Meaning & Form in HCI

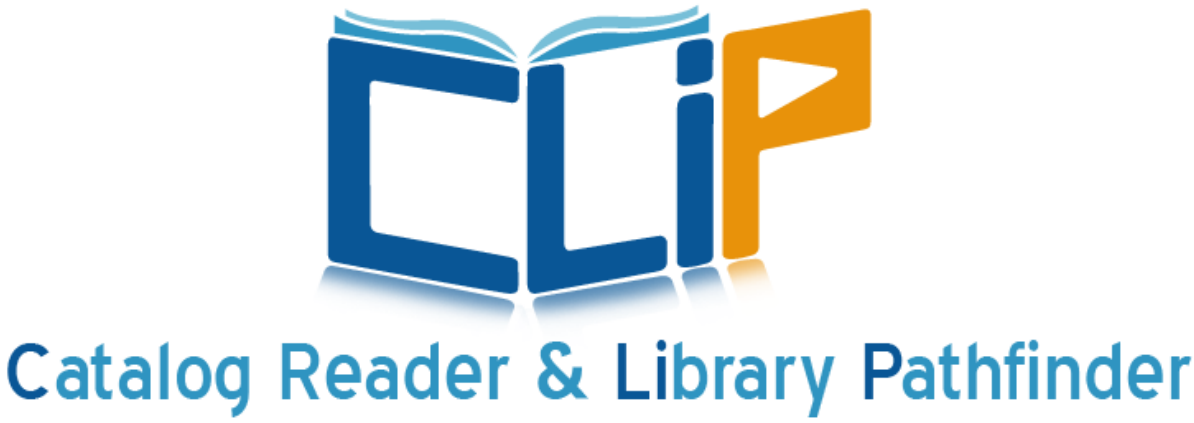

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Table of Contents

Table of Figures

Executive Summary

Application Domain

Although the Internet has become the popular medium to access information, millions of people still visit public and academic libraries each year to access information for research purposes. According to the most recent statistics from the American Library Association, public libraries reported having almost 1.6 billion visits in the 2009 fiscal year, an increase from the previous year [7]. Our project involved observing how library patrons search and locate a book in the library to identify any difficulties they may have, and designing a solution to support and enhance their overall library experience. This report discusses the data collection methods, design development, and product evaluation.

Data Collection Methods

We visited several public libraries to become more familiar with our fieldwork setting. Contextual inquiries were conducted with 3 library patrons at 2 public libraries and 1 academic library. We observed how patrons searched for books using the online catalog and how they located the books in the library. We found that patrons typically wrote down a list of interesting books they found in the catalog, including its title, author, publication date, and call number in order to locate the book on the shelf. A common difficulty among patrons was finding the book's exact holding location even though guidance signs were available throughout the library. New insights also revealed that patrons browse through a book's table of contents to get a general idea of its contents and decide whether the book is relevant to their goal. We concluded each contextual inquiry by discussing with the patron what we learned from our observations to ensure our interpretations were accurate.

Data Analysis and Design Ideas

After each contextual inquiry was conducted, we developed 5 work models (flow, sequence, artifact, physical, and cultural) to represent a patron's work practice. At the end of our data collection, we organized all of our observation notes using an affinity diagram and consolidated all of the work models to identify the key requirements for our application. We narrowed down our project's design focus to: (1) searching the catalog, (2) finding the holding location of books, and (3) acquiring book information. Developing a consolidated vision, storyboards, and interactive dialogue models helped drive our initial design ideas for the low-fidelity prototypes. The metaphor for our conceptual design is a mobile Information Desk that would allow patrons to search for books on a catalog, create a book list, and view the book locations on an interactive map.

Evaluation

After running an internal walkthrough with the low-fidelity prototypes, we eventually developed an interactive prototype of our application. We tested the interactive prototype with 3 graduate students by allowing them to freely explore the application. Overall, the users mentioned that the application would be a useful tool for library goers since it remembers what books to find and where to find them in the library. They liked the electronic book list, interactive map, and hotspots (other topic-related books) feature on the application. Finally, several additional features were suggested to incorporate in our application, such as book recommendations and book ordering options.

Project Scope & Field Setting

Application Domain

The application domain focuses on information access in a library. According to the most recent statistics from the American Library Association, public libraries reported having almost 1.6 billion visits in the 2009 fiscal year, an increase from the previous year [7]. The increase in library visitation may be attributed to the increase of various types of materials offered in the library, such as computers with Internet access. Although a vast amount of information can be researched online, going to a library is still extremely important. Among several reasons, not all information is available on the Internet and libraries offer more research-worthy books, journals, periodicals, and other resources [8]. Libraries also preserve the traditional reading experience for people who want access to physical reading materials.

Although libraries now provide online catalogs which allow users to search for a book and retrieve information about each result, little technology has been implemented to aid novice library users in actually locating a book within the library. Bookshelves are typically labeled with different topics and call numbers to use as a reference to locate a book. This activity can become very tedious and confusing especially if a library has multiple floors and thousands of materials. A location-aware system coupled with aural technology and informative visualizations on a mobile device may help improve the efficiency of finding and deciding on a book (or any material) within a library. Our project will explore possible combinations of these concepts to enhance the overall library experience.

Fieldwork Setting

Most libraries are now equipped with online catalogs that allow people to search the database for paper books, audio books, CDs, videos, and other periodicals. Private study cubicles, group work tables, and individual computer stations are currently provided as spaces to aid people in their activities.

Preliminary visitations at three Indianapolis Marion County Public Libraries revealed the following common characteristics:

- A librarian station was available in the middle of the library where people could ask for assistance, such as finding where exactly a book is located or how to use the printer.
- Computer stations were time-limited. Some people had to wait for their turn to use it. The computer screens typically had a clock counting down how much time remained. The computer stations would also be near the printer and copier machine.
- Materials (i.e. books, magazines, audio books, CDs, etc.) were organized by topic and were not in alphabetical order. Each book within a shelf was organized chronologically by call number.
- People looking for a book on the shelves tilted their head to read the title. When they grabbed a book, they would flip it over to read the back cover. This was repeated 2-3 times in one area before the reader moved on or walked away.
- The library environment was divided into separate sections for magazines, books, audio books, CDs, DVDs, computer stations, and children's play area. However, each library visited had different floor layouts.
- There was a podium where other reference materials could be found (i.e. dictionary, maps, and thesaurus).

- The study tables typically provided 4 chairs, but with all of the items one person had on top of the table (i.e. books, laptop, papers), there seemed to only be enough room for 2 people.
- The online catalogs are only stationed at specific areas of the library. A person who was not currently on a computer had to find a vacant computer to look up an item on the online catalog. The search results for a particular book in the catalog typically included the following information: author, call number, publisher, published date, title, subject, series title, physical info (# of pages, size), 1- to 3- line summary of the book.

Project Scope

Focus

We intend to explore the flow of work in a library environment by an individual. The primary activity that we want to address in our project is **- searching and fetching a hardcopy of a book in a library.** This activity includes a number of sub-activities like browsing the library catalog (in the library terminal or a personal device), physically walking to the holding positions for fetching books and carrying the books to an available study table. So we would like to narrow down our project scope to 'searching of a library catalog', 'displaying relevant information about library holdings in a user-friendly manner' and 'providing useful direction assistance to holding locations'. We propose designing a smart phone application that will allow semi-aural browsing of the library catalog on-the-go and provide directions to holding locations of books. The affinity diagram that we used to create our focus is shown below:

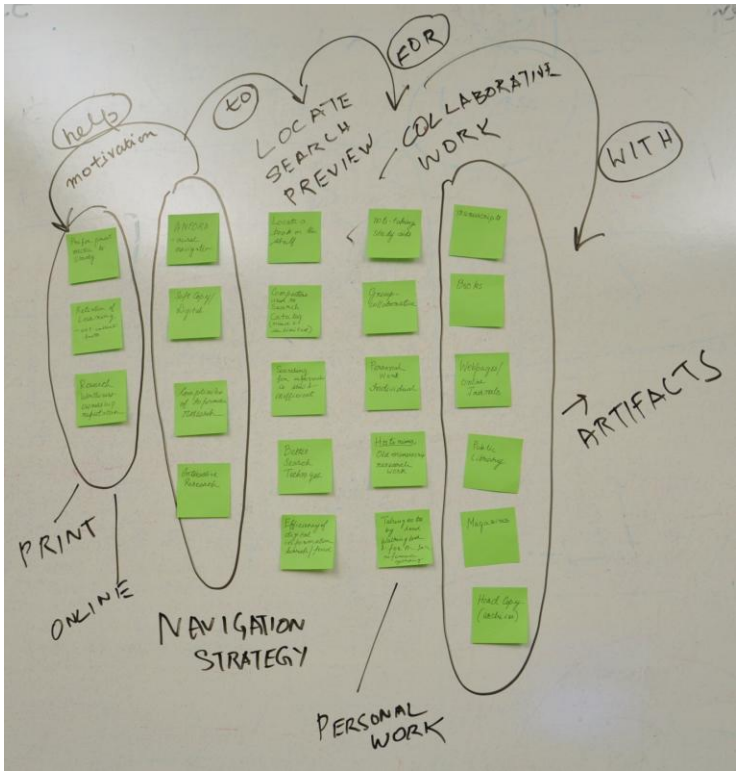

Figure 1: Affinity diagram for brainstorming the project focus

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Existing Systems

Antelman et al. [1] gives an overview of library catalogs and reports how new technologies have recently been employed to provide users relevance-ranked keyword search results. As the search technology behind the library catalogs develop, the users get a chance of getting better and quicker intended results. Cooper [2] discusses how library catalogs available over the web are accessed differently by different categories of users. He also models the usage patterns regarding search keywords, errors and assistance asked from the system. A semi-aural interface for browsing search results in a library catalog is a novel idea and may help users to utilize time while browsing books in the pre-searching phase. How existing websites can be aurally navigated is discussed in Ghahari et al. [3]. Location aware mobile library services have already been proposed in [4] and [5]. We propose to design a location aware service that provides cues to users while they are searching for books and propose a shortest tour (using Djikstra's algorithm) among the holding locations in a user friendly interface. The interface will also provide relevant information that users need for a particular book while searching for reference materials.

