

# Hybrary - Ambient Environments for Hybrid Libraries

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**Abstract:** The library of the future is required to be in the forefront of technology usage in order to survive the age of the cyberspace with the emerging digital libraries, which is promising every possible information at anytime from anywhere at your fingertips. By extending the physical library with ubiquitous computing technology as a gateway to the digital library world and using unified user interfaces in ambient environments, the gap between atoms and bits could be closed. This paper reports about some hybrary projects at the McLuhan Documentation Center in Luebeck.

## 1 Introduction

The gap between reality (atoms) and virtuality (bits) is perfectly reflected in the ongoing discussion about the advantages and limitations of digitalization of media assets. Since humans have no body in cyber space, but are rather organic organisms in the real world, they have intrinsic difficulties for accessing digital media items. The haptic experience of browsing printed documents is hard to transform into digital user interfaces. Physical books provide an almost perfect user interface, but the information is static. Non-tangible media assets support endless new possibilities for processing of dynamic content, but can't be touched and experienced with the human body and its senses. Human librarians can't perform a full-text search on the whole cyberspace during a discussion with a patron, but avatar librarians suffer from limited capacity in artificial intelligence and natural style of face-to-face interaction.

We believe that the future library should comprise at the same time a physical space and an interface to the virtual world. They should still be in buildings and maintain information collection on physical data carrier (printed or electronic), but also be high-tech centers with advanced possibilities for browsing virtual and digital information worldwide. The *hybrary* as the hybrid library of the future should be a *ThinkTank* and exploration center for information querying, using newest available technology in the most suitable form, thus placing the customer into the center of the modern knowledge society.

## 2 Hybrary Research at the ISNM

The library projects described in the following are part of a larger research initiative for ubiquitous computing at the ISNM. The concepts and prototypes have been mostly realized as student work in courses and master theses within our Master of Science in Digital Media program. The McLuhan Documentation Center is the scientific library of the ISNM and a test environment for newest library technologies.<sup>1</sup> In several projects we analyze special aspects of libraries and develop research prototypes in co-operation with leading library equipment providers.

The McLuhan library was one of the first scientific libraries in north Germany to be equipped with RFID self-booking stations already in 2004. Every media item in McLuhan is equipped with an RFID label and every student at the ISNM is equipped with a PDA with embedded RFID reader cards. Also, the patron cards are based on RFID and allow for 24/7 access with fully automatic doors and security gates. This technical infrastructure, combined with the interdisciplinary education and research at the ISNM, including courses like, e.g. *Digital Libraries*, *Human Computer Interaction* and *Ubiquitous Computing*, enabled the development of new intelligent library services.

### 2.1 Tangible Interfaces

Tangible Interfaces (TUIs) developed by Hiroshi Ishii at the MIT MediaLab [IU97] follow the concept of interfaces that need physical interaction for operation and also can generate physical stimuli responses as data output. Books and other tangible media items can already be considered to be a tangible interface, but need digital processing in order to become a library TUI.



Figure 1: Tangible Archive

The *Tangible Archive* project therefore explores the idea of using conventional tangible media items (e.g. books, CDs, etc.) as placeholders for digital content. Items are equipped with RFID labels and a *Smart Desk* with a hidden RFID reader. Users can pick the objects from a shelf and place them on the desk in order to trigger the presentation of the respective digital data in terms of an arbitrary designed multimedia presentation.

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<sup>1</sup> <http://www.isnm.de/mcluhan/>

The system supports any web page and the embedded browser is querying a URL based on the RFID number in the item's label. Instead of remembering the URL or browsing a conventional digital database, the patrons can directly remember a physical placeholder and interact with physical and digital elements using the same metaphor. A typical use case is the *AV Preview Station*, where (empty) DVD cases can be used to trigger the presentation of the respective video. The station has a convenient reader device placed next to a plasma screen (see fig. 1). Placing the video starts a video stream over WLAN. Since the reader can also detect the patron ID, the respective language track can be chosen automatically. Customer PDAs can be used as remote controls.

## 2.2 Mobile Services

Especially in large libraries, searching for or getting information about specific media items often requires the customer to move large distances over potentially several floors to access information terminals or ask for help at the librarian info counter. Instead of letting the patron to move, the information should rather be transported to the patrons. The same argument holds for typical librarian tasks, such as inventory, book weeding or patron information services.

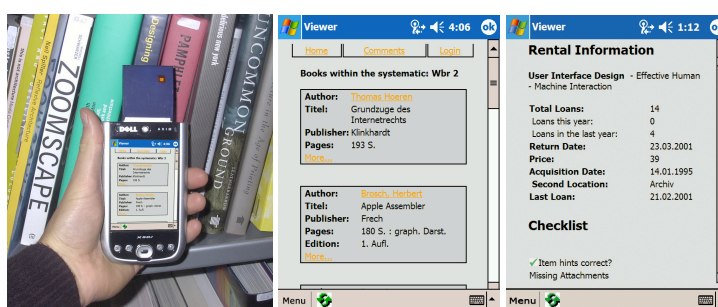


Figure 2: Mobile Services directly at the shelves

One possible way is to use mobile devices with wireless Internet access and RFID scanners. This allows for identifying objects within the physical space and thus to perform relevant tasks using respective queries on connected back-end servers. A number of systems<sup>2</sup> have been developed at libraries already, like the electronic document reader at the Open University in London [WK03], the *AirPAC* OPAC designed for PDAs<sup>3</sup> or the *Sm@rtLibrary* from GMD in Darmstadt and Technical University of Zurich [MH01].

