Global Village, Library Anywhere - Mobile Access to Library Resources

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Abstract:

This paper describes the second part of an ongoing mobile library (m-library) project for the National Library of Norway. The purpose is to develop a visual web service prototype that provides mobile access services to the library's growing repository of digital data. Several test databases have seen set up on and a number of Android applications (apps) have been developed for testing purposes. Six approaches have proved promising using mobile technology: 1) image presentation on mobile; 2) library's digital exhibition in the pocket; 3) traditional free text search; 4) location based search; 5) barcode scan for ISBN search / QR encapsulation; and 6) voice/spoken search.

Keywords: *mobile computing, digital curation, cloud technology, QR code, location based search, spoken search*

Introduction

The new electronic interdependence recreates the world in the image of a ***global village****.*
--Marshall McLuhan, "Gutenberg Galaxy", 1962.

The prescience of McLuhan's writings is striking, even though he did not foresee the rise of computers and the Internet. But 50 years later the network has indeed created a framework to sustain a virtual global village. Using cloud technology we are no longer dependent on specific schemata for the library field as such (even though they are still useful), but may share library resources on a global level with generalized protocols and access mechanisms. Access to online textual resources rapidly becomes commonplace.

The National Library of Norway provides premier information resources about Norway and the history and cultural heritage of this country; - collecting, archiving, organizing and distributing

these materials. They date back to the Middle Ages and are based on a variety of physical carriers,- paper for sure but also materials like hide, parchment, paper, glass plates and other "old" formats.

Today, the foremost pillar of the library collection is the Legal Deposit Act. This ensures that virtually everything that is published in Norway can be found in the National Library. The Library is also building the national bibliography, a catalog of all Norwegian literature, which acts as a key to the important parts of these collections.

The National Library of Norway has been in the process of digitizing all its collections in order to erect a Digital National Library. These efforts play a key role in the country's digital library service. The library preserves original digital signals as well: Four national radio/TV channels' data are transferred directly to the library every night. The library's goal is to be a multimedia knowledge center among Europe's modern national libraries. Up to now, more than 50,000 digital books have been made accessible via its website, and about 1000 books are digitized every week in the library.

At the same time providing online access, especially mobile access to these data, is of paramount concern. The number of mobile users is growing at an exponential rate. The mobile device is going to be the primary connection tool to the Internet in the future. We do not know yet how powerful this mobile exponential growth could be, but libraries must take the challenge in serious.

Image Presentation on Mobile

Mobile devices are increasingly used to access and display multimedia data such as digital images, sound recordings and video. Due to some limitations of current mobile devices, such as screen size and resolution, different strategies have been used when we design the screen renditions for our mobile users.

