Making ArcGIS Mapping Data Accessible to the Visually Impaired

HONR 491: Map Data Accessibility
University of Mary Washington
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Introduction

This document serves as the project proposal and rationale statement for the Honors Capstone project that I will undertake during the Spring 2019 semester as part of the *HONR 491: Map Data Accessibility* course. The motivation for this project is to culminate my undergraduate studies in Computer Science and Data Science at the University of Mary Washington by employing them to solve a real-world technical problem related to data accessibility.

The term “data accessibility” refers to how easy it is for those with physical disabilities to utilize the data conveyed by a software product. Within the context of this project, it refers to how the software product to be developed will accommodate visually impaired users so that they can access the data which it provides. This will be described in more detail on the following pages.

Project Overview

Background Information

There is a database owned by Dr. Alan Griffith in the Department of Biological Sciences which contains mapping data collected by students at UMW of various trees and shrubs found on campus. It includes both positional measurements (latitude and longitude) as well as statistical information (height, circumference, estimated age, etc.). This data can be utilized to generate informational maps which depict the flora and its properties across campus.

The database was compiled and is currently managed using the ArcGIS mapping software suite. However, the mapping data it contains can be served to the public online by connecting the database to websites designed specifically to host ArcGIS databases. It is also possible to embed already generated maps and their associated information into normal websites owned by Dr. Griffith.

Problem Description

The technical problem which will be addressed by this Capstone project is in regard to the data accessibility of the aforementioned database. Specifically, it arises from the fact that its mapping data is currently unusable by those who suffer from visual impairments. The blind and those with exceedingly poor vision are unable to see the visual maps with their associated information and thus cannot utilize the database in any meaningful way. It is therefore necessary to develop some means of efficiently conveying the mapping data to these people without the use of visual depictions.

Proposed Solution

The proposed solution to this problem is to develop a specialized web application that will provide complete accessibility to the mapping data contained in Dr. Griffith's database. It will manage its own copy of the database and use that to render interactive maps of the campus which convey the data via an intuitive interface. The primary focus however will be to provide the mapping data such that visually impaired users can fully utilize it through the use of existing screen reading software. Another key focus will be to develop the web application in such a way that future integration with the main UMW website will be straightforward.

Implementation Details

Because software development is a dynamic process, the exact implementation details of this project will be more definitive during the semester in which it is implemented. It is necessary to research which technologies are best suited for supporting the web application and rendering the interactive maps in an accessible manner. Additionally, correspondences with both the website administrators for UMW as well as its Office of Disability Resources need to be established in order to gather the exact requirements for making the web application fully compliant with all relevant university policies.

What is confirmed at this point is that the web application will be made as compatible with the main UMW website as possible so that future integration is feasible. The technology stack which it utilizes therefore will largely mirror that of the main website. It will include the standard set of technologies used to develop web applications (HTML, CSS, JavaScript, etc.) as well as any special software frameworks or packages which have already been deployed to the main website.

A preliminary inquiry as to how the main website is constructed has already been made to those who manage it. They recommended that the web application be developed inside a dedicated development environment which is the same as that used by the official UMW software development teams to create custom applications. Another recommendation was that this project be constructed as a custom view in a WordPress plugin called Toolset. Further research and communications regarding these recommendations are currently being conducted.

Finally, the web application will be developed using the latest technology versions as are supported by the main website. The idea is that this project will be modern and easy to maintain in the future by either an official UMW software development team or even other university students.

Working Timeline

Below is the current working timeline for this project:

Deadline	Objective
~~December 1st, 2018~~	~~Completed 1st draft of project proposal + submitted to Dr. Griffith for review~~
~~December 14th, 2018~~	~~Completed 2nd draft of project proposal + submitted to Dr. Griffith for review~~
~~January 7th, 2019~~	~~Completed final draft of project proposal + submitted to Dr. Griffith for review~~
~~January 14th, 2019~~	~~Made all changes to final project proposal recommended by Dr. Griffith~~
Spring 2019	
Week 1	Submitted final project proposal to Honors Program Committee & Data Science Committee for approval
Week 2	Held meetings with all relevant parties to gather exact project requirements
Week 4	Completed all necessary research on technologies being used + started development of web application
Spring Break	Implemented functional alpha build of web application
Research and Creativity Day	Completed web application for demonstration at R&CD event
Finals Week	Submitted all necessary paperwork to relevant parties to close out project

This timeline may undergo minor revisions as more details concerning the exact project requirements are determined.