<sup>2</sup> <http://web.simmons.edu/~fox/pda/>

<sup>3</sup> <http://www.iii.com/mill/webopac.shtml#airpac>

At the ISNM, an analysis of shelf-related business processes has been performed by investigating typical librarian tasks at public and scientific libraries in Luebeck [B05]. As a result, a novel PDA-based mobile service has been created, allowing information querying, web service activation, commenting and rating, as well as a novel *incremental inventory* directly at the shelves. The application was tested on a DELL PDA<sup>4</sup> with a large screen resolution and an attached RFID reader<sup>5</sup> (see fig. 2). Alternatively, a barcode reader can be used as well. Communication between the server and the client is realized using PHP, SOAP and different library databases. Also, smart mobile phones of customers could be supported as well. We are currently working on a reverse AJAX system for mobile phones based on automatic refreshing of web pages based on context triggers.

The patron information application supports general book information, searching for books of the same author, within the same systematic class or with keywords, and viewing Amazon.com<sup>TM</sup> comments and other book information.

## 2.3 Smart Library Tables

The *Interactive Library Table* at the McLuhan Center is equipped with a grid of 24 RFID readers mounted below the surface and a camera positioned on the ceiling above the table. For the user, the table looks like any other regular library table without any visible technology. If a media item is placed on top of the table, the nearest reader recognizes the ID and the location. If a book is opened, the camera recognizes the turning pages and can identify the current page number by using OCR [BS06].

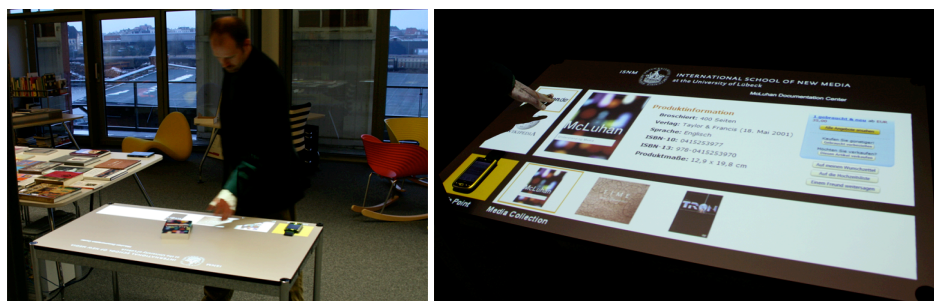


Figure 3: The Interactive Library Table

Patrons of the scientific library could use the system as a convenient interface for digital books. A ceiling mounted projector beams augmented graphics (e.g. the e-Book version in another language) on the table surface and could support virtual personal annotations.

<sup>4</sup> <http://www.dell.com/>.

<sup>5</sup> <http://www.acg.de/>



For the preparation of scientific reports, images and statements could easily be extracted from the book by pointing with the finger at the respective electronic part. The system could then automatically create the right reference entry and captions, thereby avoiding tedious tasks and plagiarism. Currently we support calling appropriate web services, like showing the respective Amazon page of a book, searching Wikipedia for author information, or browsing Internet movie databases for information about the movie.

## 2.1 Avatar Librarian

Latest since the 1992 novel *Snow Crash* by Science-Fiction author Neil Stephenson [18], who introduced the first librarian Avatar, the idea of supporting or sometimes even replacing librarians with an artificial person in the virtual world has been coined. A nice example was presented in the Hollywood movie *Artificial Intelligence*<sup>6</sup>. The promise of an artificial intelligent agent able to query digital libraries around the world on user request and communicating using speech and gesture interfaces is challenging, but offers remarkable possibilities for the remote and local services in modern libraries.

Avatars could be customized, fully aware of the user preferences and could play audio-visual media items, contact virtual colleagues in remote libraries, explain library usage to the patrons, etc.

At the ISNM, we have developed *Neva*, as a prototype embodied conversational agent for the McLuhan Documentation Center Library [AJ07]. *Neva* supports multi-model virtual characters with verbal and non-verbal communication features, detects customers via RFID and guides through all aspects of the library usage. It informs about new arrivals, offers recommendations and can make reservations.



Figure 4: NEVA – The Virtual Avatar Librarian

*Neva* is currently implemented on a dedicated kiosk system with touch screen interface. In order to improve the ambient environment, it could be further develop to virtually jump from the kiosk to the display of the user's PDA and to guide the user to the shelves.

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<sup>6</sup> <http://aimovie.warnerbros.com/>

### 3 Conclusions and Outlook

As long as human beings are still physical entities and not replaced by virtual and artificial intelligence creatures, there will be a need to physically meet and experience joint information processes. The hybrid library projects at the McLuhan Documentation Center aimed at exploring possibilities of ambient intelligent environments for enhanced library services. Currently, we are working on extensions of the smart library table and a tangible database system for children in public libraries [D08]. All projects are part of a larger ubiquitous computing initiative. By developing OCEAN as a novel ubiquitous platform [CS06] for the development of enhanced library services supporting context awareness, automatic user identification, ambient intelligence and novel multimedia interfaces, we aim at bridging the gap between reality and cyberspace and allowing a harmonized access to scientific knowledge.

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