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LIBRARY MANAGEMENT SYSTEM WITH REACT.JS

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ABSTRACT

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The main purpose of the thesis was to research and study the concept of React Js and to design and build a website for library purpose “Library Management System” using React.Js.

The theoretical part of the thesis explains the concept and the theory of React Js and its components that are useful to design a website. The web application was built using React Js along with Bootstrap CSS as a front-end tool and Node Js as a back-end tool.

The progress of the project involved major steps. To begin with, the requirement of the project was analysed and based on the requirements the project was designed using Virtual Studio code, a popular software development tool. As a result, the project was developed fulfilling all the requirement and a website design Library Management System was build which provides a simple interface for library purposes.

Key words
Components, DOM, Front-End, HTML, JSX, Javascript, ReactJs, Redux, Virtual

LIST OF ABBREVIATIONS

CSS	Cascading Style Sheet
DOM	Document Object Model
ERD	Entity Relationship Diagram
HTML	Hyper Text Markup Language
JSX	JavaScript XML
LMS	Library Management System
SEO	Search Engine Optimization
UI	User interface

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1 INTRODUCTION

In this modern world full of modern technologies, where all the information sharing and transaction are done with the help of various applications and web services, it is necessary for the upcoming younger generations to have the knowledge of computer and its applications which are provided along with it. Over the years, the rapid improvement of hardware and software technologies made computer devices, mobiles, laptops, and other digital technologies more user friendly and affordable. Since data, information and connectivity are rapidly increasing day by day, websites are challenged with durability, performance, security, and maintenance. Therefore, many technologies, new web applications architectures, and tools have been created to support these objectives specifically.

According to Herbert (2022), React provides state-of-the-art user interfaces and improves the efficiency of JavaScript-driven pages. React.js is a tool that helps developers build websites and applications that users can interact with. It was created by Facebook and is like a set of building blocks that make it easier to create these websites and applications. Instead of writing a lot of complicated code from scratch, React Js lets developers reuse small pieces of code called "components." These components are like separate parts of a puzzle that can be put together to make the whole website or application. By using React, developers can build things faster and with less code than if they were just using basic JavaScript. ReactJS library helps to create a quick response and high-performance website, build productivity rather than other frameworks in the same area and reduces the cost for maintenance in the system.

The main objective of this thesis was to learn and represent how ReactJS is used to design Library Management System. React JS is one of the popular open-source JavaScript front-end library which is used for building user interface. Nowadays, it is used by wide range of developers. The aim of this project is the use of the application for library purpose which helps with better library management system. Library Management System is a library management software used for various aspects like monitoring and controlling the transaction of a library system. The project focuses on operations in libraries like adding books, searches, adding members, searching for availability. MS is a web-based application suitable for every browser.

The main aim of the thesis “Library Management System” is to learn and represent React Js and the implementation tools used to design website design Library Management System. The focused studies and practices for the project are to present the detailed information of the topic Library Management System. Also, to give a detailed information of React JS and its core concept. To analyse the requirement and feasibility to build the project LMS. To build a website design for the project using different implementation tools and software development tools and to use the application for better monitoring and controlling for library purposes.

This thesis is structured in six different chapters. It starts with an introduction of React Js and concept of the project on the first chapter which is followed by the brief explanation and introduction of React Js and its concept in chapter two. Project analysis for requirements and feasibility analysis are discussed in chapter three. In chapter four, the implementation tools that are required to build the website design are discussed. Library Management System, website and its overall structure of the project are discussed in chapter five. Finally, chapter six of the thesis concludes the project Library Management System built for Library purposes.

2 REACT AND ITS CONCEPT

ReactJS is a highly popular JavaScript library that enables developers to efficiently build user interfaces. It is widely adopted by major companies such as Instagram, Facebook, Netflix, and Airbnb. ReactJS is commonly used to develop single-page applications and mobile applications. For instance, YouTube, the widely accessed video platform, was built using ReactJS. By utilizing ReactJS, developers can seamlessly integrate user interfaces into their JavaScript code. A ReactJS website consists of various components, each defining a distinct view of the web structure. The key advantage of this approach is the ability to reuse code lines for similar views, as each component functions independently. This reusability significantly enhances development productivity. Moreover, businesses employing applications built with ReactJS can experience various advantages and improved intercommunication, leading to enhanced benefits for the enterprise. (Oracleappshelp, 2021.)

2.1 History of ReactJS

ReactJS is an open-source JavaScript library which can be called React or React.js. It is popular for SPA (Single Page Application) the manages the view or the cover of web and mobile applications from which non-functional user interface "UI" are created. Jordan Walke, a software engineer at Facebook developed React and it was featured in Facebook news feed and Instagram.com in 2012. ReactJS came into use when the developers implemented it on Facebook's news feed and later Instagram picked it to use it in their system. The data's in React can be changed staying on the same page without a page reload. The accuracy, speed, and advantage of React framework has made it popular among other popular framework. (Pandit, 2021.)

2.2 React Virtual DOM

DOM stands for 'Document Object Model'. DOM is a programming interface for HTML and XML documents. The most important part of web application development is DOM manipulation. DOM helps manipulate data in an object-oriented model because the element of the DOM defines structure into objects, process, or properties to be easily accessible. Therefore, they are taken as nodes and represented as DOM Tree which is also represented as UI of a specific website. The DOM Tree changes itself according to the change appeared in a website. There is a challenge in updating the DOM tree when changes occur, which majorly affects the speed or performance of a website. (Anthony, A., Nathaniel, M., & Lerner, A. 2017, 134-140.)

The DOM tree in Figure 1 represents as a tree of data structure, making it easy to detect the change inside the DOM tree by searching for each level of the tree. The complexity appears when any changes occur with any elements on the upper levels of the DOM tree, which is nested by many descendent element's complex children. However, activating a DOM element properly without affecting the performance of the website was on a very high demand. To solve this problem and to improve its performance more React library introduced Virtual DOM as an alternative update strategy which is located inside the React DOM package. (Document Object Model (ODM), 2023.)

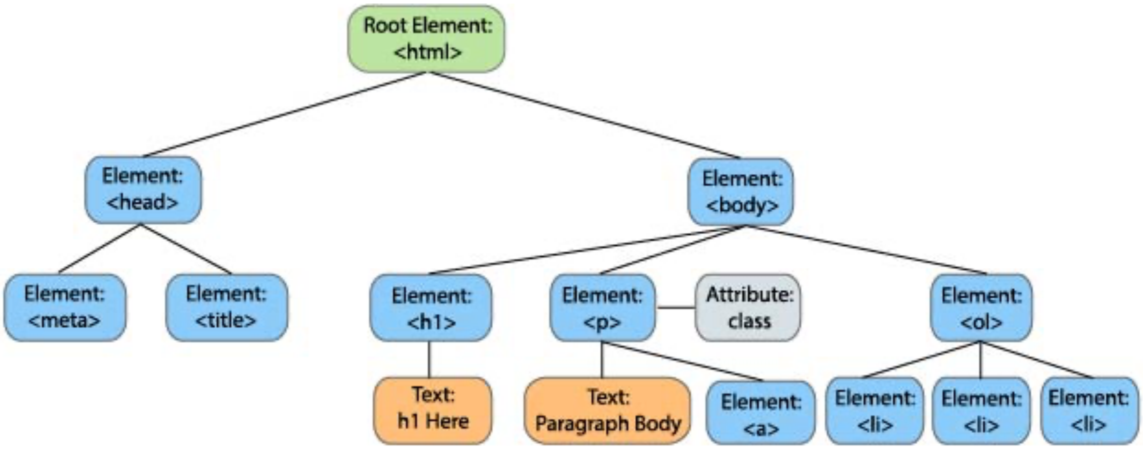


FIGURE 1. The HTML DOM Tree of Objects (Document Object Model (ODM), 2023)

A virtual DOM object is the representation of a DOM object and although it does not have real efficiency as a real DOM, Virtual DOM manipulation helps ReactJS to skip the real DOM manipulation and boost the process in a much faster speed. Virtual DOM has the same properties as a real DOM, but it lacks power to directly change what is on the screen. To understand it more clearly, in place of creating a direct change to the browser DOM model, ReactJS creates change on a Virtual DOM model. It then calculates the difference between the two DOM models, and only updates difference for the browser DOM. (Smith, 2020.)

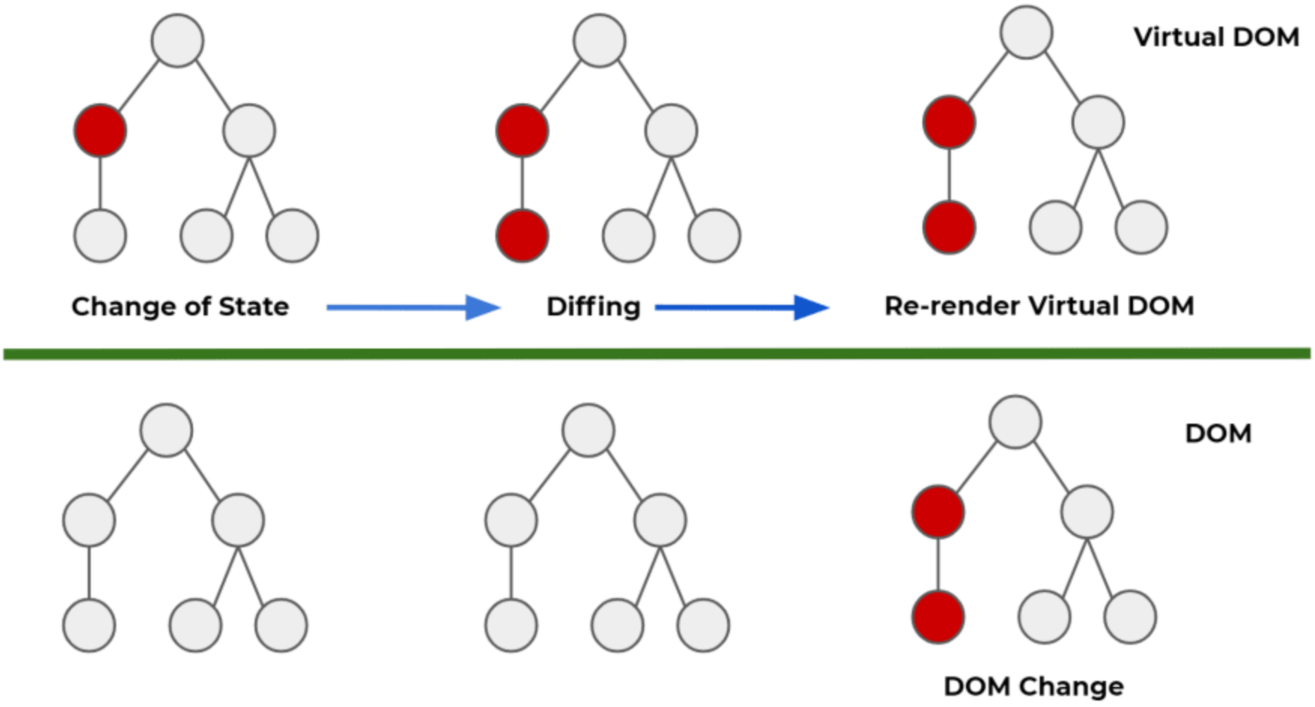
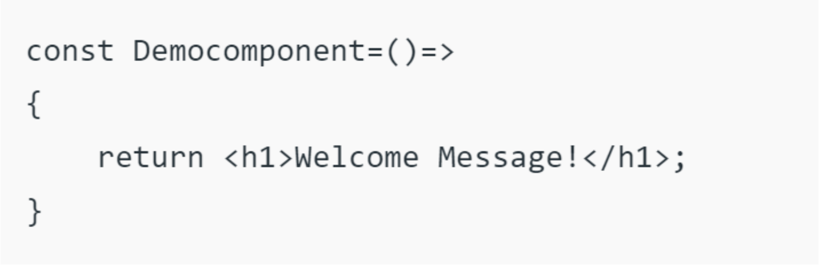


FIGURE 2. Virtual DOM reduce rendering (Smith, 2020).

