CS 411W Lab 1 – Research Link Product Description

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CS411

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October 2, 2016
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1 INTRODUCTION

Undergraduates transitioning to Graduate programs is lower than expected. In 2014, Old Dominion University (ODU) received 2,430 applications to graduate programs (ODU Factbook, 2016). This resulted in 796 enrollments that year, 139 of these were 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 a number of reasons to improve this statistic. First, improve the United States representation within the fellow Organisation for Economic Cooperation and Development (OECD) in STEM graduate degrees. The United States current rank is 28 out of 30 (Myers, 2011). Improve ODU’s research capacity by enhancing the number of individuals within the local community that are capable of leading research teams and attracting new researchers from outside the local area as well with robust research programs. Finally, increased capacity for research will provide access to more federal funding to support new research.

Identified obstacles include outdated delivery methods, lost emails, miscommunication, and lack of public awareness. These four identified attributes all orbit around the concept of communication. Events in which an individual failed to understand or receive information is a drop in communication. This concept takes many forms from dropped emails to simple misunderstandings. Current research opportunity promotion is left up to the individual(s) leading the research, this results in individualized promotion that is distinct to that person(s). This makes the promotional process unpredictable and more likely to be missed by potentially interested parties.
ODU faculty is interested in improving the Graduate/Research application rate in an effort 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 as it is identified within the research groups by recognition of top performers.

The solution to improve communication of research/graduate opportunities will be one that enhances communication through a large network of individuals. The ResearchLink product organizes opportunities in an easy to use interface that is accessible from the standard My ODU login area. The product also notifies interested users of updates and new events, in addition 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 middle men by permitting direct communication to groups or individuals, and entice new recruits with an easy to use interface that is both intuitive and welcoming.

2 RESEARCHLINK PRODUCT DESCRIPTION

ResearchLink is a web application that is capable of live streams, updated news, and customizable interfaces. The development pattern follows intuitive designs as established by leading vendors. Menus in expected areas, standard button behavior, and menu utilization metrics. The software measures user time spent within a web page or how often distinct menu actions occur. This will allow the development team to make necessary adjustments if a menu or area is found to be confusing for many users, effectively promoting intuitiveness or the idea that an individual will be able to use a feature without proof of concept. ResearchLink promotes up to date information with consolidated update pages, highlights department and student success
with front page announcements, and promotes communication with email notifications and peer-to-peer messaging. Objectives include increase research program affinity through consolidated opportunity advertising, Attract both graduate and undergraduate students to ODU, improve research interest, and increase the number of undergraduates transitioning to graduate programs.

2.1 Key Product Features and Capabilities

Account creation occurs when a new user first gains access to the interface. The user visualizes 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 are capable of creating opportunities that broadcast to interested parties. Faculty also have access to student profile search options, allowing the faculty member to quickly identify candidates that they feel are qualified to assist in the opportunity of interest. Identified student users are able to search available opportunities and message the point of contact for additional information. Once users are affiliated with an opportunity, they receive updates and messages based on their personnel settings. A faculty member or group leader may choose to override certain message settings to ensure a message is delivered as expected. Urgent messaging is an example of this, when this option is enforced, members of the group will receive the message regardless of their personal settings. When a group is established, the faculty member may choose the entire groups standard for messaging. This allows the faculty member 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 are able to view this information within the web interface or may be notified within email when new successes are made available, the latter depending on their personnel settings.

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 to ensure compatibility. The web application follows the standard development practices as defined through the W3C organization allowing any standard abiding browser to access the web site without error.

2.2 Major Components (Hardware/Software)

![Diagram](image)

*Figure 1. Major functional component diagram*
Figure 1 illustrates the major functional components of the ResearchLink web application. The logical flow of the diagram is from left to right, top to bottom. The first functional piece is the user which is comprised of both faculty and students of ODU.

The second functional component is the device used to access the web application through an internet. This device will require an installed browser program that adheres to the standards established by W3C organization. Rogue browsers that do not adhere to this standard may be able to use the web application, however behavior is unpredictable.

The third functional component is the web application itself. The web application contains a user friendly design and an intuitive interface. The application will be capable of registering new users, promoting new opportunities, forming groups and broadcasting selective information to targeted individuals dependent on settings and group affiliations. These sub-programs are implemented with a server side scripting language, Hypertext Preprocessor (PHP) and a relational database management system (RDBMS) known as Structured Query Language (SQL). JavaScript is also present as a client side scripting language with an emphasis on improving user experience.

