Lab 2 – ResearchLink Product Specification Outline

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1 Introduction

Undergraduate research is necessary for multiple reasons and participation includes benefits such as improved graduation rates, improved GPAs, and enhanced interest in graduate programs. Texas A&M University at Kingsville found that students involved in their Undergraduate Research Mentoring Program (URMP) had a 96 percent rate of graduation compared to 60 percent for traditional students. Texas A&M University found that research also included benefits for participating faculty members. Faculty members who took part in research programs were found to perform better on their annual review, increase publications and increased external funding. ("UNDERGRADUATE RESEARCH PROGRAM BENEFITS GRADUATION RATE, GPA.", 2006).

ResearchLink was developed to address the obstacles present in practical research project recruitment. Communication throughout the faculty and student body was discovered to be a major contributing factor to a lack of interest, missed opportunities, and missed deadlines. Many students claim that they had no knowledge of available research programs and understandably had little interest. The problem in communication is related to the individualized approach to research promotion. Research opportunities are promoted as the involved individual(s) determine, which leads opportunities being posted on community boards, posted on the associated professor's door, or being emailed out. The inconsistent communication creates an unpredictable environment in which students may randomly be exposed to opportunities because they happened to walk past the right door or they happened to check their email at the right time. ResearchLink will enhance the communication of research opportunities with software induced consistency and predictability.
1.1 Purpose

ResearchLink is a research opportunity organizational tool, developed to promote predictable communication and facilitate both faculty and student interest in research. ResearchLink addresses challenges to research operational management. Students, through a web interface, can search for research opportunities as they are made available. Faculty members, through a web dashboard, search for students based on various criteria such as GPA. Faculty members can also explore available research opportunities or create new opportunities that will be available for searching. The web interface provides a dashboard that promotes communication between current team members and potential future team members.

One functional goal of the ResearchLink prototype is to streamline the dissemination of research opportunities available to undergraduates. Dissemination of research opportunities is accomplished by an easy to use interface that is embedded in the My ODU homepage, prompting interested students to explore and discover the opportunities currently available. A second functional goal includes providing a platform to display student/departmental successes. Departmental/student achievements will have a particular web page dedicated to its purpose within the ResearchLink prototype interface. The last functional goal is to increase recruitment of new students and encourage the transition of undergraduate students to graduate programs. Texas A&M found that members of their URMP program regularly gained admission to prestigious graduate schools. ("UNDERGRADUATE RESEARCH PROGRAM BENEFITS GRADUATION RATE, GPA. ,” 2006).

ResearchLink provides many automated services that establish a concise predictable product that maintains its boundaries. ResearchLink provides a web interface for searching possible opportunities. ResearchLink sends notifications about new and pending opportunities,
accomplished through current programmatic date vs. target date algorithms. Automatic archive
of expired opportunities occurs driven by programmatic date analytics. The ResearchLink
interface allows students to post stories about past research experiences. The product also
supports multiple types of searches; such searches include student/faculty searches, research
opportunity searches, and student searches.

ResearchLink does not provide everything, and an administrative user must control some
attributes of the interface. ResearchLink will not automatically create research opportunities.
Research opportunities must be entered either by an administrative user or a faculty member.
Users of the ResearchLink product will not automatically delete from the database after a preset
term. Administrator users are the only individuals that can remove or delete user accounts.
Account profiles will not automatically generate for students or faculty members. Account
profiles instantiate when a user accesses the ResearchLink interface and registers a new account.
Users will not be able to apply to opportunities within the Research Link product due to the
complexity involved in maintaining application requirements that are unique to each process.
Research opportunities have very distinct application processes that would significantly increase
development costs to maintain. ResearchLink will not interface with Banner software in any
form.

1.2 Scope

ResearchLink is designed to provide a live-stream, current research news components
for both public and university communities. ResearchLink utilizes common design patterns that
make the interface both convenient and intuitive for many users. The ResearchLink product
provides a consolidation platform for research opportunities available at ODU. The use of
notifications within the product allow for automatic dissemination of information allowing
research companies to link to students of interest. The accumulated effect of the previously mentioned features instantiates a product that promotes research/co-op positions facilitating a research-oriented environment that benefits everyone involved.

Figure 1. Current process flow: deliverable assessment

The ResearchLink product attempts to reach critical goals that displace previous problems in the promotion of research opportunities. Figure 1 displays the current research development strategy employed at ODU. Starting from the top left information is sent to the selected faculty member who may choose from a few different ways to deliver the information to the student(s). The unpredictable flow of information in communication channels creates random paths of information that are difficult to track. Research information that disseminates through the ODU community does not have a predictable path, making it difficult to predict how many students are even aware of available opportunities. Goals that resolve this issue include up-to
date information, students/faculty who check on an opportunity will benefit from the consolidation of data. One source of data means that only one update is necessary to keep interested individuals current. ResearchLink's interface promotes individual/department recognition with a success page.

