Research paper on Real Time Wildlife Observational Journal using MERN Stack Technologies

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Abstract— The MERN stack is a popular technology stack used for developing web applications. It consists of MongoDB, Express.js, React, and Node.js. This paper discusses why the MERN stack is widely used and its advantages over previous technologies such as HTML, CSS, SQL, and NoSQL. The paper also provides a brief overview of the MERN stack components, their functionalities, and their role in developing web applications.

Keywords-MERN stack, MongoDB, Express.js, React, Node.js, web applications, HTML, CSS, SQL, NoSQL, front-end, back-end.

I.   INTRODUCTION

In recent years, the use of the MERN stack has become increasingly popular in web development. This technology stack consists of MongoDB, Express.js, React, and Node.js. Each component of the MERN stack has a specific function, and together they provide a full-stack development environment that allows developers to create web applications efficiently. In this paper, we will discuss why the MERN stack is widely used and its advantages over previous technologies such as HTML, CSS, SQL, and NoSQL. MongoDB is a popular NoSQL document-oriented database that stores data in flexible JSON-like documents, making it easy to scale and maintain.

Express.js is a lightweight and flexible Node.js web application framework that provides an easy-to-use API for building web applications. React is a JavaScript library for building user interfaces that allows developers to create reusable components and manage complex application states.   Node.js is a powerful and efficient JavaScript runtime environment that allows developers to build scalable and high-performance server-side applications. Together, these technologies provide a full-stack JavaScript solution for building modern web applications. The MERN stack allows developers to leverage the power of JavaScript on both the client-side and server-side, providing a seamless and unified development experience. It is highly flexible and customizable, making it suitable for a wide range of applications, from small-scale prototypes to large-scale enterprise-level systems.

II. ARCHITECTURE
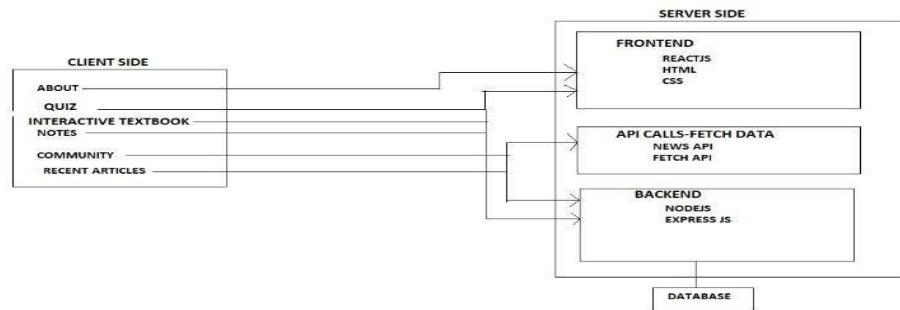
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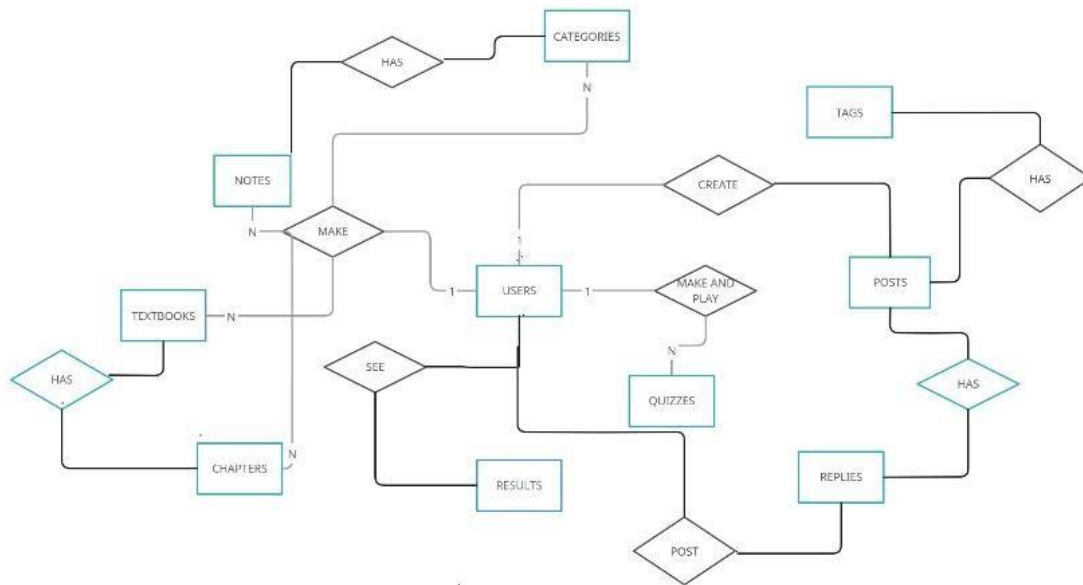
IV. WORKING