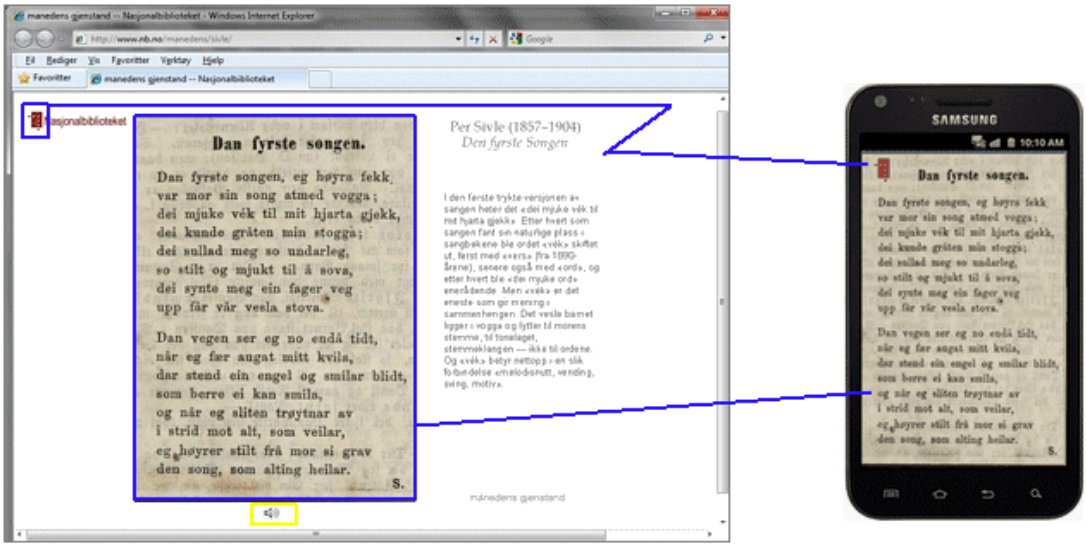


Fig.1

- **Focus on essentials.** Fig.1 shows the relationship between one page rendition on a PC screen and the similar material as presented in the mobile version. The image itself

(grayed out) is a facsimile of a well-known song. This main content of the presentation is kept on the mobile version. The rest of the PC-oriented web page, i.e. the title and explanatory text, has been removed. The latter material is kept, but presented differently on the mobile device, for example, as a voice-over or as text on a separate screen. The logo of the library is moved on top of the image, while the button for playing the song (the yellow square in Fig.1) has been redesigned. See separate bullet point on Buttons below.

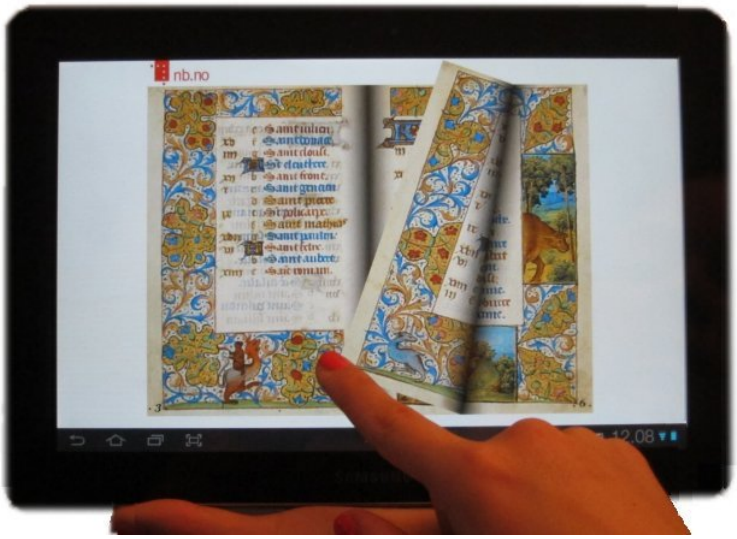


Fig.2

- **Large image**. When large images have to be displayed, the needed system resources sometimes exceed the capabilities of a mobile device. Due to some limitations of current mobile devices, screen size and capabilities, the following modifications have been used on mobile version:
    a. Resize the large image to an acceptable size which is both necessary and suitable for the target mobile screens.
    b. Two steps to display images: Show a smaller sized image first, which is best fit to the mobile screen and that gives an overview of the image. When clicking on this image the original image is displayed.
    c. Using advantages of the mobile devices to view the original large image:
        - Pan to explore different parts of the image by finger swiping.
        - Zoom to get more detailed views of the image by finger pinching.
- **Buttons:** The normal button size for PC mouse pointers is normally unsuitable for mobile touch screens, either because they become too small for fingers to touch or too insensitive and unresponsive to the touch. The solutions may be to design larger buttons for mobile versions or to make a hidden, and larger, responsive touch area ("hidden button") behind the visible button image. In Fig. 1 a hidden button has been placed behind the image. When the user clicks on it the whole image reacts as a button, and will bring on the next step of the presentation and start to play the song at the same time.
- **Sound**: Multimedia presentations with image slide shows are particularly useful for mobile users. In the previous example (Fig 1.) several images from the original collection related to the famous Norwegian song "Dan fyrste songen" have been included. Sound files have been synchronized with the pictures including old newspaper clippings, photographs of the author and the original score.

