

# **Yadey : A Social Media Web App**

Project report submitted in partial fulfilment of the requirement for  
the degree of Bachelor of Technology

in

**Computer Science and Engineering/Information Technology**

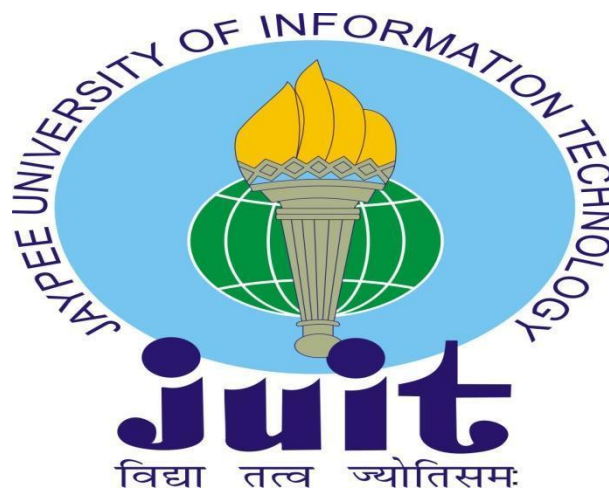
By

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Under the supervision of

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to



Department of Computer Science & Engineering and Information  
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# CERTIFICATE

## Candidate's Declaration

I hereby declare that the work presented in this report entitled “**Yadey: A Social Media App**” in partial fulfilment of the requirements for the award of the degree of **Bachelor of Technology in Computer Science and Engineering/Information Technology** submitted in the department of Computer Science & Engineering and Information Technology, Jaypee University of Information Technology Waknaghat is an authentic record of my own work carried out over a period from February 2023 to May 2023 under the supervision of **Mr. Arvind Kumar, Assistant Professor, CSE/IT**.

I also authenticate that I have carried out the above mentioned project work under the proficiency stream **Cloud Computing**.

The matter embodied in the report has not been submitted for the award of any other degree or diploma.

Kaushik Deka(191378)

This is to certify that the above statement made by the candidate is true to the best of my knowledge.

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# Table of Contents

<b>1.</b>	<b>INTRODUCTION</b>	<b>1</b>
	<b>1.1 Introduction</b>	<b>1</b>
	<b>1.2 Problem Statement</b>	<b>1</b>
	<b>1.3 Objectives</b>	<b>1</b>
	<b>1.4 Methodology</b>	<b>2</b>
	<b>1.5 Organisation</b>	<b>3</b>
<b>2.</b>	<b>LITERATURE SURVEY</b>	<b>4</b>
<b>3.</b>	<b>SYSTEM DEVELOPMENT</b>	<b>8</b>
	<b>3.1 Architecture Design</b>	<b>8</b>
	<b>3.2 System design Implementation</b>	<b>9</b>
	<b>3.3 Website design</b>	<b>15</b>
	<b>3.4 Front-end Implementation</b>	<b>18</b>
	<b>3.5 State Management using React-redux</b>	<b>26</b>
	<b>3.6 Routing</b>	<b>28</b>
	<b>3.7 APIs</b>	<b>29</b>
	<b>3.8 React Formik</b>	<b>30</b>
	<b>3.9 React Dropzone</b>	<b>31</b>
	<b>3.10 The Back-end implementation</b>	<b>32</b>
	<b>3.11 MongoDB and Mongoose</b>	<b>34</b>
	<b>3.12 Controllers</b>	<b>39</b>
	<b>3.13 Overall flow of Data</b>	<b>47</b>
	<b>3.14 Three-tier architecture</b>	<b>47</b>

<b>4.</b>	<b>RESULT</b>	<b>49</b>
	<b>4.1 Login and Registration</b>	<b>49</b>
	<b>4.2 Home Page</b>	<b>51</b>
	<b>4.3 Creating and Searching a post</b>	<b>53</b>
	<b>4.4 Performance analysis</b>	<b>55</b>
	<b>4.5 Final list of dependencies</b>	<b>55</b>
	<b>4.6 Mobile view</b>	<b>56</b>
<b>5.</b>	<b>CONCLUSION</b>	<b>57</b>
	<b>5.1 Conclusion</b>	<b>57</b>
	<b>5.2 Future Work</b>	<b>58</b>
<b>6.</b>	<b>REFERENCES</b>	<b>59</b>