So here our project is to create an online system that provides interactive textbooks, notes and quizzes. Here in this project, we use MERN stack which stands for MongoDB, Express JS, React and Node JS. MongoDB which is a database used for storing the data of the user. Here, we have created the four schemas which are notes, interactive textbooks, login details and quizzes.

We have used MONGO DB because in SQL we can store only the data which is structured but in MongoDB we can store unstructured data as well. In our notes section, we can put various types of data like images, text, bold text which is unstructured that's why we have used MongoDB. Express JS is used for authentication and error handling. Errors like if for some reason the web page is not visible then which error have to show, the Express JS will handle this. Express js is used for making server-side applications with Node JS. Here we use the port 2000.

React JS which is used for making single web page applications. We make various components like ABOUT US ,

NOTES, WIDGETS, and many more. REACT uses virtual DOM so whenever is there any requirement to change the content that component will change so there is no need to refresh the page. We use memo to prevent the unnecessary rendering of the component. Suppose, there is a component named as useColour but suppose I have not used this component but this component renders every time so this will ultimately effects to cost and efficiency so to overcome this problem we use memo.

We use various types of hooks like useState, useContext, useRef, useEffect. useState is used for tracking the state of the properties. UseState will take two properties one is the variable and the other one is the function that updates the variable. UseEffect will be same as memo which is used to prevent the unnecessary re-rendering of the applications. UseEffect takes the two arguments first is function and second one is dependency. Dependency is like a array that decides how much times we have to render the application. Use context hook used together with use State to manage the state globally. In backend we have used hackerNEWS API, which is used to fetch the news with the help of the API. We use libraries like axioms and get method in which we pass the URL of that API. The data that is returned by get method in JSON format so we have to parse the JSON to extract the relevant data. To run the JavaScript on server we use node JS. JavaScript is synchronous single threaded language so to make the JavaScript asynchronous and multithreaded language we use node JS. Synchronous means one line will be executed at a time and execution takes place from top to bottom line by line.

Asynchronous means multiple functions can execute simultaneously like setTimeOut Function which takes the function and time as the argument so this the example of asynchronous JavaScript.

We have also import the functionality of like if the user wants to read their own articles means their favorite topic articles so they can search it in search bar and the screen will displays all the articles related to that topic. We have the quiz section in which we have to provide the question with four options and if there is any question like true false type then fill another two options with 0. After that the code will generate and we need to paste that code to start the quiz.

V. MERN STACK COMPONENTS

MongoDB is a NoSQL database that stores data in a document-oriented format. Express.js is a back-end web application framework that provides a set of tools for creating RESTful APIs. React is a front-end library that enables developers to create dynamic user interfaces. Node.js is a JavaScript runtime environment that allows developers to write server-side code in JavaScript.

Express.js is a popular web framework for Node.js that simplifies the process of building web applications. Here are some important points to keep in mind when working with Express.js:

1. Routing: Express.js provides an easy-to-use API for defining routes that respond to specific HTTP requests. This allows you to handle requests and return responses based on the requested URL, HTTP method, and other factors.

2. Middleware: Express.js allows you to use middleware functions to modify the request and response objects before they are processed by the route handler. This can be used for tasks such as authentication, logging, and error handling.

3. Template engines: Express.js supports a variety of template engines that allow you to render dynamic HTML

pages based on data from the server. Some popular template engines supported by Express.js include EJS, Handlebars, and Pug.

4. Error handling: Express.js provides a built-in error handling mechanism that allows you to handle errors that occur during request processing. You can define error-handling middleware that will be called when an error occurs, allowing you to log the error, send an error response to the client, or take other actions.

5. Static files: Express.js provides a built-in middleware function for serving static files, such as HTML, CSS, and JavaScript files. This allows you to serve client-side assets directly from the server, without having to use a separate file server.

