LibraryCompass

Digitally-Enhanced Wayfinding

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What is the problem? (Pain)

It can be difficult to find specific locations and physical resources within the library.

How are we solving it? (Methodology)

A digitally enhanced wayfinding system, deployed online and in kiosks.

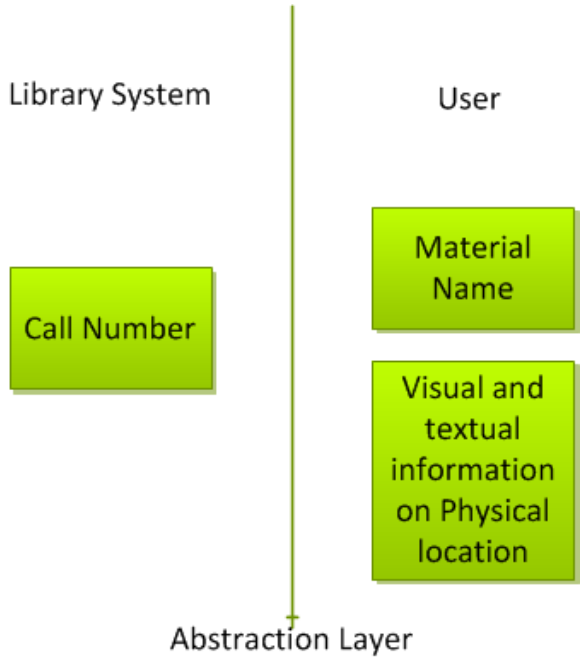
What does it mean for you? (Impact)

Easier, faster ways to find resources and locations within the library, and a drastic improvement in user experience and satisfaction

INTRODUCTION

Libraries are difficult to navigate. As physical buildings, they are bound by the architectural oddities that were created during successive phases of construction, or by unintended usage in the modern era. As collections depositories, they are constrained by the call number system by which the resources are organized. These two things cannot easily be changed. However, it is not necessary for library patrons to have to fight these forces to obtain their desired material. A system that interprets the physical peculiarities and cataloging layout of a particular library could then present to the patron clear, contextual, concise, and direct information about the resource in question and its location within the library. Such a system should also free the library patron from the confines of the computer bay, allowing resource discovery to happen throughout the library as part of a smooth workflow.

The problem we are addressing is wayfinding within the physical library using responsive web systems. The solution uses technology to bridge the gap between the physical world and digital world and aids users in finding physical items within the collection. Our solution is a **digitally-enhanced wayfinding** platform that promotes **mobility** by untethering the library patron from the desktop computer. Our system consists of two main parts, and supports a scalable deployment schedule that respects limited resources.



There is little doubt that wayfinding within the UM libraries, using the current set of systems, leaves something to be desired. On the main campus, both the Shapiro Undergraduate Library and the Hatcher Graduate Library contain multiple collections, each with a full range of call numbers. Also, these buildings are connected, and the floor layout of Hatcher is not conducive to patron discovery of resources. Physical layout aside, the current method of discovery within the library consists of a book search through the Mirlyn catalog, which provides the call number (and not in a very obvious way, to someone who may not understand call numbers). After receiving this call number, the patron must use the call number in concert with signage scattered throughout the library in order to hunt out the book. Our system replaces this unnecessary and overly-confusing system with direct textual instructions and visual representation through the use of digitally-enhanced wayfinding.

SYSTEM OVERVIEW

The system we propose consists of two main facets, both of which work in concert to create the solution we elucidate here.

FACET 1:
A back-end database solution that maps call-number spreads of resources down to the range-face level. This could be achieved through either the use of an "out-of-the-box" solution such as StackMap[1], or through the development or a home-grown solution by a group of EECS students. An overview of this database will be discussed at greater length in this paper. This facet is a critical part of the remainder of our solution.

FACET 2:
A front-end user interface that allows patrons to see where within the library a specific subject or resource is located. This interface will display maps highlighting specific range-faces, as well as creating turn-by-turn navigation instructions for the user. Additionally, this interface could be applied to other wayfinding needs within the library, including rooms, events, staff, reference desks, copiers, restrooms, etc. Once this front-end interface is created and linked with an appropriate back-end database, the basic level of functionality desired is achieved.

The basic functionality of our solution, which is digitally-enhanced wayfinding, is contained within the two systems briefly described above. The solution aims to abstract the call number into a physical location via graphics and text, which the user can easily visualize. This system combats both the confusing nature of some libraries and the patron's assumed knowledge of the call-number system, by replacing both with an easy to use and navigate system of virtual maps.