Figure 2 shows the improved flow of information facilitated with the ResearchLink product. ResearchLink provides a central consolidated source of research opportunity data that allows students and faculty to check one source for the most current news related to a research opportunity. The ResearchLink product creates a predictable environment where students and faculty know how to find the information and also know that what they are viewing is current.
Consolidated resources help reach objectives established by the ResearchLink product which includes increasing research program affinity, attract more graduate and undergraduate students to ODU, and increase the rate at which ODU undergraduates transition to graduate programs.

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.

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

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

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

**MySQL**: Open-source relational database management system (RDBMS).

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

**RDBMS**: Database management system (DBMS) that is based on the relational model as invented by E. F. Codd, of IBM's San Jose Research Laboratory.

1.4 References

UNDERGRADUATE RESEARCH PROGRAM BENEFITS GRADUATION RATE, GPA.

1.5 Overview

This product specification provides the hardware and software configuration, external interfaces, capabilities and features of ResearchLink. Prototype information presented in the remaining sections of this document include a detailed description of the hardware, software, and external interface architecture of the ResearchLink prototype. The key features of the prototype; the parameters that will be used to control, manage, or establish that element; and the performance characteristics of that function regarding outputs, displays, and user interaction.

2 General Description

ResearchLink is a web-based application through which students and faculty connect on research projects. Faculty members create research opportunities that instantiate in the database. Faculty and student users then search the available opportunities and contact indicated leaders described in the opportunity. Users of ResearchLink also have access to a newsfeed that loops through current events as provided by administrators. ResearchLink provides notification capabilities that allow faculty and administrators to contact many users at one time with valuable
information that may include expiration dates, new opportunities, requests, and other data that might be considered useful.

### 2.1 Prototype Architecture Description

The ResearchLink prototype is planned to have nearly the same structure and feature set as the real world product. Table 1 shows a direct comparison between the two. The major differences are the prototype's reliance on simulated data.

<table>
<thead>
<tr>
<th>Components</th>
<th>Real World Product</th>
<th>Prototype</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHP</td>
<td>Server side scripting for programmatic access to database</td>
<td>Fully implemented and supported</td>
</tr>
<tr>
<td>MySQL</td>
<td>RDBMS with multiple tables for storing/retrieving data.</td>
<td>Fully implemented and supported</td>
</tr>
<tr>
<td>JavaScript</td>
<td>Client side scripting for form validation</td>
<td>Fully implemented and supported</td>
</tr>
<tr>
<td>Laravel Framework</td>
<td>PHP framework for enhanced code organization</td>
<td>Fully implemented and supported</td>
</tr>
<tr>
<td>Apache Web Server</td>
<td>Mature engine for serving web pages</td>
<td>Fully implemented and supported</td>
</tr>
</tbody>
</table>

*Table 1. Component comparison between real world product and prototype*

Account creation includes three distinct types. The administrator account is used to maintain the site by invoking special actions. Individual actions that an administrator may apply to the ResearchLink application include backing up the database, deleting specific accounts, deleting research opportunities, inserting news items, or sending notifications to other users. Faculty users may browse student profiles or add new research opportunities to the website. The faculty user may also send notifications to target students about new or existing opportunities. The student user can browse research opportunities and send a notification of interest to a responsible faculty user. The ResearchLink prototype uses simulated data to facilitate displaying account attributes.
User profile settings adjust through a web interface provided once a user has logged into the application. Users have the ability to change options such as their display name, major, minor, research interests, and previous experience. These fields run through a PHP program that updates either the users table or the profile table to reflect new data. When a user applies changes to their profile or other areas, server side programs on the server execute a SQL update or SQL select statement to replace existing data with the update data or retrieve data that reflects current values.
Research opportunities are created by faculty users or administrators. Administrators can also delete research opportunities while faculty members cannot. A faculty member creates a research opportunity by accessing a web form that becomes available once the user has authenticated via login. The research opportunity web form contains various fields that the faculty user must populate, once this is done the user clicks the submit button. Once the submit button activates, PHP programs check that the same posting does not already exist in the database and that the appropriate data is provided. The research opportunity once instantiated, presents the user with a posting added message confirming that the process has completed successfully.

ResearchLink provides related information in the form of an updated Newsfeed. The Newsfeed is maintained by administrators and the service loops through news items that exist in the database. The newsfeed loop is circular in function, allowing it to redisplay items it had
shown previously, providing the user with the chance to see things they may have missed previously.

![Flowchart of Search Process]

**Figure 5.** Search: deliverable algorithm

ResearchLink provides a search engine for discovering both student profiles and research opportunities. Faculty users can search student profiles to ID students they feel will be a good fit for a current or upcoming event. Both student and faculty users can search current or expired research opportunities. The search algorithm used to develop the search engine includes populating the search block and pressing the search button. The search button once pressed checks that the input is valid. Once the data is validated, the search block converts to SQL which launches against the MySQL database by PHP programs. The results of the query are processed and displayed to the user within the web interface.

