
This paper surveys mobile websites of university libraries in United States. Library mobile websites from 26 of 129 universities which are listed on http://www.libsuccess.org/index.php?title=M-Libraries are surveyed. The home page, catalog search, informational features, assistant features, and advanced features of each mobile website are explored and analyzed. This survey provides updated view of mobile websites adapted in US university libraries. It answers the questions of what functions and services are popular on university library mobile websites, and how they are implemented. The data collected in this survey can be used to improve library mobile website design.

Headings:

- mobile website design
- catalog search
- facet search
- graphical use interface
M-LIBRARIES: A SURVEY OF UNIVERSITY LIBRARY MOBILE WEBSITE

by
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A Master’s paper submitted to the faculty of the School of Information and Library Science of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Master of Science in Information Science.

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Approved by

Bradley M. Hemminger
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1 Background

The number of smartphone users has increased dramatically over the past several years. A study released by the EDUCAUSE Center for Applied Research (ECAR) in 2009 found “51 percent of undergraduate respondents owned a web-enabled phone and another 12 percent planned to purchase one in the next 12 months; 74 percent of the students who had web-enabled phones expected their use of the internet from their phone to increase within the next three years” (Bridges, 2010). As smartphones become ubiquitous in campus, libraries will want to be prepared with mobile web sites that are optimized for smaller screens.

Modern mobile devices can be traced to their early forms like PDA (personal digital assistant). The introduction of IBM Simon in 1992 marked the first emergence of PDA (Marcial, 2012). Since then, mobile devices went through generations of products: Apple Newton (1993), Palm Pilot (1996), RIM BlackBerry (1999), Apple iPod (2001), Handspring Treo (2002), and Apple iPhone (2007). Hardware, such as large display and multi-touch screen, make it possible to deploy mobile web sites on modern mobile devices. However, designing websites for interaction with mobile devices is a complex task considering there are about 4,000 different mobile device models and nearly 200 manufacturers and half a dozen major operating systems (Marcial, 2012). Several important design considerations for mobile web sites are context (physical location, environment, nature of the interaction), keyboard, text entry, pointing and mousing, pagination, gestures and multi-touch (Marcial, 2012).
Both public and academic libraries have begun implementing mobile versions of their websites. In a case study published about the development of the mobile website at Ball State University Libraries (West, 2006), the authors found that "(1) library web sites can be adapted to the limited power, memory, small screen size, and bandwidth of mobile devices, and (2) small screen mobile devices are acceptable for showing web services that are easy to read, easy to navigate, and that provide timely information." The study shows that mobile website can be an effective medium to communicate large amounts of library content to patrons.

In a report given by Ellyssa Kroski (Kroski, 2008), she illustrated that there are a wide array of functions that can be made available via a library's mobile website. A website can provide access to the catalog, databases, information about events and programs within the library, location, and directions on how to ask for help. Some functions, such as hours and location, can be easier added to a mobile website than other functions like catalog. On a mobile platform, more attentions should be paid to functions that make sense for mobile users. To provide a good mobile experience, authors in (Griggs, 2010) recommended offering services that support time critical and location sensitive activities, such as real time information about computer availability and map-based directions; and time saving applications, such as displaying the call number next to a link to the floor map in a catalog search; and use mobile device’s native capabilities, like auto-dialing phone numbers and texting a course reserve title.

One of the key functions available on a library’s mobile website is Online Public Access Catalog (OPAC). OPAC is an online database of materials held by a library or group of libraries. Using their mobile devices, users can search a library catalog to locate
books and other material physically located at a library. The early OPACs were simply
electronic replicates of card catalogs, and offered only basic search capabilities. Since the
late 1990s, the rapid development of web technology and the fast growth of bibliographic
utilities have led to the development of OPACs as web-based rather than isolated entities.
Searching OPAC is usually conducted through queries or browsing, and people find
browsing easier than forming search queries (Niu, 2012). The faceted search approach
mitigates difficulties in query formulation, incorporates browsing into searching, and
organizes search results into groups. The basic idea of faceted search is to display the
indexing vocabularies (facets) of different dimensions as links to the users. Many web
based OPACs provide faceted search to help users find information they needs.
Relatively few mobile websites have facet OPAC.

In this paper, we survey university library websites in US to find out what kinds
of functions are provided and how these functions are implemented.