## Abbreviations

API	Application Programming Interface
NPM	Node Package Module
MVC	Model-View-Controller
HTTP	Hypertext Transfer Protocol
NoSQL	Non- Structured Query Language
JSON	JavaScript Object Notation
BSON	Binary JSON
RDBMS	Relational Database Management System
HTML	Hypertext Markup Language
MVVM	Model-View-ViewModel
JSX	JavaScript XML
SPA	Single Page Application
URL	Uniform Resource Locator
UI	User Interface

## List of Figures

Figures	Name	Page No
1.1	MERN Stack Architecture	2
2.1	The Evolution of Web	4
3.1	A 3-tier MERN architecture	8
3.2	Client side work environment	9
3.3	Server side work environment	9
3.4	NodeJS Request Flow	12
3.5	Express Js Request Flow	13
3.6	ER relationship of the MongoDB Database	14
3.7	Registration page	16
3.8	Login Page	16
3.9	Home screen in Dark Mode	17
3.10	Home Screen in light mode	17
3.11	React Workspace and folder hierarchy	18
3.12	Working of useState hook	22
3.13	Working of useContext hook	23
3.14	React hooks lifecycle	24
3.15	The flow control of redux	26
3.16	Redux state management	27
3.17	Working of react router	29
3.18	Location of API file	30
3.19	Form creation using react formik	31
3.20	React dropzone using hooks	32
3.21	Server running on port 3001	33
3.22	Client running on port 3000	34



3.23	Module import/require workflow	36
3.24	User Schema	37
3.25	Post schemas	38
3.26	Middleware code for authentication	39
3.27	Controllers	40
3.28	Getting a post	40
3.29	Updating a Post	41
3.30	Creating a Post	42
3.31	Getting User and user friends	43
3.32	Updating and removing user friends	44
3.33	Registering User	45
3.34	Logging user	46
3.35	Data flow in a typical web application	47
3.36	The web dev architecture(three-tier)	47
4.1	Login page	49
4.2	Registration Page.	50
4.3	User info in the MongoDB database	50
4.4	Clean looking homepage in Light Mode	51
4.5	Button to change to Dark Mode.	51
4.6	Logout option	52
4.7	Homepage in dark mode	52
4.8	Post creation design	53
4.9	Post on homepage	53
4.10	Post logged in the MongoDb database	54
4.11	The post's metadata on the console	54
4.12	The package.json file	55
4.13	The app mobile view	56

## List of Tables

3.1	Hardware requirements	15
3.2	Software requirements	15
3.3	Props vs State in react	21

## **Abstract**

The summary provided describes a full-stack responsive social media application built using the MERN stack (MongoDB, Express.js, React, and Node.js). The application follows a three-layered architecture and includes unit tests for each layer.

The application offers user registration with comprehensive validation, including the ability to upload a user image for their profile. Users can register, sign in using their email and password, and access a clean and user-friendly home page with various widgets. The user profile details are displayed, and the current user can create, edit, and delete posts, as well as add images to their posts. Users can view a news feed of all posts, like and dislike posts, and view comments. Friend functionality is provided, allowing users to add and remove friends, view their friends' profiles, and write posts for other users.

The application supports a light and dark mode, and it is fully responsive, ensuring optimal user experience on different screen sizes. The frontend utilises React as the framework, React Router for navigation, Formik and Yup for form and validation, Redux Toolkit for state management with Redux Persist for local storage, and React Dropzone for image uploads.

On the backend, Node.js serves as the runtime environment, while Express.js acts as the backend framework. MongoDB is used as the database, and Mongoose is employed for managing database operations. Authentication is handled using JSON Web Tokens (JWT), and Multer is used for file uploading.

Middleware is implemented to authenticate HTTP requests before sending them to the server. The frontend is built using HTML, CSS, and JavaScript, with extensive use of Bootstrap templates. On the backend, Node.js and its packages, such as Express.js and JWT, are employed, and Mongoose is used to write more readable code.