6. Security: Express.js provides a number of security features out of the box, such as CSRF protection, XSS protection, and content security policies. It also supports a variety of authentication and authorization strategies, such as session-based authentication, JSON Web Tokens (JWT), and OAuth.

VI. Advantages of the MERN Stack

1. One of the significant advantages of using the MERN stack is that it allows developers to use a single language, JavaScript, for both front-end and back-end development. This makes the development process more efficient and reduces the learning curve for developers who are already familiar with JavaScript.

2. Another advantage of the MERN stack is that it is based on open-source technologies, making it a cost-effective option for businesses and startups. The MERN stack also provides a flexible and scalable architecture that can be customized to meet the specific needs of Full-stack JavaScript.

3. The MERN stack uses JavaScript as the primary language for both server-side and client-side development, making it easy to build a consistent and seamless web application. This allows developers to use a single language and skillset to build an entire application, reducing the time and effort required for development.

4. The MERN stack is designed for rapid development, and it offers a wide range of tools and libraries that can speed up the development process. This allows developers to quickly build and deploy applications, reducing the time to market and allowing for faster iteration and feedback.

VII. COMPARISON OF HTML/CSS WITH REACT

React and HTML/CSS are both used for creating web applications, but they differ in several ways. One of the key differences is in their architecture. React is a component-based framework that allows developers to create reusable UI components, while HTML/CSS are markup and styling languages that define the structure and visual presentation of web pages, but do not provide a component-based architecture. Another difference is in the way they handle updates to the user interface. React uses a virtual DOM to efficiently update the UI, while HTML/CSS require a full-page refresh when changes are made. This makes React faster and more efficient, especially for complex web applications with many dynamic elements. React also has a steeper learning curve compared to HTML/CSS, as it requires knowledge of JavaScript and its syntax, as well as the React framework and its associated tools. However, React offers a streamlined development process by providing features such as hot module replacement, which allows developers to see changes in real-time without refreshing the page. It also has a large and active community that offers support, tutorials, and third-party libraries to enhance development.

In summary, React offers a component-based architecture, virtual DOM, efficient performance, and streamlined development process, while HTML/CSS provide markup and styling languages for defining the structure and presentation of web pages. The choice between React and HTML/CSS depends on the specific requirements of the application and the skill set of the development team.

VIII.   COMPARISON OF SQL WITH MONGODB AND NOSQL

SQL and NoSQL are two different types of databases with different data models and storage structures. MongoDB is a popular NoSQL database. SQL databases use a structured data model, where data is organized in tables with rows and columns, and relationships are established between tables using foreign keys. This makes it easy to query data using SQL, a standardized language used to manage relational databases. On the other hand, NoSQL databases use a flexible data model, where data is stored in a variety of ways, such as key-value pairs, documents, or graphs. This allows for faster and more flexible queries, especially for large datasets with complex or changing structures.

When comparing SQL and NoSQL databases, some of the main differences include:

1.   Data model: SQL databases have a structured data model with tables, while NoSQL databases have a flexible data model that can store data in various formats.
2.   Scalability: NoSQL databases are typically more scalable than SQL databases, as they can be easily distributed across multiple servers.

3.   Query language: SQL databases use SQL, a standardized language for querying relational databases, while NoSQL databases use a variety of query languages depending on the data model.

4.   Transactions: SQL databases support ACID transactions, which ensure data consistency, while NoSQL databases typically sacrifice some level of consistency in favor of speed and scalability.

IX.   WHEN COMPARING MONGODB WITH OTHER NOSQL DATABASES, SOME OF THE MAIN DIFFERENCE INCLUDES:

1. Data model: MongoDB stores data in BSON documents, which are similar to JSON documents, while other NoSQL databases may use different formats such as key-value pairs or graphs.

2. Query language: MongoDB uses a query language called MongoDB Query Language (MQL), which is similar to SQL in some ways, while other NoSQL databases may use different query languages.

3. Indexing: MongoDB has a powerful indexing system that allows for fast queries, including geospatial queries, while other NoSQL databases may have more limited indexing options.

4. Schema flexibility: MongoDB allows for flexible schemas, which can be useful for storing unstructured or semi- structured data, while other NoSQL databases may have more rigid schemas.

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