2.3 React Component

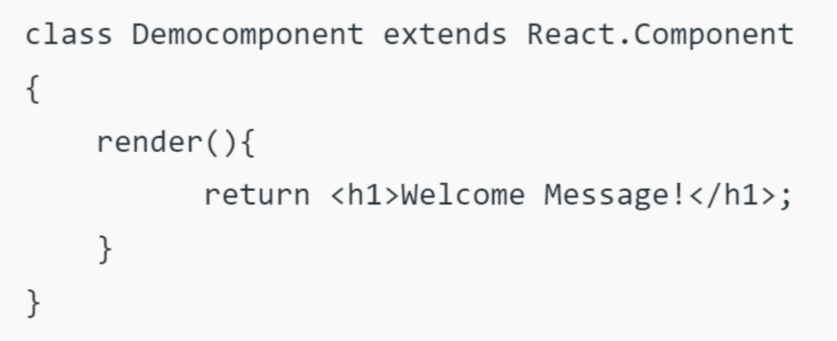
A component is one of the core building blocks of ReactJS. In other words, every application developed in ReactJS are made up of small pieces called component. Component makes the process of building UI efficient. Components are independent and reusable bits of code. Components are of two types, and they are Functional component and Class components. These two components are categorized based on the way they are created. Function components uses plain JavaScript functions whereas Class components uses ES6 class. The core difference between function and class components is that Function components are very basic in nature. The only requirement of Function component is to return a React element. (Agarwal, 2022.)

FIGURE 3 & 4 below are comparable and provide the basic difference between a Functional component and Class component. Functional components are only used when the component does not require interacting and when the component processes independently. These components do not require data from another component; however, multiple functional components can be built under a single functional component. Class-based components can also be used for this purpose but using class-based components without the need can make the application ineffective. (Tutorialspoint.)



```
const Democomponent=()=>
{
    return <h1>Welcome Message!</h1>;
}
```

FIGURE 3. Valid functional component in React. (Tutorialspoint).

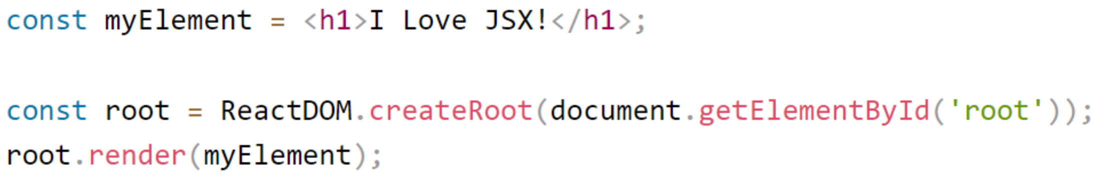


```
class Democomponent extends React.Component
{
    render(){
          return <h1>Welcome Message!</h1>;
    }
}
```

FIGURE 4. Valid class-based component in React using ES6 components. (Tutorialspoint).

2.4 JSX – JavaScript XML

JSX stands for JavaScript XML. JSX allows the user to write HTML in react and it is a syntax extension to JavaScript. It helps to make it easier to write and add HTML in React. JSX produces React" element". JSX provides a systematic way to replace the statement React.createElement() in React. The codes written in JSX convert into JavaScript so that the browser understands the implemented code. JSX has a syntax that looks both like HTML and JavaScript. The difference with normal JavaScript is that it is fast and performs optimization while translating to regular JavaScript. React does not require using JSX, but most users find it helpful as a visual aid when working with UI inside JavaScript code. It allows reactJs to show errors and threat messages. It is an extension of JavaScript language based on ES6. As you can see in the example FIGURE 5, JSX allows to write HTML code directly within the JavaScript code. (Reactjs.org, 2019.)



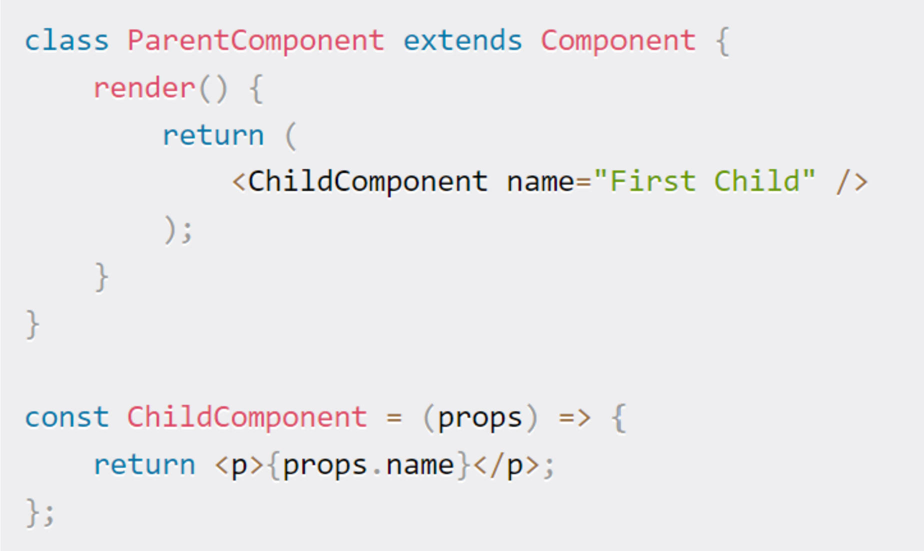
```
const myElement = <h1>I Love JSX!</h1>;

const root = ReactDOM.createRoot(document.getElementById('root'));
root.render(myElement);
```

FIGURE 5. Example of JSX (W3schools, 2023).

2.5 Props in React

Props is a short form for properties. In ReactJS, Props are data that is passed to a component from the parent component. Props are used to configure the component and pass data into the component from the parent component. This is important because it allows users to re-use the component again. For example FIGURE 6, there is a component that displays a list of products. The component can be used multiple times, and it passes in different props to configure it while using the component which allows users to reuse the same component with different data each time with accuracy. (Eygi, 2020.)



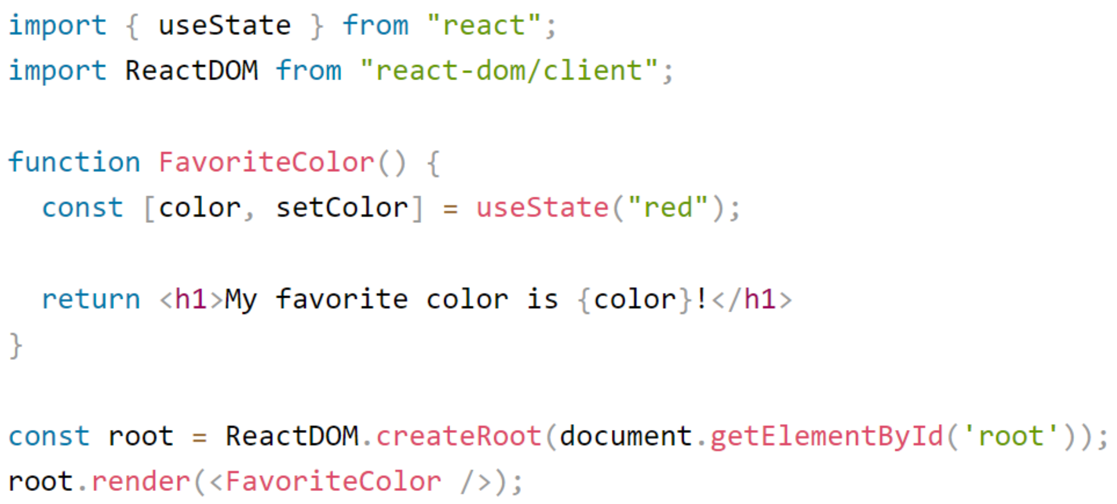
```
class ParentComponent extends Component {
    render() {
        return (
            <ChildComponent name="First Child" />
        );
    }
}

const ChildComponent = (props) => {
    return <p>{props.name}</p>;
};
```

FIGURE 6. Example of data being passed using Prop. (Eygi, 2020)

2.6 State in React

State is an updatable structure used to contain data and information about the component. The state in a component can change and the change in state over time can occur as a response to user action or system program. A component with the state is known as stateful component. The main core of the react component determines the behavior of the component and how it presents. It is also responsible for making a component dynamic and interactive. The react state should be kept as simple as possible. It can be set using the **setState()** method and calling setState() method triggers UI updates. It can be only accessed inside the components or modified by the components directly. To set an initial state, **getInitialState()** method should be used as shown in Figure 7. (Javatpoint, 2021.)



```
import { useState } from "react";
import ReactDOM from "react-dom/client";

function FavoriteColor() {
  const [color, setColor] = useState("red");

  return <h1>My favorite color is {color}!</h1>
}

const root = ReactDOM.createRoot(document.getElementById('root'));
root.render(<FavoriteColor />);
```

FIGURE 7. State variable in the rendered component. (W3school, 2023).

In React, components can utilize two key concepts: props and state. The difference between Props and State are given on below TABLE 1 which is further explained. Props are read-only and allow the passing of data from one component to another as arguments. They are immutable, meaning they cannot be modified directly. Props enable components to be reusable, as they can be accessed and utilized by child components. On the other hand, state holds information about a component and is mutable. State changes can occur asynchronously, allowing components to update and rerender based on certain triggers or events. Stateless components can accept props, but they cannot have their own internal state. In contrast, stateful components can have their own state, which can be changed by the component itself, but not by the parent component. Understanding the distinction between props and state is crucial for effectively managing data and creating reusable components in React. (Javatpoint, 2021.)

TABLE 1. Difference between Props and State. (Javatpoint, 2021.)

No.	**Props**	**State**
1.	They are read only	State changes can be nonsynchronous
2.	Props are immutable	State is mutable
3.	Props allows to pass data from one component to other component as argument.	State holds information about the components.
4.	State less components can have props.	State less components cannot have State.
5.	Props can be accessed by child components.	State cannot be accessed by child components.
6.	Props makes components reusable.	State cannot make components reusable.

7.	It can be changed by parent component.	It cannot be changed by parent component.

2.7 Advantages of ReactJS over other frameworks

React is an efficient JavaScript framework to build interactive user interface in a very easy and in efficient manner. ReactJs is a very flexible language used in front-end development. It helps in designing simple views for different state in an application and easy to update and interpret the right components efficiently when the data changes and provides users with better experience. The biggest advantage of using it is that any components can be changed at any point without affecting the other components which results in wide support among both clients and service providers. (Borusiuk, 2022.)
The advantages of React over other frameworks are given in the subheadings below.

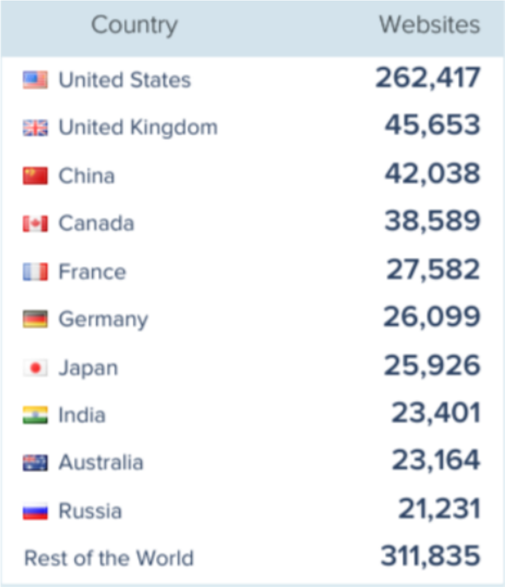
2.7.1 Code stability

Using only downward data flow, ReactJS ensures more stable code. As the parent structure is not affected by any changes made in child structure, developers only need to modify their state, make corrections for specific components, and change an object. When components are organized and structured, it leads to more stable code. It also provides a UI which is unaffected because of the component creation aspect. It follows a well-defined and stable API, due to which codebase is likely to remain stable and maintainable over time. This allows developers to efficiently conduct unit testing to avoid system crashes. The overall stability of a codebase also depends on factors such as code organization, architectural decisions, and the skill and discipline of the development team. (Borusiuk, 2022.)

