODU’s proposed Research Link.

4 RESEARCH LINK PRODUCT PROTOTYPE DESCRIPTION

The prototype of ODU Research Link will implement all major functional components but some features cannot be implemented. Faculty could get simulation of yearly reminders for recurring opportunities. Faculty can also create opportunities according to their interests. Faculty can search a student record by its completed courses and GPA. Students can apply in their interested research opportunities and would be notified with new opportunities according to their interested category. Students can also receive alerts for their expiring opportunities.

ODU Research Link is a new system, so users may underutilize it. A successful transition of a new system can be implemented by helpful tutorials. As the users will increase, the network traffic can also increase. Multiple users will simulate the research portal to testify it. Users could be students, faculty and administration and they will be capable to login onsite or remotely. Table 1 illustrated the comparison between prototype and real world product.
Table 1

*Real World Product and Prototype Comparison*

<table>
<thead>
<tr>
<th>Features</th>
<th>Real World Product</th>
<th>Prototype</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create Users</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Devices Connection</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Research Link Portal</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>SQL Database</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Web Server</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Virtual Machine</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>User Authenticity</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>MIDAS ID Credentials</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Email Notification</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table 1: Real World Product and Prototype Comparison

4.1 Prototype Architecture

Research Link will utilize different software, hardware, and algorithms in order to process different types of data. In prototype architecture, Research Link will use ODU Computer Science virtual machine as a web server hardware. It will use Apache2 server, MySQL database, PHP 7.0 version, and Laravel Framework 5.2 version software. Banner is used by ODU administration that provides controlled access to financial, student and personnel data. It is a prototype; therefore, research portal will use a simulation of the banner information only.
Figure 4 represents major functional prototype components. In prototype MFCD, devices will be connected to virtual PHP server. MySQL database queries will process data through PHP virtual machine. Then, database will process all queries and data to the user. File server is used for central storage and management of data files. Virtual machine connects with file server through file requests. Then file is passed to the users. Virtual machine is also capable of sending email notification requests to email server.

Figure 4: Prototype Major Functional Component Diagram
4.2 Prototype Features and Capabilities

The prototype objective is to demonstrate a research hub among all stakeholders. The main feature of this portal hub is to give customizable alerts to all users with the feature of introducing new opportunities. Public recognition of the successful students and departments will be a key factor to attract more students. This new system will also be capable of making an archive of expired opportunities. Faculty will receive calendar base reminders for recurring opportunities to find new talent.

Because of a new system, users might face issue to operate new system. All users will receive helpful guides and tutorials to learn this system. Advertisements will help to increase noise level of this product. As the users will increase, the issue of upgrade could be solved by prior testing techniques.

4.3 Prototype Development Challenges

All challenges and risks should be addressed properly during development of ODU Research Link portal prototype. The deployment of banner and My ODU with Research Link has technology and security issues. Banner utilizes ODU’s administration system which provides controlled access to financial, student and personnel data. The team will follow best practices for information security. Moreover, the team has limited knowledge of HTML, CSS, JavaScript, PHP and Laravel Framework. In order to address this challenge, the team has developed prototype milestones for each member. In addition, members are encouraged to ask help from the team if anyone has issue with its given task. Testing will be performed properly before deployment of any technology implementation.
Glossary

**Apache2 Server**: Web server software

**Banner**: Old Dominion University’s Administration System that provides controlled access to financial, student and personnel data. This system is only available to Faculty and Staff.

**CSS**: Cascading Style Sheets is a style sheet language used for describing the presentation of a document written in a markup language.

**GPA**: Grade Point Average

**HTML**: Hyper Text Markup Language is the standard language for creating web pages and applications

**JavaScript**: A script language for programming on the web

**LAMP**: A combination of Linux Apache MySQL PHP

**Laravel Framework**: A powerful MVC PHP framework, designed for developers who need a simple and elegant toolkit to create full-featured web applications

**LINUX**: An open source version of UNIX operating system

**MFCD**: Major Functional Component Diagram

**MIDAS**: Monarch Identification and Authorization System

**MySQL**: Open-source relational database management system

**NASA**: National Aeronautics and Space Administration; Offers Undergraduate Research Fellowships and internships

**NSF**: National Science Foundation (NSF); Offers funded research opportunities through Research Experiences for Undergraduates (REU)

**ODU**: Old Dominion University

**PHP**: Server scripting language for making dynamic and interactive Web pages
References


Vieyra, M., Carlson, A., Leaver, E., & Timmerman, B. Undergraduate Research: I Am Not Sure What It Is, But I Don’t Have Time to Do It Anyway.. Council on Undergraduate Research Quarterly. (Spring 2013, Volume 33, Number 3)