SYSTEM DEPLOYMENT

Given the creation of these tools, there are several different implementation strategies that could exploit these technologies for the benefit of the patrons. These strategies differ in several ways, but they are placed in order here through a rough estimation of cost and effort to implement, with each strategy in the increasing order.

WEB-BASED DEPLOYMENT:
The most basic deployment, this consists of a web interface displaying the content of the database. By linking resource entries in Mirlyn to the interactive web-based maps, patrons could go directly from Mirlyn to a spatial representation and textual directions to a specific resource. The software would include screen-reader capability in order to maximize accessibility. This deployment option could also include optimization for

[1] http://www.stackmap.com/

mobile web-based use as well. This option could also be used to familiarize the library user population to the utility and functionality of this wayfinding system.

WEB-BASED DEPLOYMENT WITH ADDED FEATURES:
Alongside the basics of Option 1, this includes further functionality of the front-end interface. Most importantly, this option allows users to create 'backpacks' of several resources and allows for navigation across all resources. This navigation would also include an audio-based navigation option to maximize accessibility. The backpacking and multi-point navigation will be discussed in more detail later in the paper.

KIOSK DEPLOYMENT WITH EXISTING INFRASTRUCTURE:
This option takes advantage of the already existing touchscreens in the lobby of Shapiro, and highly suggests complementary screens in the lobby of Hatcher, including the addition of MCard scanners. The graphical interactive maps become the centerpiece of the touchscreen UI, and allow patrons to quickly find a resource. The addition of buttons or audio ports would ensure the highest level of accessibility. Again, the specifics of the touchscreen interface will be discussed later in the paper.

MAIN COVERAGE KIOSK DEPLOYMENT:
Along with the existing touchscreens, this option includes the deployment of touchscreen monitors at all major decision points within the library, such as elevator bays and reference desks. The touchscreen interfaces remain largely unaltered, but this option further increases the utility of the MCard readers as a way for the system to 'remember' what each patron is looking for.

FULL COVERAGE KIOSK DEPLOYMENT:
The ultimate option, which includes all the functionality of the above options, with the addition of smaller screens at the end of every 3-5 ranges. This option has the added advantage of displaying nearby subjects as a way to increase the likelihood of serendipitous discovery of library resources. Again, the MCard readers are an important addition in order to maintain a user's experience across several disconnected screens.

With the problem space and solution scope defined, we will now discuss the structural decisions behind aspects of the front-end interface and back-end database.

USER EXPERIENCE

SOLUTION PLATFORM

One of the earliest areas of focus of this project was the definition of the platform that would be best suited to digitally-enhanced library wayfinding. Currently, the library has a system of printed signage that has developed over an extended period of time, resulting in a system that lacks consistency and is less than ideal. This physical signage is often based on traditional library wayfinding and may not accurately reflect the library landscape of today since library collections and their corresponding locations change over time. In considering alternatives to physical signage, the possibilities of a web-based service, a mobile service, or an interactive kiosk seemed most applicable.

> **WEB-BASED PLATFORM:**
> A mobile app or a web-based platform would be very cost-effective to implement, requiring only software development. Also, these services would allow for live updating, something that is difficult within the current system. However, the lack of mass visibility of these implementations could impede their effectiveness for the library patronage at large. It would be far too easy for these features to be buried deep within the library website, virtually unfindable. One way to combat this would be to include the mapping and wayfinding functionality to any search result within the catalog, as a display option.
>
> **KIOSK PLATFORM:**
> The interactive kiosk implementation carries a steeper hardware cost, based on the amount of kiosks that would be required for adequate coverage. These kiosks, if placed correctly, would have a visibility that could help individuals who needed help but weren't previously aware of the system. Additionally, they would have the same live-updating advantages of the traditional computing solutions.

Throughout the remainder of the paper, the system we are discussing is optimized for a kiosk platform, and this decision will be reflected in sketches, scenarios, and the prototype. However, the main facets of interaction and functionality discussed below can be easily applied to web-based interfaces as well.

SEARCH FUNCTIONALITY

After considering the medium, it was important to explore the options in regards to the depth of search functionality of the system. In a desktop or mobile implementation, this consideration is

less important, but in a kiosk deployment the duration of use directly affects the ability of others to use the system. With that guiding principle in mind, several levels of search were considered, ranging from full catalog access to manual call number entry to subject-based search.