2.7.2 Suitable for every purpose

Using React can reduce the time and cost of web development process. Major companies like Facebook, Netflix, and Yahoo as well as lot of other start-up companies are using this technology because of its various benefits and compatibility globally. If the application requires complex UI interactions, such as real time updates, drag and drop functionality, or complex forms, ReactJs components-based architecture and usability make it suitable to use for various purposes. The ability to break down UI into smaller, reusable components helps to maintain code organization, maintainability, and code stability. It also provides tools like React Profiler and code splitting to optimize performance. (Borusiuk, 2022.) The TABLE 2 shows the usage of ReactJs across the globe below.

TABLE 2. Usage of React across the globe. (SimilarTech, 2023.)



Country	Websites
United States	262,417
United Kingdom	45,653
China	42,038
Canada	38,589
France	27,582
Germany	26,099
Japan	25,926
India	23,401
Australia	23,164
Russia	21,231
Rest of the World	311,835

2.7.3 SEO-friendly platform

SEO, also known as Search Engine Optimization, is the process, technique, and guideline used to increase a website ranking on the search engine results page. Learning ReactJS gives a better search engine experience that helps in increasing the flow of viewers to the website. ReactJS library deals with search engine failure in a better way which creates an SEO-friendly environment. React is great at reducing page load time through faster rendering and adapts quickly in real time performance according to user’s demand. Therefore, most of the other frameworks cannot handle the features as smoothly as ReactJs. So, we can say ReactJS to be SEO-friendy platform for the developers. (Borusiuk, 2022.)

2.7.4 Simple to learn.

ReactJS is an easier framework to learn for JavaScript than any other frameworks. As it is one of the difficult jobs for companies to complete a project when technology itself is very difficult to learn because of which business companies mostly prefer to use technologies which are user friendly for the developing team. It is used by many companies and businesses as it is simple to learn, and the application is very easy and cost friendly. With the help of Virtual DOM, ReactJS takes care of updating the UI effectively, resulting in simple and cleaner code. Also, familiarity with JavaScript, HTML and CSS is beneficial for working with ReactJs effectively and in general considered to be relatively simple to learn amongst other frameworks. (Borusiuk, 2022.)

2.7.5 Better Development Experience

React is growing popular day by day as a front-end development application. Thousands of websites have been built using this framework, providing very resourceful performance, work experience and advanced web application development features. Companies continue to use React as it is designed to create rich and attractive applications with very little code. React developers will be in demand for long term, as react is used in multiple industries. Overall, the combination of component reusability, efficient rendering, hot reloading, developers tool, community support and developer friendly syntax contributes to better development experiences with ReactJS. These factors help in better development workflow, improves productivity, and enhances the overall skills experiences of developers using ReactJs. (Borusiuk, 2022.)

3 PROJECT ANALYSIS

This thesis is divided into two parts: understanding React.js and designing a Library Management System using React.js and Node.js. React.js is a popular JavaScript library for building user interfaces, known for its efficiency and flexibility. The first part focuses on exploring the concepts and features of React.js. The second part involves practical application through the development of a Library Management System, showcasing the power of React.js and Node.js. Analyzing web page requirements is crucial for successful development, involving understanding the purpose, target audience, and desired functionalities. By conducting thorough analysis, developers can design web pages that meet specific user needs. In summary, this thesis covers the theoretical and practical aspects of React.js, demonstrating its capabilities and emphasizing the importance of requirements analysis in web development.

3.1 Requirement Analysis

To analyse the requirement for Library Management System there are functional requirement and non-functional requirement. Functional requirements entail specific actions and features that the system must possess. These requirements play a crucial role in determining the system's functionality and user experience. In the context of the Library Management System, the functional requirements are explained, and the Nonfunctional requirements are explained below.

3.1.1 Functional Requirement

In the context of the Library Management System, the functional requirements of the system are Login credentials, Add and Edit Resources, Add and edit resource publication, Add and edit resource author, Add and edit resource subscriber, Resource issue, Resource Return, Add/Remove users, Issue Notice, View Profile. Firstly, the system should provide a secure login mechanism, allowing users to access the system using unique credentials such as usernames and passwords. This ensures that only authorized individuals can interact with the system. Administrators should have the capability to add new resources to the library database, including books, journals, and other materials. They should also be able to edit existing resource information, such as titles, descriptions, and availability status. In addition, the system should enable administrators to manage resource publication details, such as the publisher's name, publication date, and ISBN. This information helps in categorizing and organizing resources effectively. Administrators should also be able to add and update author information associated with library resources. This includes the author's name, biographical details, and other relevant metadata, facilitating efficient searching and filtering of resources.

Furthermore, the system should allow administrators to add new subscribers to the library and manage their information. This includes subscriber names, contact details, and subscription status. It ensures accurate record-keeping and communication with library patrons. To facilitate the borrowing process, the system should provide functionality for librarians to issue resources to subscribers. This involves assigning borrowed resources to specific individuals, updating the resource status to "borrowed," and maintaining a record of issued resources for tracking purposes. Subscribers should also be able to return borrowed resources to the library. The system should facilitate the return process, update the resource status to "available," and handle any associated fines or penalties if applicable. Moreover, administrators should have the authority to add new users to the system, such as librarians and staff members, as well as remove users who no longer require system access. This ensures proper user management and security. The system should also provide a mechanism for administrators to issue notices or reminders to subscribers. These notices can include due date reminders, overdue notices, reservation notifications, or any other relevant information to keep subscribers informed and engaged. Lastly, both administrators and subscribers should have access to their profile information. This includes personal details, borrowing history, preferences, and any additional user-specific settings. The ability to view and manage profiles enhances user engagement and customization. By clearly defining and addressing these functional requirements, the Library Management System can be developed and implemented with the necessary features and actions required to effectively manage library resources and provide a seamless user experience.

3.1.2 Non-Functional Requirement

In addition to the functional requirements, the Library Management System also requires the consideration of non-functional requirements. These requirements focus on the characteristics and qualities of the system that contribute to its overall performance, usability, security, reliability, and maintainability. Analyzing and addressing these non-functional requirements are crucial for ensuring an optimal user experience and efficient system operation. Analyzing the Non-functional requirements of the website Library Management System, the TABLE 3 shows the elements requirements that must be implemented on the project:

TABLE 3. Non-Functional Requirement of the LMS

No.	Requirements	Features
1	Security	Users will be able to access the system using authorized username and password. Only authorized user can have access to change their profile content or password,
2	Usability	The system should be user friendly and easy to use and understand.
3	Performance	Every feature presented by the system has quick response time.
4	Reliability	Users will be able to get the information about the activities of the organization.
5	Maintainability	System needs to be maintained for high performance. Updating database, monitoring and error handling should be carried out daily.

3.1.3 Use case diagram

During the implementation of the project, a case diagram was created to visualize the relationships and interactions within the application. Figure 8 represents this case diagram, which serves as a visual representation of the system's functionality and the actors involved. The diagram depicts the primary actors, such as administrators, librarians, and subscribers, who interact with the system to perform various tasks and activities. The use cases illustrated in the diagram represent the specific functionalities available to the actors within the system. These use cases include actions like logging in, managing resources, handling user profiles, issuing and returning resources, and sending notices. The case diagram provides a clear overview of the system's architecture, showcasing the flow of information and actions between different components. By utilizing this diagram, developers and stakeholders can gain a better understanding of the system's structure and functionality, facilitating the successful implementation of the Library Management System. (Hammad, 2020.)

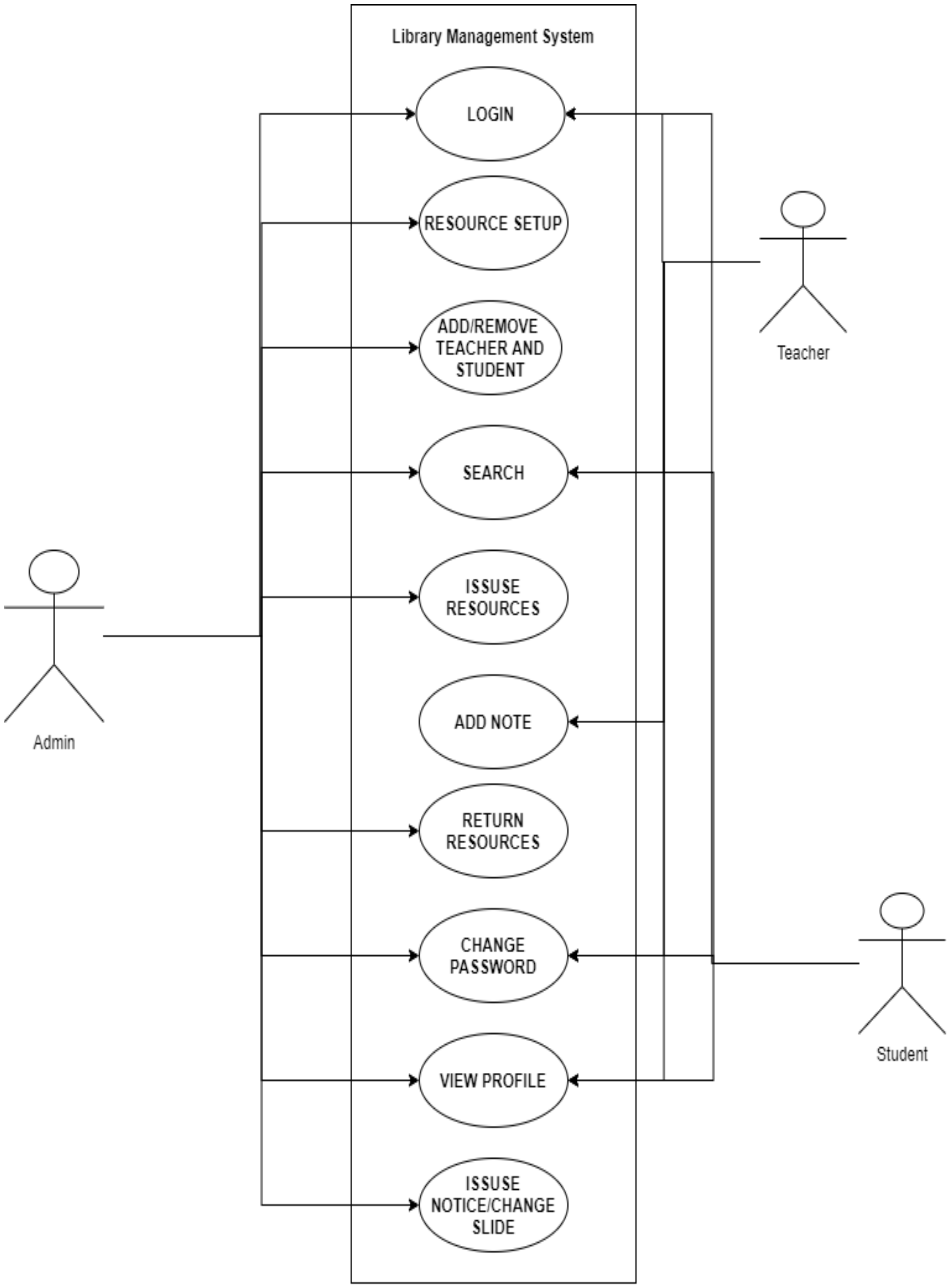


FIGURE 8. Case diagram

3.2 Feasibility Analysis

Feasibility Analysis, also referred to as a Feasibility study, is a comprehensive evaluation of key factors related to a project. It encompasses economic, technological, and operational aspects, as well as the project's time frame, to determine its potential for success. By conducting a feasibility analysis, project stakeholders can assess the viability and practicality of the project, considering factors such as financial resources, technical capabilities, and operational requirements. This analysis aids in making informed decisions regarding the project's feasibility, allowing for effective resource allocation and risk mitigation. (Osarome, 2011.)

