

Effectiveness of Cutting-Edge Technology for Library Management System

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ABSTRACT

With technology advancing, manual systems must be converted to user friendly automated system. Researchers have designed the Library Management System to transfer the physical view of libraries into a digital view. This project offers knowledge on creating and putting in place an LMS. In traditional library system people have to search for a particular book from shelf to shelf which is a tedious and time-consuming work. It can be more cumbersome if the library hasn't a properly maintained library system. The manual system isn't user-friendly not only for the borrowers but also for librarians. They have to keep an eye on each and every book lending and borrowing. And They occasionally have to arrange and classify the books. The process of creating reports

and analyzing data is also highly laborious. LMS assists the librarians for all these tasks. They can simply view, update, delete, read books and articles to manage the resources. Readers don't have to stand in long queues and no need of going around to read a book. They can read a book just by clicking a single button. The full system is designed using MERN stack, with the aid of JWT authentications and JOY dependency validations.

Keywords— Automated System, Library Management System, MERN Stack, JWT Authentications, JOY Dependency Validations

I. INTRODUCTION

A library is a location where a sizable collection of books, magazines and other materials are available for users to access. It improves the readers' exposure to intellectual and spiritual civilization. The Numerous books and research papers are enticing users to expand their knowledge in all directions. It teaches the readers how to advocate for their ideas in unique ways. This information enables the learner to improve both performance and the development of their own skills. Technology innovation creates a need for creating a method to improve the traditional library setup to a digital one. The efficiency of the library is reduced by a number of cumbersome procedures.

For instance, in a traditional library, any activity requires physical assistance. For future reference, the count and specifics of the books are recorded on the paper. Each

piece of information is retrieved and stored in the notebook for further use. The notebooks are needed in order to review any data. The ID, date and book id must all be represented in the notebook at the same time as the books are being distributed to the users. Each book must have a tag and an id provided by the librarians. The volumes must be tagged, aligned, and arranged on the shelves. They must confirm the books' consequences before taking the books away from the borrowers. Therefore, the personnel become bored as a result. As a result of the staff's delayed development, it causes the readers to get disinterested. Researchers presented a system called the Library Management system to bring the library into the technological era (LMS).

Researchers represent the LMS with Admin module. They built the LMS using MERN Stack technology which is considered as one of the upcoming technologies in IT industry. By the integration of all the modules, it will be presented on the desktop of your computer. They

implemented a computerized method for the library management system process.

When referencing about the procedure, the website loads much faster with React JS and Node JS, which also makes it more productive and beneficial for SEO. Additionally, MongoDB is a database without a schema and has excellent scalability, making data management easy and helping the user avoid delays and difficulties in the process.

When referencing about the project framework, it is possible to use a framework as a guide for addressing and resolving challenges of the same kind in the future by compiling specific concepts, techniques, and standards for addressing a particular kind of issue. When referencing about the data and information, the gathering of data is crucial to the development of a project as well as to its timely completion. The data for the project, which is kept in a database, includes user information. Only the admin has access to the information provided by the clients to ensure security.

Here it is an automatic system that lessens the workload for workers and librarians. It will control, direct, and arrange the library task. The LMS assists the librarian in adding, viewing, deleting, and updating information from the library stock. Here, researchers incorporate the entire library's data into the MongoDB setting. The librarian must first enter information on books and magazines into the database. After that, he or she can access such details using the Library Management system to view, remove, or change them. As a result, the user has 24/7 access to the library. Without any uncertainty, the librarians can assist with the data. Each piece of data is taken from the database. For any references, they don't need to write it down on paper. They can alter the parameter by modifying the data. Even though the librarian is working on the instructions, she finds it simple to operate the automated system. It offers numerous extra capabilities. It continuously keeps track of the soft copies of books in the library and provides book details. This results in flexible service for both readers and librarians. Because of its user-friendly interface, anyone with rudimentary computer skills can access the LMS. The system's ability to be modified and configured by the user makes it useful in a variety of organizations

II. LITERATURE REVIEW

An organized collection of information sources that is available to the public is referred to as a library. In our library management system, researchers have facilitated our users to experience it on a digital view.