FULL CATALOG SEARCH:
In many aspects, full catalog access could be seen as ideal. It allows patrons a full-featured search in an environment that they are accustomed to, and allows for a stand-alone experience. However, if a student occupies a kiosk for 25 minutes browsing the catalog, the dozens of students that enter the library looking for a quick reference map or the directions to a subject area are without a resource. For this reason, a full-featured Mirlyn interface would be less than ideal for a kiosk implementation.

CALL NUMBER ENTRY:
Other considerations were made for call-number entry systems, either manually or through barcodes/QR codes, but these solutions seemed overly cumbersome and required use of a library computer in addition to the kiosk in order to look up the call number. After further analysis of the workflow, we decided that the visibility of call numbers should be minimized or removed, as they offer little to no value added functionality to the lay-patron.

SUBJECT-BASED SEARCH:
Subject search seems almost uniquely suited to an interactive kiosk, as specific realms of knowledge would be mapped to discrete physical locations within the library. Patrons could approach the kiosk, view a list of subjects and sub-headings, and quickly be directed to the relevant section of the library, where they would find a whole range of books related to their thematic query, rather than a specific volume based on a semantic catalog search. The concept of contextual **discovery** of materials is central to the purpose of open stacks, and this incarnation of search highlights that capability.

BACKPACK SEARCH:
A “backpack” that patrons create either at home or within the library caters to those patrons who require more detailed and specific wayfinding and resource discovery. A kiosk could retrieve this list and display the resources graphically superimposed on a map, allowing the patron to see where things are and make informed decisions, as well as create custom directions and path information for the entire list of resources. The backpack functionality requires the addition of MCard scanners (or another log-in method) to the kiosks in order to allow for the retrieval of previously entered data. In addition, both this system and the subject search circumvent the need for individuals to employ call numbers for library-wide wayfinding, a practice that is currently in use in most libraries but may be unnecessarily complicated. This functionality could be merged with the current “favorite” feature present within Mirlyn, creating a way for patrons to easily find specific resources in the physical library.

SYSTEM VISIBILITY

After determining medium and functionality, it was important to reconsider the issue of visibility. Individuals are accustomed to the presence of large screens in public places, but these screens are rarely interactive. With that in mind, it was important to create a home screen that both established the kiosk as an interactive experience while also highlighting its primarily purpose as a wayfinding tool.

SMARTPHONE INTERFACE:
Creating a landscape analogous to a smartphone screen with a number of square buttons representing various functions would likely overcome the perceptual problem, but would not highlight the wayfinding component of the system.

CURRENT EVENTS INTERFACE:
A screen that would display event information, campus ads, and news stories would be highly informative, but patrons may be unaware of the interactive component of such a screen.

MAP INTERFACE:
A home screen that prominently features a map will broadcast its wayfinding purpose, and the presence of some buttons on the screen will suggest to patrons that there is an interactive component. Also, the creation of pertinent physical signage around the kiosk outlining its purpose would aid in the transition and accelerate widespread usage of a kiosk system.

ADDITIONAL FUNCTIONALITY

During the creation of this system, a large amount of tools and features were proposed. Although we have focused on the finding of books and other resources within the library, the system we are proposing here could be utilized for several other functions. Among the features discussed and considered most likely for inclusion are search capabilities for people, rooms, and events; mapping computer resources, reference desks, and bathrooms; and the capability to display emergency messages.

CONTEXTUAL HELP:
The system we have outlined here has been designed to conform as much as possible to existing mental models of touchscreen interfaces. However, in order to maximize the usability of the system, a series of tutorial videos that outline the interactions and functions of the system. These short videos, spanning 30 seconds or less, would create the bulk of the help menu, which is further explained in the paper prototype.

PEOPLE SEARCH:
People are an important resource within the library. Whether a patron is looking for a special reference librarian, human resources, or a current speaker, including the functionality to search for people would improve the value of the system. This search would ideally cross-reference heavily with the room and event searches to maximize usability.

ROOM SEARCH:
Within the libraries are several types of distinct rooms. There are offices, resource rooms, instruction labs, and study rooms. In terms of search, offices and resource rooms should be heavily correlated with people and event searches, in order to maximize the likelihood of a patron discovering the relevant information. Within the realm of study rooms, an ideal system would not only display wayfinding information but would also allow access to scheduling information and functionality.

EVENT SEARCH:
Event search should provide the same wayfinding functionality of the base system, but could exploit a calendar-style interface or an 'upcoming events' list in order to quickly locate the relevant event. An events detail page could include the pertinent people and room location and allow for expedient wayfinding.

RESOURCE SEARCH:
Library patrons often need to find the ancillary resources of reference desks, computer resources, and restrooms. This search could be structured as a grid of schematic icons representing the different resources within the library system. Once a patron selects a resource, the system will create a path to the closest location.