Stakeholders

The stakeholders for this project are library patrons, librarians, and library managers/owners. The library members are a diverse group of people across ages and profession. They can belong to academia, different professions or they can be readers for pleasure. The libraries can be public or private, general or specific and free or not. The following table discusses the relationship between stakeholder types and roles for our system. See the Appendix document for all stakeholder selection tables.

				ROLES										
				BENEFICIAL										
				FUNCTIONAL	FINANCIAL	POLITICAL	SPONSORING	NEGATIVE	RESPONSIBLE	DECISION MAKER	REGULATOR	OPERATOR	EXPERT	CONSULTANT
DIMENSION		**CRITERION**	**OPTIONS**											
INTERNAL	ORG	Function	S2: Librarians	X										
		Knowledge/ Ability	S2: Librarians		X				X		X		X	X
			S4: Library's Technical Team					X	X			X		X
	ION	Hierarchical	S3: Library Mangers/ Owners			X	X		X	X				
EXTERNAL		Function	S1: Library Members	X	X		X					X	X	X
		Knowledge/ Ability	S1: Library Members	X	X		X					X	X	X

Figure 2: Stakeholder Types-Roles Relationship

Fieldwork Activity and Data Collected

Methods Used

In order to gain a better understanding of the work practice of library patrons, our team conducted contextual inquiries with three library patrons (2 males, 1 female) between 25-30 years old. We began by explaining the purpose of our project and asked each patron to sign an informed consent form indicating that they understand and accept their rights as a participant. We also conducted a brief interview to gain some general background information about the library patron before beginning the observations. We learned that they spend an average of 1-2 hours in a library, doing business or academic research. They prefer to read on print media because it's easier for them. They also mentioned that objects they usually bring with them whenever they visit a library include: Smartphone, library card, earphones, pen, paper, and other textbooks.

We observed how library patrons use the library by following them around as apprentices, taking notes/pictures while we observed and asking them questions on their current thoughts and goals. We focused our attention on how they searched the online catalog for books and physically located books inside the library since that is our project focus. However, we also extended our focus on how the patrons attempted to gain information about a book since we found from our observations how that was an important step for deciding whether or not to borrow a particular book.

Data Collected

We observed that patrons typically wrote down a list of interesting books they found in the catalog, including its title, author, publication date, and call number in order to locate the book in the library.

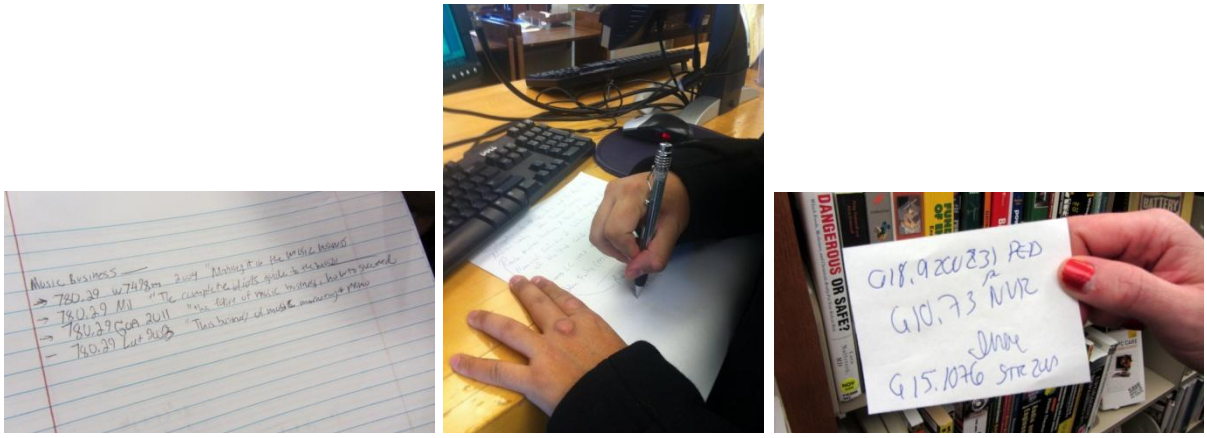


Figure 3: Creating a personalized list of books from the catalog to find in the library

A common difficulty among patrons was finding the book's exact holding location even though guidance signs were available throughout the library.

Figure 4: Finding a book's holding location

Observations also revealed that patrons briefly flip through the pages of a book and browse its table of contents to get a general idea of what the book is about in order to decide whether the book is relevant to their goal.

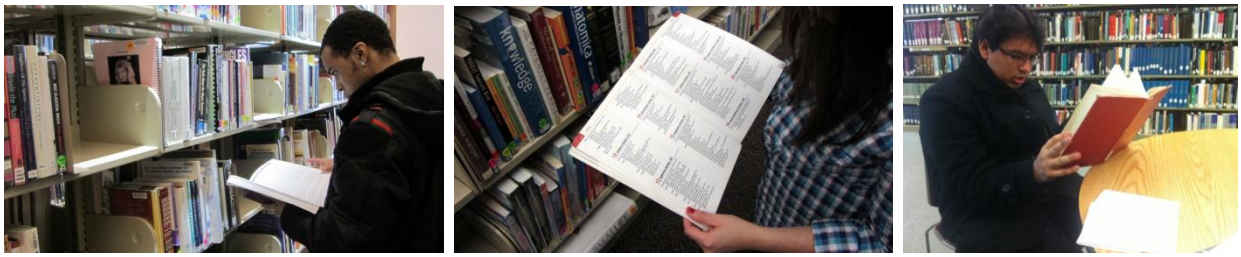


Figure 5: Trying to gain an understanding of a book's contents

We concluded each contextual inquiry by discussing with the patron what we learned from our observations to ensure our interpretations were accurate. After each contextual inquiry session, we discussed our observation notes and we developed 5 work models (flow, sequence, artifact, physical, and cultural) to represent the patron's work practice.

Consolidated Work Models

Once observation data had been collected from all contextual inquiries, we consolidated all of the work models into one set and organized our observation notes using an affinity diagram in order to identify any issues to address and key requirements for our application. For individual work models built for each of the contextual interviews, please refer to our appendix.