3.2.1 Technical Feasibility

Technical feasibility study assesses the viability of a system from a technical perspective. It examines whether the developed system is technically feasible and capable of meeting the required standards of reliability, accuracy, and security. This evaluation considers the system's architecture, infrastructure, compatibility with existing technologies, and the availability of necessary resources. The goal is to ensure that the proposed system can be implemented effectively and will operate efficiently within the desired technical framework. By conducting a technical feasibility study, project stakeholders can determine the system's technical feasibility and make informed decisions regarding its development and implementation. (Osarome, 2011.)

3.2.2 Economical Feasibility

The Economical Feasibility study assesses whether a system is economically viable. In the case of this system, it utilizes existing resources and technologies without the need for additional hardware or software interfaces. Moreover, the software used is freely available, further reducing costs. Based on these factors, it can be concluded that the project is economically feasible. The absence of significant financial investments and the utilization of cost-effective solutions contribute to the project's viability. By conducting an Economical Feasibility study, stakeholders can make informed decisions regarding the project's financial feasibility and ensure that it aligns with the available resources and budget.

3.2.3 Operational Feasibility

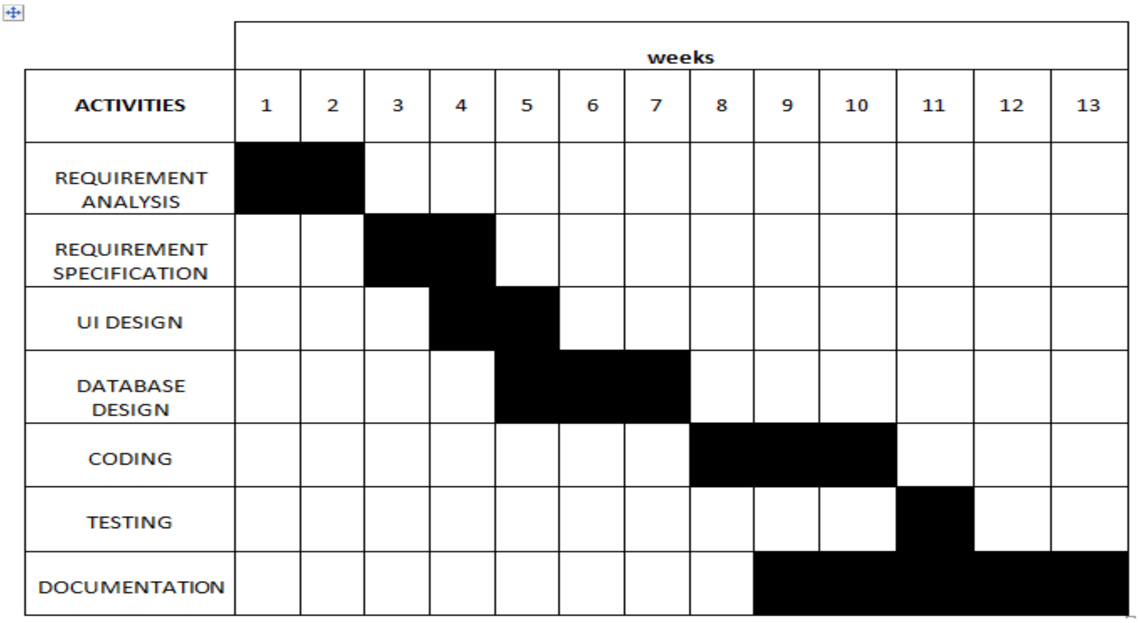
The operational feasibility of the Library Management System is supported by user-friendly interfaces like HTML and CSS, which create an intuitive environment for both technical and non-technical users.

These interfaces enable users to access the LMS from any web browser, ensuring ease of use and accessibility. Additionally, the system exhibits quick response times, enhancing its operational feasibility. These factors contribute to the overall efficiency and usability of the system, making it operationally feasible. By considering operational feasibility, project stakeholders can ensure that the system meets user expectations and can be effectively utilized in real-world scenarios. (Osarome, 2011.)

3.2.4 Schedule Feasibility

In the Gantt chart below, there is data of different tasks performed and their schedules while working on the project. The requirement analysis was conducted for two week's time. Requirement specification and user interface was done in three weeks time. Database design, coding, testing and documentation respectively took nine weeks timeframe in total. Also, the time taken to create and complete the overall project is also shown in Table 4 below.

TABLE 4. Gantt chart



	weeks												
ACTIVITIES	1	2	3	4	5	6	7	8	9	10	11	12	13
REQUIREMENT ANALYSIS	■	■											
REQUIREMENT SPECIFICATION			■	■									
UI DESIGN				■	■								
DATABASE DESIGN					■	■	■						
CODING								■	■	■			
TESTING											■		
DOCUMENTATION									■	■	■	■	■

3.3 ER Diagram

ER diagram also known as Entity Relationship Diagram, is a type of structural diagram for using the database design. ERD consists of different symbols and connectors that visualise the major entities within the system scope and the inter-relationship among these entities. ER diagrams are mostly developed to design relational databases, database design, database debugging, database creation and patching, and aid in requirements gatherings. Figure 9 and 10 represents the ER diagram for Library Management System. (Visual Paradigm, 2019.)

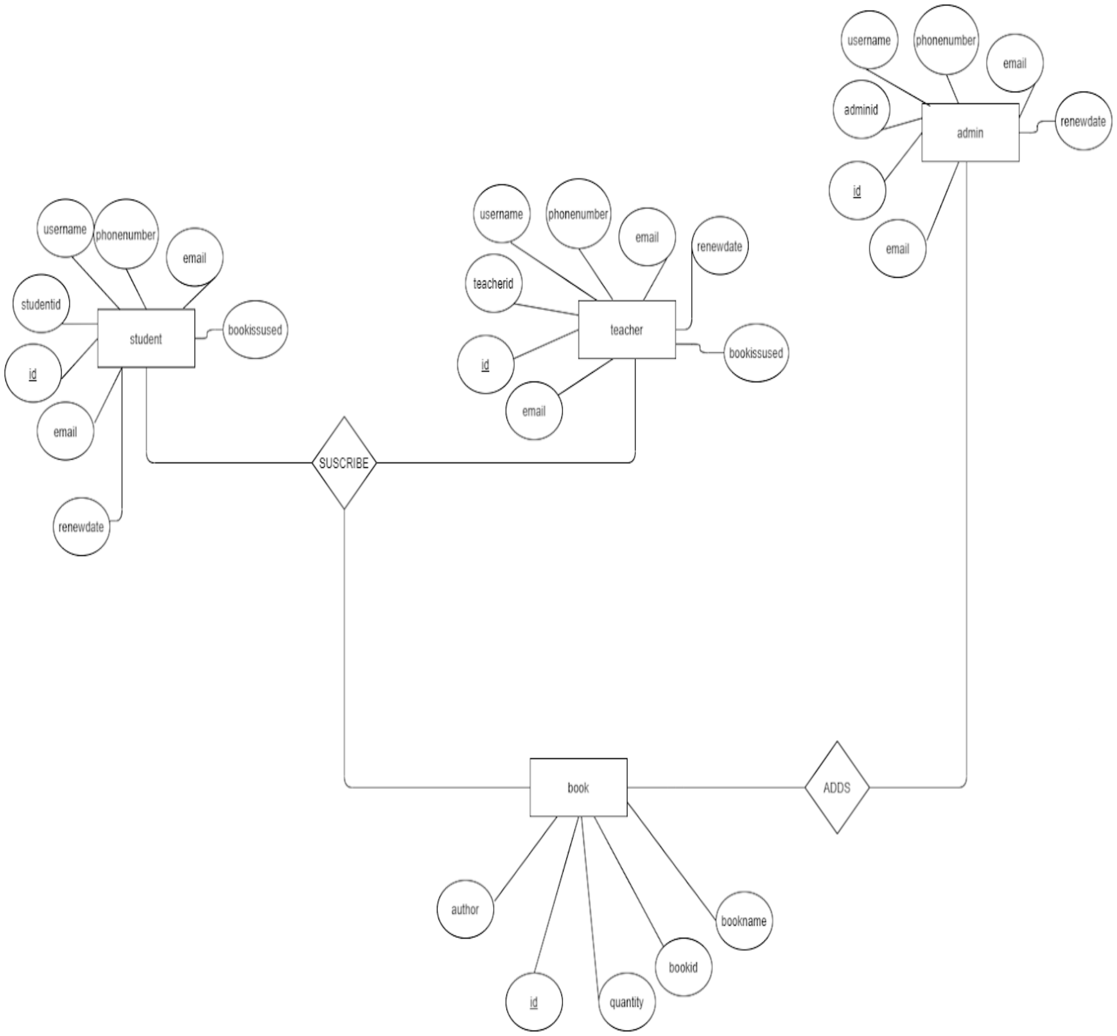


FIGURE 9. ER diagram 1

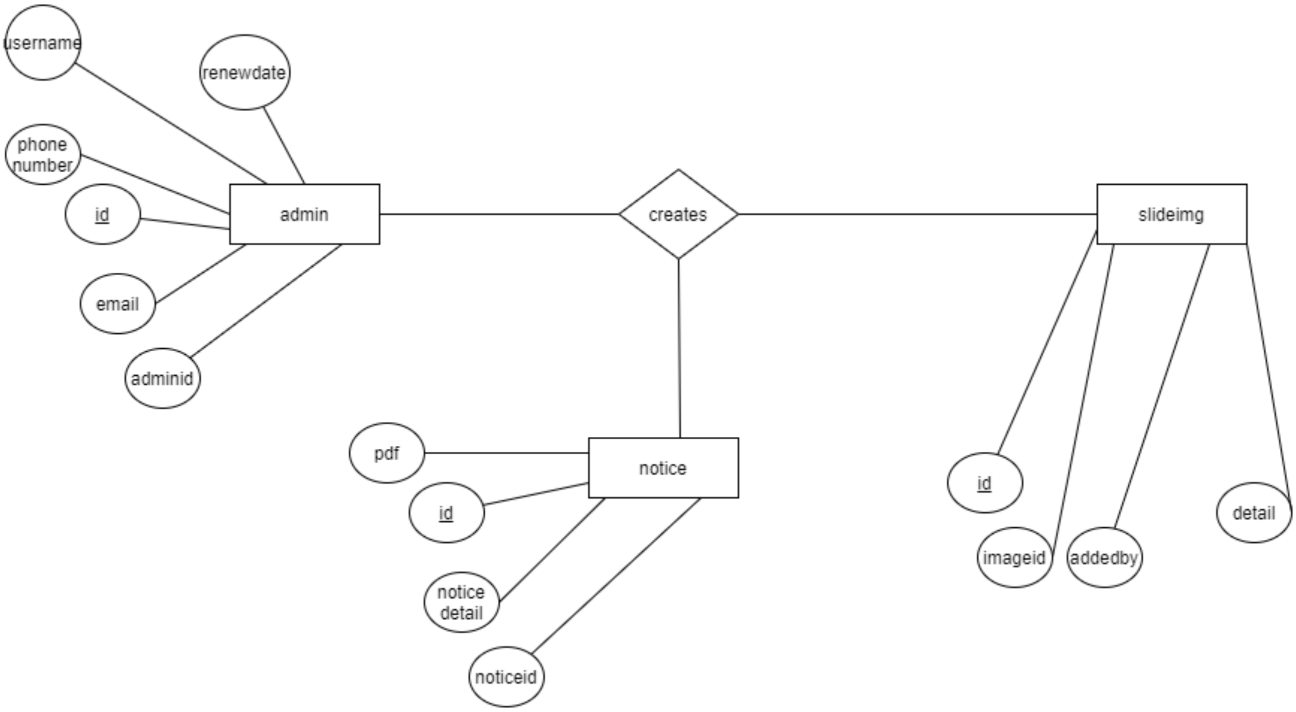


FIGURE 10. ER Diagram 2

3.4 Data Flow Diagram

In the implementation phase of the project, a data flow diagram was created to depict the flow and transformation of data within the system. Figure 11 represents this data flow diagram, providing a visual representation of how data moves through different processes, inputs, and outputs. The data flow diagram showcases the various components and entities involved in the system and illustrates the relationships and interactions between them. It demonstrates the flow of data between different processes, highlighting how information is received, processed, and distributed within the system. (Chi, 2021.) The FIGURE 11 shows the data flow diagram of library management system.