EMERGENCY OVERRIDE:
In the case of an emergency, our system would display a bright alert outlining the nature of the emergency (if applicable) and provide mapping and directions to the appropriate safe zone. This functionality, which could be married to audio functionality, would increase salience as well as ensure full accessibility.

The inclusion of this additional functionality will allow for the creation of a holistic platform that patrons will learn to utilize as a one-stop digitally-enhanced quick reference for all facets of wayfinding within the library system.

Libraries are overly complicated by confusing floor plans, patron-facing organization by call number, and the lack of comprehensive and highly visible signage. In order to aid in resource discovery and general mobility through digitally-enhanced wayfinding within the library, the installation of interactive kiosks with a suite of search and retrieval tools could provide added value for all library patrons.

BACK-END TECHNOLOGY

DATABASE DESIGN

A back-end database system is required to support the wayfinding of physical media. It would primarily consist of a database paired with static floor maps of the library, connected to the front-end system discussed previously.
There are several methods ranging from simple image based maps to systems which utilize GPS to implement map-based location finding in libraries. After an extensive analysis of each method, the most feasible option was chosen and is described below.

The back-end would consist of a database, which correlates the call number listing of each discrete resource to a specific location within the library. Information from the university's catalog is used to determine which map to display, and the database provides a method to view the map along with the directions to the range face where the desired resource is located.

The simplest solution is to create a set of images for each call number range, then use catalog data to evaluate an item's location and provide the correct image. This method is relatively easy to develop: the maps could be created with illustration software and updated by uploading new files to a web server. One additional benefit is the potential to use more sophisticated content, such as animated GIF's to display directional arrows or HTML to present additional contextual information related to wayfinding. However, this method can be difficult to sustain when hundreds of maps need updating as collections shift across ranges and floors.

In order to overcome this limitation a hybrid method could be used which drastically reduces the number of static map images. In this method a template map of each floor area along with stacks and other markers is created and an indicator is dynamically overlaid on the map depending on the specific resource requested by the user. The call number ranges and specific shelves are mapped through the database and can be updated as the collection shifts. When a search term is presented to the system, the database is queried and the corresponding range face is determined and returned to the system. This information is then translated into the dynamic overlay on the template map highlighting the range face corresponding to the original query.

The library system has already created static maps of the granularity required for these templates. The dynamic overlays and required database could be created as a home-grown solution through a summer internship project conducted by a team of computer science students.

The back-end database would also include an interface accessible only to the library staff, in order to maintain the collection as the call numbers shift. It would include a tool to map and update the locations of call number ranges, and could also include value-added functionality such as allowing library staff to print automatically updated end cards for the modified ranges.

References:

Gallagher, Paul, "Map it @ WSU: Development of a Library Mapping System for Large Academic Libraries" (2010). *Library Scholarly Publications.* Paper 35

POSSIBLE NEXT STEPS

USER TESTING

The foundations of our system and its purpose are based on very casual user-base analysis. As current students, we have made guided assumptions about the needs of library patrons at large based on our own experiences, the experiences of our acquaintances, and the feedback from a few library employees. Before embarking on any development and deployment trajectories, it would be imperative to conduct more rigorous testing of the patronage base to establish more concrete needs and expectations. Concurrently with this research, small-scale user-testing of the current prototypes could be conducted to receive early feedback about design issues or successes.

COST ANALYSIS

Before making a decision about which deployment to pursue, it would be important to discuss the variability within each deployment option that has been created. Within the kiosk options, issues such as screen size and quality, resistive vs. capacitive, inclusion of MCard readers, and the sheer number of screens that would be utilized will all impact the final cost of each option.

