Getting Smarter: Definition, Scope, and Implications of Smart Libraries

Tara Zimmerman
University of North Texas
taradz37@gmail.com

Hsia-Ching Chang
University of North Texas
hsia-ching.chang@unt.edu

ABSTRACT

Two-dimensional The term "smart library" was coined by Aittola, Ryhanen, and Ojala in 2003, and librarians have been striving to implement smart libraries in different ways ever since. However, in the 15 years that have passed, no definitive explanation of a smart library has emerged, and it seems unclear what technologies or services truly make a library "smart." In a world of smartphones, smartwatches, and even smart homes, innovative librarians want to move toward creating next generation smart libraries, but how? Because the majority of studies relevant to smart libraries take a qualitative approach, a meta-synthesis of existing qualitative research on smart libraries has been conducted and analyzed. Three time-periods have been identified to demonstrate the transition of technology changing to meet users' needs.

KEYWORDS

Smart library; RFID; Internet of things; future libraries

ACM Reference format:
Tara Zimmerman and Hsia-Ching Chang. 2018. Getting Smarter: Definition, Scope, and Implications of Smart Libraries. In Proceedings of The 18th ACM/IEEE Joint Conference on Digital Libraries, Fort Worth, TX, USA, June 3–7, 2018 (JCDL'18), 2 pages. https://doi.org/10.1145/3197026.3203906

1 INTRODUCTION

The term "smart library" first appeared in the academic publication in 2003 [1]. To date, research on smart libraries has consisted mainly of case studies of particular libraries and innovative "smart" services they offer, ranging from library automation systems to use of artificial intelligence to full integration with a smart campus or city. While these studies have been illuminating, a key baseline of information is still missing. Librarians need a clear definition of what a smart library is, including the range of ways it can be implemented, in order to begin contemplating setting up or converting their own smart library. With that goal in mind, this study will examine what features make up a smart library and what technologies undergird it. The research questions are 1) What is the definition or the scope of a smart library?, and 2) How is a smart library implemented by using different technologies? This research will benefit the library and information science fields by synthesizing existing research and summarizing the overall findings.

JCDL '18, June 3–7, 2018, Fort Worth, TX, USA

ACM ISBN 978-1-4503-5178-2/18/06.
https://doi.org/10.1145/3197026.3203906

2 RESEARCH METHODOLOGY

We chose to use a meta-synthesis of relevant literature for this study. The essence of meta-synthesis is to gather existing qualitative research about smart libraries, analyze it, and summarize the findings to benefit understanding and future research [2]. The first step was to search the Academic Search Complete, EBSCOhost, Web of Knowledge, ProQuest, and ScienceDirect databases using the terms "smart library," "mobile services," "digital library," and "internet of things". In addition, Publish or Perish software tool (version 6.21.6145) was utilized to search recent publications through Google Scholar. A total of 40 articles were located and analyzed. (A list of articles used can be found at: https://goo.gl/N9Uhku.) Finding representative articles was much more difficult than anticipated, which reinforced the idea that the smart library has not been well-defined in academic literature. The definition and scope of the term "smart library" were gleaned from each article. In addition, specific uses of technology within the smart library were noted. Text analysis was applied to this information, revealing trends through the frequency of terms used. Each article was reviewed in-depth by two researchers, and its research question, methodology, and findings organized and further analyzed to identify patterns. All this information was compiled in a table to sum up the current state of research on smart libraries and to serve as a roadmap for future researchers.

3 SYNTHESIS RESULTS

Through analysis, it became clear that the evolution of understanding smart libraries over time was key. Reviewing articles chronologically as they were published highlights the change in emphasis from books to information services and eventually to knowledge infrastructure. The following three time periods have been identified to show the progression of technology changing to meet users' needs.

3.1 Library Automation (2001~2011)

Of the 40 articles reviewed, six (15%) were published between 2001 and 2011. A text analysis of the titles, definition/scope of smart library, and technology was conducted, and the word "books"

appeared with more than double the frequency of any other term. For example, in 2008, Kwok, et al. [3] wrote about the large amount of human effort and time required to perform inventory management in a library, stating that RFID technologies could help to enhance library operations, "especially in book check-in, check-out, and stock checking processes." This reflects the old library paradigm. The smart libraries of this time period began automating library systems for inventory control, borrowing, returns, renewal, and tracking of library resources.

