

Cloud-based Library Management and Book Tracking through the Internet of Things

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Abstract

The cognitive content of this research article is to create a library management system that will eliminate the need for registers and other time-consuming manual methods of tracking inventory and processing payments. Students often fail to make use of the library's seating resources because they are unaware of their availability. Students may use this system to inquire about book availability, locate a seat in the library, and see detailed information about any book in the library's collection. Library management systems that use barcodes or radio frequency identification have been used before with some success, but they have drawbacks. In order to ensure the smooth, efficient, and theft-free functioning of libraries, the suggested technique makes use of cloud-based IoT technology. With this setup, the user may read a full book's worth of content without having to carry around their laptop or desktop computer; they only need their smartphone and a portable reader. Using IoT, library data may be accessed from the comfort of home. This "Smart Library System" is designed to streamline the process of locating and checking out books through the Internet.

Keywords: Smart library management system, IoT, Cloud based, RFID, optimization

1. Introduction

The course on Library Management System (LMS) is based on a project that provides comprehensive details about the library. New books may be added to the catalogue, and information about existing books can be retrieved. LMS has the ability to give books to students and keep track of their borrowing history, as well as access information on the library's publication and stock levels. This setup allows to charge a fee from pupils who don't

return their assigned reading material by the due date. It also provides a daily summary of library admissions and use IoT to control library seating on this system [1-5]. The books are shelved according to the topic in the library. Since there is a lot of traffic going in and out of the library, it is possible that some of these volumes may go missing. When books are misplaced, it becomes a monumental task for both the librarian and the reader to track them down [6]. Finding the frame in large libraries is never easy, even with the barcode that specifies the rack and the access number of the volumes. If the books go missing, the situation worsens. Therefore, it would be extremely helpful and time-efficient if there was a system that could take the user immediately to where the book is located, and to track down the lost books. With the widespread availability of smartphones and internet access, it is a practical notion to create a "connected library system" that allows patrons to use their mobile devices to access the library's resources and locate books using GPS [7-9].

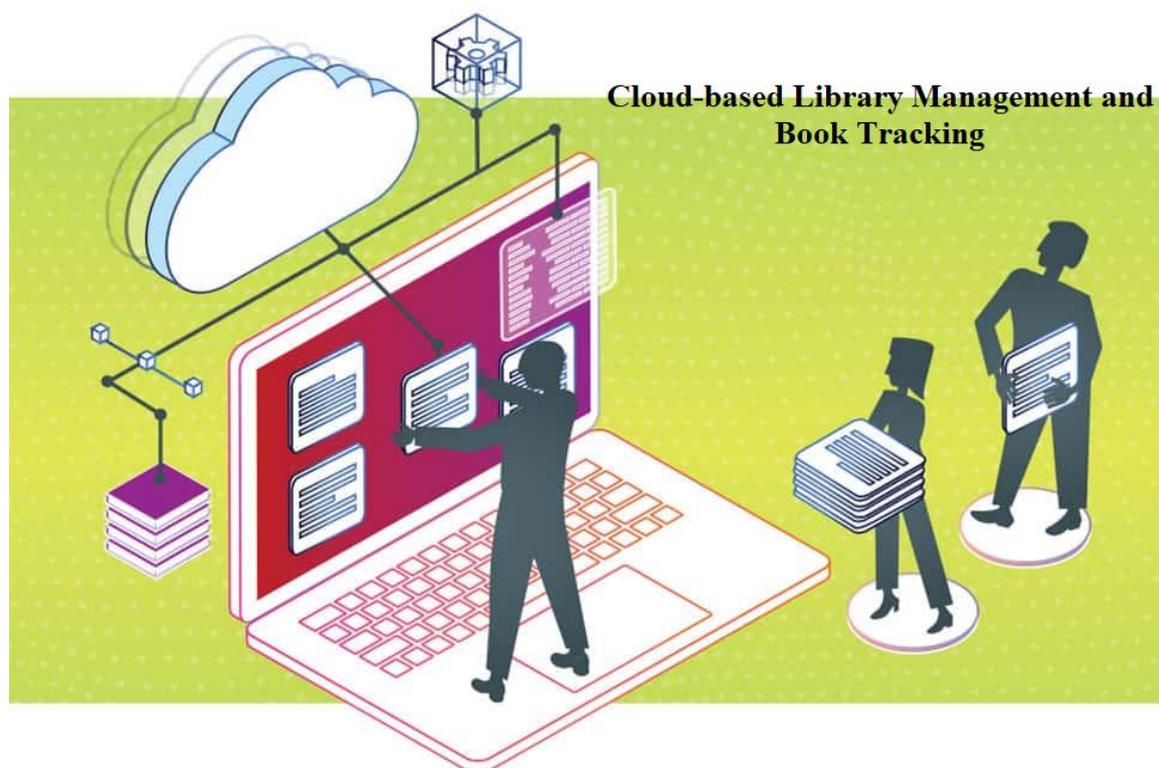


Figure 1. Cloud based LMS for Book Tracking [17]

An intelligent library's worth extends well beyond its ability to serve as a central reading facility for the community. Intelligent librarians, intelligent direction, intelligent service, and intelligent form are necessary for the realisation of a library's construction [10]. The success of a forward-thinking library relies on its ability to provide competent services, using a variety of management principles to accomplish diverse tasks [11,12].