Flow Model

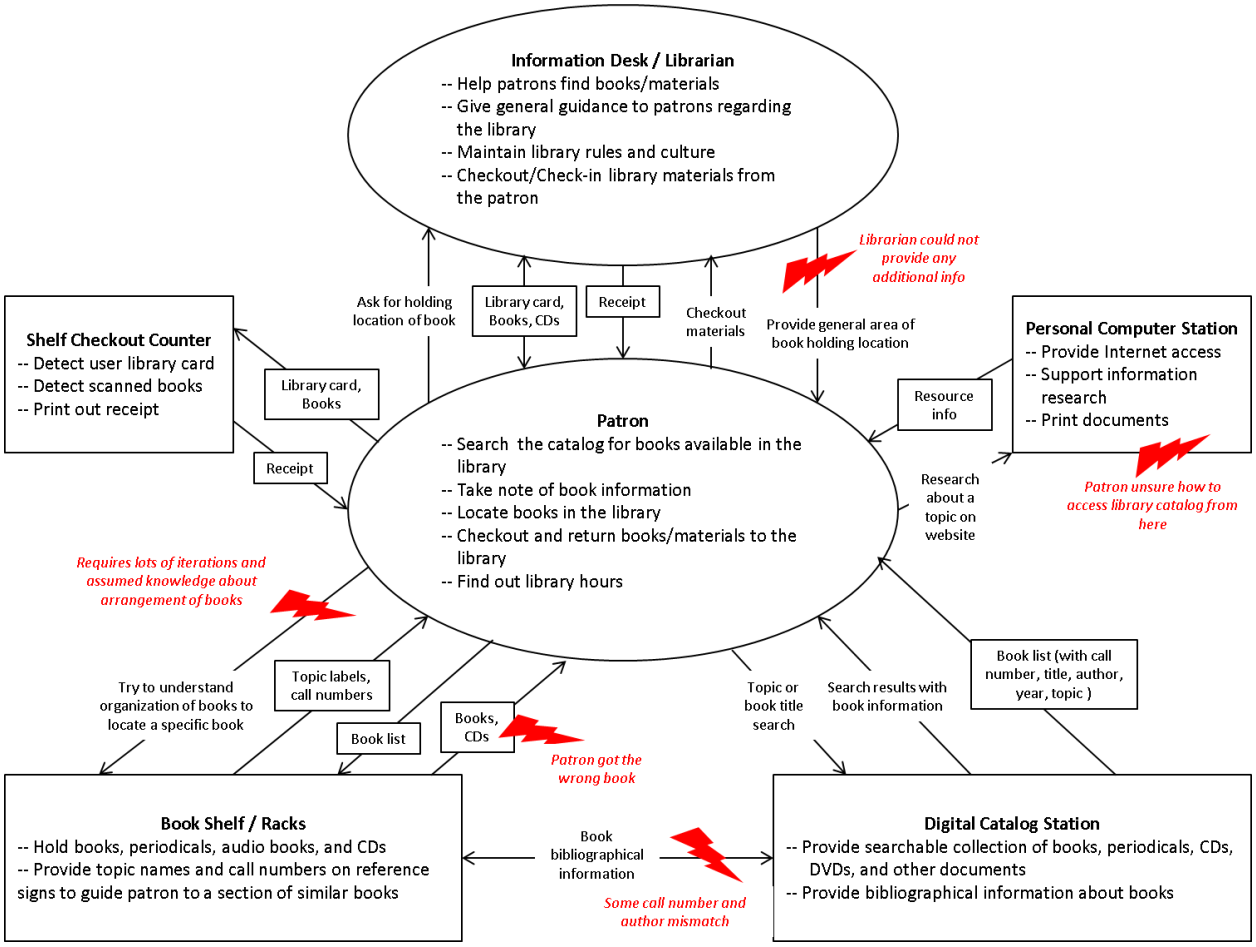


Figure 6: Consolidated Flow Model

It is important to note here, that the main entities in this flow model are the users (library patrons), the librarian and the different places visited by the user (such as book shelves, personal computer station, digital catalog station, etc.) The major breakdowns are happening between the following flows:

- User and librarian
- User going to bookshelves
- User moving in between catalog station and bookshelves

Sequence Model

ACTIVITY	INTENT	ABSTRACT STEP
Research a topic	• Re-visit any reference materials that might help to search for certain books in the library	• Trigger: Find out more on the research topic to look for related book(s) in the library.
Find pertinent book(s)	• Find the paper/journal online where the user first read the term using the Smartphone connected to the school WIFI to get access to the journal website. • Read the paper's references to see any physics paper cited. • Walks to the nearest computer kiosk to read more on the topic and find related books. • Finds some related books in the Wikipedia page with definition for the searched concept. • Writes down 4 books to figure out if the library has those books. • Finds a kiosk to browse the library catalog. • Go to the computer with library catalog • Search the catalog with keywords • Read the short description accompanied with the title of the book retrieved in the search. • Use advanced search and filter options • Browse the search results for title and publication year	• Trigger: Find the name of related books to his interested topic. • **Breakdown: Smartphone is conducive to quick information search, but not serious reading to retrieve information** • Trigger: Coming to the library to get information. • Academic , personal interest • Look for available books in the library. • Narrow down the search results of books to tailor her preferences. • To check how recent a book is.
Find the book's location in the library	• Note the call number, author and title of the book from the digital catalog of the library.	• Try to find what book is available with the library and where.
Remember the book(s) and their location	• Note down the call number, author • Lists in a piece of paper the section where the book is held and the call numbers. Also maps the call numbers to the titles (written previously on the same paper) of the books by drawing arrows.	• Externalize memory load by noting down book information and holding location information on some artifact. • **Breakdown: Could note only limited information on the interested topic.**
Go to the holding location of a book	• Walk to the nearest Library information desk and ask the librarian about the books' holding locations. • Try to guess the holding locations of the books from the librarian's directions and walk to the library floor mentioned. • Use existing field knowledge that higher call numbers usually denote higher floors. • Use book shelf reference signs as guide to correct book location • Stands in front of the 'direction stand' before the stairs to understand where the holding locations can be. Confused about the terms used. • Goes to the information desk to ask the librarian any additional information on how to find the books.	• Trigger: Get directions for the books noted down from the library catalog. • **Breakdown: Could only get some vague feel about where the books might be found. Confusion about the directions.** • Use any resource visible to know a tentative location for books I am looking for. • Trigger: When failed to locate a book without help, look for help. • **Breakdown: No help from librarian regarding finding a book.**

Locate the book in the bookshelves or holding location of the library	• Try to locate the exact call numbers/ books in the library racks • Not find any of the books noted in the notebook from the catalog search. • Start scanning titles of the book in that holding location with similar call numbers as the books noted from the catalog. • Match book call numbers and author • Finds the location where the book must be. Then realized he had not checked whether the book is available or on loan. Goes back to find the computer to search the library catalog. • Finds a book with the same title. Starts trying to find out the paper on the topic in the book and realizes that the book is but of a different topic of the same series. • Uses that book visually to find the other books on the series in the adjacent locations.	• Trigger: Try to locate the books listed from the library catalog in the library shelves. • Look for alternatives when I cannot find the exact book I am looking for. • **Breakdown: Lost time in locating the exact holding location of the books user wants to find.** • More information needs to be retrieved before the user goes to locate a book. • **Breakdown: Important information is missed because of no salient instructions from the catalog.** • **Breakdown: Books with same titles but topic different not easy to differentiate.** • Needs to diligently match a book's call number exactly to locate the book. • Looks for alternatives to locate a book. • **Breakdown: Has to settle with some other books that looked interesting on the fly.**
Decide whether to borrow the book(s)/material(s)	• Browse the table of contents, the publication year and choose two books that look interesting and easy read. • Find the book and read through its contents	• Trigger: Get a related book on the interested topic. • Decide by looking at exemplary features of a book, whether it will be related to my topic and decide to borrow it from the library. • **Breakdown: Has to physically handle each of the books, find the information and read it.** • **Breakdown: User realized she was picking up irrelevant books or old publications**
Borrow book(s)/ other material(s) from the library	• Check them out	• Check any related books I decided to be relevant enough to my research topic to be borrowed from the library.

Figure 7: Consolidated Sequence Model

In this quite an elaborated sequence model, we can find that the activities that always happen in a sequence are searching for books, remembering certain books and finding those books in the library. The major breakdowns happen mostly while locating a book in the library and finding pertinent books. Sometimes even breakdown happens while deciding on which book to borrow.

The triggers for most of the steps are related to the end of the previous step; for e.g., getting the results of a search on the digital catalog triggers remembering some of the results and then locating the book in the library.

Artifact Model

In our context of library, the four major artifacts that we captured were: the digital catalog kiosk, the book list on paper, the topic signs in the library and the call number stickers on the books. As shown above, the major breakdowns happen while moving from the digital catalog kiosk to the paper book list as well as while trying to make sense of the topic signs as well as call numbers on books. The topic signs are supposed to direct the user to the area where certain kinds of books are present, and call numbers are supposed to help him/her to find an exact book.