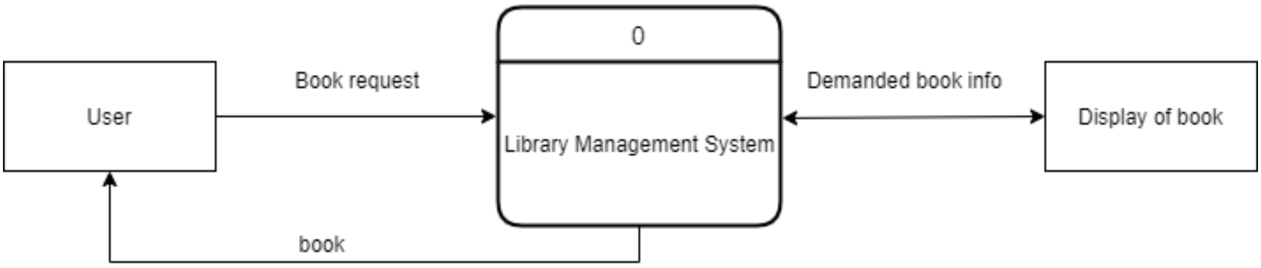


FIGURE 11. Data flow diagram

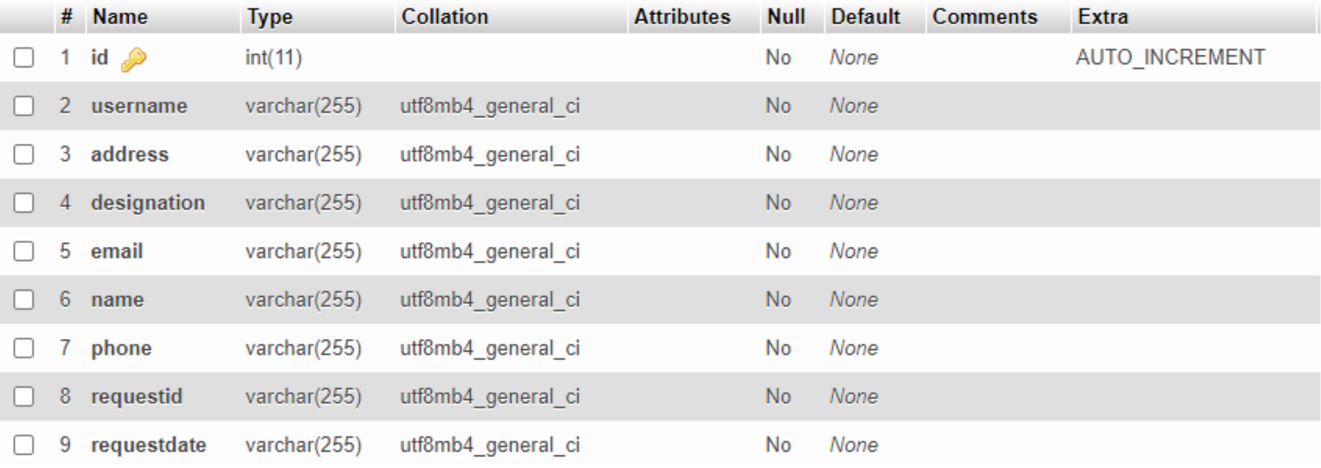
3.5 System Design/Framework Plan

System design also known as framework plan is the method of characterising the components of a framework such as the design, modules and components, the distinctive interfacing of those components and the information that goes through that framework. System design is implied to fulfil needs and prerequisites of a commerce or organisation through the designing of a coherent and well-running framework. Framework plan suggests an orderly approach to the plan of a framework. It may take a bottom-up or top-down approach, but either way the method is systematic wherein it takes into consideration all related factors of the system that must be created-from the engineering to the desired equipment and program, right down to the information and how it voyages and changes all through its travel through the framework. System Designs plan at that point covers framework analysis, systems designing and framework architecture. The framework's plan approach to begin with showed up right around the time of World War II when engineers were attempting to illuminate complex control and communications issues. (Didacus, 2018.)

3.5.1 Database Schema

The essential part of a database is to store and show overhauled data to an application. Database applications are utilised to look, sort, channel and show data based upon web demands and can moreover contain code to perform scientific and factual calculations. Databases allow and constrain information based upon criteria and implement information keenness by guaranteeing that information is collected and displayed employing a steady format. The 9 different names of the table 5 are for different purposes in order to smoothly run the application created on SQL (Structure Query Language) and to connect/communicate the application to the database NodeJs has been implemented. Some created tables for working our application are mentioned below in TABLE 5 while example of all the tables created are displayed the website section. (ThoughtSpot, 2023.)

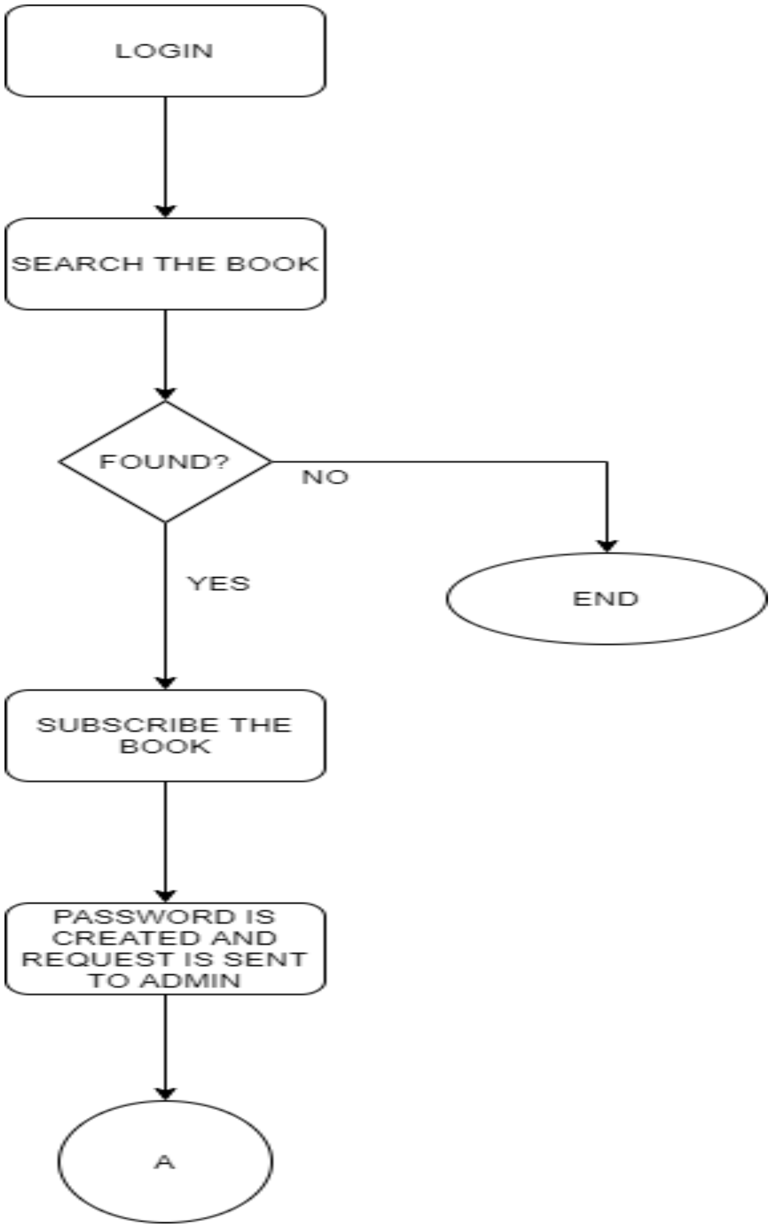
TABLE 5. Examples of tables created on SQL.



	#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra
□	1	**id** 🔑	int(11)			No	*None*		AUTO_INCREMENT
□	2	**username**	varchar(255)	utf8mb4_general_ci		No	*None*		
□	3	**address**	varchar(255)	utf8mb4_general_ci		No	*None*		
□	4	**designation**	varchar(255)	utf8mb4_general_ci		No	*None*		
□	5	**email**	varchar(255)	utf8mb4_general_ci		No	*None*		
□	6	**name**	varchar(255)	utf8mb4_general_ci		No	*None*		
□	7	**phone**	varchar(255)	utf8mb4_general_ci		No	*None*		
□	8	**requestid**	varchar(255)	utf8mb4_general_ci		No	*None*		
□	9	**requestdate**	varchar(255)	utf8mb4_general_ci		No	*None*		

3.5.2 Flow Chart

A flow chart uses simple shapes and symbols to show how the program operates. Process flow diagrams allow us to specifically define the workings and fundamental building blocks of the program. Flowcharts will have all the information from input to output locations, as well as how the data is handled, depending on the sorts of flowchart. A flow chart diagram FIGURE 12 shows the diagrammatic representation of algorithms for book subscription.


LOGIN
SEARCH THE BOOK
FOUND?
NO
YES
END
SUBSCRIBE THE BOOK
PASSWORD IS CREATED AND REQUEST IS SENT TO ADMIN
A

Contd.