# CHAPTER 1 : INTRODUCTION

## 1.1 Introduction

It is a full stack responsive social media application using MERN stack that implements CRUD operations based on the three layered architecture. Programs at each layer have their own unit test. The social media application consists of a register page with complete validation along with functionality to upload a user image for their profile. Any user can register and can then use the registered email address and password to sign in. The home page has a very clean UI with a number of different widgets. There is also a box that shows the complete user profile details. The current user that's signed in will be able to make posts as well as add an image for the post. They can edit, delete and actually make the post. They can also see the users news feed of all the posts that have been created. The users can also actually like and dislike any posts that they want. They can view the comments as well. They can add a friend if they would like and the friend list will be updated over. The users can add any amount of friends and can remove them if we want to. They can also view the profiles of other users and can see the other person's friends. The person also has the ability to write a post for another user and then can see their user post as well. We can change from light mode to dark mode and vice versa and more importantly everything is going to be completely fully responsive so the user can see the exact same website on smaller screens with modified adjustments for everything most importantly. Everything on the frontend, all the information comes from backend APIs which are retrieving information from the databases(MongoDB). The project is done on the MERN stack which includes Mongo database, Express.js, React and Node. Specifically for the front end, React is used as a framework. React router for navigation. Formic and YUP for form and form validation. Redux toolkit for state management with Redux Persist to store in local storage and React Dropzone for image uploads.

For the back end, Node.js is used as the runtime environment. Express.js as the backend framework. Mongoose for managing the database. JSON Web Token (JWT) for authentication and Multer for file uploading.

There is also an implementation of middleware that authenticates the http request before sending it to the server. Front-end of the website is made using html, css, javascript.

Bootstrap templates are used extensively. For the back-end we are using nodejs and its packages such as Express js, JWT(for authentication and security). Its library Mongoose is used to write more readable code.

### 1.2 Problem Statement

To apply industrial best practices and create a fast, scalable and secure web application. To learn and apply the knowledge of front-end development in real life projects and to understand the in-depth working of MERN Stack applications.

### 1.3 Objectives

To create testable, structured, clean and maintainable web applications by using industrial best practices. To apply the knowledge about the technologies thought to us thus far and gain practical experience.