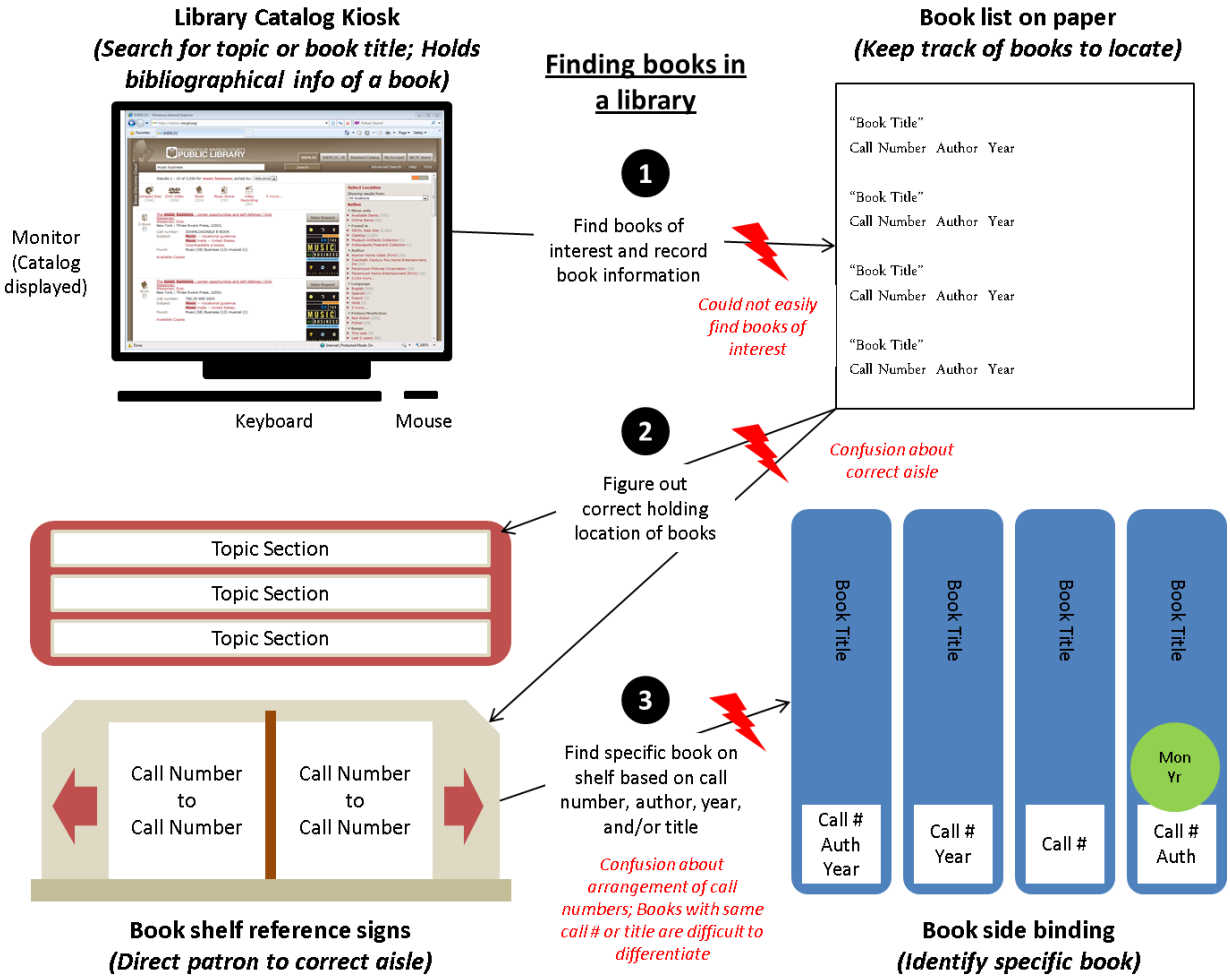


Figure 8: Consolidated Artifact Model

Physical Model

In the physical model, we captured how the user is mainly visiting certain places in the library like the librarian desk, the bookshelves, the catalog station, the personal web browsing station, the direction stand, etc. Irrespective of the relative spatial layout of these places in the library, the breakdowns always happen at the bookshelves and near the direction stand.

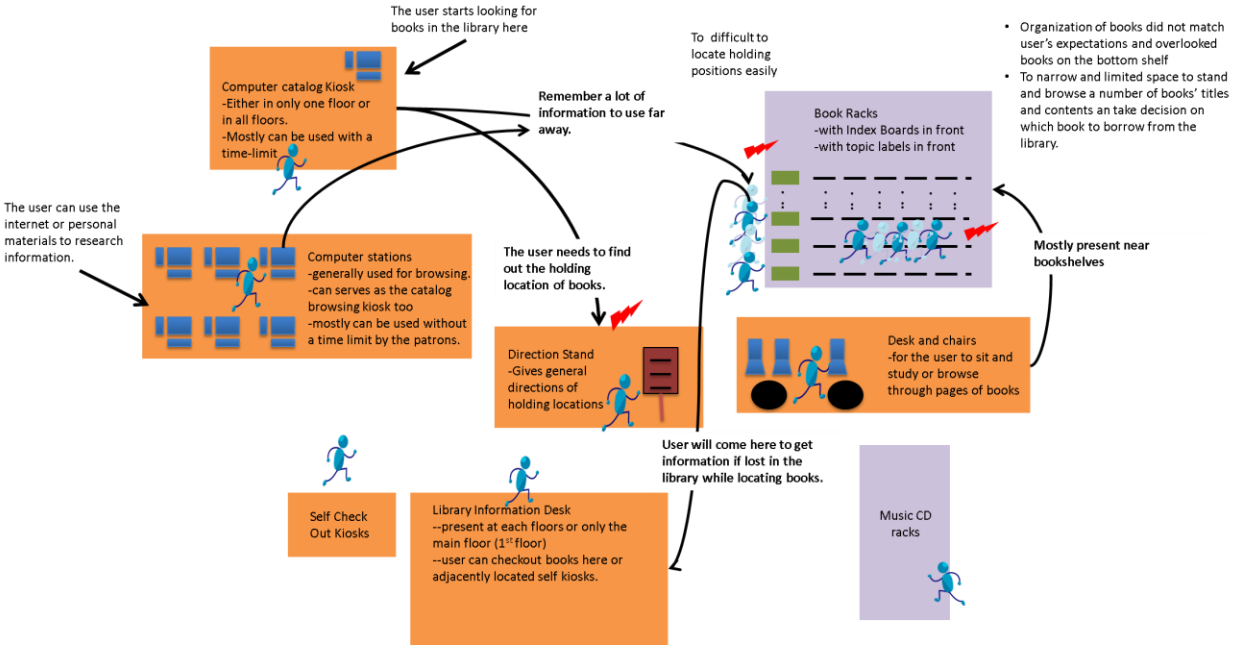


Figure 9: Consolidated Physical Model

Cultural Model

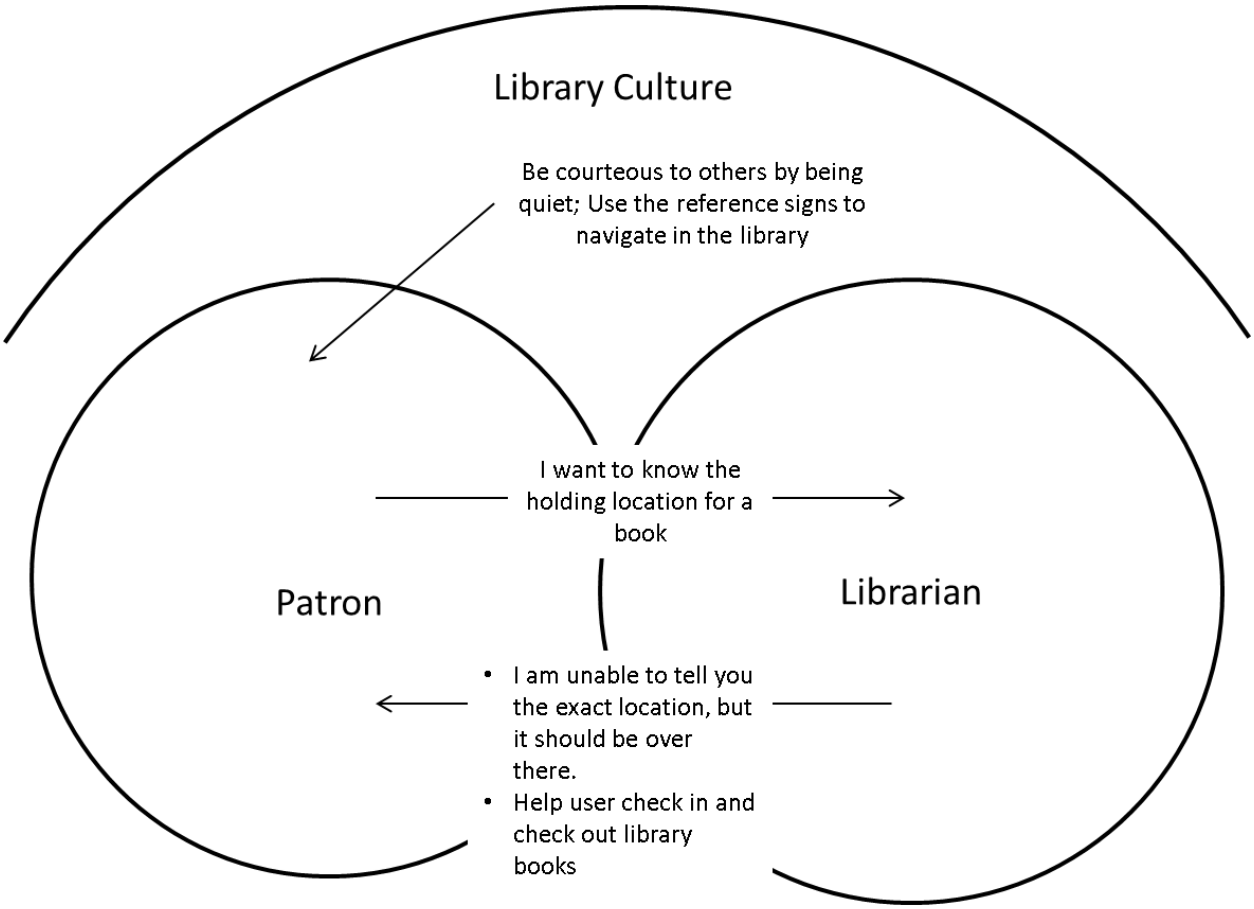


Figure 10: Consolidated Cultural Model

For our context of library, we did not find the cultural model very significant. It captures the official, formal relationship between the librarian and the user as well as the overarching library environment culture of silence, organized and systematic.