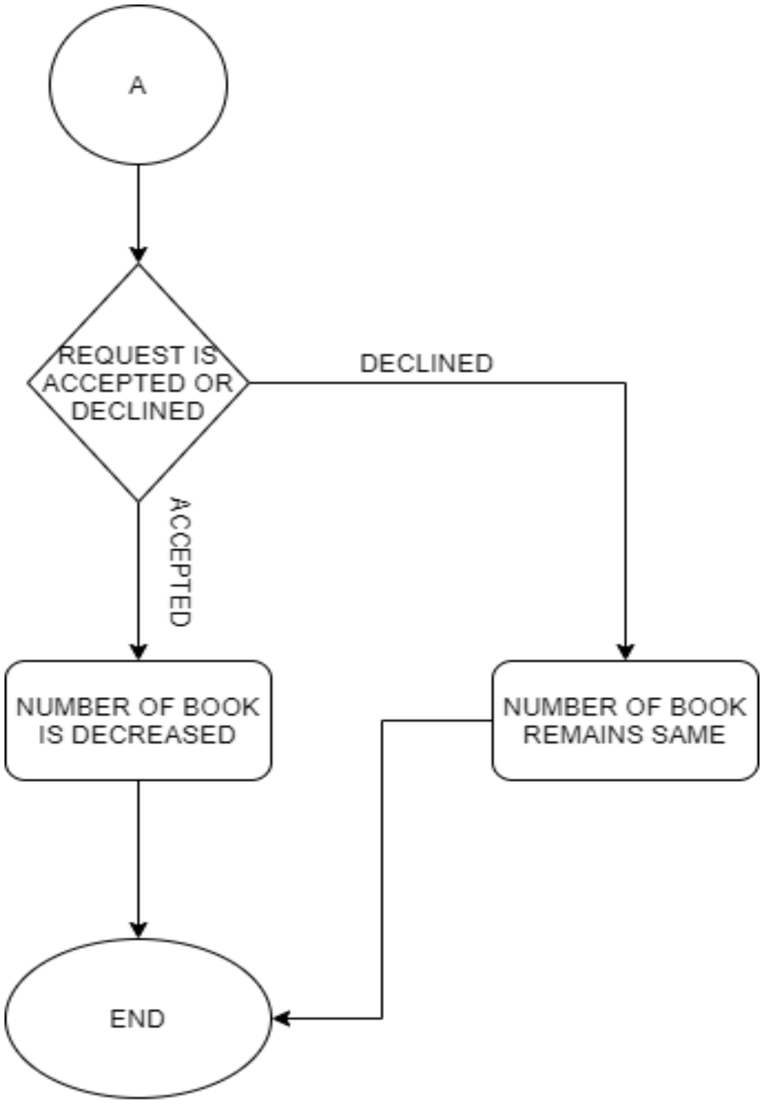

A
REQUEST IS ACCEPTED OR DECLINED
DECLINED
ACCEPTED
NUMBER OF BOOK IS DECREASED
NUMBER OF BOOK REMAINS SAME
END

FIGURE 12. Flow chart diagram for book subscription

4 PROJECT IMPLIMENTATION (LIBRARY MANAGEMENT SYSTEM)

In countries where providing education to the people is still a major problem, a good library where students and readers can pass quality time reading and studying is a good step to encourage education to people. For that requires a good library where modern technologies like computers, internet, e-books, and a good library system is available to store information and data of books and customers which helps provide better service. Therefore, as the digitalization world has taken over our human lifestyle and for more costumer friendly environment the idea of Library Management System approached. The aim of this project is the use of an application for library purposes which will help with a better Library Management System. (MyEdu, 2019.)

4.1 Implementation Tools

During the implementation of the system, a combination of front-end and back-end development tools were utilized. The front-end development tools encompassed technologies such as HTML, CSS, and JavaScript, which were employed to create the user interface and design elements of the system. These tools allowed for the creation of visually appealing and interactive components that enhance user experience. On the back end, programming languages and frameworks like React.js and Node.js were utilized. React.js facilitated the development of dynamic and responsive user interfaces, while Node.js provided a server-side runtime environment for executing server-side logic and handling requests.

4.2 Front End Tools

Front End Technologies are the set of technologies that are used to create the UI (User Interface) of web applications and web pages. With the aid of front-end technologies, developers can create the design, structure, animation, and everything that you see on the screen while visiting a website, webpage, web application, or mobile app. It plays an important part in attracting users and getting them to take action. A seamless front-end will make users adore and recommend the application. Employing front-end tools and technologies to increase user interaction, efficiency, interactivity, and visual design of the application is critical for establishing user loyalty. To accomplish this, mobile and web developers need to be more efficient and precise. The use of React (JSX), CSS and Bootstrap front end technologies are implemented on the system. (Levai, 2022.)

4.2.1 React (JSX)

The render function of React components plays a crucial role in generating HTML for the user interface. By utilizing JavaScript extensions like JSX, developers can create HTML-like code using JavaScript syntax. JSX is an HTML-like syntax that is supported by ECMAScript, allowing it to coexist with JavaScript and React code seamlessly. Preprocessors utilize this syntax to convert the HTML-like code into standard JavaScript data that can be consumed by a JavaScript engine. React JSX is utilized in building the front end of the system, enabling developers to create dynamic and interactive user interfaces. (Norton, 2021.)

4.2.2 CSS

CSS, or Cascading Style Sheets, is a simple design language intended to make web pages presentable by simplifying the look and feel process. It handles the visual aspects of a webpage. Using CSS, control of the color of the text, the design of the fonts, the spacing between paragraphs, the way columns are sized and positioned, and a variety of other things. CSS is used to control the appearance of an HTML document and may be combined with HTML or XHTML to create the majority of the web application. The styling of the project has been done with CSS. (Norton, 2021.)

4.2.3 Bootstrap

Bootstrap is a free and open-source web development framework which offers a variety of syntax for template designs to make the web development process simpler and more responsive, mobile-first websites. Bootstrap's major goal is to produce mobile-first websites. It supplies navigation bars, grid schemes, image carousels, and buttons as example interface elements. As a result, web developers can produce websites more rapidly without needing to handle the fundamental issues. It includes HTML, CSS, and JS code for a variety of web design-related functions and components. Bootstrap is used in the project to add functionality and to make it system responsive and contains CSS and JS-based design templates which makes it easier to build the webpage. (Norton, 2021.)

4.3 Backend Tools

The backend application of the Library Management System was developed using specific tools for effective implementation. In the implementation of the Library Management System, specific backend tools were utilized for effective development and implementation. One of the key tools used was Node.js, which served as a communication interface between the application and the database. Another important tool utilized was MySQL, a relational database management system. MySQL operated based on the Structured Query Language (SQL), a standardized language for managing database data. (Levai, 2022.)

4.3.1 Node.js

Node.js played a pivotal role as a communication interface between the application and the database in the project. It facilitated the smooth exchange of data from the database to the frontend, enabling seamless integration and transmission of information across different components of the application (Shahid, 2021). By leveraging the power of Node.js, the project achieved efficient data flow and effective communication between various parts of the application. This played a crucial role in enhancing the overall performance and functionality of the system, ensuring a seamless user experience.

4.3.2 MySql

For data management and organization, the project utilized MySQL, a powerful relational database management system. MySQL operates using the widely adopted Structured Query Language (SQL), which provides a standardized approach to managing database data. Leveraging the capabilities of SQL, the system performed various essential operations such as data insertion, deletion, and modification. With MySQL at the backend, the system ensured secure and efficient storage and manipulation of data, playing a vital role in the development of a robust Library Management System. By leveraging the features and reliability of MySQL, the project achieved effective data management, enhancing the overall functionality and performance of the system. (Shahid, 2021.)

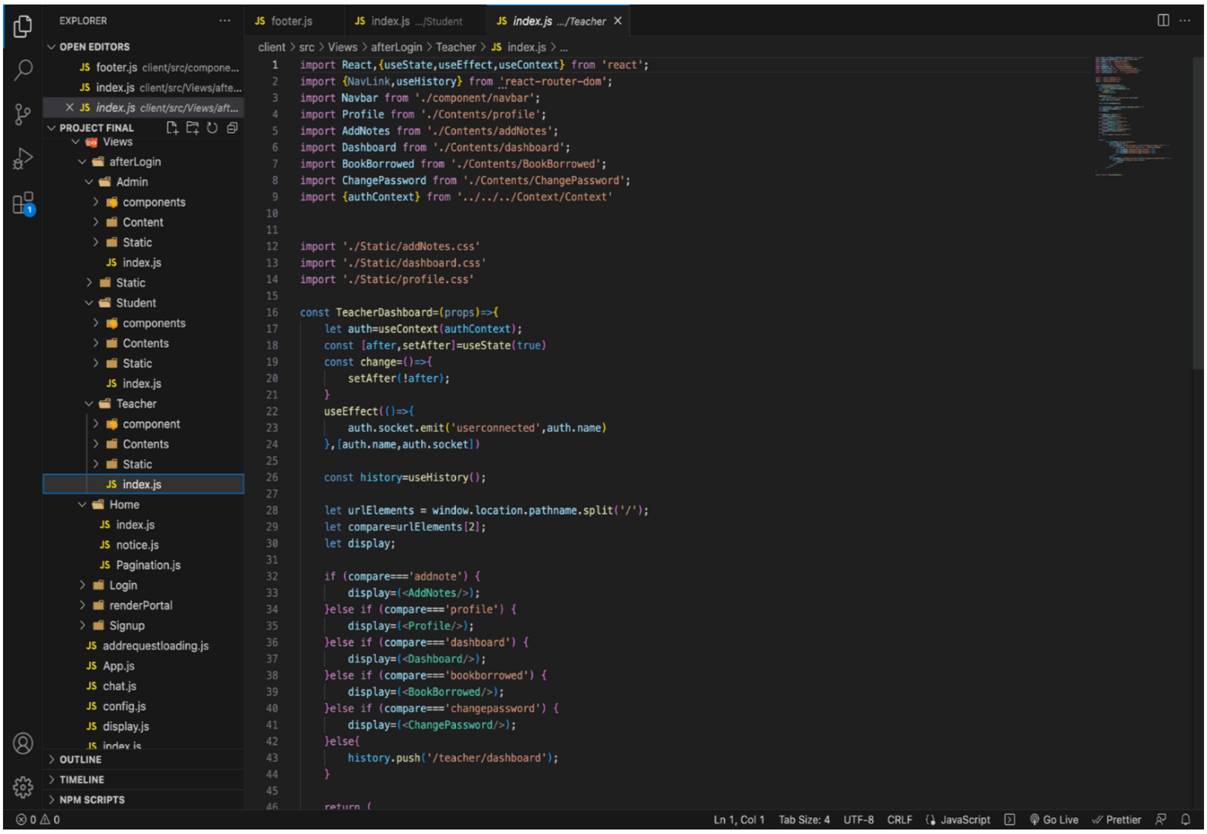
5 WEBSITE AND ITS STRUCTURE

When starting to build a program, choosing the right code editor is important. It should support good code quality, have the latest features, make programming easier, and be free to use. Visual Studio Code, Atom, and Sublime Text are popular options. Visual Studio Code was selected as the preferable code editor for creating the application because it is great for JavaScript and has useful extensions. There are a number of useful extensions and add-ons that have been implemented into Visual Studio Code to improve the programming process. Snippets for ES7 React, Redux, GraphQL, and React-Native, Node.js Modules and Prettier - Code Formatter are a few of them. These extensions add helpful tools for working with React, Node.js, and formatting code neatly. Overall, Visual Studio Code helps us write better code and work more efficiently.

5.1 Project structure in Visual Studio Code

The library management system project is structured in Visual Studio, as illustrated in Figure 13. It encompasses various folders and components that play crucial roles in the project's implementation. Within the project, the package.json file serves as a manifest that lists the dependencies required for the Node.js project. These dependencies consist of external packages or libraries necessary for the proper functioning of the project. The SRC folder, located under the client directory, serves as the core of the project. It contains subfolders, components, content, and elements that constitute the website's structure and functionality. The Views folder contains the after-login and login subfolders. The after-login folder encompasses the code for the admin page, teacher page, and student page, each with their respective CSS files stored in the static subfolder within each main folder. The login folder, on the other hand, includes the code specifically related to the login page. The sign-up folder is responsible for handling the code related to the sign-up page.

Under the components folder within the SRC directory, the navbar.js and footer.js components are present. These components play a crucial role in rendering the respective pages and ensuring a consistent layout and structure. Finally, the App.js file acts as the main component, known as the App Component, in the React application. It serves as a container for all other components, providing a centralized structure and organization for the project. This well-structured project architecture enhances the development process, promotes code organization, and ensures efficient implementation of the library management system. As shown in the FIGURE 13 the project was structured in different folders and components for each page. The respective CSS was written under the static folder. Different folders named student, teacher, admin, login, signup was created to ease the project.



```javascript
import React,{useState,useEffect,useContext} from 'react';
import {NavLink,useHistory} from 'react-router-dom';
import Navbar from './component/navbar';
import Profile from './Contents/profile';
import AddNotes from './Contents/addNotes';
import Dashboard from './Contents/dashboard';
import BookBorrowed from './Contents/BookBorrowed';
import ChangePassword from './Contents/ChangePassword';
import {authContext} from '../../../Context/Context'


import './Static/addNotes.css'
import './Static/dashboard.css'
import './Static/profile.css'

const TeacherDashboard=(props)=>{
    let auth=useContext(authContext);
    const [after,setAfter]=useState(true)
    const change=()=>{
        setAfter(!after);
    }
    useEffect(()=>{
        auth.socket.emit('userconnected',auth.name)
    },[auth.name,auth.socket])

    const history=useHistory();

    let urlElements = window.location.pathname.split('/');
    let compare=urlElements[2];
    let display;

    if (compare==='addnote') {
        display=(<AddNotes/>);
    }else if (compare==='profile') {
        display=(<Profile/>);
    }else if (compare==='dashboard') {
        display=(<Dashboard/>);
    }else if (compare==='bookborrowed') {
        display=(<BookBorrowed/>);
    }else if (compare==='changepassword') {
        display=(<ChangePassword/>);
    }else{
        history.push('/teacher/dashboard');
    }

    return (
```

FIGURE 13. Library management system visual studio code.