2 Method

There are many functions and services provided by a university library website,
e.g., catalog search, booking a study room, reading e-book or e-journal, etc. Different
universities implement different subset functions on their mobile websites. In this survey,
we group functions of a mobile website into six categories: homepage, catalog search,
informational features, assistant features, advanced features, and resources. To collect
data, we browse university mobile websites on a mobile device: iPhone 5 (iOS 6.0) with
Safari web browser. For each mobile website, we observe whether a function is
implemented or not.
2.1 Homepage

The homepage provides an overview of functions that are accessible on a website. Due to the limitation of small screen size, putting many functions into a homepage that is easy to be viewed and navigated on a mobile device is a challenging task. As shown in Figure 1, three homepage layout styles have been observed in university library mobile websites (Tay, 2010). In Figure 1.a, each function is represented by an icon, which resembles the home screen of iPhone. In Figure 1.b, functions are listed as menu items. In Figure 1.c, a hyperlink is used. We call these three homepage styles icon-based, menu-based, and text-based.

Figure 1. Three homepage styles: icon-based, menu-based, and text-based.

In this survey, following aspects of a homepage are observed:

- **Homepage style** icon-based, menu-based, or text-based.
● **Link to library full website** whether a homepage has a link to library’s full website?

● **Link to university mobile website** whether a homepage has a link to a university’s mobile website?

● **Redirect** when visiting a library's full website on a mobile device, whether the home page is redirected to a mobile website?

● **Function items** A list of functions accessible on a homepage. Take Figure 1.a as an example, following is the list of functions:

  ● Hours
  ● Catalog
  ● Your Accounts
  ● Ask Us
  ● Database & Guides
  ● Articles & Journals
  ● Multimedia & Computing
  ● Library Maps
  ● Study Spaces
  ● Staff Directory
  ● Events
  ● Apps

### 2.2 Catalog search

Catalog search is one of the key functions provided by university library website. In spite of techniques and best practices that have been used in a full website, mobile
devices poses new challenges to make online catalog both easy to use and powerful to find relevant materials. In this section, a number of functions that are common on a library's full website are presented. And each of the functions is examined on a mobile website to see whether it has been implemented.

- **Auto-suggest for catalog entry** auto-suggest in a search box.
- **Search engine** utilize third-party products such as Summon, WorldCat, etc.
- **Advanced search** searching fields such as title, author, publisher, ISBN/ISSN etc.
- **Video and/or audio materials** support video and/or audio material? the same user interface for video/audio/text search?
- **Search history** will search criteria be saved for later use?
- **Result display** how many found records being displayed per page?
- **View in full website** can the search results be viewed in a full website?
- **Facet searching** can users refine search results through facet?
- **Reserve online** can users reserve a found item?
- **Read online** can electronic material be read online?
- **Send search result(s)** can a search result be sent through email or text?

### 2.3 Informational features

A set of features are represented on almost all library mobile websites. These features are used to provide information to users and are easy to be implemented.

- **Hours**
- **Location**
2.4 Assistant features

These features act as interactive communication channels between users and librarians to answer users’ questions.

- Librarian online chat
- Contact telephone, text, email

2.5 Advanced features

There are features that are among some, not all, library mobile websites surveyed. For example, linking to social network websites such as Facebook, Twitter, and Flickr are implemented into several libraries’ mobile website. There are also several features that are uniquely applicable to mobile devices, e.g., search via barcode scan. All these functions are put into an advanced features category.

- Social networks Facebook, Twitter.
- Loan period how long materials can be hold by faculties, students, staff?
- Search via barcode scan
- Floor map
- Classroom calendar
- New books
- Recommended reading books
- Citation guides for citing sources; comparison of citation management software: RefWorks, EndNote, Zotero, Papers, and Mendeley.
• Link to apps in AppStore

2.6 Resources

There are many library resources on internet, e.g., online databases such as EBSCO, Google Book, IEEE Xplore, JSTOR, NLM Mobile, PubMed, etc. University libraries usually make those online databases searchable on their full websites. Some university libraries have ported this functionality to their mobile websites. If any of those online databases are accessible through a mobile website, we say this mobile website can access third-party databases.

There are also lots of resources in university intranet, for example lecture slides, tutorials on a subject, or digital collections of images, photographs, and galleries. Some library mobile websites have links to these university online resources.