Affinity Diagram

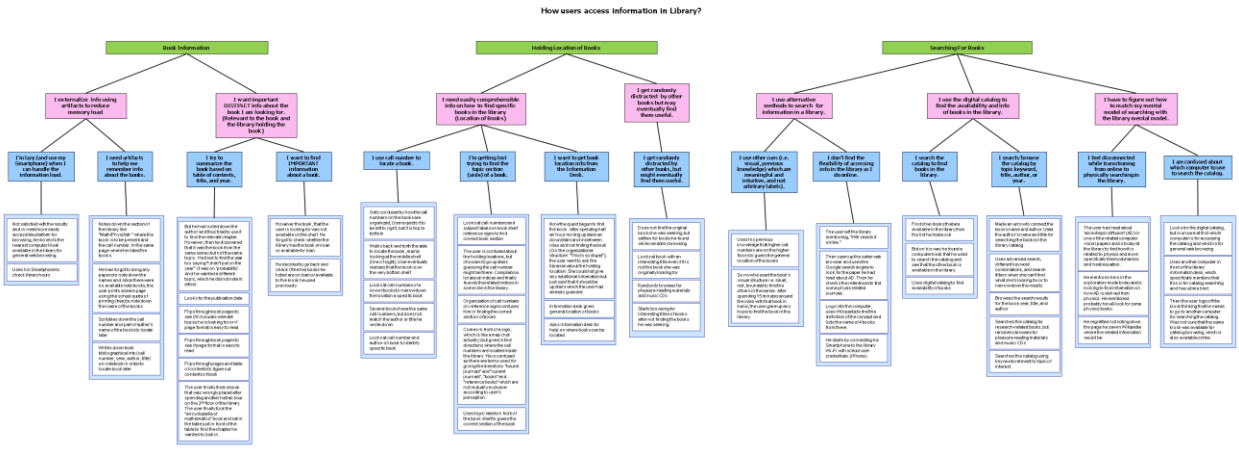


Figure 11: Affinity Diagram

The final affinity diagram includes the following high-level labels:

1. **Book Information**
    a. I externalize info using artifacts to reduce memory load.
        i. I'm lazy (and use my Smartphone) when I can handle the information load.
        ii. I need artifacts to help me remember info about the books.
    b. I want important DISTINCT info about the book I am looking for. (Relevant to the book and the library holding the book)
        i. I try to summarize the book based on table of contents, title, and year.
        ii. I want to find IMPORTANT information about a book.
2. **Holding Location of Books**
    a. I need easily comprehensible info on how to find specific books in the library (Location of Books).
        i. I use call number to locate a book.
        ii. I'm getting lost trying to find the topic section (aisle) of a book.
        iii. I want to get book location info from the Information Desk.
    b. I get randomly distracted by other books but may eventually find them useful.
3. **Searching the Catalog**
    a. I use alternative methods to search for information in a library.
        i. I use other cues (i.e. visual, previous knowledge) which are meaningful, intuitive and not arbitrary labels).
        ii. I don't find the flexibility of accessing info in the library as I do online.
    b. I use the digital catalog to find the availability and info of books in the library.
        i. I search the catalog to find books in the library.
        ii. I search/browse the catalog by topic keyword, title, author, or year.
    c. I have to figure out how to match my mental model of searching with the library mental model.
        i. I feel disconnected while transitioning from online to physically searching in the library.
        ii. I am confused about which computer to use to search the catalog.

Requirements and Goals

Goals

Our aim is to provide a mobile application that provides a seamless transition from searching for books on the catalog to physically locating books in the library. The primary goals of our application are to:

1. Support the catalog search activity
2. Improve the process for creating a personalized book list and finding a book's holding location
3. Enhance the ability for gaining information about a book

User Requirements

- The user must be a comfortable Smartphone user.
- The user must be familiar with Smartphone applications.
- The user must be willing to use earphones to listen to the Smartphone when necessary.
- The user must be using the library to get books on a pre-defined topic and not browsing randomly.

Functional Requirements

- The application will allow users to effectively locate any book in a library.
- The application will not give vague direction to holding location of books but provide an interactive map.
- The application will essentially be deployed as a Smartphone app.
- The application will provide context awareness by letting the user know if any related books are available in his/her vicinity if the user has provided the app with his/her interested topic.
- The application will effectively tailor the library's holding locations according to the user's selection of topic on the day of library visit.
- The application will also allow the user to listen to his/her search results of books according to his search topic.
- The application will allow user to speak out or type in his search topic and use this to fetch the books available in the library holdings.
- The application will also provide brief and relevant information about each book to the user, in which the user can read it or look at it in his/her Smartphone.
- The application will provide also a visual for each book, helping the user to recognize it on his way.
- The application will also have a QR (Quick Response) code reader that the user can use on the books to get all important information about the books on the phone in a gist format.

Usability Requirements

Effectiveness

- The application must provide the user with clear directions to the holding location of a book in the library.
- The application will have a diverse set of functions, so it needs to be well-coordinated, intuitive and easy to use.
- The application must allow users to search the catalog or acquire book information visually and aurally.

Efficiency

- The application must return search results quickly.
- The user must be able to use to the application immediately.

Safety

- The application must keep the library patron's account information confidential.

Learnability

- The application should have meaningful and intuitive navigation, and easily accessible to all services.

Utility

- The application must allow the user to save her/his QR (Quick Response) codes or searches in the app.

Non-functional Requirements

- The application should run on all platforms and allow user to save search results if s/he is logged in to his/her profile.

Negative Requirements

- The application will not provide a real-time map of the library with holding locations but will generate a map at user's request at a certain place in the library and give him/her direction to the holding locations.
- The user will be able to disable all aural features at his/her discretion.

User Profile

Primary Users

- Students, professors, academicians, and other professionals who use a library to get access to information, study, and research
- People who are unfamiliar with or easily get confused with the organization of books in the library
- Motivated people who already know what topic they want to research or specific book they want to find in the library
- Smartphone users

- People who bring earphones to listen to music while they study in the library

Secondary Users

- Librarians helping patrons use the application

Scenario 1: Searching the catalog for books

Claire is a 22-year-old college student who is majoring in History and has to do a research paper on the collapse of the Mayan Empire. She decides to the go to her local public library to find some relevant books. The library is busy when she arrives and many of the catalogs are currently being occupied. She turns on her Smartphone to open the Catalog Reader & Library Pathfinder (CLiP) app, and checks in to automatically detect the current library so she can use the mobile catalog instead.

Using the mobile catalog, she speaks to her phone the keywords "Mayan Civilization" as a general topic and the catalog returns several items. She browses through the results and clicks a button next to a few books to add it to her personalized book list which keeps track of the books she wants to find later on. She eventually added 3 books to her book list that she is interested in locating.

Scenario 2: Locating books in the library

It has been a while since Claire has been to this library and has become unfamiliar with how the books are organized. She reviews the book list she made earlier from searching the catalog and clicks a button next to the first title to locate it in the library. It displays a map of Claire's current location relative to the holding location of the book. The book is on the 3rd floor, so Claire heads to the escalator.

As she is walking, she decides to put on her earphones and listen to the book descriptions on her book list, including its table of contents. She continues to follow the path to the first book until she reaches its holding location. When she finally finds the book, she flips through it to get the gist of the content, look at some of the images, and decides to get it. After finding all the books on her list, she found only 1 book to be useful.

She needs more sources, so she decides to use Hotspots map on CLiP to find where other topic-related materials can be found. Fortunately, she was able to find another book and some related journals that she failed to see while the searching the catalog earlier. In the end, Claire was happy to checkout with 3 books to use for her research project.

Vision and Storyboards

Vision

The consolidated vision for the Catalog Reader & Library Pathfinder (CLiP) includes a central database where all book information and library user accounts are stored. The database can be accessed from an online catalog station in the library or from a user's Smartphone. If a library patron uses an online catalog station, s/he can search the catalog and add books to a personalized book list which can be stored on the user's library account. On the Smartphone, the user can check in to the current library as a

guest to use the mobile version of the catalog and create their book list, or check in with their library account to access a previously saved book list. Both methods will allow access to the library catalog so it is available to the patron at anytime.

Both an online catalog station and the CLiP app will also provide maps indicating the holding location of books in the library. However, the CLiP app will provide more flexibility while the user is on-the-go in the library since initial observations revealed that patrons eventually leave the catalog station to physically find the books. Even though the map will not update in real-time as the patron is moving the library due to current technological limitations, CLiP will allow the user to press a button to update his/her current map view.

CLiP will provide options for patrons who often multitask or don't like to read on a small device to listen to the book information instead. At the press of a button, CLiP can also indicate the location of other topic-related books that were not initially added to the book list. CLiP will even incorporate a Quick Response (QR) code reader so users can acquire book information on-the-fly while s/he is within the book aisles by taking a picture of its QR code.