5.2 Website

The designed single page application offers a user-friendly experience, enabling easy usage for both teachers and students. Teachers have the capability to effortlessly add files to the designated category, while students will encounter no difficulties accessing the library's online server. The student and teacher can view the available books and facilitate their book selection and subscription process. The application also simplifies tasks such as book renewal and deletion, further enhancing its user-friendly nature. The result of the website is further explained and shown below.

5.2.1 Login page

Figure 14 illustrates the login functionality of the system, showcasing the user interface where authorized users can enter their username and password. This visual representation aids in understanding the login process and the interface design. The system validates the provided credentials against the predefined records, ensuring the authentication of the user. Once successfully logged in, users are redirected to the dashboard, granting them access to the system's features and resources. The login functionality serves as a pivotal security measure, safeguarding the system from unauthorized access and protecting sensitive information. Through the implementation of Figure 14's depicted login process, the system ensures a seamless and secure user experience, promoting the efficient usage of the library management system.

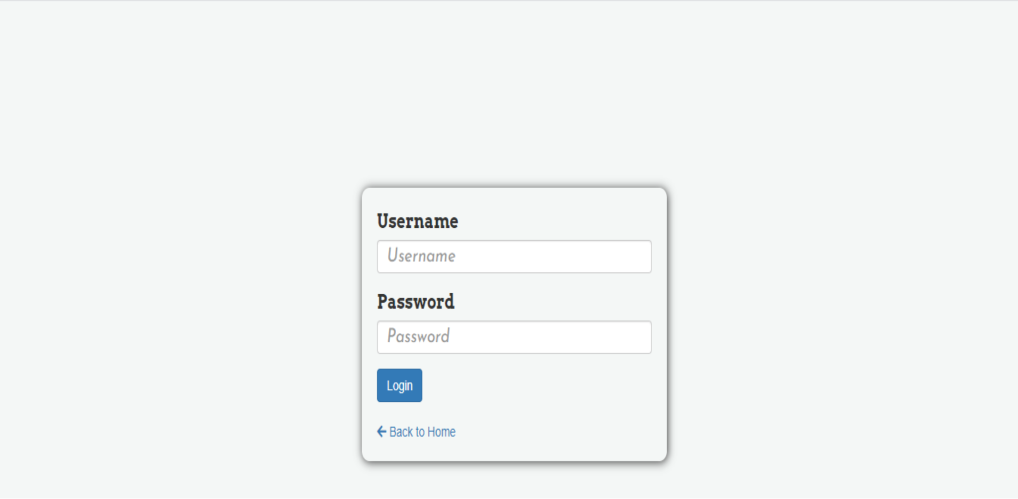


FIGURE 14. Login page

5.2.2 Navbar

Figure 15 showcases the navbar of the project, which is positioned on the left side of the screen and is accessed by clicking the burger menu. The navbar serves as a crucial navigation menu, providing users with easy access to various sections and functionalities of the application. By clicking on the burger menu, users can expand the navbar and view the available options for navigation. This intuitive design ensures that users can quickly and conveniently navigate through different areas of the application. The navbar enhances the user experience by providing a clear and organized menu structure, allowing users to effortlessly explore and utilize the features and functionalities of the project.

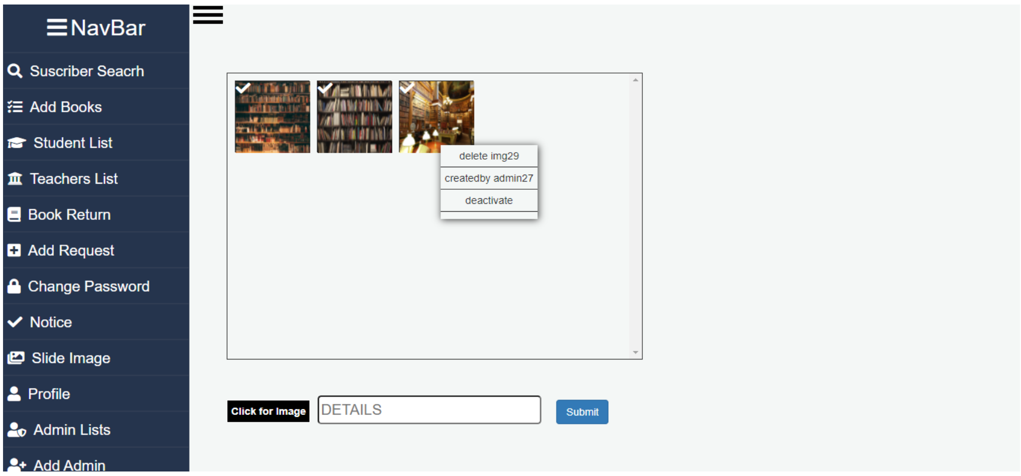
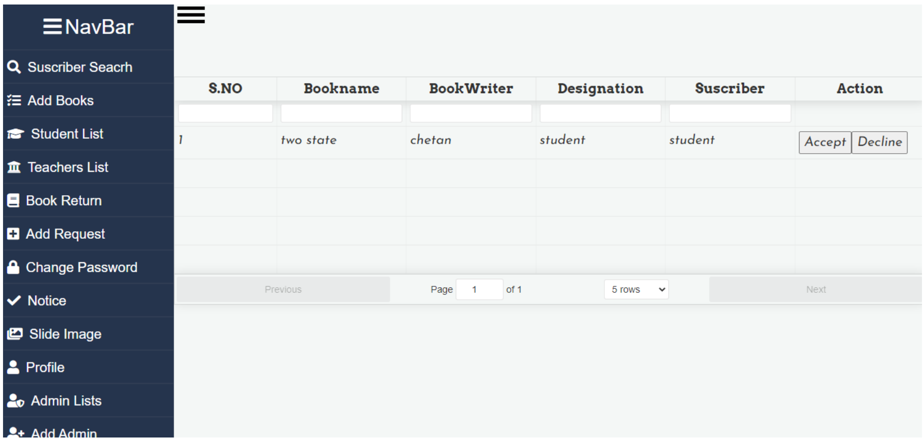


FIGURE 15. Navbar

5.2.3 Subscriber Search

Within the described navbar, users can find several buttons that offer quick access to different features and information. One such button is the search button, as depicted in Figure 16. By clicking on this button, users can initiate a search for subscribers or students within the system. The search functionality enables users to locate specific individuals or access relevant information by inputting search criteria. This feature enhances the usability and efficiency of the system by facilitating easy retrieval of desired data. Figure 16 visually represents the search button and its associated functionality, providing users with a clear understanding of how to utilize this feature. With the search button in the navbar, users can efficiently navigate the system and access the necessary information they require.

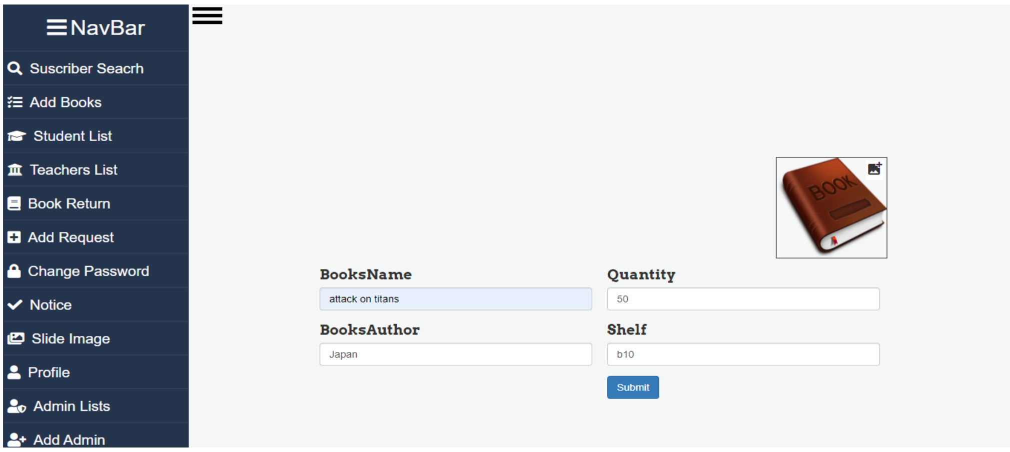


S.NO	Bookname	BookWriter	Designation	Suscriber	Action
1	two state	chetan	student	student	Accept Decline

FIGURE 16. Subscriber search

5.2.4 Add Books

The "Add Books" functionality, represented by Figure 17, plays a vital role in the library management system. By clicking on this button, users with appropriate privileges, such as teachers or administrators, can access a dedicated form to input the details of new books. This form allows for the efficient and accurate recording of essential book information, such as the title, author, publication, and other relevant data. The "Add Books" feature ensures the systematic and organized addition of new books to the system's library, contributing to the expansion and management of the collection. Figure 17 visually illustrates the form interface, providing users with a clear understanding of how to input the required book details. Through the "Add Books" functionality, users can streamline the process of updating the library's inventory and ensure the availability of accurate and up-to-date information for users.



BooksName: attack on titans

Quantity: 50

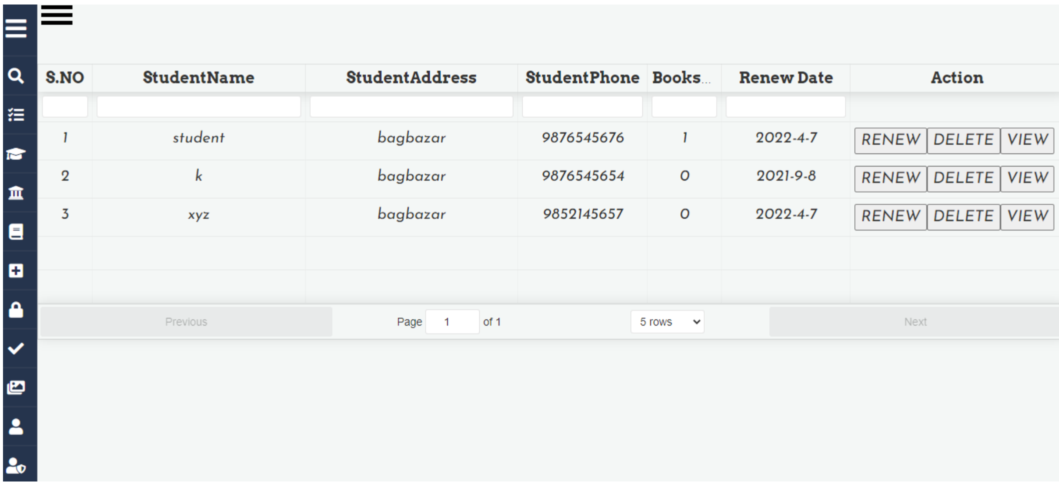
BooksAuthor: Japan

Shelf: b10

FIGURE 17. Add book page

5.2.5 Student List

The "Student List" feature, represented by Figure 18, grants users the ability to access a comprehensive list containing information about all the students registered within the system. By clicking on this button, users can conveniently view student profiles, associated books, renewal dates, and other relevant details. This functionality facilitates efficient student management, allowing users to track student activities, loaned books, and other relevant actions. Figure 18 visually represents the interface where the student list is displayed, providing users with a clear overview of the available information. With the "Student List" feature, users can effectively monitor and manage student-related activities within the library management system, ensuring smooth operations and efficient student engagement.