- **3 dimensions:** One exciting usage domain for the mobile users, especially for the youngsters, is the possibility that mobile technologies opens up for exploration and object manipulation. 3-dimensional objects may be explored by rotation, zoom functions etc. Fig.3a shows an example on a mobile device with a simulated 3D animation of football court for our sports collection.
- **Interactivity and games:** The library has a varied and extensive collection, but the online field is also strongly competitive with many players. It is thus urgent for the library to develop interesting and interactive solutions based on its materials. In this respect, games may appeal to users' curiosity. They can be played anywhere. Let me use a map as a representative example. The library has an extensive collection of maps, including the historically first known map of the Nordic area. It was published in 1482. The map depicts how Europe may have been perceived and how maps were factually drawn in the 15th century. From this material we have created a puzzle (Fig.3b) for both PC and mobile users. The map is shown in vague outline and as 12 separate and moveable jigsaw pieces. When the user has successfully placed all the pieces where they belong above the outline, the game enters the second phase. More detailed information about the original map is then displayed.

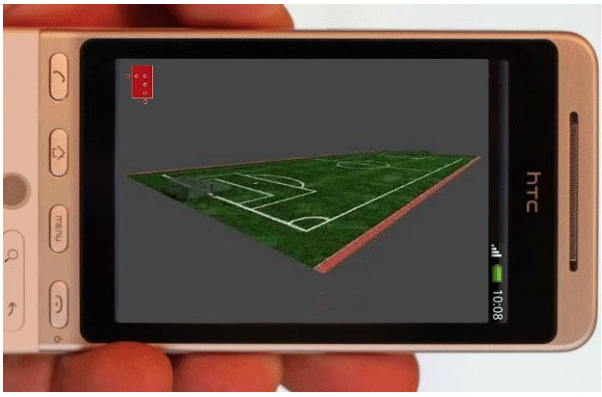


Fig.3a

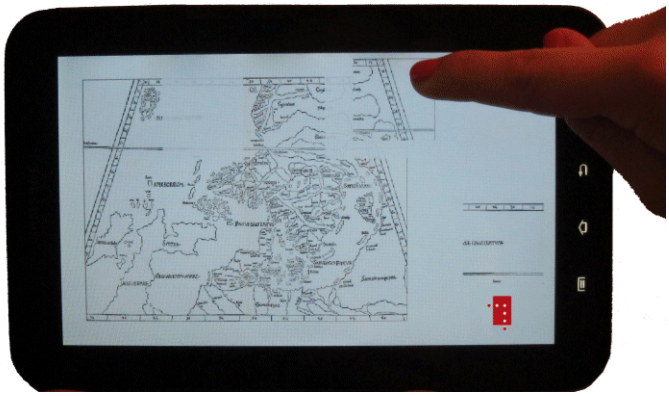


Fig.3b

Library's Digital Exhibition in the pocket

The National Library has an ongoing program for digital and combine physical/digital exhibitions. Within this context a thematic exhibit is organized every three months in the library's exhibition hall. On display are physical artifacts about the chosen topic. In addition some of these materials are represented in digital formats as well as still and moving images (videos, animations) and other presentations for touch screens. (Fig.4a)

Fig.4a

Fig.4b

The challenge here is to make “mini” digital exhibition for pocket devices so that our mobile users may show our exhibitions videos to their friends on their mobile phone and play our digital shows outside the library. How can we transfer digital presentations from the large exhibition touch screens to mobile devices?

Fig.4b presents a mind map structure for the relationship between items in the physical collection, the touch screens in the exhibition hall (see left square in the diagram), PCs and mobile devices. The QR (Quick Response) code in the center of the diagram illustrates a core function. This is used to align or connect between different accessing modalities. Mobile users may access the digital exhibition by scanning the QR code that is placed on the wall of the touch screen box or beside a physical exhibit. Content is immediately conveyed by the wireless network in the exhibition hall and rendered on their mobile phone or e-pads. The m-users can also download exhibition apps on their mobile devices by scanning a similar QR code.