For observing and managing library transactions, there is a program called the Library Management System [1]. The Library Management System supports the library's fundamental needs, including acquisition, cataloguing, circulation, and other divisions. And also, in our system researchers have categorized the available books to improve the effectiveness of the system. Users can search for books

by filtering a desired category. By that it's easy to find the particular book for the readers.

The most advanced open source integrated library system on the market right now is LibLime KOHA. The main flaw of this library management system is that it is web-based, which makes it less secure because hackers might hack the database and access or edit the user's information. [2] Although the designed system is web-based, researchers have secured our site using JWT authentication which is useful when securing routes of the system.

The Capital's library software offers the following benefits as another library management system which increases the amount of support that is accessible to staff and users in any service provided by a modern library, and offers an effective, creative system that enhances user experience while saving time in the library [3]. In the system researchers also have designed two different sides for admins and users. Interfaces have been designed according to the functionality of the user role.

Open Library is an effort started in 2006 to create "one web page for every book ever published". It provides access to many public domain and out-of-print books, which can be read online. The tools used to develop this system are thingDB, PHP and GitHub [4]. In this system researchers have used MERN stack technology. In MERN stack mongo DB database is much secure. Node js is the popular and powerful JavaScript server platform. Utilizing such resources, researchers were able to create an effective system.

The Online Books Page is a website that facilitates access to books that are freely readable over the Internet. It also aims to encourage the development of such online books, for the benefit and edification of all. Now their local index includes more than 2 million works in various formats. All of the books they list is free for personal and noncommercial use [5]. Similar to that in the designed system researchers have given the facility to read books freely. In contrast to the online book page, researchers have built the interfaces to be incredibly user-friendly.

Manish Sahani had developed a library management system for an existing manual library system. The method used to develop that system was Software Development Life Cycle (SDLC). [6] In order to design, build, and test high-quality software, researchers adopted the agile methodology throughout their development process. This methodology consists of a number of steps or stages. The entire system is divided into two primary sprints by their design. The library management system designed by Manish Sahani has used unit testing, integration testing and system testing in order to find any errors that was left undetected during the coding phase. In this system, researchers have used simple, reliable testing tools such as selenium and SonarQube to perform the tests.

Mini project on library management system done by PRABHAKAR KUMAR uses MYSQL database for database operations [7]. In the designed system researchers have used MongoDB, which is an open source, nonrelational database management system (DBMS) that uses flexible documents instead of tables and rows to store data. There researchers created separate documents for user, book, article and publisher in a single collection created for the whole system.

III. METHODOLOGY

There are four crucial management arenas listed as book management, article management, user management and publisher management. Following diagram shows the high-level diagram for the implemented system with above mentioned management sides.

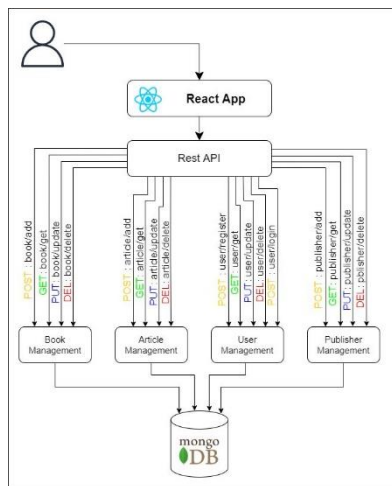


Figure 1: High level diagram for the implemented system

Database will be used by the user management system to register, login, and view user information. All user interactions with the react app occur through the API. Each registered user can view books and read them in accordance with the diagram. Apart from that they can add, view, delete and update articles. Administrator of this system can handle the users, admins, books and publishers.

