Mobile Options for Online Public Access Catalogs

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ABSTRACT

As mobile devices continue to proliferate and become more tightly integrated with our daily activities, a number of libraries have begun deploying customized mobile Web portals and applications to promote accessibility for patrons. Despite rapid growth of these mobile solutions, their novelty has meant relatively little is known about the alternatives and tradeoffs in designing for mobile access to libraries. To investigate these issues, we describe three complementary approaches. First, we report on a content analysis comparing mobile solutions offered by 22 institutions. Next, we present a user survey of university students, staff, and faculty regarding their uses and needs for mobile catalog access. Based on these findings, we describe a prototype mobile application we built to provide mobile access to our own university's library catalog. Overall, we find that libraries have several tiered options that make it simple to provide basic functionality with relatively little effort and deliver a significantly improved user experience in comparison to relying on traditional browser-based solutions.

Categories and Subject Descriptors

H.3 [**Information Storage And Retrieval**]: H.3.3 Information Search and Retrieval – *information filtering*; H.3.4 Systems and Software – *user profiles and alert services.*

General Terms

Measurement, Design, Human Factors, Standardization.

Keywords

Mobile information access, browsing and search behaviors, mobile application interface design, mobile search.

1. INTRODUCTION

Information access is increasingly shifting away from the desktop and into mobile environments. While most companies, libraries, museums, and cultural institutions already provide traditional Web-based Online Public Access Catalogs (OPACs), some have begun to deploy specialized mobile access applications as well.

While the provision of such enhanced services helps to ensure libraries stay abreast of the latest access technologies employed by patrons, the perceived cost and effort in developing such applications may deter some institutions when an OPAC already exists. Consequently, greater information is needed to help institutions understand and evaluate tradeoffs of different mobile design solutions for OPACs.

As a simple motivating scenario for mobile access, consider how people today often first lookup call numbers from an external desktop computer or library terminal, then write down or email themselves lists of these call numbers to bring to the library. They then must locate each book and its corresponding stack location manually, before going to find each book. A mobile phone application can simplify this entire process by allowing users to carry both the search mechanism and results with them.

While mobile devices have been in popular use for some time, today's devices boast superior large, color displays with high resolution, multi-touch capabilities, computational horsepower, and high-speed connectivity. These features have all combined to dramatically alter the possibilities and experience of mobile information access today in comparison to just a few years ago. Furthermore, the rich developer tools available for today's devices make it easier than ever to build and deploy mobile solutions. Consequently, we restrict our attention to exploring the design space and solutions for this new generation of devices.

To investigate the issues involved, we pursued three complementary strategies. First, we performed a content analysis of mobile catalog access solutions offered by 22 institutions. Second, we conducted a survey of 52 university personnel to solicit user feedback about uses and needs for such mobile catalog access. Finally, to garner a first-hand understanding of the various issues and tradeoffs involved, we developed our own prototype mobile application for accessing our university's library catalog. Informal user feedback regularly solicited throughout the development of our prototype further enabled us to evaluate how well we could meet user needs and the relative effort required by different features. Overall, we found that libraries have several tiered options that make it simple to provide basic functionality with relatively little effort and to deliver a significantly improved user experience in comparison to relying on an existing browser-based OPAC.

The following research questions motivated our work:

- What alternative interface options exist for mobile access solutions to OPACs, and what are tradeoffs among them?
- What existing solutions have been deployed and what are the greatest needs for further innovation and refinement?
- What do patrons want, need, and expect from mobile interfaces for libraries? What popular usage patterns or surprising uses or needs do we observe after deployment?

The remainder of this paper is organized as follows. Section 2 reviews related work. In Section 3, we present a content analysis characterizing existing mobile solutions provided by various

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institutions. Next, Section 4 reports on a survey of university personnel regarding their uses and needs for mobile catalog access. Section 5 then describes the prototype mobile application we developed and our experiences with it. Finally, Section 6 discusses possibilities for future work and concludes. Our preliminary findings were described in an earlier paper [4].

2. RELATED WORK

We focus our review of related work on search behaviors on the mobile Internet (MI), mobile application interface design, and mobile information access for libraries.

The Association of College and Research Libraries recently reported that mobile device use and tight budgets are key trends for 2010 [1]. Bridges et al. similarly suggest that libraries should prioritize development of mobile options [3]. They report a set of user experiments comparing three interface styles and a commercial service on typical mobile devices. Their results show that different approaches can help users to explore Web search results more efficiently.