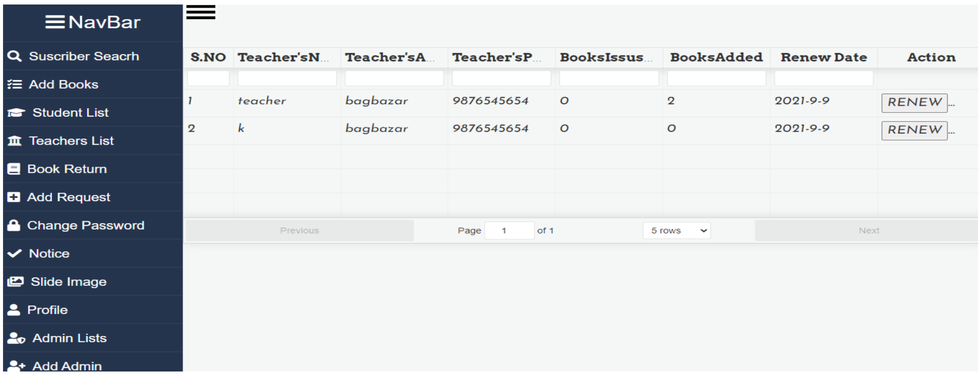


S.NO	StudentName	StudentAddress	StudentPhone	Books...	Renew Date	Action
1	student	bagbazar	9876545676	1	2022-4-7	RENEW DELETE VIEW
2	k	bagbazar	9876545654	0	2021-9-8	RENEW DELETE VIEW
3	xyz	bagbazar	9852145657	0	2022-4-7	RENEW DELETE VIEW

FIGURE 18. Student list page

5.2.6 Teacher List

The "Teacher List" feature, illustrated in Figure 19, provides users with access to a comprehensive list containing information about teachers registered within the system. By clicking on this button, users can conveniently view teacher profiles, contact information, book issues, book additions, renewal dates, and other relevant details. This functionality facilitates effective management of teachers within the library management system, allowing users to monitor teacher activities, track issued books, and perform necessary actions. Figure 19 visually represents the interface where the teacher list is displayed, presenting users with a clear overview of the available information. With the "Teacher List" feature, users can efficiently manage teacher-related activities, establish effective communication, and ensure smooth operations within the library management system.

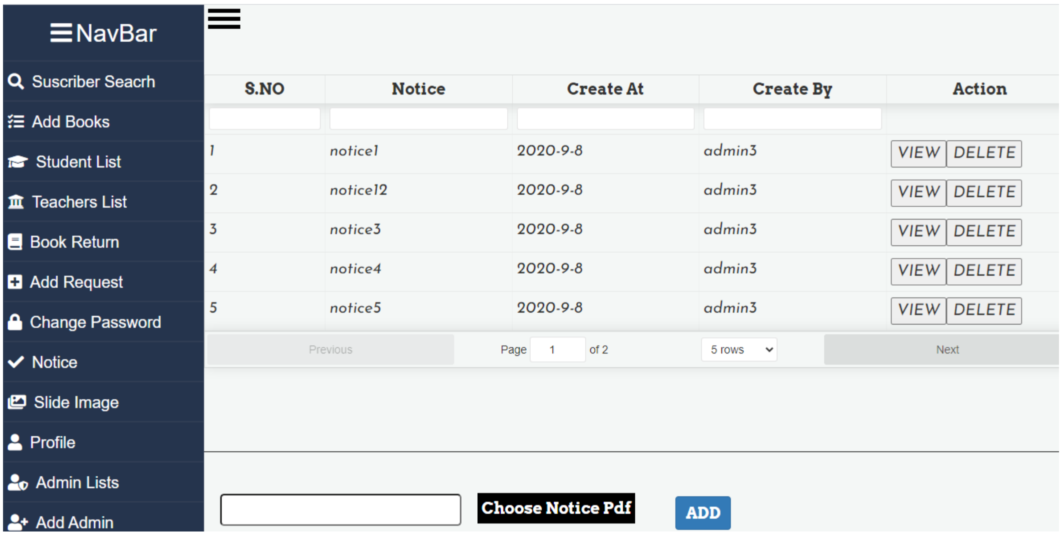


S.NO	Teacher'sN...	Teacher'sA...	Teacher'sP...	BooksIssus...	BooksAdded	Renew Date	Action
1	teacher	bagbazar	9876545654	0	2	2021-9-9	RENEW ...
2	k	bagbazar	9876545654	0	0	2021-9-9	RENEW ...

FIGURE 19. Teacher list page

5.2.7 Notice page

The "Notice Page" feature, as illustrated in Figure 20, grants users access to a dedicated section within the system for system-wide notices or announcements. By clicking on this button, users can conveniently view important messages, updates, and notifications that are relevant to both students and teachers. The "Notice Page" serves as a centralized platform for disseminating critical information to the system's users, ensuring effective communication and timely awareness of important matters. Figure 20 visually represents the interface where notices or announcements are displayed, providing users with a clear understanding of how to access and view the relevant information. With the "Notice Page" feature, users can stay informed about system-wide updates and important notifications, fostering effective communication and engagement within the library management system.



S.NO	Notice	Create At	Create By	Action
1	notice1	2020-9-8	admin3	VIEW DELETE
2	notice12	2020-9-8	admin3	VIEW DELETE
3	notice3	2020-9-8	admin3	VIEW DELETE
4	notice4	2020-9-8	admin3	VIEW DELETE
5	notice5	2020-9-8	admin3	VIEW DELETE

FIGURE 20. Notice information page

5.2.8 Slide Image

The button represented by Figure 21 introduces a slideshow feature within the system. By clicking on this button, users are directed to a dedicated page that presents a collection of images or visual content. The slideshow functionality allows users to manually or automatically scroll through the images, providing an engaging and visually appealing experience. Users can enjoy the visual content presented in the slideshow, which may include images relevant to the library, events, promotions, or other visually captivating elements. Figure 21 visually represents the interface where the slideshow is displayed, offering users a glimpse into the immersive visual experience provided by this feature. With the slideshow functionality, users can enjoy a dynamic and visually stimulating presentation of images within the library management system.

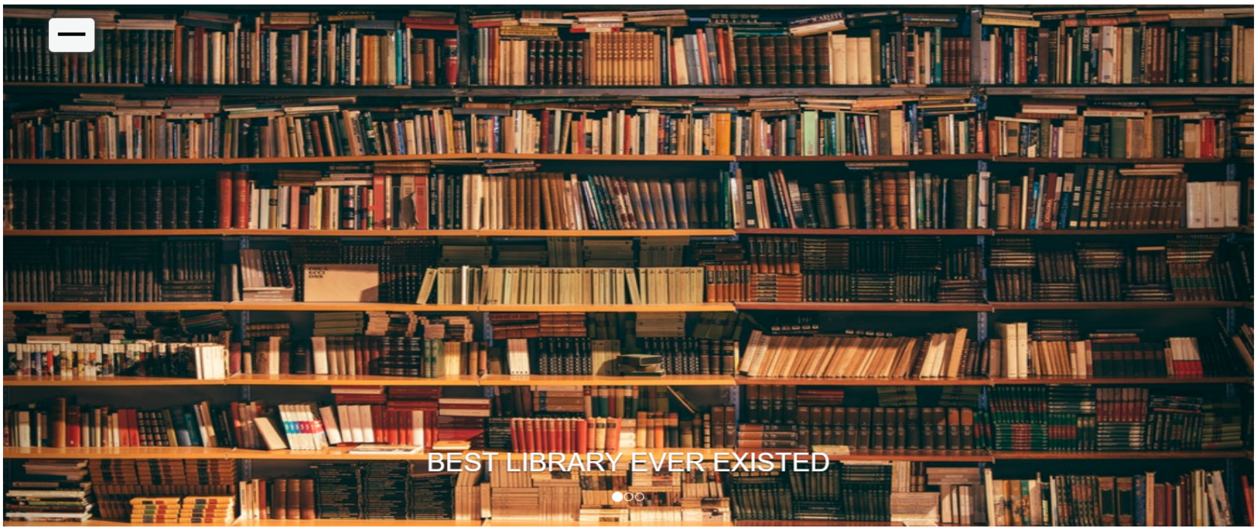
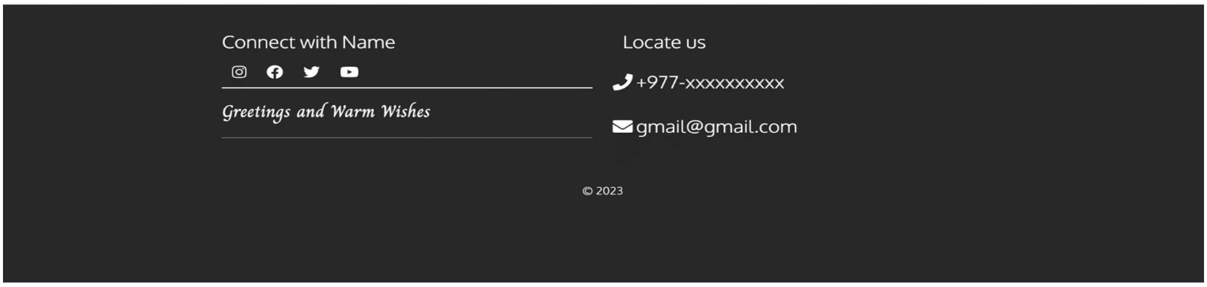


FIGURE 21. Slide image page

5.2.9 Footer

The footer section, as shown in Figure 22, is an essential component of the library management system website. It includes a "Connect with Name" section with logos of popular social media platforms like Instagram, Facebook, Twitter, and YouTube, allowing users to engage and stay updated by accessing the library's social media profiles. The footer also provides a "Locate Us" section, displaying the library's contact information such as address, phone number, and email address. This enables users to easily find and contact the library for inquiries or assistance. The footer section enhances the user experience by providing convenient access to the library's social media presence and contact details, promoting effective engagement, and facilitating communication.'


Connect with Name

Greetings and Warm Wishes

Locate us

☎ +977-xxxxxxxxxx

✉ gmail@gmail.com

© 2023

FIGURE 22. Footer of the website

6 CONCLUSION

The project's primary motivation was driven by a desire to enhance skills and gain valuable experience by venturing outside the comfort zone. Although my initial knowledge of React.js was limited, I took on the challenge and embarked on a journey of expanding my skill set and exploring unfamiliar technologies. This project served as a platform for me to learn and acquire new skills, which I believe will significantly benefit me in future endeavors. By pushing myself beyond what I was familiar with, I have gained valuable insights and experiences that have broadened my horizons and allowed me to grow both personally and professionally. I am confident that the skills and knowledge acquired through this project will serve as a solid foundation for my future endeavors in the field.

The project is primarily divided into two parts. Acquiring the knowledge and concept of React Js framework was the first goal of the project. Another part was to put the theory into practice and build a simple website design Library Management System with React Js. With these sets of goals, the thesis began with the theoretical subjects about React Js and its concepts. To understand the knowledge and concept of React Js various research was done with the help of the technologies available on the Internet. In the final part of the project, the goal was to build a website design. After some study of several web services technologies, the development framework was executed. This system offers an organized platform to the users. It overcomes the limitations of old library management and provides a platform for teachers, students, and administrators with effective library management resonating with the modern generations. Even though the project Library Management System (LMS) still is an ongoing project website design, it has met the requirements to complete the thesis and to provide all the requirements to accomplish the objectives of the thesis. In summary, the objectives of the thesis were acquired when comparing the two parts of the thesis with the result. Additionally, opportunity to learn the variety of web development matters, and experience was also gained while completing the thesis.

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