Fig.5a

Fig.5b

The exhibition PCs are integrated in exhibition boxes with touch screen surfaces on the top (Fig.5 a & b). In Fig.5a, a user is scanning the QR code on the touch screen box using her mobile phone. Fig. 5b a user is browsing the image presentation on a pad (10” Galaxy Tab) after scanning the QR code. The

users can also scan the QR code and download the presentations/videos on his/her mobile device and play them later anywhere outside the library.

Mobile Search

To explore mobile search facilities we have made several test databases on the library's server. These may be accessed from prototype Android applications (*apps*). At this stage four different approaches have proved promising:

1. free text search
2. searching by ISBN / barcode scanning
3. location based search
4. voice/spoken search

(A test version is available on YouTube at http://www.youtube.com/watch?v=o3KtUTHmDbc)

The following is a brief walk-through for each of these approaches.

1. Free text search

Free text search *in situ* is equal to traditional computer searches with the benefit of geographical contextualization. The challenge is to develop item descriptors that respond well to probable requests and to implement solutions in new computational environments, - in this case using App Inventor for Android.

Databases are an important component in mobile search and web applications for store and retrieve data. Google provides a build-in database that's already on the Android devices and associated with custom apps. This design allows the app to store and retrieve information via a simple Application Programming Interface (API) with the StoreValue and GetValue functions:

- **StoreValue**: Store data to the database each time the user submits a new value
- **GetValue**: When the app launches, load the data from the database into a variable

Google has created a framework that allows a user-defined app to store data on the web database which runs on Google's App Engine. It is also possible to access other repositories, but this also requires a call-through the Google server. This architecture is somewhat complicated and probably mandated by security and possible commercial concerns.

In our case the design was based on a separate MySQL database on our library's own server park, but with the addition of several PHP scripts that establish communication through the Google intermediary and that are compliant with App Inventor's communication protocols.

2. Searching by ISBN

It is not easy to type on a mobile phone's touch screen and user may easily make typing errors. A great built-in Android function is related to Barcode Scanning. With Quick Response (QR) encapsulation of pertinent information, a physical artifact may be enhanced with digital descriptors or references that are decoded by the mobile device. To exploit this option, we need to build our app so that it activates the Barcode Scanner on the mobile device, transfer the relevant search profile to the database and retrieves the results for display on the portable device.