The scrum methodology under agile software development was primarily used in this system. This system was developed using the VS code. For testing, SonarQube and Selenium were used. The project management tool was Azure Boards. Researchers used GitHub to manage our source code.

First, the user interfaces were created. Then, in Azure Board, researchers created backlog items for Sprint 1. Researchers needed to make a chart for the work they were doing, so they linked the azure board to the git hub. With that program's work was simple to manage. The GitHub repository was then branched and committed. Sprint 1 was completed successfully. Researchers also

integrated the system they built separately. Following that, backlog items.

When referencing the technologies that researchers used are,

A. React JS

- ReactJS is a component-based JavaScript UI library that is simple and feature-rich. It can be used to create small as well as large, complex applications. ReactJS offers a minimal but solid feature set for launching a web application. The React community supplements the React library by offering a large set of ready-made components for developing web applications in a short period of time. On top of the React library, the React community also provides advanced concepts such as state management, routing, and so on. [8]

B. Node JS

- Node.js is a powerful JavaScript-based platform built on the JavaScript V8 Engine in Google Chrome. It is used to generate I/O-heavy web applications such as video streaming sites, single-page applications, and other web applications. Node.js is open source and completely free, and it is used by thousands of developers worldwide [9].

C. Express

- Express is a Node.js web application framework that offers a variety of features for developing web and mobile applications. It can be used to create a single-page, multi-page, or hybrid web application. [10]

D. MongoDB

- MongoDB is a popularly used, open source, scale-out NoSQL database that offers high throughput for data-driven applications. In contrast to relational databases such as SQL Server, Oracle, and MySQL, which store data in tables with a rigid schema, MongoDB stores data in documents with a flexible schema. There are numerous non-relational databases available, such as CouchDB, Raven DB, and Couchbase. However, I prefer MongoDB for its scalability, speed, and dynamic querying capabilities. [11]

E. Axios

- Axios is a Node.js and browser-based promise-based HTTP client. Axios POST and GET requests make it simple to send asynchronous HTTP queries to REST endpoints and perform CRUD operations. [12].

F. JWT

- A JWT is a mechanism for determining who owns some JSON data. It's a URL-safe encoded string that can hold an infinite amount of data and is cryptographically signed [13]

Following diagram depicts how the system is designed by using the above-mentioned technologies. It shows the flow of the system which researchers built.

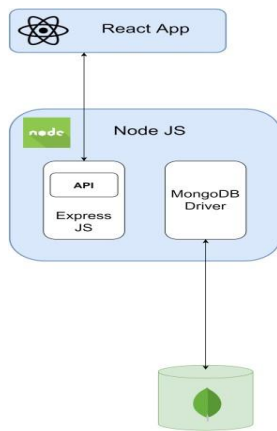


Figure 2: Flow of the system

IV. PROPOSED SYSTEM

Researchers have developed a digital representation for a library's actual physical representation. Basically, in this system there can be identified two main personas as user and administrator. As a user he/she can create a user profile, edit profile, delete profile, add articles, modify or delete articles and view books. As an admin they have the authority to add books, modify or delete books. They can add publishers, view publishers, modify or delete publishers. As well they have the authority to view users and the articles added by users. Additionally, they can generate reports by the system. Following diagram shows the main use cases of each persona which can be define as the use case diagram of the library management system.

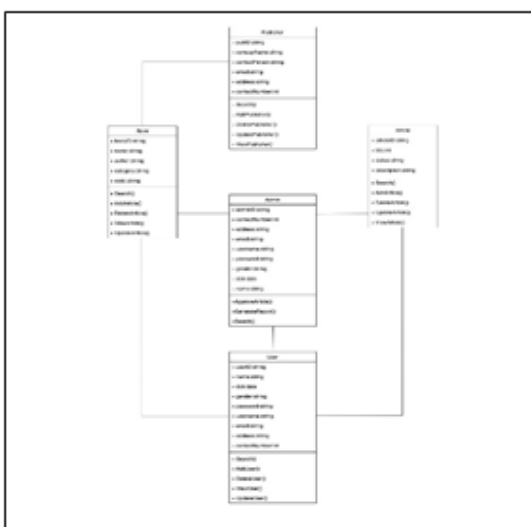


Figure 3: Use case diagram of the system

Once the data was mastered, researchers started working by performing a comprehensive data model

