Lab 1 – ResearchLink Product Description

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Lab 1 – ResearchLink Product Description

1 Introduction

Research is an important tool that supports advancements in today’s society, especially in the Science, Technology, Engineering and Mathematics (STEM) world. With graduate programs focusing on research and analysis of topics related to specific areas of study, undergraduates need to be aware of the importance of research and prepare them for the type of work they will be doing when they choose to pursue a graduate degree as well as when they move forward in their career. With a lack of STEM students progressing into graduate programs, there is a need to increase undergraduate participation in research opportunities. The current problem consists of undergraduate research opportunities not being effectively communicated to and from faculty, students, and external organizations. Prospective undergraduate researchers are unaware of the research opportunities that are available due to an inefficient system by which information is being shared, thereby contributing to the lack of participation in undergraduate research.

Without an environment to present research opportunities as well as identify qualified participants, undergraduate students will not become aware of the opportunities that exist. Many of these potential researchers will also be hesitant to seek out the information simply because many initially believe that at their current undergraduate level they would not be permitted to participate in real world research pending some extra special arrangement. An additional aspect of the current problem is the lack of an environment in which the Computer Science department is able to highlight departmental and student successes in the research that is being conducted. This information is not reaching the public, which has a negative effect on attracting new Computer Science students to ODU. ResearchLink will provide a consolidated environment in
which students and faculty may access and track current research opportunities and learn more about the successes occurring throughout the research being conducted at ODU. These successes will also be visible by the public, therefore showcasing the innovations occurring within the university and promoting additional enrollments and participation in research.

Old Dominion University (ODU) expressed the need for a tool to help improve ranking and enrollments for the university. External agencies will always need resources to help fill available spots for the internships, scholarships, and skill camps that they offer in order to help recruit and retain talent within their organizations. ResearchLink will provide the environment in which faculty will be able to share their research opportunities and students will be able to locate, receive notifications about, and track opportunities of interest, thereby removing the middleman in the process. External agencies will have a system where they are able to advertise these opportunities for research to the appropriate student body. Faculty will have the opportunity to share departmental and student successes with both the public and the university community, thereby improving enrollments in both undergraduate and graduate programs.

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ResearchLink will provide a convenient system in which registered users will be able to access all current research opportunities that are available, thereby enhancing opportunity exposure. The system will greet the users and public with a live-stream news feed of departmental and student successes on the launch page of the product. Users will be able to follow specific opportunities of interest and modify notification settings to fit their specific needs.

By creating one repository in which all research opportunities and successes may be advertised and tracked, ResearchLink will aid in the dissemination of information to all
interested parties and ensure faculty is able to stay on track with annual opportunities that are available within the university. Faculty will also be able to spotlight innovative research and successful students through the news feed, which achieves the objective of increasing university departmental public presence.

2.1 Key Product Features and Capabilities

Faculty will have the capability to create and update their professional and departmental profiles, allowing them to share research opportunities that they are participating in currently or have in the past. They will have the capability to create and manage research opportunities. Faculty accounts will have the authorization to conduct filtered searches based on interests, completed courses, and GPA in order to identify qualified students support those opportunities.

Students will have the capability to create and update their student profile, with the option to add interests, completed courses, and their GPA. Interests and completed courses may be selected from a repository by using keywords. Adding this information will increase profile visibility in faculty searches. Students will also have the ability to share the research opportunities they have participated in, thereby showcasing their experience with research work. They will have access to utilize filtered search options to view research opportunities that are available to them.

Administrators will monitor access and operations within the system. Those with Administrator access will have the capability to create accounts, create opportunities, and archive old opportunities. User accounts will be tied to the Shibboleth system; therefore, the ResearchLink Administrator will not be responsible for user access as those will be managed by the Systems Group.
Faculty will have the ability to push information out that is related to specific departmental interests. If there are specific types of research opportunities that they conduct on a yearly basis, ResearchLink will use a calendar-based system to determine that it is time for them to send out information relative to those opportunities. This feature will aid the faculty in keeping track of important opportunities that benefit the university each year.