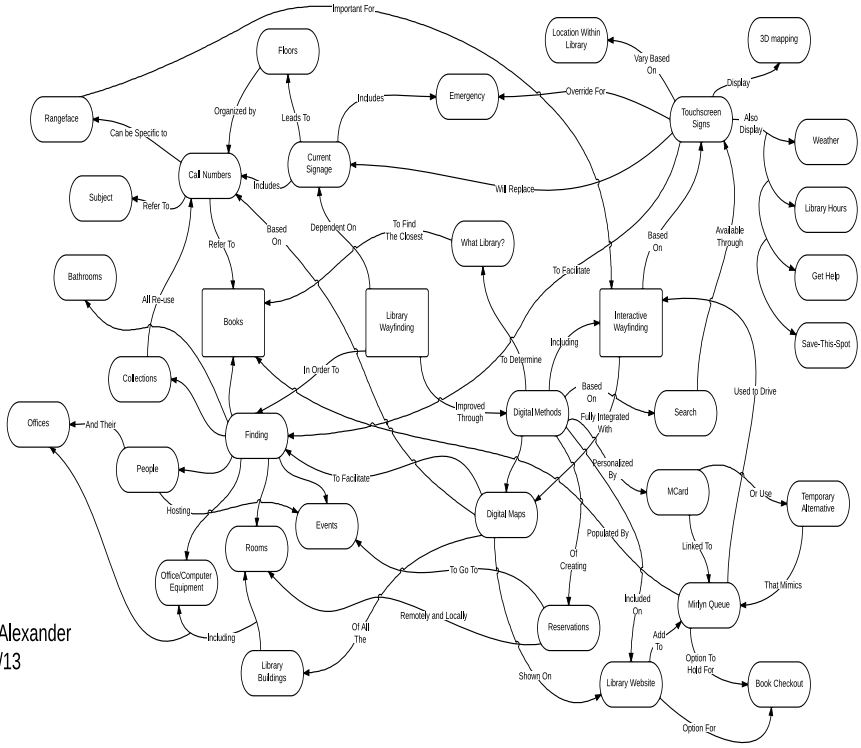
VENDOR COMPARISON

Although we argue that a home-grown solution would likely be more tailored (and likely cheaper) than a commercial out-of-the-box solution, it would be valuable to view the options available commercially. There are several different public touchscreen interfaces on UM campus alone, and several other options available as well. Researching these options could also help determine additional functionality that could be included in any final solution.