research (class diagram model). It helps to identify the main classes and relationships between them. Basically, in this system there can be identified five main classes listed as admin, book, user, article, and publisher. Following diagram shows the class diagram of the system.



Figure 4: Class diagram of the system

There are two types of users listed as registered and unregistered users in this system. Unregistered users can have a look on what type of books are available in the site. But they cannot read a book if he/she isn't registered. Depending on whether the desired book is available on the website, they can determine whether or not to register. It saves the time taken to travel to a physical library. Following diagram shows the user interface of options available to register as a new user or login if the user is already registered.



Figure 5: Options available to register or login

To read a book, user must register to the website. Users can create a profile providing the first name, email, phone number, desired username, birth date, gender and the password. All these fields must be filled in order to register to the site. Following diagram shows the registration form that new users have to submit in order to register as a new user.



Figure 6: Registration Form

Following diagram shows the login page provided to registered users. None of the fields can be empty in order to login to the site. This will be validated using JOY dependency.

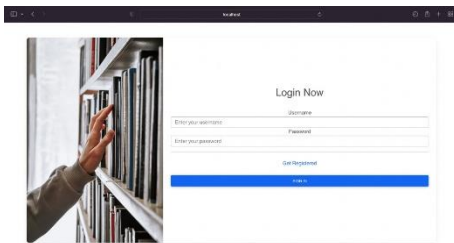


Figure 7: Login Interface

After registering to the site users are given authority to read books, post articles, modify articles and modify their personal user profiles. Admins have the authority to view all the users and their details. Admins can search for users in the search bar. Following diagram shows the user details that can be viewed from administrators' side.

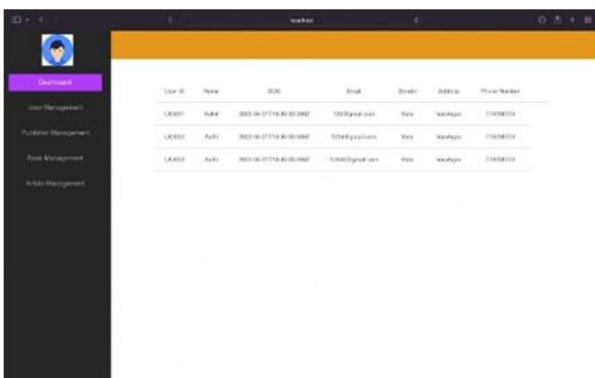


Figure 8: User details accessed by admin

Having a profile in the system provides many facilities. User can view the books which are available in the system. According to his preference he can filter the result by searching with keywords. User can search for a specific book in the search bar. User can view the book name, author name, category, book content and the

publisher's name of each book. Book categories are classified into six types: adventure, sci-fi, autobiography, fiction, novel, history and romance.

The administrator can add books by specifying the title, author, category, and publisher in addition to including the pdf file containing the book's content. Following diagram shows the user interface which is provided for admins to add a new book to the system.

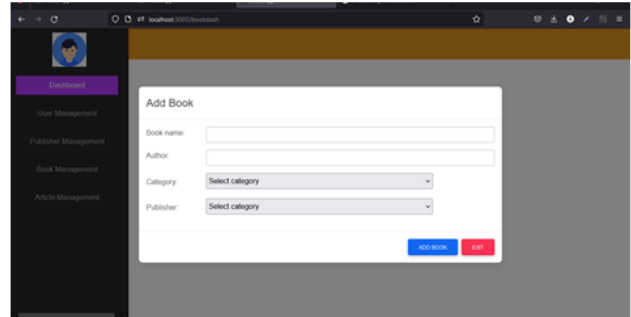


Figure 9: Add a new book to the system

Books that are already available on the site can be edited or deleted. Following diagram shows the view interface of book list.