### 1.4 Methodology

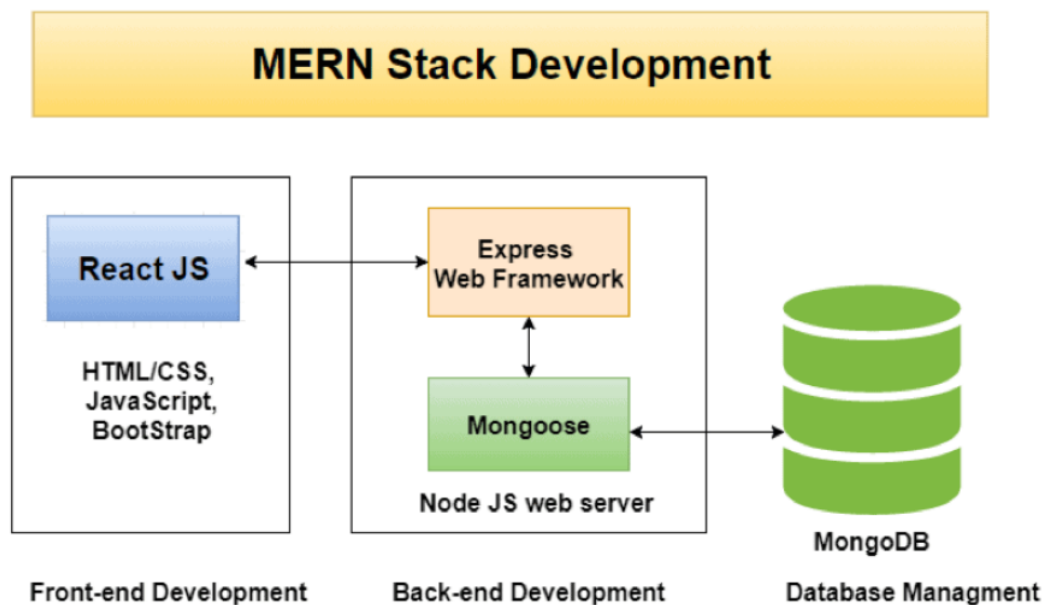


Fig 1.1 MERN Stack Architecture

The front-end of this website is developed exclusively using Reactjs. Material-ui is used for styling instead of plain CSS. This combination allows faster development and scalability. Each component can be developed simultaneously and error in one component won't affect other components. The project is done on the MERN stack which includes Mongo database, Express.js, React and Node. Specifically for the front end, React is used as a framework. React router for navigation. Formic and YUP for form and form validation. Redux toolkit for state management with Redux Persist to store in local storage and React Dropzone for image uploads.

For the back end, Node.js is used as the runtime environment. Express.js as the backend framework. Mongoose for managing the database. JSON Web Token (JWT) for authentication and Multer for file uploading. We have used Expressjs for making APIs and MongoDB as a database. Mongoose is a framework for MongoDB and Express Js.

Executing HTTP requests is React's responsibility. They can set up dynamic data downloads in this way without having to reload the website. This makes the website significantly faster than usual.

## **1.5 Organisation**

Five chapters make up the substance of this project report. Several research articles that are related to this project activity are included in the literature review, which is detailed in chapter 2 after this introduction chapter. The Second chapter provides an overview of the various works on similar domains that was carried out previously by various authors. The third chapter gives an overview of the proposed model about how the web application architecture is specifically designed. It explains all the intricacies that are going on in the backend and also the frontend of the application. The fourth chapter shows the final outcome. The entire UI of the project along with its various functionalities as presented to an user is shown. The final chapter provides a conclusion to the project. It gives an overview of all the various things I have learned while working on the project. And what improvements can be made to it in future.

## CHAPTER 2 : LITERATURE SURVEY

Full-stack developers are in greater demand than ever before in the modern world. The biggest demand is accompanied by an amazing average income of \$110,770 in the US, according to a poll conducted by Indeed. [1] A person who is technically capable of working on the front-end and back-end development of a dynamic website or web-based apps is referred to as a "full-stack developer."