APPENDICES

APPENDIX 1: CONCEPT MAP FOR LIBRARY WAYFINDING

Library Wayfinding Concept Map

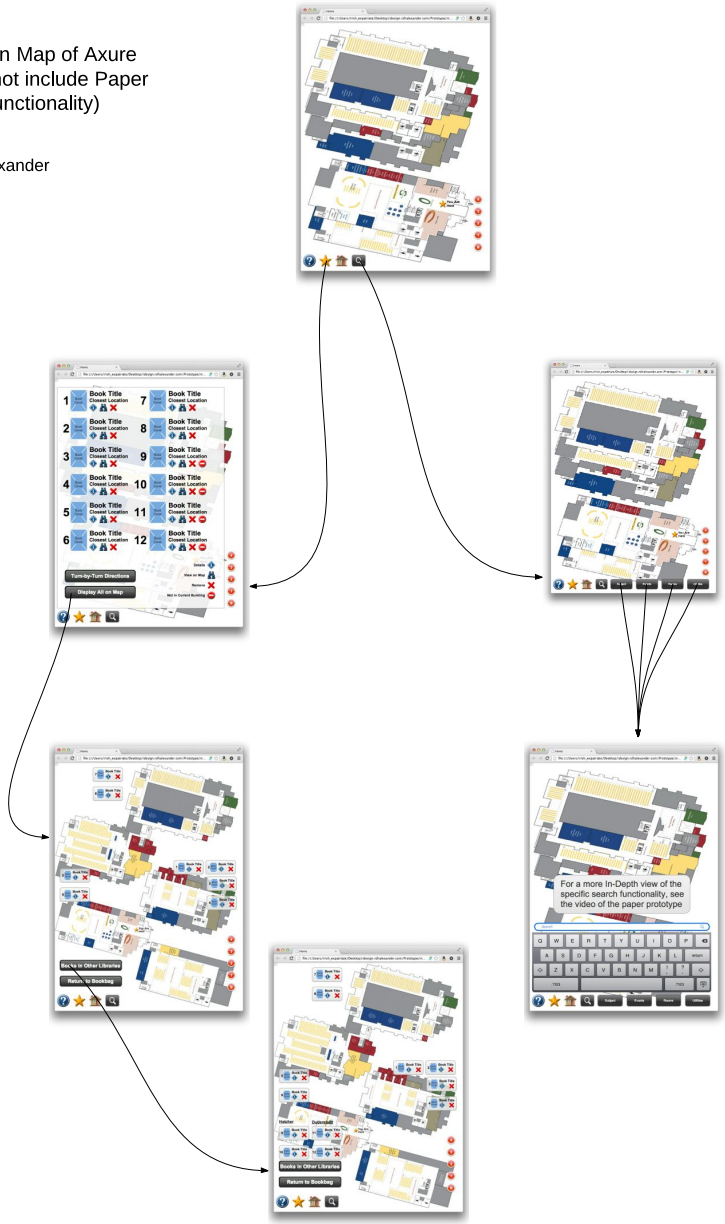


Created By: Ray Alexander
Date: 2/16/13

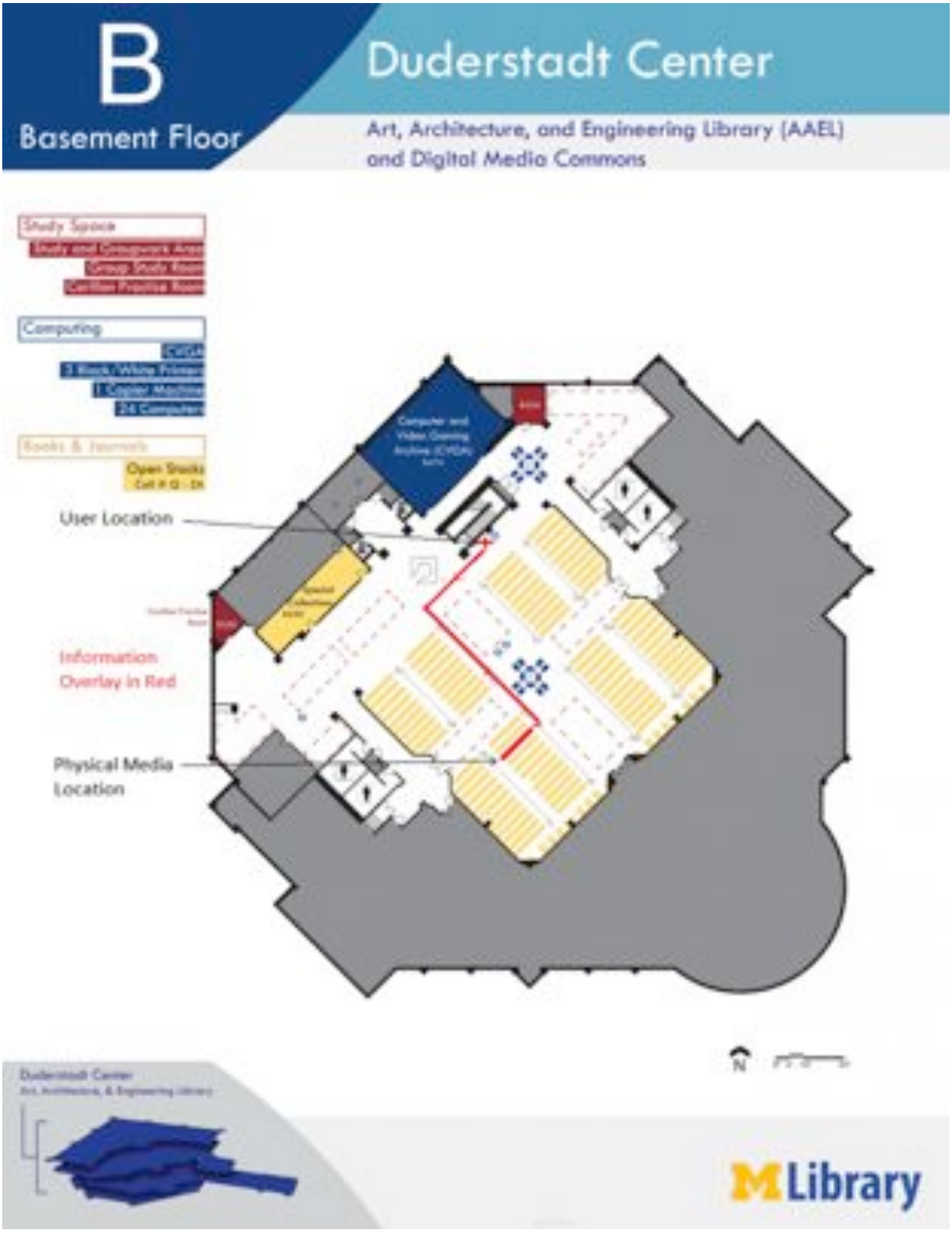
APPENDIX 2: FRONT-END INTERACTION MAP

Rough Interaction Map of Axure Prototype (Does not include Paper Prototype Functionality)