3 Data Collection and Processing

In this survey, university library mobile websites are explored and results are saved in XML format. The content of the XML file is coded according to categories and functions described in the method section. Figure 2 shows an example of XML code for Georgetown University Library mobile website. A benefit of collecting data into XML format is that the content is easy to be manually modified, it is readable to human beings, and it can be understood by computer programs through XML tools.

<Library University="Georgetown University Library"
URL="www.library.georgetown.edu/mobile" />
4 Results and Analysis

4.1 Homepage

In library mobile websites surveyed, 20 of them have menu-based homepage style, 3 have icon-based style, and 3 have text-based style. The majority of homepage styles are menu-based. One of the reasons probably is that menu-based homepage style is relatively simple to be implemented in comparison to icon-based style.

Limited by the screen size on mobile devices, the total number of menu items placed on a homepage is relatively small. The average number of menu items on a homepage is 8. The maximum is 13 menu items on a homepage: California State University Monterey Bay and University of Massachusetts Dartmouth. And the minimum is 5 menu items: California State University Fullerton, Fairfield University, and Harvard University.

In spite of a relatively small number of menu items on a homepage, several essential functions are presented on almost all mobile websites’ homepage, e.g., library hours, contact, and catalog search. These functions will be described in details in sections of informational and assistant features.

On mobile website homepage, a link to library’s full website is a useful feature since a full website usually provides more functions than a mobile website does. In this
survey, we found that a majority of libraries (22 of 26) put a link to full website on their mobile website homepage. Besides, many universities have a mobile website portal. For example, North Carolina State University’s mobile website portal is shown in Figure 3. There are 7 of 26 libraries put a link to its library website on their mobile portal.

Another useful feature is auto-redirect to mobile website when visit a library full website using a mobile device. We found 15 of 25 university libraries implemented this feature.

Figure 3. NC State University mobile website portal.

In few university libraries, following features are included on their homepages to improve usability of mobile websites. For example, Brigham Young University, California State University Fullerton, and Fairfield University put “Today’s Hours” on the homepage. The rationale behind this design would be that when users want to find

![NC State University mobile website portal](image-url)
library hours, they are usually interested in today’s hours. Therefore, having “Today’s Hours” on a homepage make it easier to find needed information. Another example is to put search textbox on homepage, such as in Brigham Young University and Harvard University library mobile website.

Table 1 lists top 11 features that are implemented on mobile website homepages. In 26 surveyed universities, the most common feature is “Contact Us” (24 out of 26). Some homepages provide multiple contact channels, e.g., email, telephone, online chat, and text message. Few homepages provide telephone numbers as the only contact method. The second common features are library hours and catalog search (both 23 out of 26).

TABLE 1. Top features listed on mobile website homepage.

<table>
<thead>
<tr>
<th>University</th>
<th>Contact Us</th>
<th>Hours</th>
<th>Catalog</th>
<th>Full Site</th>
<th>Location</th>
<th>News Events</th>
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<td>Renew books</td>
<td>Mobile databases</td>
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Table 1. Top features listed on mobile website homepage (continued)

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</table>

### 4.2 Catalog search

Several university libraries utilize commercial products or services to provide catalog search function to their users. The third-party products or services found in this survey are Summon from Serials Solutions, WorldCat, AirPAC from Inovatice Interfaces Inc, Xerxes open source library portal application, LibraryAnywhere mobile app from Bowker, and Primo. In the XML file, the “Engine” attribute indicates whether a third-party product or service is used, for example, `<Search Engine="Summon">`. An empty “Engine” attribute means a website implements its own catalog search function. In 26 university libraries, 11 of them use third-party catalog search products or services, 12 of them implement their own catalog search function.

Advanced search fields, such as title, author, or publisher, are useful in narrowing down catalog search criteria. Among 12 libraries which do not use third-party search products or services, 9 of them have advanced search fields, and 3 of them do not.

Almost all university libraries surveyed support video/audio search, which has the same user interface as text search.