The fourth functional component is the database that stores all information affiliated with the web application and its users. The data is stored using a RDBMS database known as MySQL. MySQL databases contain data arranged in tables that are accessed by select/update statements as passed in by PHP. PHP programs read the available data, make decision with the data, and update the database when necessary while directing the user through the application in a predictable manner.

The fifth and final functional component is the involved hardware running 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 many different hardware/software configurations. The current implementation is maintained within the ODU environment running the Apache2 Server within a Linux environment. This creates a Linux, Apache, MySQL, and PHP environment known as LAMP.

3 IDENTIFICATION OF CASE STUDY

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*Table 1.* Feature comparison between full product and competitors
Research opportunities at ODU receive disjointed promotion. Promotion of an opportunity varies by department and by individual. It can be by word of mouth, flyers, email, or all three at times. It however, is not consistent and the information provided is not always complete. Current solutions include 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 specific university needs a solution specific to their process and design. Table 1 directly compares the ResearchLink product to competing solutions. The one size fits all approach is apparent to the pivot product, it is not degree specific. This is because many schools have distinct degrees and requirements. This is the same case with consideration to department centric support. These features would be immensely difficult in a manner that supported numerous universities successfully. To correctly facilitate this, an organization would have to closely examine a schools educational layout and make customizations based on findings. This would be much more costly and defeat a one size fits all approach.

Undergraduate research participation is much lower than desired. 6% is not considered an acceptable rate of participation. 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 faculty 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 be provided. The opportunity for example cannot be created without a name. Advertising ResearchLink on the ODU homepage and my ODU web portal page also promotes 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 PROTOTYPE DEMONSTRATION DESCRIPTION

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 contain pseudo data representing various opportunities and groups. The demonstration will begin with a review of the involved functional components and a description of the test data used to facilitate the demonstration. Using a standard sized personnel computer, a test user will access the web application and register within the web application as a faculty member. Once registered, the test user will search for available students based on custom search options. The test user will create a new research item and send messages to students identified in the first part of the process. The test user will then log out of the current user and login as one of the identified students. The test user will view the promoted research opportunity that was just created and respond. The user will search the database and view various data objects that are available to the student type user.

Once the initial demonstration is complete, another user will log in as a faculty member and message the student user while they are logged in. This demonstrates the real time collaboration available to users of ResearchLink. The user that logs in as a faculty member will be able to perform this action remotely. Finally a third administrative account will be displayed
with options that allow for removal of objects that may include incorrect research items, bad student information, or old user credentials. The administrator is also able to reset passwords on an individual bases, group bases or entire user group base.

The final part of the demonstration will include discussion of identified risks and mitigation strategies designed to prevent them. Risks include an underutilized system and the difficulty involved with transition to a new system. The common mitigation strategy implemented to combat these problems include helpful guides and tutorials available in both a text and video format. The videos are created with expedience in mind.

4.1 PROTOTYPE Architecture (Hardware/Software)

![Functional flow diagram](image)

*Figure 2. Functional flow diagram*

The functional flow diagram displays the flow of information from the components to the user. The users access the resource and the resource intelligently returns information back to the user in the form of responses and automated notifications.
The PHP Server component implement 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 is contained within a virtual machine in the CS department.

4.2 Prototype Features and Capabilities

The ResearchLink prototype will demonstrate the same capabilities expected in the final product with one exception, the prototype will not be available from the My ODU homepage. The prototype will allow the test user to configure alerts and observe the results. Opportunity creation is central to the products purpose, the prototype is capable of displaying this feature. The opportunity when created is stored in a distinct table object within the MySQL database. Once the data is stored, alternate PHP programs display the data to users or send user messages supporting the new opportunity. Profile creation follows the same path, users create the data, PHP programs store and retrieve the data making decisions on how the data should be interpreted along the way. 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.

The prototype also features automated capabilities that preserve data for historical purposes. Opportunities that have expired are automatically archived in a special historical table that exists on 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 within the product. 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.

**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. This diminishes the perspective that ResearchLink will be easy to use and access when it is 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, this would allow users to access ResearchLink content more directly and not require additional log in 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 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 was processed into the database utilizing CSV files. The programs ran through this data, providing the development team with evidence that the programs worked correctly and would function correctly 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:** 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:** 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