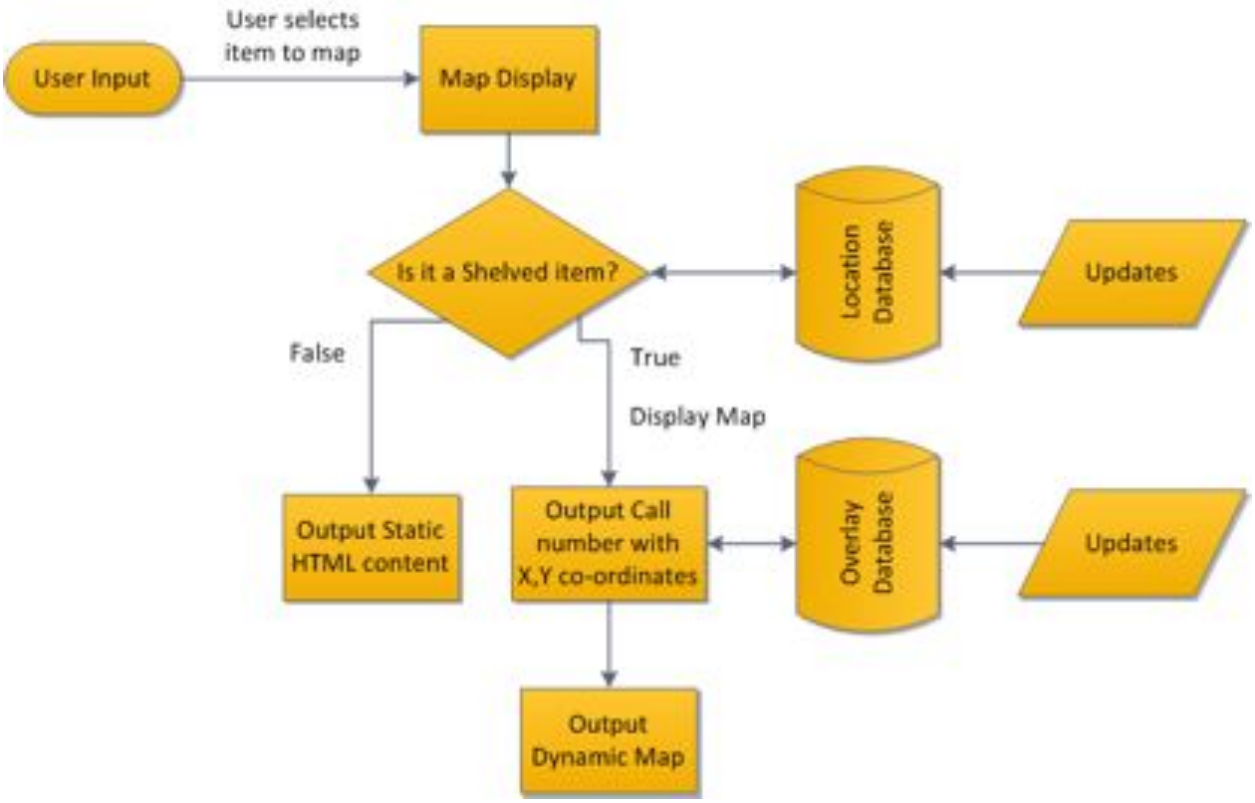
Ray Alexander



APPENDIX 3: EXAMPLE OF WAYFINDING VIEW



APPENDIX 4: SCHEMATIC VIEW OF BACK-END SYSTEM



APPENDIX 5: SKETCHES

APPENDIX 6: SCENARIOS

Scenario 1:
Agent: Alice, an undergraduate student at UM
Setting: Shapiro Undergraduate Library
Goal: Find resources for history paper

Alice is in her second semester at UM, and is taking History 196 in order to fulfill a Social Science requirement. She has been asked to write a paper about the French Revolution, and she has no prior knowledge. Upon entering the Shapiro library, she notices one of the new touchscreens set up in the lobby, with a sign above it mentioning book finding and subject exploration. However, Alice walks past this kiosk and heads to a library computer, where she begins to search Mirlyn for books on the French Revolution. She is quickly overwhelmed by the depth of literature n the subject, and is unable to decide which books would be appropriate for her level of study. Getting a little bit worried, she remembers the phrase “subject exploration” on the sign above the touchscreen kiosk.

She walks up to the screen in the lobby and, after swiping her MCard, sees a “Book Search” option on the screen next to the map. After tapping that and selecting the “Subject Search” option, she types in “French Revolution.” The 3D map of the library zooms in and rotates around until it highlights the shelves of the library that contain the books on the French Revolution. Alice taps the “Take me There” button, and a list of directions, similar to Google Maps directions, appears on the screen, with a matching graphical path on the 3D map. The directions tell her to go up to the third floor, and then lay out a path towards the French Revolution shelf, which is near the back of the building. She walks confidently towards the stairs, and heads up to the third floor.

