Lab 1 – ResearchLink Description

1. Introduction

Research is a fundamental component in the progress of mankind. Most of the academic institutes promote a research culture among students. Old Dominion University (ODU) is one of such institute offering 54 master programs, and 42 doctoral programs (University Facts & Figures, 2016). At ODU, undergraduate and graduate enrollments in 2016 are 81% and 19% respectively (University Facts & Figures, 2016). There is a gap between undergraduate and graduate enrollment rates. Most of the ODU undergraduate students are not participating in the research because of the lack of research opportunities information in a timely manner. It is also found by American Council of Learned Societies and referred by Council on Undergraduate Research that students are not engaged in undergraduate research due to; lack of time and interest, or rare information of available opportunities (Vieyra, 2013). Hence, students can be inspired towards research if they can receive information for research opportunities well in time.

The ODU administration aims to improve the different issues including: awareness of updated information regarding research activities, the creation of communication channels among all stakeholders, and capitalization of available opportunities.

At ODU, one of the major reasons for low interest in research programs is minimal research culture which fails to attract research-oriented undergraduate candidates. Currently, ODU is using the conventional method to announce research opportunities. This method attracts few undergraduate students. Currently, a research opportunity is posted on one or more notice boards. In today’s era of technology, such an obsolete method of announcements does not work; students usually are not aware of all opportunities. Outdated opportunities remain on the notice boards, which is another barrier for interested researchers in capitalizing such opportunities.
Moreover, an electronically updated notification system to announce deadlines is missing at ODU. An absence of such a system results in research not being publicly recognized for completion of research projects.

According to Council on Undergraduate Research, students who participated in research activities during their undergraduate studies were more inclined towards graduate programs (Vieyra, 2013). Hence, the promotion and systematic sustainability of research culture can increase the enrollment rates in graduate programs. Therefore focus on improving the current system of information dissemination through electronic announcements of research opportunities, reminders for deadlines, and recognition of achievements is required.

The proposed solution, ResearchLink, would create a hub for students, faculty, and administration. This hub would decrease the communication gap among all related stakeholders. By creating more undergraduate research opportunities, ODU would improve its enrollments in graduate programs. The proposed system would not only aim to facilitate the students in terms of research opportunities but also through announcements of available internships and scholarships. Thus, the students at undergraduate and graduate levels would have an opportunity to explore more in terms of their professional grooming and financial assistance. With research, a pool of talented students could be expected to be sustained at ODU.

2. ResearchLink Product Description

ResearchLink, through a web portal, would be available for students, faculty, and administrators. Research opportunities, co-op, and internships positions would be posted directly on the ResearchLink portal. An upcoming event and auto notifications system would update all stakeholders in a timely manner. Students, faculty, and administration would be able to align their profiles according to their capabilities and interests. ResearchLink would highlight the
individual and departmental achievements within the web portal. ResearchLink would also increase research program affinity, and attract more graduate and undergraduate students due to new research opportunities.

2.1. Key Product Features and Capabilities

ResearchLink can be controlled by three major roles - faculty members, administrators, and students. Each role has different privileges while using the research portal. ResearchLink can also be used by people not affiliated with ODU. They are restricted to creating profiles and searching opportunities. ODU students can login to their profiles in the web portal with their Monarch Identification and Authorization System (MIDAS) IDs. They have the facility to create their own profiles while highlighting their interested research areas. Consequently, they can also apply for related research activities. They can be notified about current and upcoming opportunities along with the given deadlines.

Similarly, faculty would have a platform to announce the upcoming opportunities which may include: duration of research, budgeted amount, and required number of participants. The faculty would also be able to view the archives of expired opportunities. They would further be facilitated through a customized searching option which would help them to filter students in terms of qualifications, GPA, and research interests. The shortlisted students would be notified about available opportunities by the faculty and department. The faculty would also have the opportunity to announce achievements made by individuals or groups in terms of completion of research projects.

The administration would have administrative roles which include: development of individual profiles, modification of profiles, and deletion of profiles. Administrators would also have the privileges of all other roles. Moreover, they would be capable of upgrading a student’s
status to faculty status and vice versa. Authorized users can use the ODU ResearchLink through
a web browser and mobile devices.

2.2. Major Components (Hardware/Software)

ResearchLink would use two major hardware components - Microsoft SQL Database
Server and Web Server. The developing software structure consists of Linux, Apache, MySQL,
and PHP(LAMP). ResearchLink would use MySQL to create and maintain the database for
user’s information. Apache would be used as a web server because of its reliability, speed, and
sound security. PHP, a server-side scripting language, would be implemented to incorporate the
database information. The web server would process the PHP scripts and fetch the required data.