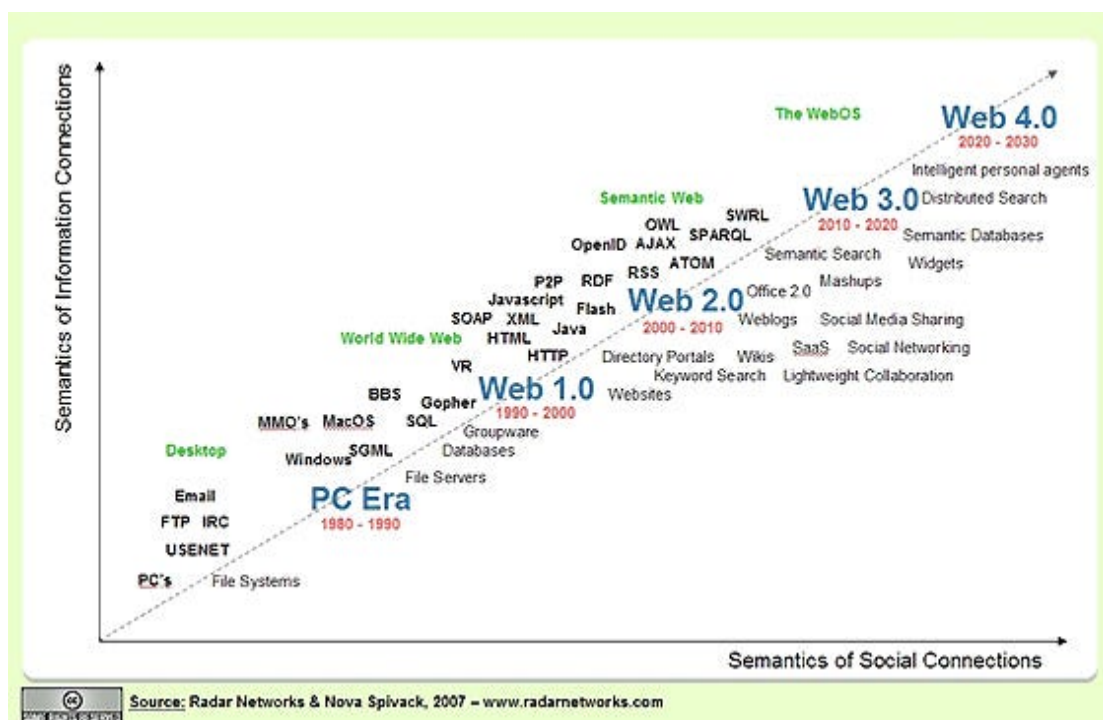


Fig 2.1 The Evolution of Web

The foundations of the modern commercial internet were laid in 1990. Tim Berners-Lee developed the fundamental ideas of the World Wide Web as well as other tools for effective web usage at the end of 1990.

These include the HyperText Transfer Protocol (HTTP), the HyperText Markup Language (HTML), the first web browser and code editor, the first web server, and the first web page that introduced the concept of the world wide web as well as a technique for creating one's own web page [8]. Since 1990, the internet has rapidly developed, and four generations of

development may be identified (Fig. 2.1)[11]. Users could only browse web material on the first generation's static, infrequently updated web sites.

The basic tenet was to read just the web. All web sites were created using HTML, and HTTP was the primary communication mechanism [11]. Beginning in 2004, the second generation is characterised by phrases like diverse social networks, blogs, the ability for users to create web page contents, and improvements to the user experience when navigating web interfaces. Famous social networks like Facebook, Twitter, LinkedIn, and others have emerged throughout that time. These social networks allowed user connection on a worldwide scale.

New technologies that enable the presentation and delivery of web services without issues with web distribution also emerged at that time, including JavaScript, Document Object Model (DOM), Ajax, Cascading Style Sheets (CSS), eXtensible HTML (XHTML), eXtensible Markup Language (XML), eXtensible Stylesheet Language (XSL), and Flash. 2010 marks the beginning of the third web generation, which is characterised by the semantic web (which adds semantics to the web), content personalisation, intelligent search, and computers' ability to create a variety of material. Ontologies are employed in the representation and justification of meaning. In addition to ontologies, technologies like Web Ontology Language (OWL), Resource Description Framework (RDF), and others are employed in the third generation of the web.

People could be able to refer to Internet 4.0 as the active web for the fourth generation. The usage of search engines is still essential in the present web 3.0, which provides us with knowledge in its most comprehensive online applications that we may utilise as needed. In contrast, Web 4.0 will be different. While completely developed, it won't require many of the processes that are required while using web 3.0, making use of it simpler and more undetectable.

The LAMP stack, which consists of Linux, Apache, MySQL, PHP or Perl, and Java (Java EE, Spring), which includes a variety of programming languages, was the major foundation for web development in the past. With the advent of the MERN stack, JavaScript facilitates web development by having the ability to operate on both the client- and server-side. There are four main technologies in the stack: MongoDB, Express.js,



React.js, and Node.js. Studying the nature of each component in the stack and developing a social platform that can link individuals were the main objectives of this project. The outcome is a platform that has sufficient features to demonstrate the connections of each of the components in the MERN stack.

The goal of the project is to implement the fundamental elements of the MERN Stack[4,6] technology, including MongoDB, ExpressJS, ReactJS, and NodeJS platform. Using the fundamental features of an e-commerce web application, such as sign-up and sign-in, dashboard display, and product and shop category display, building a web application with a payment gateway and product stores using MERN Stack technology. Implement website administration tools including user management, store management, analytics, and reporting.

The user interface of a web page is referred to as web design. Design is the global language of the visual world. The design's primary objective is to focus on the content so that consumers can access and use it with ease [15]. Web design has undergone significant change as a result of various technological advancements and fashion trends. From the first web generation, which displayed contents using a straightforward text page, to the second generation, which used lots of graphics and vibrant colours to create memorable web pages, and finally to the simple and user-friendly web design we see today. The design and content of a website should always be current.