3.2 User-Centered Services (2012~2014)

Sixteen articles (40%) were published between 2012 and 2014, and the same text analysis was utilized on information from those articles. The word "service(s)" dominated, displacing "books" from first place. This is representative of a secondary phase of development of the smart library concept, the user-oriented phase. An example of this was provided by Brian, et al. [4] in 2014 when they introduced a service to patrons in which a local positioning system and embedded tags on books linked to the user's smartphone so that he/she can check in real time whether a book is available and be directed to its exact placement on a shelf. Expanding beyond automated library services, exemplary smart libraries from this era were integrating mobile apps and smartphone usage into their system, using text and email features to communicate with users, and posting videos to help remote users access their various services.

3.3 Knowledge Infrastructure (2015~2017)

Publications on the topic continued to grow, and from 2015 to present, there were 18 articles published (45%). Text analysis reveals that "information" and "knowledge" are both seen more frequently than "service(s)", while "book(s)" was much less important. This moves away from physical books and services and toward more intangible goals such as knowledge and information, which indicates a key change in what the term smart library has come to mean. For example, Jerkov, et al. [5] considered a smart library as a "knowledge broker" locating qualified sources of critical knowledge to solve specific problems. Beyond library space and place, this is the knowledge infrastructure connecting smart libraries to smart cities. A real-world example is the Stark County District Library where users can check out smart devices (e.g., radon detector, air quality monitor and electricity monitor) to experience smart home capability. Those smart home devices serve critical components of smart cities for home safety and monitoring energy consumption.

4 Discussion

A factor essential to the changing definition of smart libraries is technology, which has advanced exponentially since the first smart library articles were published. These early articles referenced artificial intelligence and basic RFID as important to facilitating smart libraries, but this understanding grew to include a broader application of RFID, which is now the standard framework for most Smart Libraries. Taking recommendations from each article and synthesizing them reveals an overall outlook for the future of smart libraries. One of the strongest overall recommendations is libraries continue developing mobile apps and websites services. Increasing engagement with users online is a major step toward building a successful smart library, and it is critical to offer patrons quick and easy remote access. A second overall recommendation is that smart librarians are a key priority in implementing a smart library. Skilled and competent staff are crucial to create a dynamic smart environment. Researchers also recommendation is to offer next generation digital features and access, using Web 2.0 and social networking services to encourage patrons to produce new knowledge.

5 CONCLUSIONS

Libraries are experiencing a need to transition resources and services to include more technology, while also honoring their primary focus of meeting user needs. This exploratory study is an examination of smart libraries, specifically how they are being defined and framed in academic literature. A meta-synthesis was chosen as the best methodology to review the articles and revealed a progression of understanding of smart libraries in articles published from 2001 through today. Over time, more libraries extended services to users by applying new technologies in innovative ways, expanding the definition of the smart library. What began as just library automation grew to include more information services and ultimately knowledge infrastructure. The corresponding growth of RFID technology to become the standard smart library framework can be seen over this time period as well. Next steps of this study are to continue seeking more articles focused on smart libraries and evidence-based library practices in realizing the concept of smart libraries in order to broaden and enrich the data and to learn more about both the benefits and risks of Smart Libraries to their communities.

REFERENCES

[1] M. Aittola, T. Ryhänen, T. Ojala. 2003. Smart Library: location-aware mobile library service. Lecture Notes in Computer Science 2795: 411-416.

[2] C. Urquhart. 2010. Systematic reviewing, meta-analysis and meta-synthesis for evidence-based library and information science. Information Research, 15(3) colis708.

[3] S.K. Kwok, C.F. Cheung, W.B. Lee, A.H.C Tsang & M.C. Tang, (2008). Development of an RFID-enabled mobile smart library system. *International Journal of Enterprise Network Management, 2*(2).

[4] A.L.A. Brian, L. Arockiam, & P.D.S.K Malarchelvi. (2014). An IoT based secured smart library system with NFC based book tracking. *International Journal of Emerging Technology in Computer Science & Electronics 11*(5), 18-21.

[5] Aleksandar Jerkov, Adam Sofronijevic, Dejana Kavaja Stanisic. 2015. Smart and sustainable library: Information literacy hub of a new city. In: Kurbanoglu S., Boustany J., Špiranec S., Grassian E., Mizrachi D., Roy L. (Eds) Information Literacy: Moving Toward Sustainability, Springer.