A library is a place where books and other reading and research materials are housed, catalogued, and maintained for the benefit of its patrons. Even as far back as 3000 B.C., there is evidence of libraries being in use. The library serves a number of purposes, including the collection and cataloguing of books and other media, the creation of new databases, and the promotion of civic and social education. The library's primary function is to serve its patrons; thus, it must excel in meeting their basic informational requirements and accommodating their specific research interests. When it comes to organising and executing reading programmes, the library is in the vanguard. Intelligent equipment to completely assess readers' reading preferences and integrate information to expand the collection resources is also required to satisfy the fundamental demands of instructors and students [13 -15].

In addition, the library has established a reader-librarian interactive platform where users may engage in the necessary communication activities. For books that aren't accessible in the library, for instance, users may initiate the necessary feedback process on the hub. Reader feedback is used to inform the library's acquisitions strategy, which is subsequently put into effect. Therefore, in recent years, research has focused heavily on how to get value from such large datasets and volumes of information [16]. Inefficient use of information results from people's inability to efficiently get the resources they need from the vast amounts of data available. As a result, it is important to offer content or goods to consumers based on factors including their information requirements and interests [17].

2. Literature Survey

The term "Internet of Things" refers to the networking of individually addressable embedded computer devices already present in our everyday environments. A "Smart World" based on the interconnectedness of embedded gadgets is rapidly becoming a reality. In recent years, barcode and RFID-based library management systems have proven effective, but not without their share of issues. The suggested system relies on Near-Field Communication (NFC) technology, with NFC tags implanted to ensure the libraries run smoothly, efficiently, and without theft. With this setup, the user may read a full book without having to lug along a bulky PC or laptop—all they need is a smartphone and a dedicated handheld reader. Using IoT, library data may be accessed from the comfort of home [18].

In contrast to the assessment model, which describes the present condition of patrons and predicts their future choices based on past behaviour and preferences, the marketplace model emphasises communication between librarians and customers and has major selection

criteria. In order to help guide future study and application in the recommendation sector, the researchers studied several management systems. In order to address the data sparsity issue and adapt to users' shifting preferences, researchers suggested a novel approach in [19].

According to the literature, a LMS is a group of protocols who have formed a legally binding agreement to work together in order to pool their resources, cut down on expenses, and provide greater value to their patrons. In the past, library association groups have crossed the line into library territory; library hierarchy is not all that different from other types of organisations; and all members of the Alliance of Library Alliances have the same legal protections and responsibilities. Because of the unique nature of each library's collection, for instance, all the institutions that make up the consortium have a solid grounding in common practices for building and exchanging resources. Collaboration between libraries, sharing of library resources, library networks, and library consortia have all been the subject of study in countries with an emphasis on information exchange [20].

To prevent theft and save time, the suggested device will automatically arrange books on shelves when the user presses a button. The current methods of book circulation i.e., using barcodes or magnetic tape, require direct visual contact and a great deal of time. The library personnel and patrons, both experience delays in their respective tasks. Barcodes can only be read from a certain distance, therefore they can't be used for automated stock-taking or finding lost objects. Replacement expenses are far higher than the declared value. All these obstacles may be cleared away by combining RFID with a multiplexer [21].

2.1 Fixing the Issue

The solution is an Android app that allows the user to check out and return the book. For efficient record-keeping and to save resources, management makes use of technological tools. Library management's primary objective is to free up librarians and other library personnel so that they can do a better job of disseminating information.

3. Methodologies

3.1 Concept

Each book has an NFC tag affixed to it, allowing for easy and accurate identification. The kids will be able to communicate wirelessly thanks to the NFC chips included in their ID cards. Users will be given access to a certain number of computers. In a cutting-edge library system, each reader must be opened an account individually so that a patron may peruse the

contents in search of a book that will be of personal benefit. As a result, there will be occasions when a lot of time might be required. A book's index, abstract, or a PDF copy of the text will automatically load into the suggested system when users scan the book's ID. As a result, they can quickly scan a large number of books to determine which ones are best.

3.2 Integration of LMS

Once the optimal book has been determined, the user may check his or her ID and choose the option to have the book issued. Selecting that link will make the book available to the user. That way, patrons don't have to wait in line and the librarian's time is conserved. The user may enter their account and look for the book from any internet-connected device.