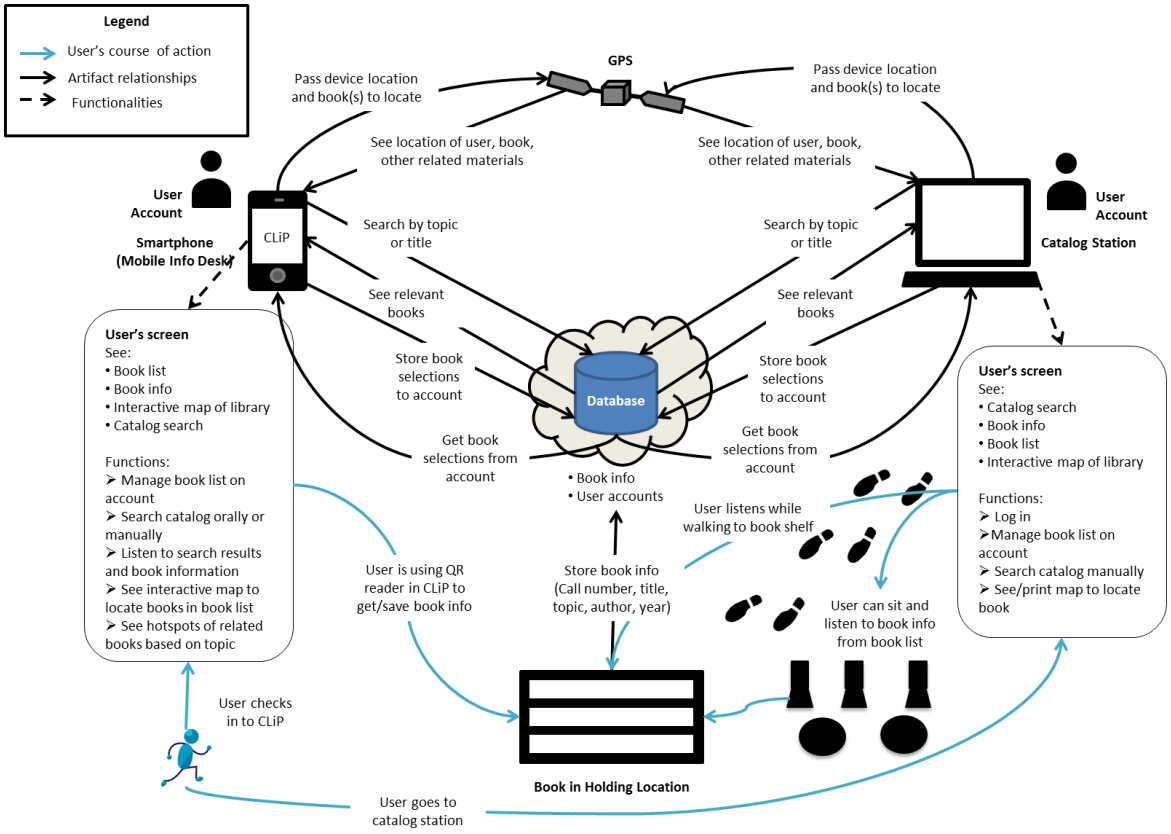


Figure 12: Consolidated Vision

Storyboards

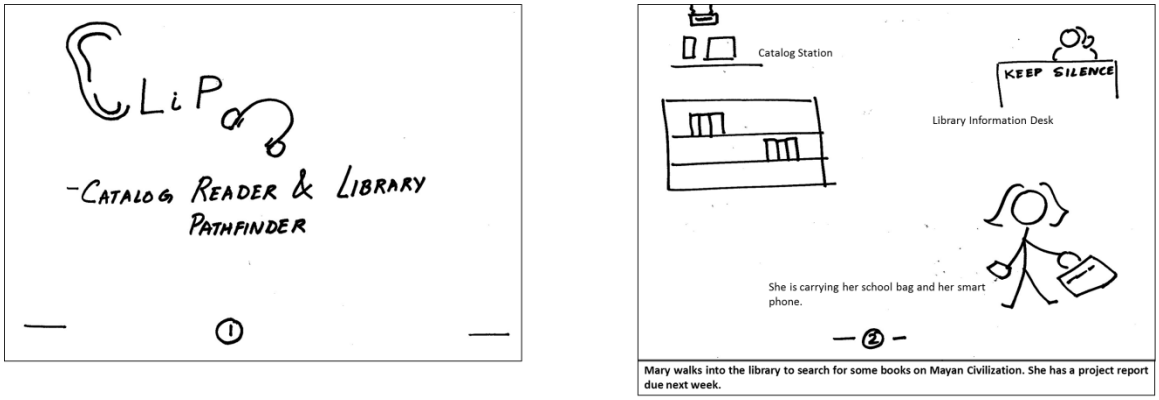


Figure 13: Arriving at the library to do research

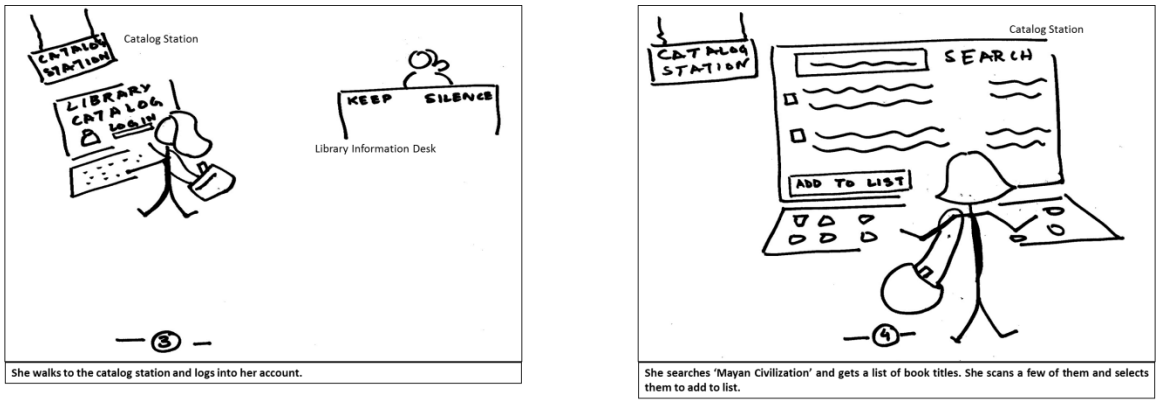


Figure 14: Searching at the catalog and creating a personalized book list

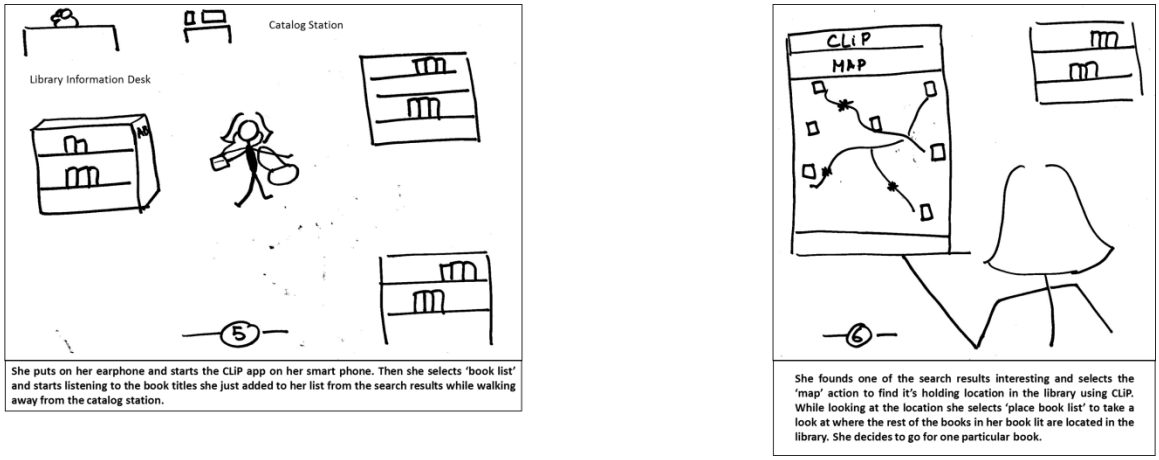
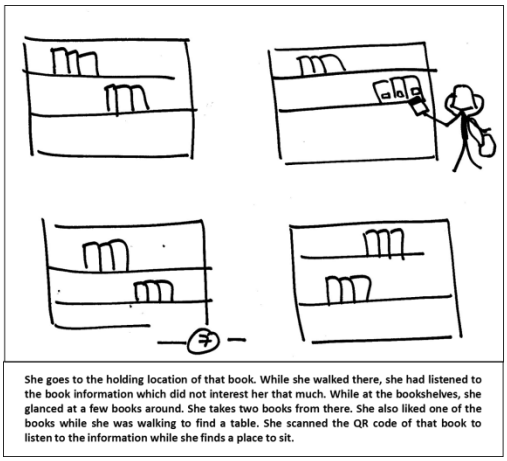


Figure 15: Walking around the library to locate the books



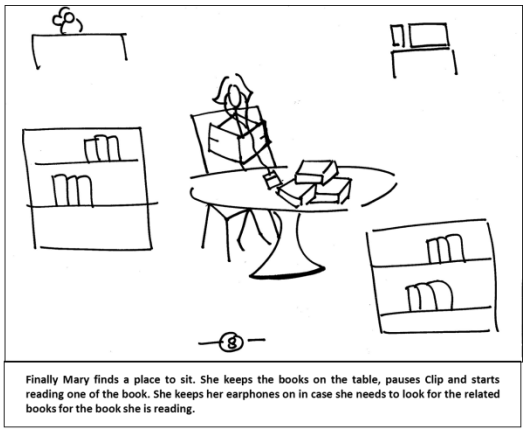


Figure 16: Getting the books and reading through them

Conceptual Design

Metaphors and Analogies

The metaphor for CLiP mobile app is a mobile information desk. It will enable users to search the catalog, get information about a book, and find out where the book and other related materials are located in the library. The user can also listen to the book information or search results on-the-go while walking or sitting in the library.