ResearchLink includes a notification system that takes advantage of date metrics to operate. Notifications load into the respective MySQL table by various programs embedded in
the application. The program responsible for notification generation runs against the database once a day and compares the current date to the deadline stored in the notification table in the target record. Once the current date is the same day or newer than the target date, the notification program executes the notification through email using available PHP methods. Once the notification generates, the record in the database has the "sent" bool item updated from false to true. The bool value within the notification file prevents the program from resending the same notification the next day.

2.2 Prototype Functional Description

ResearchLink allows an authenticated user the opportunity to update their profile. A web form accessed by the user through the interface, once the form displays, it contains data already stored in the database about the user. The user may then edit the data with new entries and click the submit button. Once the submit button activates, the web form is checked for changes via JavaScript. Once the submission has passed the JavaScript tests, the form posts to the PHP web server for further processing. The PHP program then updates target fields in the database and refreshes the web form the user is viewing once complete. Once the web form restores, the user will see that their data has successfully updated.

The ResearchLink prototype allows authenticated faculty users to create new research opportunities. The research opportunity creation web form allows faculty members to submit new opportunities to the database for storage and retrieval. The faculty member fills in the data blocks available on the web form and clicks the submit button. Once the submit button activates, PHP programs check that the data does not already exist in the database. The PHP programs also check that the data provided is valid if invalid data is detected, an error message generates, and the user is prompted to fix the problem. Once the data is validated, the provided fields transform
into a SQL update statement that executes against the database. Once the database instantiates the record, the submitting user views a success message. Each research opportunity includes an expiration date. When the expiration date equals or is older than the current date, the research opportunity enters an inactive status. The database tracks this status with a bool variable that is true for active or false for inactive. An opportunity once expired, is removed from active search results. To assist faculty users with expiration dates, a calendar feature allows the selection of a date instead of having to type it in. This calendar feature will help faculty avoid type errors when submitting new opportunities to the database.

Opportunity searches initiate by authenticated users with a web form submission. The web form is filled out by the user and includes desired filtration and sort options. Research opportunities, for example, could be filtered by required GPA and sorted from the most recent opportunity to older opportunities. All opportunities retrieve from the primary database; no third party opportunities exist. The filtration and sort options resolve on the SQL layer of the application, not the PHP layer. This choice will allow for quicker results and scales better when compared to the alternative of sorting and filtering on the PHP layer. Once the web form is submitted, JavaScript checks that the form passes initial validation before posting the form to the PHP server. The PHP program constructs the SQL select statement to execute against the database while respecting the sort and filtration options passed in by the user. The results of the select statement are maintained and passed back to the user in the order derived from the database.

User profile search functionality exists through a web form available to authenticated faculty members. Authenticated student users cannot search other student profiles; this privilege is for faculty. Student search restricts to faculty members due to student privacy concerns. The
ResearchLink application will only contain user profiles of students and faculty that have registered with the product through the registration web form. Accounts do not automatically assemble from third party sources. The profile search web form supports sorting by numerical fields such as user id or GPA. When an authenticated faculty user fills out the required data and presses the submit button, the data validates on the client side with JavaScript. Once data validation passes, the web form posts to the PHP web server for execution against the MySQL database, the results are presented to the user with the indicated sort.

The website notification system allows the ResearchLink prototype to generate notices to users on various topics. Notification topics include messages related to research opportunities, account status changes, and information related to a user's department. Authenticated users may mark notifications as read or delete the notification. ResearchLink supports dated notifications that occur at any future date to include the day that they instantiate. Dated notifications are checked daily by an embedded PHP program that compares the current date to the deadline and decides if the notification should send or not based on the date and the "sent" bool variable in the database affiliated with the particular record.

The email notification system in ResearchLink instantiates with a PHP program that reads the database and communicates with an email server for email delivery operations. The email system is required for registration when a user registers with the ResearchLink product; a confirmation email sends to the indicated email. The notification system and the email system work together to deliver both the notifications and the emails together creating a consistent messaging pattern. Authenticated users may disable notification within their user profile to help control email volume. The email system also checks the current date against the target date and delivers the email messages using available PHP methods at the appropriate time.
ResearchLink provides news highlighting, keeping users informed of current events related to research opportunities. The looping feed exists through a PHP program that loops through a news item table available in the database. The database table responsible for the news items updates by faculty and administrators through a web form. The web form similar to previously mentioned web forms contains data fields that must be filled out and a submit button to confirm submission. Once the submit button activates, data is validated client side with JavaScript and then posted to the PHP web server. The PHP web server checks that data is not duplicated, if it is an error message is provided to the user otherwise a success message is delivered following data insertion. News items will be active for 60 days before being moved into an inactive state. The active/inactive state of news items is facilitated with a calendar feature that measures the date the item instantiated against the current date. The newsfeed will also facilitate internal and external feeds. The external feed is considered public and authentication is not required, this feed is available on the first landing page of the website. The internal feed is for authenticated users and can be found on the landing page following authentication.