Anticipated Goals

Upon successful completion of this project, the following goals should be achieved:

1. A web application which connects to a copy of the mapping database and renders interactive maps of its data will be functional and tested.

2. The web application will have full data accessibility and accommodate those who are visually impaired.

3. The web application will be mostly compatible with the main UMW website so that future integration is feasible.

4. This project as a whole will be demonstrated at the Spring 2019 Research and Creativity Day event held on campus.

5. This experience will fulfill my Capstone requirement for the Honors Program.

Honors Outcomes

The primary Honors outcome for this project is the completion of my Capstone requirement for the Honors Program. Additionally, developing the web application will serve as a cumulative utilization of the Computer Science and Data Science skills which I have acquired during my undergraduate studies at UMW. This is primarily because it will be the first practical web application that I have developed at UMW to solve a real-world technical problem. In addition, it is a sizeable project that provides a comprehensive evaluation of many of the things which I have learned. This includes not only my general computer programming knowledge but also my ability to design a complex software project, gather the necessary resources, establish a timeline for its development, and then successfully implement everything according to a set specification. These are all fundamental components of every professional software development position, which I intend to have shortly after graduation. Therefore, this project as a whole is an excellent test of my readiness for the field.

This project also facilitates the three Honors Program Student Learning Outcomes of self-directed learning, written and oral communication skills, and context-driven research skills. The first is achieved by how I will be the one implementing the web application under the supervision of Dr. Griffith. The second is because this project requires me to write numerous proposals and project plans/updates such as this one. The third is fulfilled through how I need to research the technologies being employed, especially those related to making data accessible to the visually impaired.

Lastly, as stated above, the completed project will be demonstrated at the Spring 2019 Research and Creativity Day event held at the end of the semester. This will be the first time at UMW that I have given a formal demonstration of a project at a symposium such as this. I anticipate that the presentation skills I will develop during this experience will be very useful in my future career as a software developer. Demonstrating software projects to management or clients, most of whom likely do not have knowledge regarding the technical details of how they work, is a routine occurrence in my profession. Thus, I look forward to having an opportunity to practice and improve this critical skill at an event such as this one.

References

1. Accessibility. [accessed 2019 Jan 18]. https://www.w3.org/standards/webdesign/accessibility

   This is the official World Wide Web Consortium's website on accessibility protocols and guidelines for websites. It will serve as the primary reference to ensure that the completed web application meets all applicable accessibility standards.

2. Section 508 Checklist. [accessed 2019 Jan 18]. https://webaim.org/standards/508/checklist

   This is a simple checklist for making digital products such as websites 508-compliant. It is an additional resource for ensuring that the completed web application achieves full data accessibility.

3. Student Learning Outcomes. 2017 Apr 3 [accessed 2019 Jan 18]. https://academics.umw.edu/honorsprogram/student-learning-objectives

   This is a reference list of the Student Learning Outcomes for the UMW Honors Program. Those which apply to this project are listed and explained in the Honors Outcomes section of this proposal.

4. About ArcGIS. [accessed 2019 Jan 18]. https://www.esri.com/en-us/arcgis/about-arcgis/overview

   This is the product overview page for the ArcGIS software suite. Because the mapping database was compiled using ArcGIS, it will likely be necessary to utilize the software suite frequently over the course of this project.

5. Toolset. [accessed 2019 Jan 18]. https://toolset.com

   This is the official website for the Toolset plugin for WordPress. It will be determined in the coming weeks if Toolset is a viable option for implementing the web application.