Lab 1 – ResearchLink Product Description

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Lab 1 – ResearchLink Product Description

Introduction

Undergraduates transitioning to graduate programs are lower than expected. In 2014, Old Dominion University (ODU) received 2,430 applications to graduate programs (ODU Factbook, 2016), resulting in 796 enrollments that year which includes 139 computer science graduates. By May 2014, ODU had awarded 11,908 degrees ("ODU Online at a Glance", 2016). The disparity between undergraduates going into graduate programs is 6% for general applications and 1% for computer science graduates. There are many reasons to improve this statistic. Improve the United States representation within the fellow Organization for Economic Cooperation and Development (OECD) in STEM graduates. OECD is an organization that promotes policies to improve economics and social well-being around the world. The United States current rank is 28 out of 30 (Myers, 2011). Empower ODU’s research capacity by enhancing the number of individuals within the community that are capable of leading research teams and attracting new researchers from outside the local area to strengthen diversity.

Identified obstacles of undergraduate research participation include old delivery methods, lost emails, miscommunication, and lack of public awareness. Events in which an individual failed to understand or receive information indicates a problem with communication. Current research opportunity promotion is up to the individual(s) leading the research which results in an individualized development that is distinct to that person(s). The promotional process becomes unpredictable due to the personalized promotion of projects and is more likely to be missed by potentially interested parties.

ODU faculty is interested in improving the graduate/research application rate to improve rankings and enrollments. (J. Brunelle, personal communication, February 7, 2016) Increased
application rates will result in more internships, scholarships, and skill camps derived from improved funding and need. External organizations will also recruit and retain talent within the research groups by recognition of top performers, accomplished with awards, promotions, and success stories.

Solutions to improve communication of research/graduate opportunities will be one that enhances communication through a broad network of individuals. The ResearchLink product organizes opportunities in an easy to use interface that is accessible from the official My ODU login portal. The product also notifies interested users of updates and new events; also some customization options will allow the user to strengthen their notifications or turn them off. ResearchLink will standardize the communication into a predictable pattern that is easy to follow, remove unnecessary intermediaries by permitting direct communication to groups or individuals, and entice new recruits with an easy to use interface that is intuitive, increasing the adoption rate.

2 Product Description

ResearchLink is a web application solution that is capable of live streams, updated news, and customizable interfaces. The development pattern follows intuitive designs as established by leading vendors. Intuitive design means menus in expected areas, standard button behavior, and menu design that follows established industry standards. ResearchLink promotes up to date information with consolidated update pages, highlight department and student success with front page announcements, and improves communication using email notifications and peer-to-peer messaging. Objectives include increase research program affinity through consolidated opportunity advertising and increase the number of undergraduates transitioning to graduate programs.
2.1 Key Product Features and Capabilities

Sharing information and making opportunities available starts with account creation. Account creation occurs when a new user first gains access to the interface. The user will then visualize a login screen with a register button; this is familiar to anyone who has used web login products in the past. Clicking the register button allows the user to fill in the information required to use the product. Once the user is identified as faculty or student, they are capable of distinct actions based on this affiliation. Faculty users are capable of creating opportunities that broadcast to interested parties. Faculty users also have access to student profile search options, allowing the faculty member to identify candidates that they feel are qualified to assist quickly. Designated student users can explore available opportunities and message the point of contact for additional information. Once users affiliate with an opportunity, they receive updates and messages based on their personal settings. A faculty member or group leader may choose to override individual message settings to ensure a message delivers as expected. When a group instantiates, the faculty member may want to define the entire teams standard for messaging. Enforcing a group level of messaging allows the faculty member to achieve predictable results with an emphasis on enhanced communication for the group.

Faculty members provide the opportunities available and push additional information which may include departmental interests and reminders. Faculty members also provide department and student success stories through messaging and success pages. Success pages highlight recent achievements while providing access to historical examples. Students can view this information within the web interface or may be notified by email when new results are made available.
Web application accessibility is available through standard web interfaces which include mobile devices with browser programs. Special consideration to mobile web development was implemented to mitigate the need for an independent mobile app that would have required additional development. The web application follows the standard development practices as defined by the W3C organization, allowing any standard abiding browser to access the website without error.

2.2 Major Components (Hardware/Software)

Major functional components include the hardware selected to implement the prototype and the software chosen to support the implementation. Hardware selected includes the database server and the web server. The software chosen for the prototype consists of Linux, Apache, MySQL, and PHP. Figure one illustrates how the software and hardware components interact with the users affiliated with the application.