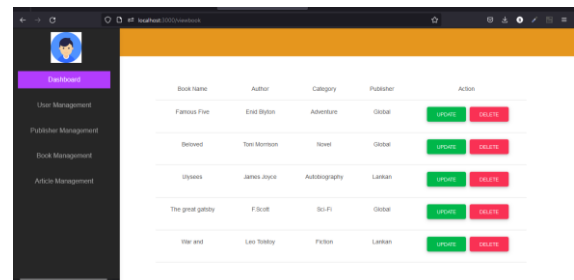


Figure 10: View interface of book list (admin side)

Users can publish articles by adding the title, description, and a suitable image. Title and the description must be greater than the mentioned length in order to successfully add a new article. The fields are validated by JOY dependency. Following diagram shows the interface provided for users to add new articles.

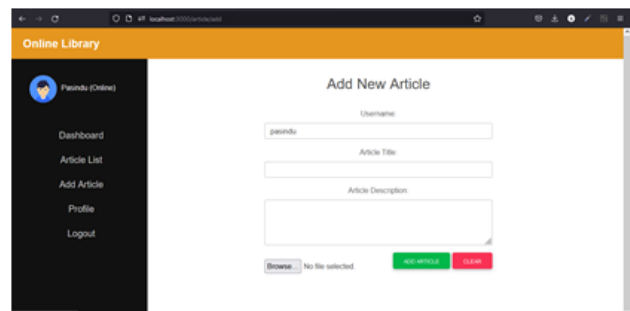


Figure 11: Add article interface

The articles posted by a particular user can be edited or deleted if they wish to do so. Other users can view and read the articles. Articles can be filtered by searching for the needed article in the search bar provided. Following diagram shows how the articles are viewed on the site. The article list is shown in carousel mode to enhance better user friendliness.

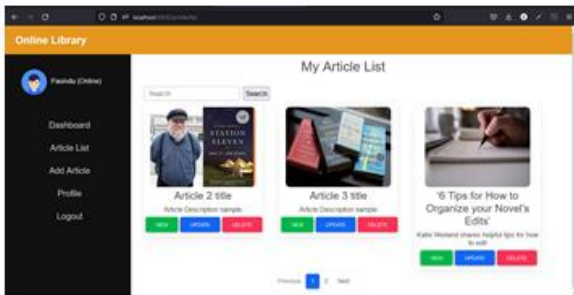


Figure 12: View interface of article list

Apart from these management sides there's another management as publisher management. Admins can add a publisher by adding publisher name, contact person, address, contact number and email. None of these fields can be empty in order to add a new publisher. Following diagram shows the interface provided for admins to add new publishers.

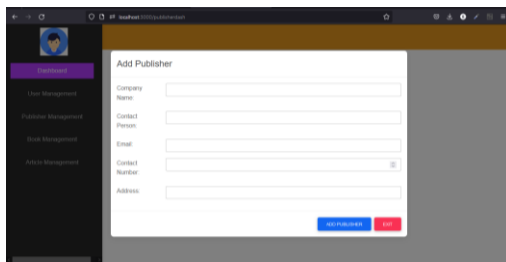


Figure 13: Interface provided to add publishers

They can view, edit or delete publishers if they wish to do so. According to his preference he can filter the result by searching with keywords. User can search for a specific publisher in the search bar. All these tasks can only be done by the administrators. Following diagram depicts how the publisher list is viewed for admins.

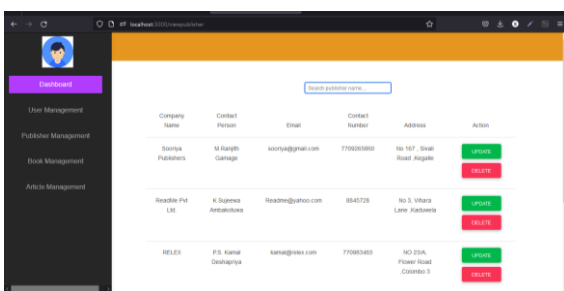


Figure 14: Interface provided to view publishers

Apart from all these functions admins have the feature to analyze the data and to generate reports. The

system can generate reports relating to user, article, book, and publisher management. Admins can download the pdf version of the report into their local device. And as well the count of available books, publishers and articles can be viewed from the admin dashboard as shown in the below diagram.



Figure 15: Admin Dashboard

Not only all these features the researchers have designed a communication tunnel between the administrators and the users. Users can contact the admins and solve their issues by the interface shown below. Apart from that they can subscribe to our daily updates by simply ticking the option which will facilitate to get daily updates of newly added books and articles through notifications

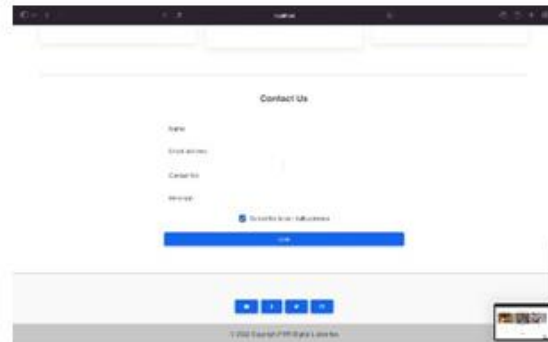


Figure 16: Contact us user interface

V. DISCUSSION

These four separate managements available in the system which are user, book, article and publisher are accessed through two main parties, user and admin. Once the admin adds books, users may read them by browsing, whereas users can upload articles, which must be authorized by the admin before they are published in the system. If any changes need to be done that will also be done under the approval of the admin. Before receiving access to the system, the user must first register, after which he will be assigned a unique id, as there can be multiple users with the same name. Then the user must login to start browsing books. All these interactions are done through separate rest APIs. When it comes to keeping information on the number of users who utilize the system on a daily and weekly basis, consistency is key. A separate dashboard for that

purpose has been created. Each APIs were tested thoroughly using the Postman application before embedding them to the frontend. Once it is embedded, Selenium extension was used to identify the flaws in the navigation of each function. Finally, the quality of the code was tested through SonarQube application in which researchers had a fair score. Some of the key challenges which would be faced after developing this system are, data saved online is vulnerable to cyber-attacks, insufficient user education and the deteriorating qualities of digital material.

VI. FUTURE WORK

The aim is to develop the system with variety of alternatives to ease the readers' and librarians' experience. Therefore, as the next step, it is expected to improve the system into a phase where admins can add audio books as well. Furthermore, researchers plan to improve the system which will facilitate to arrange the volumes by title, author, publish date, or any other criteria the librarian deems appropriate for the library. Additionally, this functionality will make it simpler for management to keep track of all current supplies. Moreover, researchers intend to utilize Artificial intelligence to assist in the non-textual search such as speech recognition.

VI. CONCLUSION

This paper primarily focuses on how to improve the old technique of running a library because the traditional method entails doing everything by hand, which is cumbersome, inefficient, unsafe, and sluggish. An online library management system that tackles all the effort by automating and digitizing the actual process is the answer to this problem. This system which was made using the MERN stack collection of technology facilitates registered readers to explore and read books online for free, which they may easily accomplish from a desktop or mobile device. The web application has books divided into categories which makes the user convenient to browse books. Each book has its name, author, publisher, and the page count. Users get daily updates of newly added books and articles through notifications which eventually reminds the user, the existence of the system. This system allows users to share their thoughts on any book, which may aid developers in improving the system's shortcomings in future.

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