A 2010 survey of University of California campus faculty, staff, and students indicated that more users still had phones lacking Internet access [8]. They also reported that Apple products were the most common brand, that more people used the cellular network than wireless, and that users with Internet access commonly transfer information between devices via email. The authors further noted that mobile use changes rapidly and so libraries must be agile in adapting to these changes. Research into methods for design may or may not help alleviate issues preventing more widespread adoption. In answer to the question of whether to use a mobile website or an application, the authors suggest mobile sites will be easier and require no downloading, while applications benefit from access to built-in features such as the camera or geo-location tools.

Search is quickly gaining popularity on mobile platforms. Church et al. showed that search was increasingly common for information access especially in relation to certain types of mobile handsets and information needs [5]. Their study showed that while browsing continued to dominate mobile information access, search was already becoming more popular as an alternative especially in relation to certain types of mobile handsets and information needs. Moreover, sessions involving search tend to be longer and more data-rich than those that do not involve search. In 2008 Church et al. conducted a follow-up study of users' interaction with their results [6]. They suggest that mobile phone searching is moving toward portal search. Portal search in this context refers to application based searching to support specific tasks rather than a one-size-fits-all search.

Similar trends have come forward in Web search studies, and task-specific searching has emerged as an important research topic. Specific search is often referred to as a "vertical", and users can often obtain better search results from engines that cater to verticals or aggregate results from certain verticals [2].

Prior work has suggested that users click on results much less frequently on a phone than they would on a personal computer, though users refined their searches even on mobile phones. Mobile users were also seen to search for specific tasks more than general topics, and their searches contained many repeat or overlapping searches, with more than 50% being similar to previous searches by the same user [9].

For mobile phone searchers, these issues are joined by problems of little time to spend on search, and increased multi-tasking. Mobile users typically need information fast and in a condensed form when they are on the go. But the type of search is just as varied as it is under normal circumstances; trivia, directions, information on friends and locations are just a few examples of common information needs. The more urgent a need is, the easier the method of search must be, or users will find another channel to get their information. Users are interested in built-in applications to support various specialized searches [10].

Kamvar et al. also stress the importance of personalizing the search experience for mobile phone use. Task specific searches can also be designed to better serve a user's needs. While smart phones are more similar to computers in technological capabilities than to older models of cell phones, they present a different set of usage behaviors and problems to address [11].

In their paper on mobile search interfaces, Luca et al. stress that design for use on mobile devices must provide improved navigation and visualization of result sets [12]. These methods enable a user to retrieve documents with fewer interactions and less data traffic, which is especially important for mobile devices . This means that mobile search application should provide a concise overview of the essential elements of a result set.

Prior work has also shown users' willingness to accommodate the limitations of the small interface of mobile phones and type keywords using the limited keypad of an ordinary mobile phone [13]. This same work also suggests an increasing search revolution as mobile devices enable location-based search.

Study of mobile gaming has similarly shown users desires for mobile application interfaces to fit the small screen space naturally [7]. It is not surprising to expect similar user expectations with regard to mobile solutions for library access. In general, past work has shown a variety of approaches to designing mobile application interfaces, including reformatting for vertical scrolling on a small screen, organizing chunks of content by screen size, and using zoom features.

3. CONTENT ANALYSIS

To characterize the space of existing mobile solutions for catalog access, we conducted a content analysis to identify, analyze, and compare existing mobile solutions from 22 leading institutions. We expect knowledge of the design space collectively explored by these institutions will be informative to others considering development of similar mobile applications. This review revealed broad trends in the field, popular design elements and key features, features exhibiting significant variance in realization across institutions, and current best design practices.

As peer institutions, we considered both academic and public libraries with applications focused on online library catalog search. We did not consider any museum applications, or mobile phone applications focused on library location finding or exhibition focused applications. Our analysis included the following mobile solutions for online public access catalogs:

1. Duke University Libraries
2. Miami University Libraries
3. Nashville Public Library
4. North Carolina State University Library

5. Oregon State University Libraries
6. Temple University Libraries
7. California State University, Oviatt Library
8. Auburn University Libraries
9. Cornell University Library
10. New York Public Library
11. University of California San Diego Library
12. Miami University Libraries
13. University of Houston Libraries
14. U. of Illinois at Urbana Champaign University Library
15. University of North Carolina at Chapel Hill Libraries
16. University of Richmond Boatwright Memorial Library
17. University of Texas Libraries
18. University of Virginia Library
19. Washington DC Public Library
20. WorldCat
21. Hong Kong U. of Science and Technology Library
22. Deakin University Library

3.1 Findings

Most libraries use the tailored website approach or a combination of tailored websites and downloadable applications (Figure 1). Key mobile catalog features identified are presented in Table 1 and described in further detail below:

1. *Search box and button*: A typical interface included a search bar with a "go" button on the same line.
2. *Search type options*: Fourteen out of twenty-two of the surveyed solutions included search type options. A drop down menu was commonly employed to select search by keyword, title, author, or other standard library options.
3. *Author and title*: These elements were commonly included and received a prominent place in both list and detail views. Only three applications did not include author in their list view**.**

4. *Call number and location*: All surveyed applications included this metadata and usually included it on a detailed page rather than the initial list of results page.
5. *Cover image*: More than half of the applications included a cover image. 5 out of 15 have included a cover image on the result list page.

6. *Status of book*: All applications except WorldCat included whether or not the book was checked out; this information was usually prominent in both list and detail views.

We also characterized additional mobile catalog features, including features for which we observed the most variance across different institutions' applications (Table 2):

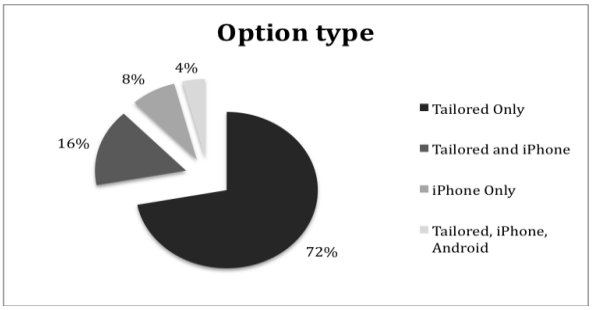

Figure 1. Distribution of mobile solution types offered by the 22 institutions included in our content analysis.

Table 1. Prominent mobile features offered by many of the 22 institutions considered by our content analysis.

Feature	Included in	Notes about feature
Search box	22 of 22	Always on front page.
Search type options	14 of 22	Most of them use drop down menu; UT and Ball State use checkbox layout; HKUST Library use buttons layout. Search by keyword, title, author, and subject are the most common.
Author and title	All applications	Usually included on initial results list pages; four institutions use title only.
Call number and location	All applications	Six provide them on result list page; all others provide them on detailed page.
Book Status	21 of 22	Usually included in the detailed page; 10 institutions include it on the initial result list page; WorldCat did not provide unless clicking on the specific library page.
Cover image	15 of 22	Usually included in the detailed page; 5 include cover image on initial result list page as well.

1. There were only two applications that provided a scan option for the ISBN of books. One of them was an option offered for a fee. The other was in an experimental phase.

2. Few applications provided a way for the user to customize search results. Examples of such customization observed included sorting by various fields such as relevance, date, title, author, language, library, and format.

3. Some applications had social bookmarking features. Only 8 applications provided means to email citation or other information about a book. Similarly, only 3 had the feature of texting the record. Email and Text features could allow users to save the information by performing some common tasks.

4. Three of the applications provided some form of map system. One system showed more info about the library location on a Google Map. One system provided a "Shelf Number" link that showed the books from the same shelf as well as their call number. This could be helpful since nearby books normally have similar topics, enabling browsing and exploration of books available on the same subject matter. One university has very detailed map system that shows which floor the book is on and highlights the stack and the book location in the stack.

5. Five applications made it possible to request a book on a mobile device. Considering the literature review and our questionnaire, we believe this to be especially important on a phone, where the use scenario is often satisfaction of an immediate need. If a user looks up a book online with a specific book in mind, the next step would be to put a hold on the book. Rather than sending them to a computer in order to finish the task adding a request feature is more direct.

Table 2. Additional mobile features offered by some of the 22 institutions considered by our content analysis.

Feature	Included by	Details
Sort By	6 of 22	by "Relevance" or "Date" are the most common
# Per Page	3 of 22	In one example, the user can choose 5, 10, or 15.
View Available Record Only	5 of 22	
Email a Record	8 of 22	Email a link, or citations
Text a Record	3 of 22	
View Record in Full Catalog	4 of 22	Two applications return to the full catalog after the list page.
Map	3 of 22	One example shows the floor map, highlights the stack, and point out the position.
Google Preview	1 of 22	Support for searching book content; can be challenging on a small mobile display.
Request/Place Hold	5 of 22	Common task but very few examples support this action.
Author / Series / Topics Link	7 of 22	For example, a link to books that were written by the same author or from the same series.
Bookmark	5 of 22	Social aspects of mobile access (e.g. sharing ideas, connecting with others) were rare.

Of the applications surveyed, WorldCat often took a different approach, probably because it is an aggregated search of catalogs rather than an institution-specific application. The features common across applications were that each one included a menu bar and at least three interfaces: an initial search interface, a results list interface with basic information about the books, and a detailed item interface that provided more information about selected books or objects.

The initial search interface included a search box which usually defaulted to a keyword search. They also often had: a dropdown with the search type options, a drop down with other options such as locations, and an advanced search option (Figure 3).

The results list interface includes abbreviated key information on the book list such as author, title, and status. The detailed item interface repeated these fields, as well as location (call number and library), publisher, and in a few cases the cover image.

As technology evolves and libraries design mobile applications, using standardized features will help users adjust to new interfaces. This means both adapting existing interfaces such as the current OPAC to the mobile interface, and following the example of other applications.

4. USER SURVEY

Before conducting our online questionnaire, we completed a pilot study to test our methodology and questions for discovering important features of mobile access. Feedback from undergraduate and graduate students familiar with our university's current browser-based library OPAC helped us to gauge user preferences about the usefulness of alternative features. The pilot study suggested that important features would include title, status, and author metadata, followed by call number and location, cover image, and publisher.

The pilot study informed design of our final user survey. Four preliminary questions addressed participants' educational background, phone use, and library catalog use. Six questions addressed mobile options for library catalogs. The full questionnaire is listed in the Appendix. The survey was conducted with University of Texas students, staff, and faculty.

4.1 Findings

Of the 52 respondents, just over 70% reported an educational level of graduate study or beyond. Most respondents reported using the university library catalog less than 5 times per week, while some did not use it at all (Figure 2). In contrast with earlier findings [8], 66% of our respondents reported owning smart phones, where a smart phone is a mobile phone that offers data connectivity in addition to normal phone functions.

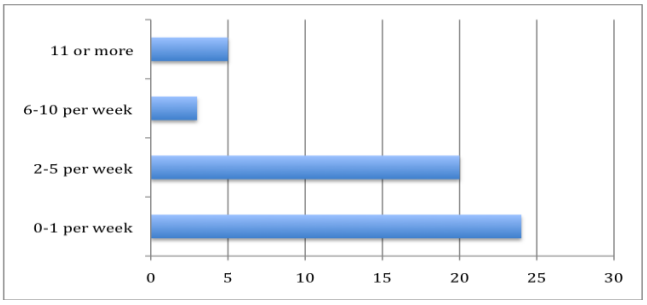

Figure 2. Frequency of Online Library Catalog Use.

The majority of respondents (63%) reported clicking on a result to get more information "often", followed by those who reported clicking "sometimes" (33%).

Respondents considered advanced search and search type to be the most important features for mobile catalog access. Four participants mentioned database search in the "other" category, an option we had not originally considered (Figure 3).

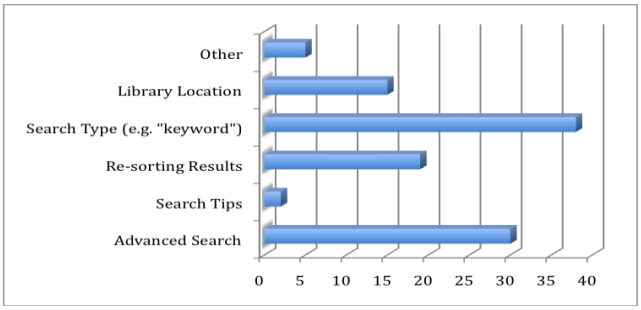

Figure 3. Important Library Catalog Features.

The most important metadata fields were the call number, year of publication, title, author, location, and current status. The respondents three who marked "other" wrote in that subject and credibility, online availability, and table of contents were additional fields that would be important to them (Figure 4). Publisher was marked low in importance, as was cover image.

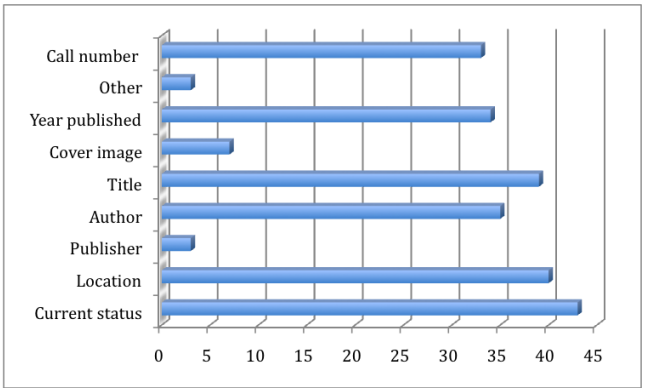

Figure 4. Important Library Catalog Features.

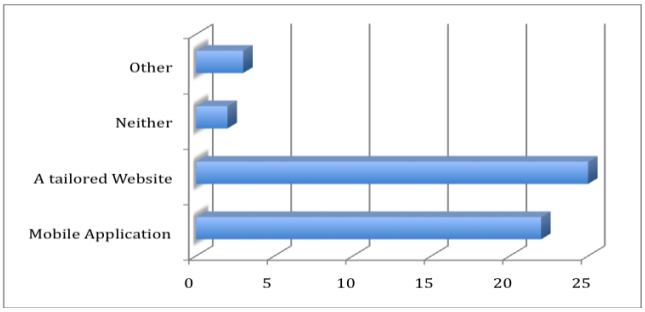

Figure 5. Preferences for type of mobile solution: tailored website vs. custom application.

Respondents' opinions on tailored websites versus mobile applications, but most indicated that they would want one or the other over no option (Figure 5). A tailored website was defined as a website re-sized to fit your phone screen that you are redirected to via the phone's browser. A mobile application was defined as a program you download and access directly from an icon on your screen. The "neither" answer was defined as the user preferring to use the existing browser option automatically resized by their phone operating system (OS).

Saving a booklist proved the most highly rated function for a mobile application of a library catalog, followed by viewing a map of the location of the book in the stacks. Search by scanning a barcode was the least popular. Most respondents rated scanning functionality low, especially in comparison with the more even distribution of the other ratings (Table 3).

In response to the final question asking for participant comments, responses provided interesting insights. Several respondents noted that simplicity was important to them when considering mobile options. Others stressed the importance of saving citation information and including options for article search, as well as options for full text access to those articles.

Two responses were especially pertinent for possible future work exploring use of mobile phones for self-checkout. One respondent noted, "I also really like the idea of being able to scan a book and check it out without having to go to the circulation desk, especially after hours when the desk is closed." Another astutely asked, "If you could check a book out with a phone, how would you disable the security strips in those books?"

Table 3. User Ratings of Potential Future Features.

Function Description	Average Rating
Searching by scanning book barcode rather typing text	2.73
Viewing more details via an external link such as Amazon.com	3.4
Saving selected book results to a customized list for later reference	4.08
Viewing a digital map of where a given book is located in the stacks	3.79
Using phone to check out rather than using the circulation desk.	3.71

5. PROTOTYPE MOBILE APPLICATION

This section describes our approach and experiences developing a prototype mobile application for accessing our university's OPAC. We built our application based on Google's Android platform[1]. For testing, we used an Eclipse emulator, a Motorola Droid A855, and an HTC Hero.

5.1 Programming Platform

The Android Software Development Kit (SDK) is a Java based programming language for Android applications. Developers can download the SDK and emulator at no cost. For implementation, we used Eclipse, an Integrated Development Environment (IDE) that is compatible with the Android SDK. Android applications are bundled into packages with the extension .apk, and can be easily downloaded and installed on Android enabled devices. Android instructions and several open source packages are available online in forums or on the official site. Barcode scanning was implemented using the zxing[2] package.

5.2 Included Features

The prototype application includes a menu with "Search", "Scan ISBN", "About" and "Book List" (Figure 6, left). The "Search"

[1] http://developer.android.com

[2] http://code.google.com/p/zxing/

option allows users to return to the search page at any time. The option to scan a barcode allows scanning the ISBN of any book and search by that number. The "Book List" option displays the items in the personalized book list. The "About" option provides more information about the mobile phone search application.

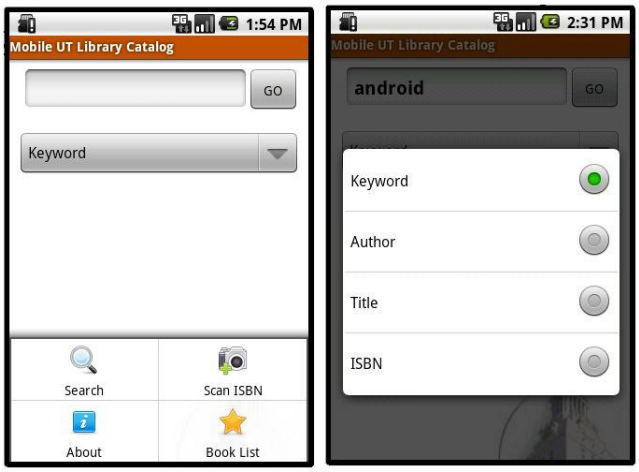

Figure 6. *Left*: the main search interface, and *right*: the four search types that users can choose from.

5.2.1 Search

The first view in the prototype is the Search interface (Figure 6, left). It provides quick and easy keyword-based search.

The output of the search action is a list of books (the results list view) indicating status, title, and the author of the specific book (Figure 7, left). The user can tap any item, for example the book, "Professional Android application development," to find out more information about that book.

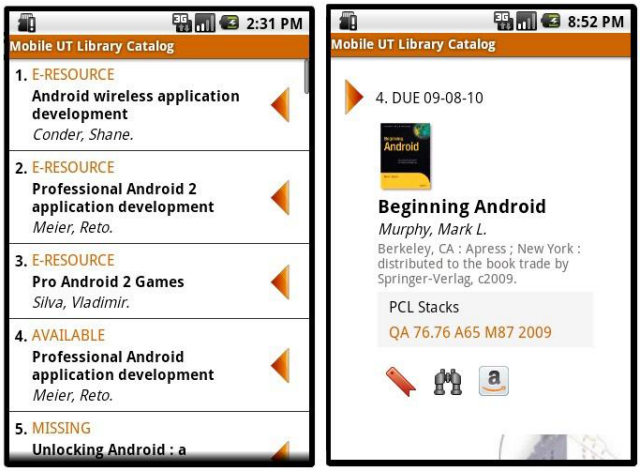

Figure 7. Views for search results and the detailed item.

The third interface (Figure 7, right) is the detailed view, and shows more about a single book. Using traditional interfaces, users need to write down the call number, the title of the book and the author's name before trying to find a book in the library. In order to simplify the process, this application allows users to save or email a book for future reference. The "save" button provides the user with the functionality to save book to a list, or if the book is not available, she/he could request it directly. The Amazon icon button allows price comparison or reading reviews.

5.2.2 Scan

From the menu, users can select the "scan" option. This option uses the zxing package to scan the ISBN of a book and returns whether or not the book is in the library. If the library owns the book, users can view details about the book in the same manner as if they had searched for the book by any other method.

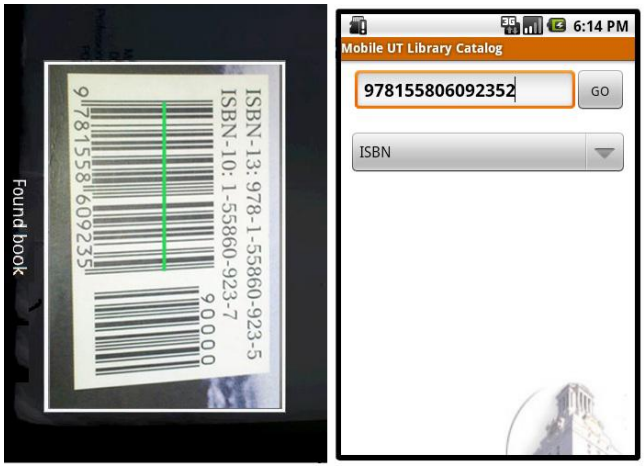

Figure 8. Views to scan a book and return the ISBN.

5.2.3 Personal Book List and Map

Based upon user feedback, we added a map system that allows the user to navigate through the library and locate books (Figure 9). Any book can be selected to view its location in the stacks. The library map shows the (floor) level number (e.g. Level 6) and highlights the stack number (e.g. "N").

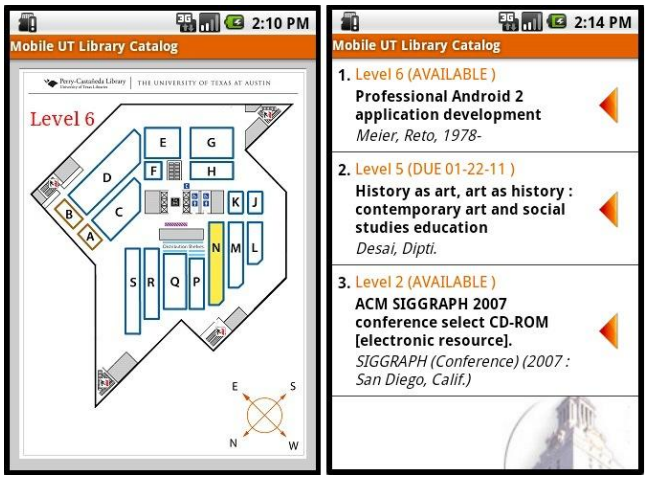

Figure 9. A map feature was easily added to the prototype after the original implementation.

In addition to the map interface, the user can create her/his personalized book list for future retrieval. A personalized book list is slightly different from book result list (Figure 8, Right); instead of the book's current status, the floor level will be highlighted. Once the search is done, the user could simply go to the book list and find the books there.

The "about" option will bring up a standard message interface that gives a good description of the application. Using this standard message interface we created several message popups.