3.2.1 Distributing system

A unique RFID code is assigned to each book, and that code is used to track the book's whereabouts and record other data. Users may look up information about a book's author, publication date, and more, by accessing the library's database through the mobile app or website. Borrowing a book from the library is easy; however, without first being scanned, an alert will sound. Benefiting from RFID's convenience, returning a book is as simple as scanning it [22]. The library may institute a 24-hour book return service, patrons can return each other's books, etc.

3.2.2 A Method for Classifying Books

After that, the removal and relocation procedures are executed.

3.2.3 Automatic Occupancy Registration System

A library's main purpose is to assist its patrons; hence, it often has spaces for borrowing books and studying, available to the public. In college and university libraries, where seating is limited, this is particularly factual before final exams.

3.3 Suggested Changes to the Text Supporting Technology

There has to be a system in place to keep user profiles and find recommendations materials. Users may log in using their university-issued unified identity credentials to access their personal settings. In addition, the module for providing recommendation results, emails the results to the user according to their preferences. The tailored resource suggestion is now complete.

3.4 The Module for Producing Recommendation Results

After characteristics are retrieved from a resource, they are compared to the user's satisfaction with the resource. Then, it is suggested from highest to lowest overall weight, with the highest weighted option being shown first. Improving resource quality, integrating resource breadth and depth, and visualising resource organisation are all ways to maximise personalised services in mobile libraries. Creating resource scenarios for mobile libraries entails fusing dis-organised components into a more streamlined whole, with the goal of maximizing available resources. This is also a gradual process of improving the customized service. The fundamental motivation for the resource scenario customization is the major value driver for the electronic format of the information content [23].

3.5 Systematic Improvement through Optimization

Information gleaned from user actions contains a wealth of useful insights and guidelines. It can still benefit from recommendation services. In this case, recommending other books that are either the same or closely related to the one they just retrieved or browsed. To lessen the possibility that the book search service is a complete waste of time for its customers, it is easier for them to locate the precise books they require. Intelligent retrieval may be thought of as a kind of objective suggestion. It's a process that involves investigating and extracting data from online stores [24, 25]. It's a useful use of data mining analytical technique for finding relevant data.

4. Degree of differentiation of personalized test

The suggestion function may be made more specific thanks to the information service system. In the first place, it facilitates an easy-to-use topic book push service based on patrons' preferences. The information service system aggregates RSS feeds from several foreign-language journals and lets users choose just the journal-related content that interests them the most. Once the preferences have been set, readers will automatically get updates with the newest journal titles. The current university library system is unable to deliver intelligent library information resource recommendation services, and much less in addressing the increasingly varied information demands of users.

As can be seen in Figure 2, the suggested method's fundamental recommendation services, such as wide-scale lending and new book suggestions, cannot discriminate between readers and users, and thus recommend the same book to everyone.

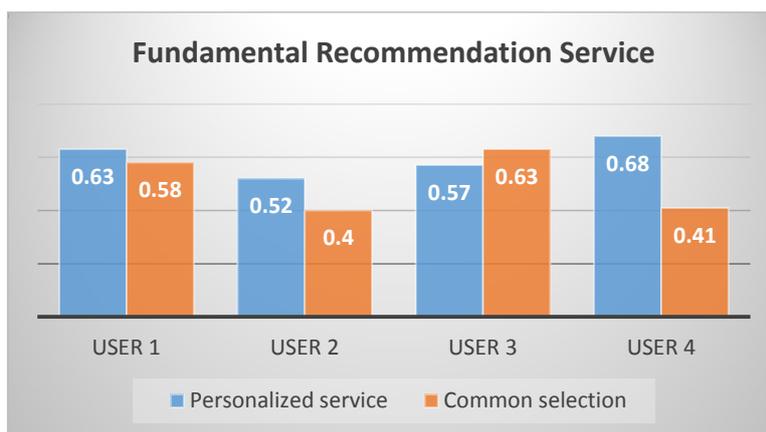


Figure 2. Comparison of personalized and common selection service

When compared to the simple suggestion built into the system, the information service system is able to leverage; because university staff and students have generally consistent disciplinary histories that are significantly tied to their faculty backgrounds. When a user logs into the library's information service system, he or she will be given access to the default topic library's resources if no subject preference is specified. After the reader selects a preferred academic field, the system will recommend relevant reading materials. Customizing the topic choices based on the prior knowledge, expertise, or job in the field, can help the tailored suggestion service better serve the user's needs.

5. Conclusion

This research looks at the history of library recommendations and analyses their development. In addition to that, it contrasts the individualized service with the standard selection service. This phenomenon leads to more precise book tracking, and it will complement the Internet of Things technology that has been developed lately. Quantitative and qualitative data are used to facilitate screening, categorization, and integration. In addition, it summarizes the current service status and gaps in the university library recommendation services. Finally, this study offers a summary of the present state of the issues faced by the services offered by domestic university libraries.

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