Concepts, Objects & Operations

The application has two main concepts: searching for a book and locating the book. The task-domain objects created by the user will be **a *search query*** (i.e. the topic for which the user is searching a book in the library). The search query can also be a book title or author by itself. Based on the search query, a ***list of search results*** will be displayed. Each of the items in that list is a ***book***, and each book has a location and a ***brief representative information snippet*** about it. For each book, there is also a ***holding location*** in the library. Our application allows the user to create these objects and manipulate their attributes. The user can create his/her ***book list*** to save certain search results. The operations supported are ***searching***, reading/ listening to search results, ***reading/listening*** to book information, and reading how to locate a book in the library using a ***map*** to get the holding location.

Relationship Between the Concepts

The ***search query*** is the most important object in our concept. It triggers the generation of other objects. The ***list of search results*** contains all the ***book items*****.** The ***book list*** is a user-generated selection of books from the search results. Each ***book item*** contains information about the book, including its ***holding location*****.** The ***map*** contains the ***holding location*** of all books.

Mapping Between the Concepts

CLiP will include four interaction types: instructing (i.e. find the book in the library), conversing (i.e. system asks user what elements of a book the user wants to listen to), manipulating (i.e. selecting books to add to the book list), and exploring (i.e. viewing where other related books are located in the library).

The user can ***search*** the catalog via CLiP app or catalog station and add any books of interest in a ***book list*** under his/her account. While sitting at a table or walking around the library, the user can also ***listen*** to the book details. S/he can use the book list to find directions to the books using an interactive map that indicates the user's current location relative to the location of the books. Additionally, the user can choose to view any related books on the map that s/he did not add to the book list or add a book to the list. The relationships between the concepts will allow the user to better transition from searching for books on the catalog to physically locating books in the library, and also provide an alternative method book details that is important to the user's decision making process.

Conceptual Interactive Dialogue Model (C-IDM)

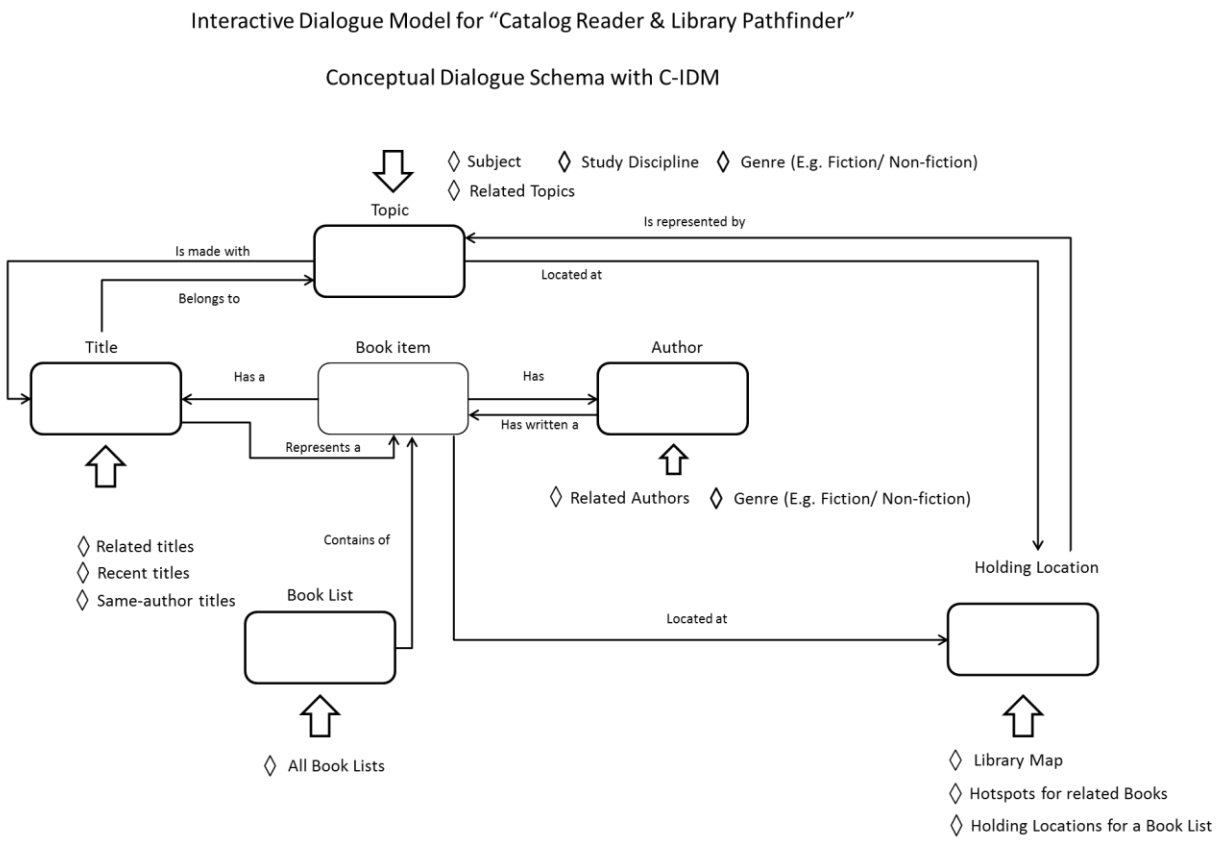


Figure 17: C-IDM

Logical Interactive Dialogue Model (L-IDM)

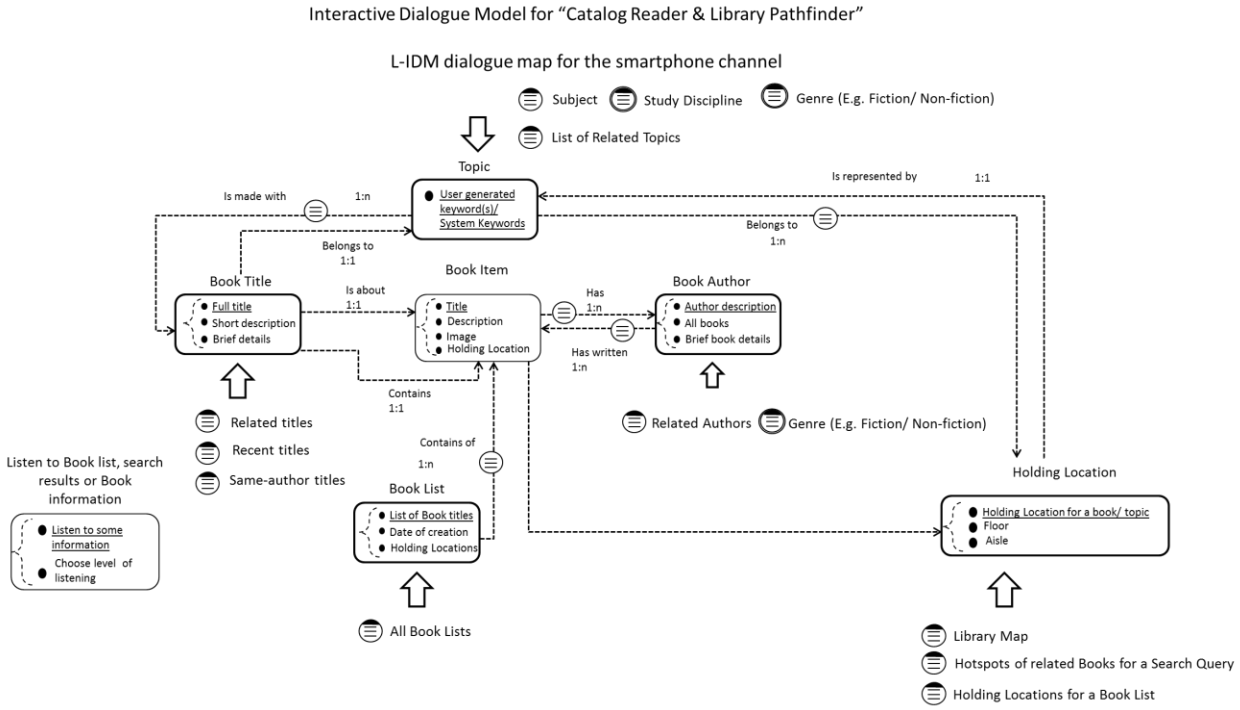


Figure 18: L-IDM

Page Interactive Dialogue Model (P-IDM)

Home	
Page element	**Description**
Content	Logo and main page links
Structural links (if any)	
Transition links (if any)	
Group of topic links	
Orientation info (if any)	
Landmarks	Links: Book List, Catalog, Map, Hotspots, Settings

Figure 19: P-IDM for Home page

Book List	
Page element	**Description**
Content	Book image, title, author, publication year, "Edit/Done" button, "Find/Remove" button
Structural links (if any)	Book item, Map
Transition links (if any)	Book item
Group of topic links	Came from: Catalog, Map, Related Materials
Orientation info (if any)	"Book List" label at top
Landmarks	Links: Home, Add Book, Listen

Figure 20: P-IDM for Book List

Catalog (search by Topic, Title, or Author)	
Page element	**Description**
Content	Search bar, search results (book image, title, author, publication year), Add-to-List checkboxes, "Topic|Title|Author" buttons
Structural links (if any)	Book item
Transition links (if any)	Topic, Title, Author, Book item
Group of topic links	Came from: Book List
Orientation info (if any)	Search bar at top
Landmarks	Links: Home, Book List, Listen