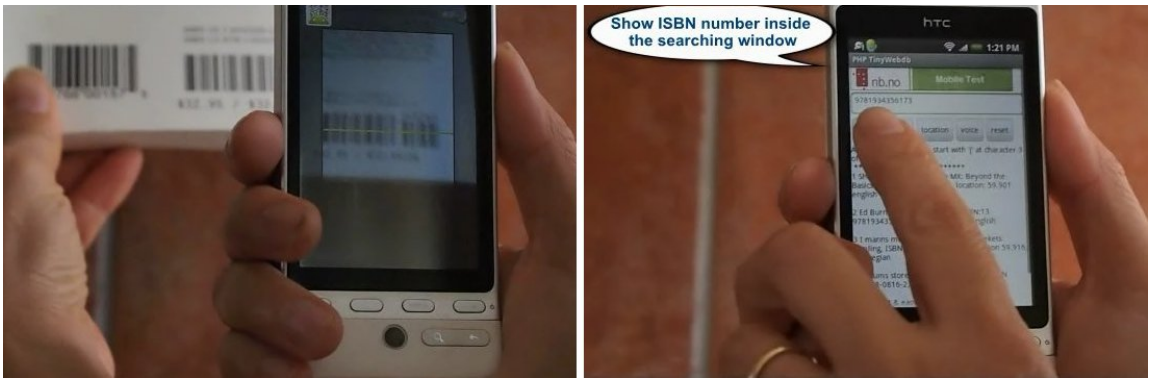


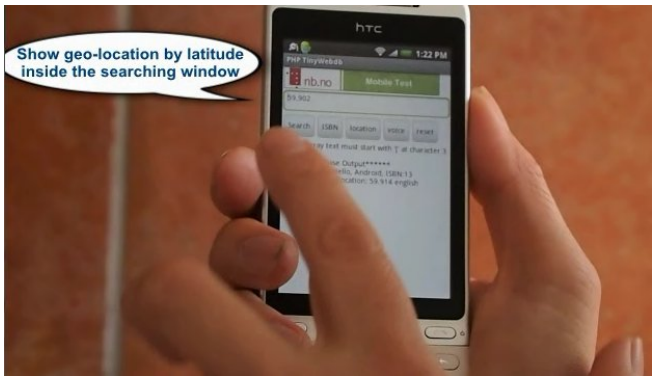
Fig.6

Our Android app has a simple user interface that lets the mobile user enter a book's ISBN number. The program looks up and lists the corresponding title, author, ISBN and publication information from the library's collection.

Additionally, the app can active the Barcode Scanner on Android mobile devices so the users can scan a book's barcode to trigger the search directly without manually typing the ISBN number. (See Fig.6).

3. Location based search

In location search, one may exploit the fact that mobile devices are "geographically aware" and may use geographical coordinates to enhance search and retrieval applications with contextual information.



Google Android software provides a mobile user's exact location information on Google Maps via the Google Latitude application. This information is automatically updated when he/she moves around. Google Latitude is an application that brings location tracking to user's mobile phone even without the General Positioning System (GPS). If a user is travelling with a mobile phone that has Google Latitude installed, his/her friends can track the exact location on Google Maps through a mobile device or any Internet connected computer.

The location sensor in Android allows us to create Android applications that utilize the Android phone's location capabilities. With this function we will find our current location information by latitude and longitude numbers.

This is an advanced feature in Android system that could make it possible to integrate location sensor directly into our own Android applications. The application design steps are as follows:

- determining the location of an Android mobile device using the Location Sensor

- recording the location data in a database directly on the device
- user's exact location information by latitude and longitude numbers will be sent in the searching window in the app's interface
- procedure will search for the location **Fig.7**
  number string in our test databases on our library server and return the result with the matching search string, and then show the result set on mobile screens (Fig.7)
- using the ActivityStarter to open Google Maps from our app and show the current location

When a mobile user click on the "location" button in our search app interface the user's exact latitude and longitude parameters appear in the search window via our search application (Fig.8). The result, together with the users search string from our database, is shown on the mobile screen. This facility will enable mobile users to search dynamically for library's collection in the nearby area where he/she currently located.

4. Voice/Spoken search

More and more users use their mobile devices to stay in touch with their friends, families and coworkers wherever they are. They are not only talking over the phone, but also use messaging, emailing, chatting, photo sharing and blogging systems. This habit of talking to the phone may enhanced by voice/spoken input for other purposes as well. Dictation of commands and search profiles etc. liberates the user from dexterity constraints. Voice/spoken input also allows us to make our applications more interactive and fun.

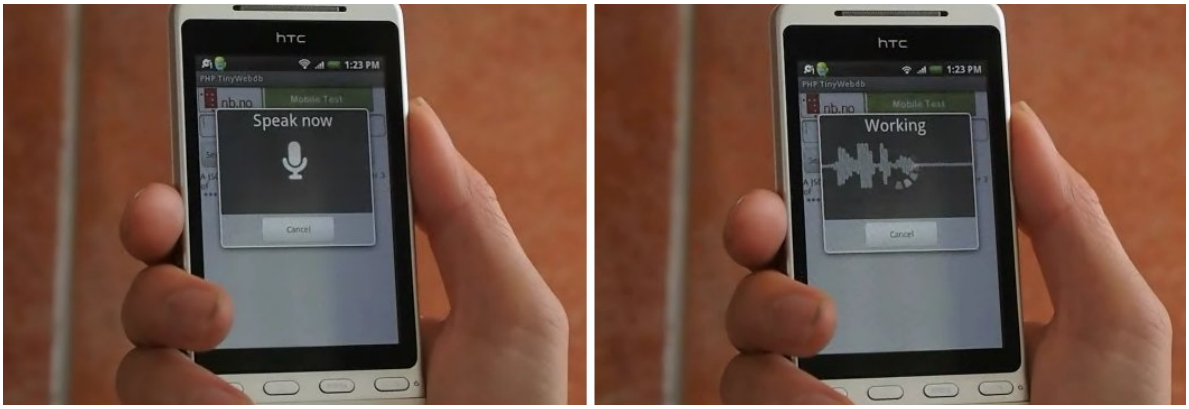


Fig.8

We can use the Text to Speech component in Android to convert voice/spoken input into text strings. The Voice Recognition component allows users to speak to their mobile phone. The sound bite is converted into a text, and that text will be used in the program to retrieve items from a repository.