ResearchLink will push notifications to the students, both through email and within the ResearchLink environment, depending on the student’s notification settings and the calendar-based system that controls the triggering of notifications. If a student has chosen to incorporate their interests with their profile, they will receive notifications containing the information pushed out by the faculty member. The calendar-based system will also control the auto-archival of expired opportunities.

While access to ResearchLink information will differ between registered users and the general public, up-to-date information will be available to all audiences in the form of a news feed. This information will consist of the successes of recent research endeavors and students involved in the research at ODU. Faculty will have the capability to add information to the news feed while students and the public will only have access to review those successes that have been shared.

ResearchLink will be accessible through both a web and mobile device compatible interface. Login credentials will be tied in with the Shibboleth system, therefore students and faculty will use the same credentials as they use to access the rest of the services provided by ODU. The information a user is able to access is controlled by the type of account that they have. Verification of a user’s role is completed through cross-checking their information against the information stored in Banner to determine whether they are an ODU faculty member or student.
Users without an account will only have access to the public news feed that resides on the ResearchLink landing page.

**2.2 Major Components (Hardware/Software)**

ResearchLink is supported by a SQL database server and a web server. The software components are set up as a LAMP Structure, consisting of Linux, Apache, MySQL, and PHP. ResearchLink will be integrated with the Shibboleth and Banner systems to facilitate user login and authentication.

**3 Identification of Case Study**

In 2014, out of the 1,552 applicants accepted to graduate programs available at ODU, only 796 of those applicants chose to enroll (ODU Factbook). 17.46% of those graduate program enrollments consisted of Computer Science students. With the percentage of Computer Researcher jobs being only 1% of the STEM Computing jobs (CS Presentation 2015), the need to encourage undergraduates to move on to earn a graduate degree is important as there is a growing need for talented STEM Researchers. Participation in undergraduate research is the best place to begin.

Undergraduates are often unaware of the importance and availability of research opportunities, which will better prepare them for graduate school and the amount of research that is required to be successful. They will find that their graduate experience will be more beneficial as they will have gained crucial experience in research and analysis. With this better understanding of subjects in their field, they will be more appealing to future employers. An increase of involvement in research will also help drive publicity of the university and ultimately drive an increase in student admissions, to include those undergraduates moving on to seek admission into the graduate programs available at ODU. Research involvement will provide
additional opportunities for the university to obtain funding to support the educational experiences that the faculty is able to provide to students.

It was found that the manner in which research opportunities are advertised to the ODU community is not efficient, as opportunities are pushed deeper into the past of faculty and student mailboxes, only to be forgotten and never be reviewed again. Outdated advertising methods, such as using a bulletin board or placing opportunity information on office doors, often leave distance learning students out of the loop. These disconnects illustrated in Figure 1 of how information is being shared prevents students from being aware that there are opportunities available. These opportunities can aid in their development and help improve the ranking of the school by conducting research that is meaningful and beneficial to all those involved.

Figure 1. Current Process

By modifying the method in which these opportunities are delivered to the student body, this solution will eliminate the chances of an opportunity being missed. Figure 2 depicts how both students and faculty will have constant access to the research opportunities that are
available in relation to their interests. Opportunities of interest will not be missed due to the incorporation of notifications which may be customized by the student to his or her liking.

![Diagram of ResearchLink Process]

**Figure 2. Modified Process**

### 4 ResearchLink Product Prototype Description

In order to demonstrate the benefits that ResearchLink will provide to the CS Department, the prototype will be able to demonstrate the main features and capabilities that were mentioned in section 2.1 of this document. Demonstration will provide proof of a resolution to the problem at hand. The prototype will simulate an environment to broadcast departmental and student successes, issue notifications when necessary, and allow for effective searching of opportunities available that will facilitate students in supporting an available opportunity.

#### 4.1 Prototype Architecture (Hardware/Software)
The hardware required to support the prototype consists of one individual component – the CS Virtual Machine (VM). The VM must be loaded with Apache2 Server, MySQL Database, PHP 7.0, Laravel Framework 5.2, and Composer. The VM will be the component which all requests and data will be funneled through. The breakdown of the prototype functional components is outlined in Figure 3.

![Figure 3. Major Functional Component Diagram](image)

4.2 Prototype Features and Capabilities

The ResearchLink prototype will contain all features and capabilities other than the interfacing with Banner for authentication of the type of user account and Shibboleth to manage the logins that will grant access to the system. Table 1 outlines the variances between the real world product and the prototype. This will not interfere with demonstrating the overall functional
goal of providing a convenient and consolidated environment that houses available research opportunities and showcasing successes to help advertise accomplishments that are occurring through ODU research, namely in the Computer Science department.

Table 1. Real-World versus Prototype

<table>
<thead>
<tr>
<th></th>
<th>Real-World</th>
<th>Prototype</th>
</tr>
</thead>
<tbody>
<tr>
<td>News Feed</td>
<td>Present on launch page and internal to ResearchLink</td>
<td>Present on launch page and internal to ResearchLink</td>
</tr>
<tr>
<td>Searchable</td>
<td>Opportunities and profiles are searchable</td>
<td>Opportunities and profiles are searchable</td>
</tr>
<tr>
<td>Filterable</td>
<td>Searches are filterable based on user selections</td>
<td>Searches are filterable based on user selections</td>
</tr>
<tr>
<td>Automatic Notifications</td>
<td>Customizable notifications for faculty and students</td>
<td>Customizable notifications for faculty and students</td>
</tr>
<tr>
<td>User Profiles</td>
<td>Customizable profiles for faculty and students</td>
<td>Customizable profiles for faculty and students</td>
</tr>
<tr>
<td>Banner Integration</td>
<td>Banner information used for user authentication during profile creation</td>
<td>Simulated through SQL Database</td>
</tr>
<tr>
<td>Shibboleth Integration</td>
<td>Shibboleth used for login credentials; integrated with MyODU portal</td>
<td>Simulated through SQL Database</td>
</tr>
</tbody>
</table>
| Interface            | Hosted on ODU server, in conjunction with system integrations               | Hosted on CS Virtual Machine                                               

The main features are easily demonstrated by utilizing multiple laptops and different profile types for each laptop being ran by a different member of the team. This will also allow the demonstration of profile creation and updates for both faculty and student profiles. The news feed will be available on the launch page and upon login through a faculty or student account, demonstrating that there is both public and internal access to the news feed that broadcasts
departmental and student successes. Research opportunity creation will demonstrate the options available for each opportunity that is listed within the system, which can be modified to suit the further needs of the department and university as a whole.

Once research opportunity creation has been demonstrated, this opens up the capability of demonstrating the calendar-based notifications tied to deadline reminders and also recurring opportunity reminders for faculty. Archival of expired opportunities will also rely on a calendar-based system. These features will be demonstrated by modifying the date and time to simulate time passing and stakeholders may see how the system shares notifications and also archives expired opportunities.

The prototype will incorporate helpful tutorials to aid in training users that will utilize the system. Making these guides available will help with risk mitigation for both transitioning users to a new system and ensuring that the system does not end up being underutilized. If users do not understand how a new system works, they are less likely to utilize the system often, if at all.

4.3 Prototype Development Challenges

There are no challenges that the team is tracking other than integration with existing systems, such as Banner, MyODU and Shibboleth. These challenges are overcome by the simulating of a database that will provide authentication for user accounts and login credentials for access. The prototype will easily demonstrate the capabilities of the product without the integration with these systems. Access to these systems will be crucial in order to provide seamless implementation of the real world product within the university community.
Glossary

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.

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

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

HTML: HyperText Markup Language is the standard language for creating web pages and applications.

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

MySQL: Open-source relational database management system.

Apache2 Server: Web server software.

NSF: National Science Foundation offers funded research opportunities through Research Experiences for Undergraduates (REU).

NASA: National Aeronautics and Space Administration is an organization that offers Undergraduate Research Fellowships and internships.
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