When Alice walks out onto the third floor, she panics a little. She has forgotten the rest of the way to her section. Looking around, she sees a smaller screen on the wall opposite her, with a similar sign to the one in the main lobby. She walks over, swipes her MCard again, and the screen immediately reverts to her last view, showing her an updated path from her current location to the French Revolution. With the route fresh in her mind, Alice walks quickly back to the correct section, and is able to quickly determine which books are of an appropriate scope and depth for her History 196 paper.

Scenario 2:
Agent: Bradley, an undergraduate student at UM
Setting: Class, and Shapiro Undergraduate Library
Goal: Attend office hours

Bradley is in his second semester at UM, hoping to eventually attend the medical school at UM following his undergraduate education. However, Bradley is having trouble in Chemistry 210,

and is beginning to fall behind. At the latest lab session, Bradley overheard his GSI talking about office hours, which would be held “tomorrow afternoon, somewhere in Shapiro.” Bradley knew that in order to maintain hope of attending medical school, he would have to take advantage of these office hours. However, Bradley had never been to the Shapiro Library, and was a little worried about the prospect of finding his GSI “somewhere in Shapiro.”

The following afternoon, Bradley crossed the Diag and walked into Shapiro for the first time. The lobby was full of students walking around, talking, and drinking coffee. Through the buzz, Bradley caught a glimpse of a kiosk with large screens and the main reference desk in the middle of the lobby. Since the reference desk had a long line, Bradley approached the kiosk in the hope that it would contain some sort of directory. The sign above the screen mentioned finding and exploration, so he was feeling hopeful. The screen was asking him to swipe his MCard, so he obliged and the screen showed him a 3D map of the library, along with a list of menu options on the right, including a “Person Search” function. Bradley tapped on this option, and then entered in the first few letters of his GSI’s name, until it popped up on the screen. Bradley could see that the GSI had reserved a study room in the basement for the next 3 hours under the title of “210 office hours.” After tapping on the room, Bradley was shown the location on the 3D map, along with a calendar-style schedule for the study room, showing that the study room had no other reservations that afternoon. After glancing at the 3D map, Bradley felt confident that he could find the room.

Bradley made his way down to the basement and found the room with no problems. Outside the door, he noticed another touchscreen that was displaying the same room schedule he had seen upstairs, with a button that said “Reserve this Room.” He paid this no mind and walked in for some help on the upcoming exam. At the end of office hours, the GSI left, but Bradley and one other student were still discussing the finer points of the latest chapter. Remembering what he had seen on the way in to the room, Bradley popped his head out of the room and was able to quickly reserve the study room for an additional 2 hours, allowing him to feel fully prepared for the exam by the time he left the library that evening.

Scenario 3:
Agent: Carrie, a graduate student at UM
Setting: Home, and Hatcher Graduate Library
Goal: Quickly return home for further study

Carrie is a second year graduate student in the Department of Philosophy, working on creating a thesis statement in preparation for doctoral studies. It is a Friday at lunchtime, and she has decided to spend the entire weekend reading and researching in the hopes of narrowing her research focus. She cannot use the MGet It service to deliver her books on the same day, and she is also a firm believer in the value of searching the stacks in order to discover the book that she didn’t search for. However, she does not want to deal with the Hatcher Graduate Library for longer than is necessary, so she decides to try a new service out.

She goes to the library website from the comfort of her own apartment, sitting on her couch with Downton Abbey playing in the background. As she browses the massive amounts of literature on philosophy and narrows her search criteria for each iteration of her search, she clicks on the “Add to StackPack” button beside each book that seems interesting to her. From a previous visit to the website where she clicked the little “info” button beside this, she knows that this creates a backpack for her books that will somehow aid in finding them at the library. After about an hour on Mirlyn, Carrie looks at her final list of 37 books, empties out her backpack, and heads to campus. Her first stop is the Hatcher Graduate Library.

When Carrie arrives at the library, she heads for one of the kiosks, which she learned from the website are the main portal for the ‘StackPack’ function. After swiping her MCard, she taps on “StackPack” and sees her list of books. She hits the “Map It!” button at the bottom of the screen, and the books fly on top of the 3D map of the library. A window pops up, letting her know that 5 of her books are in the Bentley Library, but that Shapiro also has copies. Carrie taps to update her list, and the 3D map now shows where all of her books are within Hatcher, with a second, smaller map showing Shapiro off to the side. Also on the screen is a list of turn-by-turn directions. Since the first cluster of books is clearly highlighted on the screen, Carrie is able to set off from the kiosk and begins to efficiently gather all the books needed for a long weekend of research.

APPENDIX 7: STORYBOARD

Based on SCENARIO 1: