Lab 2 – Research Link Specification Outline

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1 Introduction

Research is the foundation of new development and the expansion of current knowledge. Universities that heavily focus on research understand the importance of student involvement at both the graduate and undergraduate level. It is the contributions of faculty and students that drive progress in areas such as science, technology, engineering, and mathematics. For instance, at public universities between the years of 2012 and 2013, research resulted in more than 13,322 patent applications, 522 start-ups, 3,094 licenses issued and 3,278 patents awarded (American Academy of Arts & Sciences, 2016).

The Council of Graduate Schools has recently reported a significant increase in graduate enrollment stating that “first-time graduate school enrollment was up 3.5 percent in 2014 from the previous year” (Flaherty, 2015). As the interest in graduate education continues to rise, universities are aiming to intensify their focus on the development of future candidates by connecting them with more research opportunities during their undergraduate career. The participation in undergraduate research can prepare a potential student with the experience needed to be successful in a graduate level program.

The process to attract more students to undergraduate research is not free from complications. In fact, many issues can contribute to the decrease in the number of students searching and applying for research positions. The delivery method of available openings plays a vital role when attracting applicants and, therefore, could be considered the main culprit of missed opportunities. In the past, faculty members have relied on office bulletin boards or word of mouth to disperse related information. However, to reach as many students as possible, these dated delivery methods must be abandoned and replaced with modern solutions.
One other issue surrounding the miscommunication between faculty members and potential participants is the lack of persistence with deadline communication. Once a student has received information via word of mouth, bulletin board post or email, there is often little follow-up from faculty regarding a student’s interest or approaching submission deadlines. With the amount of current undergraduate research opportunities available, it is impossible to assume that any faculty member could remember which students are willing to participate.

The proper solution must meet specific criteria to be considered a success. The most important characteristic of this product is the ability to distribute information directly to interested participants. Doing so will decrease the amount of miscommunication between students and faculty members via dated information delivery methods. Automatic notifications should be incorporated to notify users via email and an in-app notification center of newly created opportunities that may be of interest to the student and approaching submission deadlines for applications not already completed. Universities and students should receive recognition for their work and achievements associated with their involvement. Therefore, having the ability to showcase success and highlight student accomplishments via Internet would be a needed feature to promote and encourage more participation.

1.1 Purpose

The purpose of Research Link is to provide a university with a streamlined process for delivering valuable information to current students regarding possible undergraduate research positions. Research Link aims to increase student participation rates in undergraduate research by providing a platform to showcase student and departmental successes. The participation in undergraduate research not only provides students with a greater understanding of the topics in
their field of study, but it can also improve the chances of students ultimately deciding to pursue a graduate level education. The application will be developed for the computer science department at Old Dominion University to simulate a proof of concept and evaluate the level of efficiency of the modified information distribution process. After a successful evaluation, other departments within ODU will be invited to use the product.

Research Link will provide an interface for creating, modifying, searching and distributing undergraduate research opportunity information. Registered users receive notifications for newly created opportunities and approaching application deadlines. Students are allowed to view the profiles of faculty members, and faculty members are authorized to search student profiles to promote transparency among all participants. Research Link will not automatically create research opportunities within the application. Profiles are not set up for every student or faculty member within the university nor will the application automatically populate profile information with data mining algorithms.

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Figure 1. Current process model. This figure illustrates the issues found in the current process of distributing research opportunity information. Reprinted from “Lab-1 Research Link Product Description,” by Author K. D. Ashley, 2016. Reprinted with permission.

1.2 Scope

Research Link is a web-based application that will enable direct information distribution of research opportunities, internships, scholarships and skills camps between faculty members of universities and qualified student candidates. The main objective of this application is to increase the participation rate of students in undergraduate research at Old Dominion University. This application supports the goal of increasing ODU’s research program affinity among current and future students by helping to confirm ODU’s position as a prime location for advanced research.
1.3 Definitions, Acronyms, and Abbreviations

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.

Bootstrap: HTML, CSS, and JS framework for developing a responsive web-based project.

Browser: A web browser is a software application for retrieving, presenting, and traversing information resources on the World Wide Web.
**CSS:** Cascading Style Sheets is a style sheet language used for describing the presentation of a document written in a markup language.

**Date Object:** An object that enables basic storage and retrieval of dates and times.

**Engine:** In computer programming, an engine is a program that performs a core or essential function for other programs.

**GPA:** Grade Point Average.

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

**JavaScript:** A scripting language for programming on the web.

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

**Laravel:** A powerful model-view-controller (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.
OECD: Organization for Economic Cooperation and Development.

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

Virtual Machine (VM): In computing, a virtual machine (VM) is an emulation of a computer system.


Web Application: In computing, a web application or web app is a client–server software application in which the client (or user interface) runs in a web browser.

1.4 References


Ashley, Kevin. (2016, October 23). Lab 1- Research Link Product Description.

1.5 Overview

This product specification provides the configuration for both the software and the hardware components that will be used to create the application prototype. It also includes information regarding external interfaces, capabilities, and features associated with Research Link. The objective of this document is to establish the goals and purpose of developing this application, as well as, provide the necessary information of how to accomplish set goals.
2 General Description

The development of Research Link will begin as a prototype. However, there are minimal differences between the functionality of the prototype and the real world application. The main variance between the two is the ability of the application to validate registering users against Banner, ODU’s database of active faculty members and students. The other capabilities and functionality will be identical between the two and are included in the prototype to evaluate its candidacy as a replacement for the current process found at Old Dominion University. The prototype will simulate the ability of the application to handle multiple concurrent requests for usage, account creation by all user types, research opportunity creation, student matching capabilities, automatic notifications and displaying news/highlights.