Figure 21: P-IDM for Catalog

Map	
Page element	**Description**
Content	Map if library with indicator of users location, book location, location of related materials, "Refresh" button
Structural links (if any)	
Transition links (if any)	Book item
Group of topic links	Came from: Book List, Book item
Orientation info (if any)	"Map" or "Hotspots Map" label at top
Landmarks	Links: Home, Book List, Hotspots

Figure 22: P-IDM for Interactive Map

Book Item Info	
Page element	**Description**
Content	Book side and front image, title author, publication year, topic & call number (location), availability info, table of contents, other bibliographical information (i.e. number of pages), "Add to Book List" button, "Back" button
Structural links (if any)	Image, Map
Transition links (if any)	Map
Group of topic links	Came from: Catalog, Book List, Related Materials, Map
Orientation info (if any)	Book title at top
Landmarks	Links: Home, Related, Map, Listen

Figure 23: P-IDM for Book Item Information screen

Related Books	
Page element	**Description**
Content	Book image, title, author, publication year, Add-to-List checkboxes
Structural links (if any)	Book item
Transition links (if any)	
Group of topic links	Came from: Book item

Orientation info (if any)	"Related Works" label at top
Landmarks	Links: Book Item, Book List, Listen

Figure 24: P-IDM for Related Books screen

Listening Options	
Page element	**Description**
Content	Radio buttons for listening options, "Done" button
Structural links (if any)	
Transition links (if any)	
Group of topic links	Came from: Book List, Book Item, Catalog
Orientation info (if any)	"Listening Options" label at top
Landmarks	

Figure 25: P-IDM for Listening Options screen

Settings (including Account, Map, Catalog, Book List)	
Page element	**Description**
Content	Application configuration options, "Save Changes" button
Structural links (if any)	
Transition links (if any)	
Group of topic links	
Orientation info (if any)	"Settings" label at top
Landmarks	Links: Home, Account Settings, Map Settings, Catalog Settings

Figure 26: P-IDM for Settings screen

Page Design and Prototype Pages

Low-Fidelity Prototypes

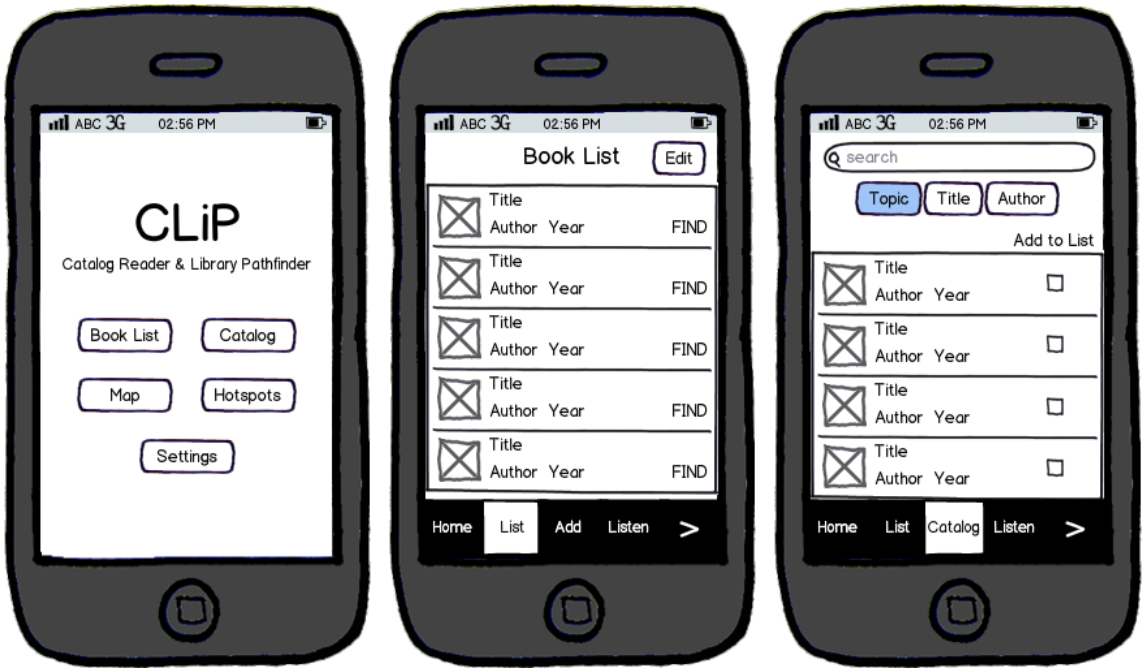


Figure 27: Home, Book List, and Catalog screens

Figure 28: Map, Hotspots Map, and Book Item Information screens

Figure 29: Related Books, Listening Options, and Settings screens

Internal Evaluation

Based on the issues found during the internal evaluations with the low-fidelity prototypes, our group made the following revisions for the interactive prototype:

Book List

- Replace "Add-to-List" checkboxes to buttons that toggle "Add to List / Delete from List".

Catalog

- Move the three buttons above the search box so the user can select a search type before searching

Related Books

- Replace the "Book" button to the "Home" button
- Put a "Back" link at the top

Hotspots

- Add a search bar at the top so users can search for a topic on this map

Book Info

- Replace "Map" button with "Find" button
- If accessed from the map, make this a pop-up page with a "Done" button at the top and without the main navigation at the bottom.
- Reword "Related" button to "Related Books"

Listening features

1. Overlay the audio controls on top of the screen. Users can tap on the screen to display it, and it will fade out after a few of moments.

Additional pages

2. Check In – allows users to click a button to check in so the system can detect their current library

High-Fidelity Prototypes

The interactive prototype can be found at: http://katherinepmanuel.com/clip

User Feedback

The application was evaluated by 3 graduate students (2 male, 1 female) who were asked to explore the application. Afterward, they rated 6 aspects of the application using a 5-point Likert scale.

1=Very bad 2=Bad 3=Neutral 4=Good 5=Very good

	User 1	User 2	User 3
Effectiveness	5	4	4
Efficiency	5	4	5
User Friendliness	5	5	4
Learnability	5	4	4
Memorability	5	5	5
Interface Design	5	5	4

The evaluations were concluded by verbally asking each user 5 open-ended questions. Below are their responses.

1. *Do you think this application will be useful for library patrons? Why?*
   - **User 1:** "Yes. Finding book is difficult. Just to see where the book is in the library with phone in your hand is good. The map feature is good."
   - **User 2:** "Yes. I always write down on paper the books I want and go to the library to find it. This can help me do it electronically and also locate the books in the library easily without writing down the call number. It's difficult to remember call numbers and classification of books."
   - **User 3: "**Yes. People already go in the library with some books and topics in mind. They can locate the books easily."
2. *What are your thoughts on the overall concept of CLiP?*

- **U1:** Likes the map feature, does not think will make much use of the listening feature (but is a good option).
- **U2:** "Locating the book is useful. Hotspot is a useful tool – almost like a recommendation system. There is usually lot of books around where you don't know if they are useful or not."
- **U3:** "This is an add-on to the web-based catalog. This adds in the location awareness dimension, which is a "plus". Listen feature does not seem necessary unless user has a visual disability."

3. *Any more features that you think are relevant to our concept?*
   - **U1:** "A feature for ordering books if not available. Search for other materials (i.e. articles), not just books."
   - **U2:** "Maybe it will be useful to show in the map vacant workstations, quiet desks for reading."
   - **U3:** "Recommendation like Amazon does."
4. *Can you think of any difficulty that you except any user will encounter while using this application?*
   - **U1:** "No."
   - **U2:** "I spent some time to find how to listen to a book. Actually this I think is not very useful if I am already in the library as the table of content is not that useful."
   - **U3:** "The vocabulary is fine. Maybe 'hotspots' is a little ambiguous; made me think that it is where the most popular books can be found or areas where readers can sit."
5. *Would you like to use this application while not in the library?*
   - **U1:** "No, not outside the library."
   - **U2:** "No. I will not use it outside the library if I cannot listen to the entire book."
   - **U3:** "Maybe I will use it when I am out of the library in the wild. I will probably not want to use the audio while in the library. But when I am in the cafeteria or on-the-go I might want to listen to my booklist. The environment has to be in the wild and in the moment."

Overall Summary

- Users found the map, hotspots map, and book list to be a useful tool for library users since it is difficult to locate books in the library and these features help to improve that process.
- Users did not find the Listening feature to be necessary.
- Suggested additional features: Add locations for vacant workstations in the library, book recommendation system, and book ordering options

Future Improvements

Following the user feedback on an overall walkthrough of our concept, we came up with the following enumeration of plausible future improvements. All these directions are within our focus of building an assistive tool for library goers. We did not put much heed to suggestions that would try to replace the existing digital catalog browsing with our application.

1. Allow the map to provide other library-relevant information like the availability of vacant workstations.
2. Use the listening feature to integrate audio books available by the library that users can listen to while on-the-go. Also allow them to listen to a saved book list while multi-tasking in the wild.

Appendix

Please see Appendices document.

References

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