Node.js is a system application, a server environment, and it is open source. Using the NodeJS platform, which was independently developed using JavaScript from Chrome, we can create network apps rapidly and easily. To run the code, use the JavaScript engine on Google. Additionally, a significant portion of necessary modules are written in JavaScript 6. Node.js includes a built-in framework that enables programmes to act as Web Servers similar to Apache HTTP Server.

Express.js A framework developed over NodeJS is called Express.js. It offers a wide range of cutting-edge features for web and mobile development. Because HTTP is supported by Express.js, the API is incredibly robust, dependable, and simple to use. Without slowing down NodeJS, Express adds more tools for developers that aid in creating a better programming environment[6]. The most popular NoSQL[6] database today, MongoDB, is

free source and used by thousands of users. It was created using one of today's most widely used programming languages. Additionally, MongoDB is a cross-platform data store that utilises the notions of Documents and Collections, offering great performance with high availability and flexibility in terms of extension. Since this database was created using the JavaScript Framework and the JSON data type, it is a source database format that does not utilise Transact-SQL to access data[7]. With its introduction, it has been able to improve operating speed and functionality while overcoming the drawbacks of the RDBMS relational database management system concept.

Additionally, MongoDB is a cross-platform database that uses a collection- and document-based strategy to create sharp output, enormous availability, and simple scalability[11]. A scripting, object-oriented, and cross-platform programming language is JavaScript. Host environment objects can be linked to JavaScript and set up in a way that makes it operable. JavaScript includes common libraries like Array, Date, Math, and the core elements of programming languages including managers, control framework, and statements objects.

React is built around components. A component can be created by creating a Class function of the React object, the starting point of accessing this library. ReactJS creates HTML tags unlike we normally write but uses Component to wrap HTML tags into objects to render. Among React Components, render function is the most important.[9] It is a function that 104 International Journal for Modern Trends in Science and Technology handles the generation of HTML tags as well as a demonstration of the ability to process via Virtual-DOM. The web application will develop and function more effectively with more research and understanding of new technologies, frameworks, and testing tools. Web development employing various technologies would be beneficial to many businesses in India and throughout the world in the future since it fosters a digital ecosystem and makes doing business easier for everyone.