2.1 Prototype Architecture Description

The Research Link prototype is a web-based application that runs on a virtual machine located on an ODU computer science server. The prototype’s hardware components consist of an Apache web server and a database server. Software components include MySQL, PHP, PHP Composer, and the Laravel Framework. The application consists of a web interface, notification system, and database. The web interface utilizes PHP, HTML, CSS and JavaScript for development. Bootstrap is included to access the application from any device regardless of screen size.
Figure 3. Prototype major functional component diagram. This figure illustrates the major functional components found within the Research Link Prototype. Reprinted from “Lab-1 Research Link Product Description,” by Author K. D. Ashley, 2016. Reprinted with permission.

There are three different user levels of interaction associated with this application consisting of Administrator, Faculty, and Student. These user types will determine the capabilities allowed for each feature found in Research Link. During the account creation process, users choose between Faculty and Student on the registration page. Once this page is submitted, a mock Banner database populated with fake user data assists in validating the selected user type. This method of validation mimics the implementation of the real world product. The user will receive an email after this validation has occurred containing a verification link in which they must
follow to verify their account with the application. Only after this process will a user gain access to Research Link via the login page.

*Figure 4. Prototype registration page*

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Authenticated users have the ability to modify their profile information from the Update Profile web page. Information found in a profile will differ between user type. Faculty and Student profiles will both contain similar personal information. However, students update their educational information while faculty members update professional information. Faculty members create research opportunities via the create opportunity web page. This page will contain a web form to enter and submit the necessary details of the opportunity.
There is a looping newsfeed consisting of past student and department achievements in two locations. The first location is on the landing page of the application which will be used to promote undergraduate research to unregistered users. The second location resides on the main page of Research Link accessible only to authenticated users. Search engine algorithms allow faculty members to search student profiles based on specific criteria such as GPA or interest area. All users are allowed to search current research opportunities.

The notification system provides email and in-app notifications for new opportunities and approaching application deadlines. Students are provided with the capability to send their resume for a particular opportunity in which the lead faculty member will receive a notification stating that a student requests consideration for a position. The prototype database will be an instance of MySQL and will house fake, pre-populated data for demonstration. User accounts, profiles, and research opportunities are among the data found in the prototype database.

2.2 Prototype Function Description

The manage user profile page is a web page form that provides an authenticated user the ability to modify and save profile information. The form is pre-populated with previously saved data from the database. The profile's content will remain empty until the user has updated the information. Faculty and student user types will edit personal information within their profile. However, students will modify educational information whereas faculty will update professional information. Once the user has entered information into the appropriate fields, the form must be submitted to save the new data to the database.

Faculty or Administrators create research opportunities by navigating to the create research opportunity web page and entering information into an empty web page form. Once the user
completes the form, it must be submitted to save the new opportunity to the database. Each opportunity will remain active until the deadline date has passed and automatically marked as expired. Expired opportunities are not searchable by students but can be modified by faculty.

Searching for an opportunity requires an authenticated user to navigate to the Search Opportunities web page. All research opportunities will be retrieved from the database and displayed to the user. The user will then have the capability to filter opportunities using interest
keywords, research agency name, academic department, compensation status, and distance learning status. The user will also have the ability to sort opportunities by the application deadline, opportunity start date, GPA, and compensation amount.

In some occurrences, faculty members will need to search student profiles to find qualified candidates. This capability is provided via the User Profile Search web page and will allow searching by completed prerequisite courses, academic major, grade level, and interest keywords. The page will also allow sorting results by numerical fields such as GPA.

Notifications are an important component to the success of the prototype. Email and a website notification center are the delivery mechanisms for notifications within Research Link. The website notification center will alert and display messages to authenticated users regarding research opportunities, approaching deadlines, departmental announcements, and account status change. Users have the ability to mark notifications as read or delete them from the notification center. The indication that a user has a new notification will appear above a notification icon in the top right portion of the interior website navigation bar. Users that are logged in when a new notification arrives, a small announcement will momentarily appear in the bottom right corner of the current page. Email notifications dispatch to the authenticated user's email address found in their profile. They will be identical to the message in the website notification center. Users may suspend email notifications from the user settings page.

It is essential for the customer to showcase recent research accomplishments and student achievements. Promoting these successes supports the application’s goal of aiding the client with increasing student interest in undergraduate research. The newsfeed component will be visible in two locations. The first location is found on the prototype's landing page to display research
activity for public, nonregistered visitors. The second area resides on the interior home page for authenticated users. Faculty and Administrators have the ability to create a new record by navigating to the News/Highlights web page. The user will be presented with a blank form and must click submit after entering appropriate data to save news information to the database. News articles remain active for 60 days and are then archived and deactivated from the newsfeed.

Testing the functionality of the prototype will consist of creating a test admin user with the capability to manipulate date and time configurations to dispatch notifications that are deadline sensitive. Changing these settings will showcase the application's ability to send notifications for approaching deadlines. The prototype database will consist of fake research opportunity and newsfeed data. There will be a mock Banner database, filled with fake user data, created to demonstrate the application's validation process for registering users.