Google's Voice Search application could respond to a recognizer-intent by displaying the "Speak now" dialog and streaming audio over WiFi 3G 4G networks to Google's servers. As Android developers, librarians may integrate voice/spoken capabilities into their Android applications. The Android SDK makes it possible to integrate users' speech-input directly into our own application.

The application uses the startActivityForResult() function to broadcast an intent that requests voice recognition, including an extra parameter that specifies the language model. The voice recognition application that handles the intent processes voice input and sends the recognized string back to the

application (Fig.8). Then a PHP Scripts is called which activates a stored procedure that will search for that string in the test databases. This test application then retrieves and returns the relevant values from the database as a list of the objects that contain the searching string. The result is shown on the users' mobile screens. Mobile users will benefit from having this facility on mobile:

- Freed from typing on limited screen size
- Voice- to- text input in database for commenting, blogging and so on
- Live recording to store text inputting for important information

Library in the Cloud

In the location based search and voice/spoken search we exploit the possibilities inherent in cloud computing. Cloud technology is a set of equipment designed specifically for storage or transmissions of a variety of data. All devices are synchronized with up to date content at any time. Cloud technology allows users to store their work files on cloud servers, which can then be edited from any computer with an Internet connection. Innovation changes technology and technology changes the mode of service. Cloud technology is currently changing the way we read, store and transfer data, including the modes of interaction with library services. Cloud technology is a revolutionary initiative that will bring disruptive changes to the library.

There are actually many such services available like music streaming and online photo/document sharing. As one example the spoken search mentioned above is based on the Google's speech recognition system, which is stored on Google's cloud server. In general cloud technology is more suitable for mobile devices since it is wireless and thus ubiquitous; and because portable devices are limited in terms of storage and processing capacity. Cloud technology has changed the mobile phone, from communications equipment into a handheld device connected to the network.

There are several different platforms on both desktop and mobile and they compete ferociously for users' attention. Users may carry more than one device which runs different operating systems. The perfect synchronization scenario is that a user's devices know what he or she has been doing on the others and recreate the same context on any device. This is currently being done by reading titles from Amazon where one can stop reading on one page on one device and the book is opened on the same page on all the others.

Such functionality is also a challenge for the library field.

By using cloud technology, libraries and especially the smaller ones no longer need to configure complex computer system and other infrastructure for themselves. They can get rid of software maintenance as well as equipment and technical constraints and focus more on library services and innovation.

Now network has become a virtual global village. Library resources may be distributed in the cloud, with global mobile access, to really achieve a global library network. Using cloud technology, sharing library resources global--a simultaneous happening is becoming true. The basic usage of “cloud" is to store and share. Data stored in the cloud server, anybody free to use on any kinds of devices at anytime, anywhere. This is exactly consistent with digital libraries' vision.

Selected references

- McLuhan, Marshall*: The Gutenberg Galaxy: The Making of Typographic Man, University of Toronto Press 2011*
- Google Inc.: *Android Developers. The Official Website at http://developer.android.com/*
- Mednieks, Zigurd; Dornin, Laird etc.: *Programming Android 2011*
- Steele, James & To, Nelson: *The Android Developer's Cookbook 2010*
- Rogers, Rick; Lombardo,John, etc: *Android Application Development: Programming with the Google SDK 2011*
- Rosenberg, Jothy & Mateos,Arthur*: The Cloud at Your Service 2011*
- Gurley, Bill: *Why Dropbox Is A Major Disruption 2012*