5.3 Prototype Findings

Overall, the time spent on developing the application was fairly modest. Two graduate students with no prior Android programming experience spent an approximate 20 hours total per week for four weeks to create the prototype. Both programmers had written applications using Java but were not experts.

One challenge we encountered in designing the application was getting to a data set to create a results list from. We needed a data set that included books with library metadata such as author, title, availability, and status. Since the University library catalog does not provide a publicly available search API, we accessed the library results page and parsed the HTML for the results.

Lacking an API, parsing the HTML was the best solution for the prototype but affected search execution time and robustness. A better solution would be to utilize an available API. Providing APIs offers the additional advantage of providing the opportunity to crowd-source work as a community may provide free or inexpensive applications when given the tools needed.

5.4 Informal User Feedback

We gathered feedback from users of the application throughout the design and implementation process. Initial feedback indicated that some gestures and functions were not easily understandable, for example, the long-click function was not intuitive and would be better implemented as a double-click. We were easily able to incorporate this type of feedback into the final design.

Users found the scan function to be "neat" but were hard-pressed to think of actual situations they would use it. Overall, users expressed that the interface was clean and simple but left them wanting more. For example, the mapping function does not guide you to the book in the stacks given your own location; it only highlights where the book is on each floor and area. Limited precision of GIS data may limit the functionality requested here.

More formal user studies as an evaluation of the prototype are clearly needed and will be addressed in future work.

6. CONCLUSION

Our results indicate that the following aspects are particularly important for a mobile OPAC solution.

1. *Task-specificity*: Simplicity of an interface is important; some applications we saw appeared too text-heavy or feature-dense.

2. *Screen appropriate size*: The fit of custom mobile applications on the screen critically reduces time and frustration for users.

3. *Library user services*: Some added functionality (e.g. "place hold" or "map") is viewed as valuable even when not used.

4. *Automation of search*: A scan function is an option to reduce time typing if an ISBN is available. Our review indicates that there should always also be an option to type in search terms.

Our experience suggests that in comparison to existing browser-based OPACs, libraries can build simple, well-liked mobile applications at relatively low cost and effort. In our case, two graduate students working a combined 20 hours a week for four weeks were able to build a working prototype with basic functionality. Parsing the HTML took a large percentage of time and was not particularly robust, returning some erroneous characters in certain search cases. A search API or official access to a database would make applications more robust.

We anticipate that mobile application maintenance will be relatively inexpensive by designing these applications as thin interface layers atop a regularly maintained catalog access API. Our current prototype is more fragile, however, since changes in the HTML presentation of catalog search results could compromise assumptions we encoded to translate current HTML page layout into the prototype's views.

Our experience also confirms general best practices for tightly coupling application design with frequent user feedback to ensure that each iteration of the application works well for the target audience. Also, the application should be simple to extend, as we did with the mapping feature and personalized booklist.

As with other mobile applications, we see mobile catalog users prefer task-specific applications for websites or online services that they use often. The perceived benefit is sufficiently great that users often download applications such as our prototype even when they only visit sites sporadically. Moreover, users have now come to expect that custom applications for their mobile devices are widely available, and may become frustrated when such customized applications are absent.

Looking ahead, one can imagine a variety of more advanced features that mobile applications might support to further enhanced library access. Spoken search and social network integration are clear trends for mobile applications in general. Other potential features include: (1) allowing users to download electronic resources to their device, (2) providing self-checkout functionality via barcode scanning, (3) and improved guided navigation from a user's current location to the location of a given physical resource. With the popularity of recommendation engines, another intriguing possibility would be providing book suggestions that are *locally relevant*: using GIS and saved preferences, nearby books in the stacks could be suggested by the system for the user to browse while in close proximity.

7. ACKNOWLEDGMENTS

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8. REFERENCES

[1] ACRL Research Planning and Review Committee. (2010). 2010 top ten trends in academic libraries. *College & Research Libraries News*, *71*(6), 286-292.

[2] Arguello, Jaime, Diaz, Fernando, Callan, Jamie, & Crespo, Jean-François. (2009). Sources of Evidence for Vertical Selection. In *Proceedings of SIGIR* (pp. 315-322).

[3] Bridges, Laurie, Rempel, Hannah Gascho, and Griggs. Kimberly, Making the case for a fully mobile library web site: from floor maps to the catalog. *Reference Services Review* 38.2 (2010): 309-20.

[4] Broussard, R., Zhou, Y., & Lease, M. Mobile Phone Search for Library Catalogs. In *Proceedings of the 73rd Annual*

Meeting of the American Society for Information Science and Technology (ASIS&T), 2010.