Major Functional Component Diagram (MFCD) in Figure 1 illustrates the structure of the
software. The “users” category includes students, faculty, and administration. They will be able
to connect the ODU ResearchLink portal through their valid MIDAS IDs. The users will be
connected to the MySQL database after processing their MIDAS authentication. MySQL
database would be connected to ODU web servers managed by ODU management. Four
algorithms are used to check the authenticity of the data - login, creating the profile, creating
research opportunity, and searching with a specific criterion. These algorithms would not process
invalid or duplicated data. Users would receive error messages if inaccurate entries are made.
Moreover, two algorithms would be used to process the notification system. The option of “Send
Notification” would notify the related users after comparing the deadline date with the current
date. The option of “Add Notifications” through another algorithm, would add a record in the
notification table after notifying the users. The user interface would make things easy for all
stakeholders so they can get things done quickly. Faculty and administration would be able to get
required reports through MySQL database queries.
3. Identification of Case Study

Due to the conventional communication system at ODU, the information of different opportunities reaches to the limited audience. In today's technology, no one can ignore the importance of Computer Science. Everyday new applications, or new products are launching in the market due to Computer Science innovation. ODU is currently offering many graduate and doctoral programs; where a large number of undergraduate students can be motivated to join the graduate programs. At this point of time, the ODU ResearchLink is proposed only for Computer
Science Department at ODU; however, its scope can be extended in future to facilitate other departments and research organizations.

4. **ResearchLink Product Prototype Description**

The ODU ResearchLink would use prototype which is a working model of software with a limited functionality. The prototype would allow the users to evaluate and test the product before its formal launch. There could be additional requirements identified by the users during prototyping. The prototype of ODU ResearchLink would consist of all major functional components but some features might not be implemented. For example, MIDAS authentication could not be verified during simulation. Faculty would use a simulation of the yearly reminders for recurring opportunities. However, they would be able to create opportunities according to their interests. Faculty would also be able to search a student record by its completed courses and GPA. Students would be able to apply against their interested-research opportunities. They would also be notified new opportunities according to their interested area and receive alerts of expiring opportunities.

The ODU ResearchLink is a new system; hence, it may be underutilized initially. During the development process, ResearchLink prototype can also identify the deficiencies. The scalability of the system in terms of network traffic would also be tested through dummy data. Moreover, multiple users will simulate the research portal to test the integrity of the system. The real-time users of the system (student, faculty, and administration) can login onsite or remotely.

4.1. **Prototype Architecture (Hardware/Software)**

ResearchLink would utilize different software, hardware, and algorithms in order to process different types of data. The ResearchLink prototype would use two algorithms for notifications; MySQL database for storing and processing the data, and the user interface for
user’s interaction with the system. In prototype architecture structure, ResearchLink would use the ODU Computer Science virtual machine as a web server hardware. It would use Apache2 server, MySQL database, PHP 7.0 version, and Laravel Framework 5.2 version software. Banner would be used by the ODU administration that provides controlled access to financial, student and personnel data.

Figure 2 illustrates prototype major functional components diagram (MFCD). In prototype MFCD, devices would be connected with virtual PHP server. MySQL database queries would process data through PHP virtual machine. The database would then process all queries and data to the user. The file server is used for central storage and management of data files. The virtual machine would also be capable of sending email notification requests to email server from ResearchLink web portal.

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4.2. Prototype Features and Capabilities

The prototype objective is to demonstrate a research hub among all stakeholders. The key function of this web portal is to send customizable alerts to all users for new opportunities. Public recognition of the successful students and departments would be a key factor to attract, engage, and support more students. The proposed system would also be capable of making an archive of expired opportunities. Users would receive calendar based reminders for upcoming opportunities. The users would also be able to testify all features with the dummy data. Table 1 illustrates 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>
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</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>ResearchLink Portal</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>MySQL Database</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Web Server</td>
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<td>No</td>
</tr>
<tr>
<td>Virtual Machine</td>
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<td>Yes</td>
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<tr>
<td>User Authenticity</td>
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<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

### 4.3. Prototype Development Challenges

There are certain challenges and risks associated with the development of ODU ResearchLink portal prototype. The deployment of Banner and My ODU with ResearchLink has technological and security issues because ODU Banner database provides controlled access to financial, student and personnel data. The team has followed 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. 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).