Two university libraries let user save search result so that it can be retrieved when a user visit mobile website later.
How to present search results on a relatively small screen of mobile devices is a challenging task. Ten university libraries list 10 found records on one page, which is a long scrolled page. Others list 5, 20, or 25 found records on one page. Sometimes, users may want to view search results on a full website since there are more details for each found item. Several libraries have a link to full website on mobile search results. Clicking on the link redirects a user to a full website page that contains the same search results. In this survey, seven university libraries have this ViewInFullSite function. In the search results, if a found book, article, etc. has electronic version, 9 libraries have a link to let users to read it online. Five libraries let users reserve a found record online through their mobile devices, and five libraries let users send a found record through email or text message.

Refining search results using facets is common on libraries’ full website, however it is not common on mobile websites. In this survey, we found this function, facet search, only on those university libraries who utilize the Summon third-party search product. Figure 4 shows an example of facet search utilizing Summon.
4.3 Informational, assistant and advanced features

The most popular features found in 26 libraries are contact, library hours, and catalog. These features are implemented on almost all 26 mobile websites surveyed. In the Location feature, half of libraries have a link to Google Map. In comparison to features of Hours or Location, relatively fewer library mobile websites, 12 of 26, publish news and events about university libraries. Some universities have a link to a blog website as News and Events, others use HTML pages to display news.
In advanced features, integration of social networks is a popular feature among university libraries surveyed. Usually, a link to a university's account on Facebook and/or Twitter is shown on a homepage. Another popular advanced feature is Floor Map. A variety of methods are used to show floor maps. For example, as shown in Figure 5, Binghamton University library displays an image as floor map; Boise State University library highlights an area in a floor map given call numbers. The remaining advanced features are less popular and are implemented by few university libraries. Such advanced features include loan period, material renewal, newly released or forthcoming books, meeting room or study room reservation, computer availability, citation, and links to apps in Apple AppStore.
Figure 5. Floor maps. (Right) a red dot highlights a location given call numbers.

4.4 Resources

Several university libraries surveyed have links to third-party online databases on their mobile websites. Popular third-party online databases include WorldCat and RefWorks. Binghamton University library has the most comprehensive list, which contains 16 third-party online databases. Nine university libraries have links to their intranet resources, most of which are tutorial presentations and lecture notes. Boston College library puts digital collection like images, photographs, gallery etc. on its mobile website.
5 Summary & Conclusions

In this paper, a survey is conducted to study mobile websites of 26 university libraries in US. The survey is focused on what functions are provided on mobile websites and how these functions are organized and implemented. The results are reported and analyzed according to six categories: homepage, catalog search, resources, informational features, assistant features, and advanced features.

We found that menu-based homepage is the most popular homepage style. Useful features on homepages include auto-redirect to mobile website when visiting library’s full website, today’s hours, search box, a link to full website.

Several university libraries utilize third-party catalog search products to provide searching functionality, for example, Summon, WorldCat, AirPAC, Xerxes, LibraryAnywhere, and Primo. For those libraries who implement their own catalog search functionality, most of them (9 of 12) have advanced search options. The only libraries that support facet search are those who use Summon as catalog search engine. To present search results, typically 20 found records are displayed on one webpage. For each record, beside showing essential information such as title, authors, and call numbers, additional features are available in a couple of university libraries. Such features include sending a found record through email or a text message, reserving the found item, and reading electronic version of a book online.

Basic information about a library such as contact, library hours, and catalog are included in almost all 26 mobile websites surveyed. Also, a majority of university libraries support online chat on their mobile website. Although not ubiquitous in mobile websites surveyed, news and events about a library are contained in 12 of them.
Social networks such as Facebook and Twitter can be found in several library mobile websites, which is typically implemented as a link on homepage. Floor map is another advanced feature that is common in university libraries surveyed. Other advanced features, although can be found in only few mobile websites, do improve usability. These features include loan period, material renewal, new coming books, meeting room or study room reservation, computer availability, citation, and link to apps in Apple AppStore.

Online databases, e.g. WorldCat and RefWorks, are accessible from several library mobile websites. Some universities put resources that appear in full website on mobile websites.
6 Bibliography


Appendix A. Homepage screenshots of university library mobile websites
8 Appendix B. Results in XML format

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    <Menu Name="Hours" />
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    <Menu Name="Email" />
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  <Menu Name="Ask Us" />
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    <Menu Name="Contact US" />
    <Menu Name="Directions" />
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    <Menu Name="Loan Periods" />
    <Menu Name="Links" />
    <Menu Name="Phone" />
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