Figure 1. Functional flow diagram
Figure 1 shows the major functional elements of the ResearchLink web application. The logical movement of the diagram starts at the user icon and travels left following the arrows. The first major hardware component includes the relational database management system (RDBMS) known as Structured Query Language (SQL) implemented with a MySQL solution. MySQL databases contain data arranged in tables that resolve by select/update statements as passed in by Hypertext Preprocessor (PHP). PHP programs read the available data, make decisions, and refresh the database when necessary while directing the user through the application in a predictable manner. The web server component installs in the same physical/logical location as the RDBMS solution. The web server creates the web application presented to users of the system. The web server accomplishes this with multiple PHP programs that work together to facilitate the web applications function and user experience.

The software component includes the operating system that facilitates the functions of the web application. The scripting languages and RDBMS chosen are not confined to specific vendors, allowing for implementation across different hardware/software configurations. The current implementation is maintained within the ODU environment running the Apache2 Server within a Linux environment. Linux, Apache, MySQL, and PHP used together creates an environment known as LAMP.

3 Identification of Case Study

Research opportunities at ODU receive a disjointed promotion. Promotion of an opportunity varies by department and by the individual. It can be by word of mouth, flyers, or email. It, however, is not consistent and the information provided is not always complete. Current solutions include the web application Pivot, a research consolidation service provided to
numerous universities on a common platform. Pivot takes a one size fits all approach, which creates problems when a particular school needs a solution specific to their process.

Undergraduate research participation is much lower than desired. Six percent is not considered an acceptable rate of involvement. Undergraduate research offers numerous benefits to the community as well as the student participating in the research. Research evidence has shown that participation in undergraduate research helps retain students in science majors, heightens graduation rates, and increase participation in graduate programs. (Myers, 2011)

ODU faculties have cited various problems hampering the organization and communication of research opportunities to undergraduate students. These include limited knowledge of opportunities and poor advertisement. ResearchLink enhances communication through standardizing the delivery method and the expected content. A new opportunity requires that the appropriate information exists. The opportunity, for example, cannot be created without an opportunity name reducing ambiguity among research opportunities. Advertising ResearchLink on the ODU homepage and my ODU web portal page also promote the product solution to unaware parties that include students and faculty members. ResearchLink facilitates improved collaboration on undergraduate research between ODU students, staff, and third-party research organizations.

4 Product Prototype Description

Proof of concept for the prototype establishes through multiple simulations and demonstrations. Simulations include yearly reminders that respond to false date data, the creation of an opportunity, and a student search demonstration. The ResearchLink prototype demonstration requires a functional web application that invokes PHP programming to access test data in a MySQL database. The test data within the MySQL database will contain false
student and faculty information. It will also include pseudo data representing various opportunities and groups.

The final purpose of the prototype will include discussion of identified risks and mitigation strategies designed to prevent them. Risks include an underutilized system and the difficulty involved with the transition to a new system. The standard mitigation strategies implemented to combat these problems include helpful guides and tutorials available in both a text and video format. The videos are created with expediency in mind. Effective demonstration and risk mitigation will ensure that all involved customers are satisfied with the product before being implemented for the student and faculty body at ODU.

4.1 Prototype Architecture (Hardware/Software)

The PHP Server component implements the Laravel Framework 5.2 into its environment. The engine interpreting the PHP program is the Apache2 server solution. The PHP programs access the MySQL database with select/update statements, make decisions based on available data and the requests of the user. Notifications are generated and submitted to target users using date objects available on the server. The PHP server and MySQL database exist within a virtual machine in the computer science department.

Figure two displays the major functional components of the ResearchLink Prototype. Users consist of students, faculty, research organizations and any other assigned personnel such as administrators. The Banner database is used to validate user credentials and authenticate faculty users. The prototype access component includes devices used to connect to the ResearchLink prototype which may be any device with a W3C compliant browser; this includes mobile devices. A dedicated website hosted within the My ODU environment allowing complete integration. The servers host the database from which the web application accesses and
transcribes new data. The prototype utilizes PHP programs to handle all programmatic decisions such as providing the user a particular file or dispatching an email to a target user once the specified date has passed.

The PHP Server component implements the Laravel Framework 5.2 into its environment. The engine interpreting the PHP program is the Apache2 server solution. The PHP applications access the MySQL database with select/update statements and make decisions based on available data. Notifications are generated and submitted to target users using date objects available on the server. Date sensitive notifications generate by PHP programs that validate the current date against the target date as established by calendar objects accessible to the user. The PHP server and MySQL database are contained within a virtual machine in the CS department.

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4.2 Prototype Features and Capabilities

The ResearchLink prototype will demonstrate the same capabilities expected in the real data with one exception. The prototype will not be available from the My ODU homepage. The prototype will allow the test user to configure alerts within the edit profile web page and observe the results. Account alterations established by the user are stored in the database allowing the prototype to "remember" the settings and take appropriate actions. Opportunity creation is central to the product's purpose. The prototype is capable of providing a user the opportunity to create an account. The opportunity, when created, is stored in a distinct table object within the MySQL database. Once the data storage is complete, other PHP programs display the data to
users or send user messages supporting the new opportunity. Profile creation allows the user to establish data related to their particular account instantiation, PHP programs store and retrieve the data as the user commits edits to their profile. Users are capable of updating their profile from the web application interface. Once changes are submitted, data within the MySQL database is updated to reflect the requested changes.

ResearchLink supports live news feeds as established by the user community. News feeds include updates on departmental successes and student achievements that have been submitted to an administrator for updating. Current news feed implementation depends on an administrator updating and inserting the desired data into the prototype. News feed updates are accomplished by an administrator accessing the news update web page available only to the administrator user.

The prototype also features automated capabilities that preserve data for historical purposes. Opportunities that have expired, automatically archive in a special historical table that exists in the MySQL database. This is accomplished with PHP programs that capitalize on built-in date functions to make predefined decisions on data sets. The date functions also support the calendar feature. Based on data entered by administrators or faculty users, data will automatically transmit in the form of reminders to users who are set to receive them.
Table 1

Feature comparison between full product and prototype

<table>
<thead>
<tr>
<th>Features</th>
<th>Real World Project</th>
<th>Prototype</th>
</tr>
</thead>
<tbody>
<tr>
<td>Account Creation</td>
<td>Distinct for each user. Established when a user first accesses the product</td>
<td>Prepopulated with false account data.</td>
</tr>
<tr>
<td>Client Computer</td>
<td>Any device with W3C compliant browser</td>
<td>Lecture room PC with Internet access and a web browser</td>
</tr>
<tr>
<td>ResearchLink Website</td>
<td>Hosted on ODU web server. Interacts with Banner product for authentication</td>
<td>Hosted on virtual ODU web server. Authentication with Banner product simulated</td>
</tr>
<tr>
<td>Research Opportunity Creation</td>
<td>Established by faculty users. All users allowed viewing</td>
<td>Created by development team. All users allowed viewing.</td>
</tr>
<tr>
<td>Live News Feed</td>
<td>Established by administrators with data provided by faculty</td>
<td>Developed by development team</td>
</tr>
<tr>
<td>Data Archival</td>
<td>Data programmatically selected for automated archive by date expiration</td>
<td>Feature demonstrated with false date data that will drive the archive process the same way current dates would</td>
</tr>
<tr>
<td>Calendar Reminders</td>
<td>Users automatically selected for email reminders based on current date versus stored target date.</td>
<td>Feature demonstrated with false date data. Procedure and behavior will behave identically to real world project</td>
</tr>
</tbody>
</table>

Table 1 Feature comparison between full product and prototype

4.3 Prototype Development Challenges

Challenges to prototype development include multiple obstacles. The prototype is not integrated into Banner or My ODU as the final product is expected to be. The lack of Banner integration diminishes the perspective that ResearchLink will be easy to use and access when displayed as a product not integrated into the virtual ODU environment. In addition to this, it does not allow the development team to develop and successfully connect data transfers between
the two sources, and this would enable users to access ResearchLink content more directly and not require additional login credentials.

Knowledge-based challenges include developing in languages that are unfamiliar to the development team. The development team has little experience with HTML, CSS, JavaScript, PHP, and MySQL, languages that must be connected each other efficiently and have their own syntax and semantic rules. Web application security is handled through standard encryption protocols and methods. The PHP language has methods built into it that allow for an easy and standard development of protected resources.

Testing and deployment presented unique challenges that were answered with the development of reusable pseudo data. This false data processed into the database with CSV files. The programs ran through this data, providing the development team with evidence that the programs worked correctly and would function while displaying the prototype.
Glossary

**Browser:** A web browser is a software application for retrieving, presenting, and traversing information resources on the World Wide Web.

**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.

**JavaScript:** A high-level, dynamic, untyped, and interpreted programming language.

**LAMP:** LAMP is an archetypal model of web service solution stacks, named as an acronym of the names of its original four open-source components: the Linux operating system, the Apache HTTP Server, the MySQL relational database management system (RDBMS), and the PHP programming language.

**Laravel:** A free, open-source PHP web framework, created by Taylor Otwell and intended for the development of web applications following the model–view–controller (MVC) architectural pattern.

**MySQL (RDBMS):** An open source multi-user relational database management system.

**ODU:** Old Dominion University

**OECD:** Organisation for Economic Cooperation and Development

**PHP:** A server-side programming language designed for building dynamic 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.

**W3C (W3C):** The World Wide Web Consortium.
References