[5] Church, K., Smyth, B., Cotter, P., & Bradley, K. (2007). Mobile information access: A study of emerging search behavior on the mobile Internet. *ACM Trans. Web*, *1*(1).

[6] Church, K., Smyth, B., Bradley, K., & Cotter, P. (2008). A large scale study of European mobile search behaviour. In *Prof. of the 10th intl. conference on Human computer interaction with mobile devices and services*, (pp. 13-22).

[7] Fritsch, T., Ritter, H., & Schiller, J. (2006). User case study and network evolution in the mobile phone sector (a study on current mobile phone applications). In *Proceedings of the 2006 ACM SIGCHI international conference on Advances in computer entertainment technology* (p. 10).

[8] Hu, R., and Meier, A. (2010). Mobile Strategy Report: Mobile Device User Research. *California Digital Library.*

[9] Jones, M., Buchanan, G., Cheng, T., & Jain, P. (2006). Changing the pace of search: Supporting "background" information seeking. *Journal of the American Society for Information Science and Technology*, *57*(6), 838-842.

[10] Kaikkonen, A. 2008. Full or tailored mobile web- where and how do people browse on their mobiles? In *Proceedings of the international Conference on Mobile Technology, Applications, and Systems* (pp. 1-8).

[11] Kamvar, M., Kellar, M., Patel, R., & Xu, Y. (2009). Computers and iphones and mobile phones, oh my!: a logs-based comparison of search users on different devices. In *Proceedings of the 18th international conference on World Wide Web* (WWW), pp. 801-810.

[12] Luca, E. W. D., & Nürnberger, A. (2005). Supporting information retrieval on mobile devices. In *Proceedings of the 7th international conference on Human computer interaction with mobile devices & services* (pp. 347-348).

[13] Roto, V. (2006). Search on mobile phones. *Journal of the American Society for Information Science and Technology*, *57*(6), 834-837.

[14] Sohn, T., Li, K. A., Griswold, W. G., & Hollan, J. D. (2008). A diary study of mobile information needs. In *Proceeding of the twenty-sixth annual SIGCHI conference on Human factors in computing systems* (pp. 433-442).

[15] Xie, X., Miao, G., Song, R., Wen, J., & Ma, W. (2005). Efficient Browsing of Web Search Results on Mobile Devices Based on Block Importance Model. In *Proceedings of the Third IEEE International Conference on Pervasive Computing and Communications* (pp. 17-26).

[16] Yi, J., Maghoul, F., & Pedersen, J. (2008). Deciphering mobile search patterns: a study of Yahoo! mobile search queries. In *Proceeding of the 17th international conference on World Wide Web* (WWW), pp. 257-266.

9. Appendix: User Survey Questionnaire

1. *What is the highest level of education you have completed?*

   Less than High School, High School/GED, Some College, 4-year degree, or Graduate Study and beyond

2. *Approximately how many times per week do you use the UT library online catalog?*

   0 - 1 per week, 2 - 5 per week, 6 - 10 per week, or 11 and more often.

3. *Do you own a smart phone (a mobile phone that offers data connectivity in addition to normal phone functions)?*

   Yes, No , or No Answer

   4. If you answered yes to question ## Do you ever search for library books or related information on your phone?

   Yes, No, or No Answer

5. *Which features from the UT library catalog search page are the most important to you? (You may choose one or more.)*

   Advanced Search, Search Tips, Sorting By (Year, Material Type, etc.), Search Type (Title, Authors, Keyword, etc.), Library Location, or Other (please specify)

6. *Which of the following information about a book is important to you during a search? (You may choose one or more.)*

   Current Status (Available/Due Date), Location, Publisher, Author, Title, Cover Image, Year Published, Call No. (e.g. QA 76.73 J38 S545 2010), or Other (please specify)

7. *When searching the UT library catalog, do you often click on a result to find out more details?*

   Often, Sometimes, Rarely, or Never

8. *If the UT library offered a mobile option, would you prefer…*

   A mobile application (a program you download and access directly from an icon on your screen).

   A tailored website (a website resized to fit your phone screen that you are redirected to via the phone's browser., Neither, I prefer to access the website as it is via my phone's browser., or No Answer.

9. *Please rate the following catalog search features for usefulness, with 1 being the least useful and 5 the most.*

   Searching by scanning a book barcode rather than typing text.

   Viewing more details about a book via an outside link such as Amazon.com

   Saving select book results to a customized list for later reference.

   Viewing a digital map of where a select book is located in the stacks.

   Using your phone to check out the book rather than going through the circulation desk.

10. *Please comment on any questions above or add your thoughts about mobile search for a library catalog.*