## CHAPTER 3 : SYSTEM DEVELOPMENT

### 3.1 Architecture Design

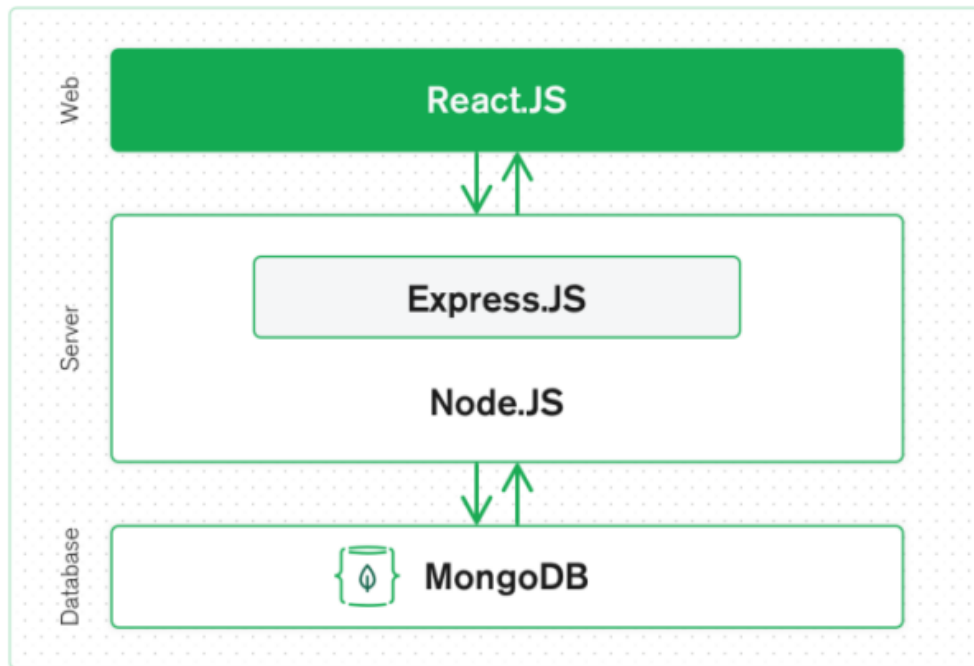


Fig 3.1 : A 3-tier MERN architecture

MERN, or MongoDB, Express, React, and Node.js, are acronyms. With MongoDB as the database, React.js is a web client library, Express.js is a web server framework, and Node.js is a server-side platform. It enables programmers to create Web applications that only use full-stack JavaScript.

Since MERN combines four cutting-edge technologies, including Facebook's strong support, it eliminates the need for developers to learn other platforms like .NET, PHP, or Java. Learning new technologies for application development saves developers time and effort. The stack is supported by a large number of open-source packages and a committed community of programmers to boost scalability and maintain software due to the same JavaScript platform.

The foundation of the MERN stack is Node.js, which is a server-side technology with

extremely high performance and quick response to all tasks, including massive and complex data, as shown in Fig 3.2. TypeScript is not required for MERN; all that is required is the adaptable React framework, which is now the most well-liked and influential front-end technology.

### 3.2 System design implementation

**Separation of concerns :** A react web application usually has two sub-folders for client-side and server-side applications. Each sub-folder is then divided into separate folders and files based on hierarchy.

The client side is mainly responsible for the user interface and experience while the creation, deletion, updation and retrieval of the data is managed in the server side folder.

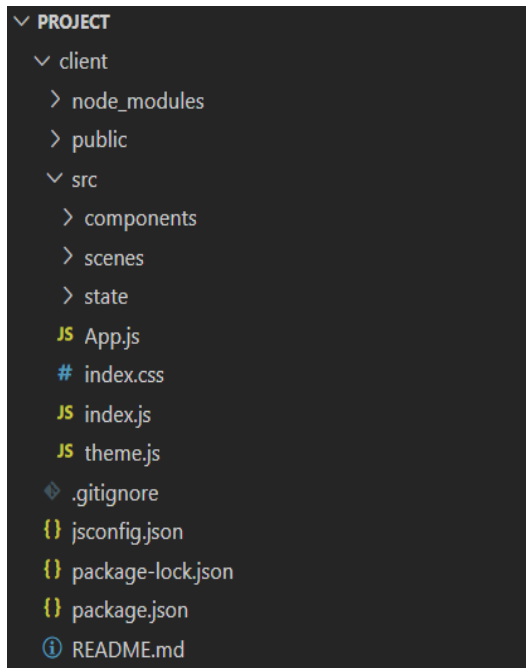


Fig 3.2 Client side work environment

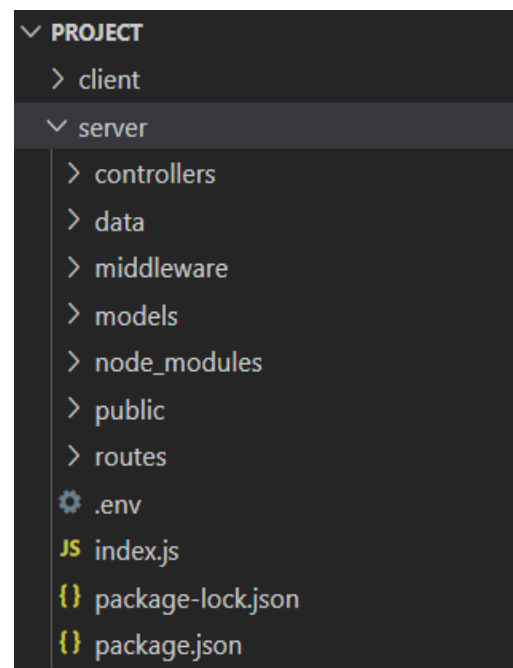


Fig 3.3 Server side work environment

#### 3.2.1 Identification of features

The features of web application includes :

- Dark mode and Light Mode in UI
- Creation of a post with images.
- Deletion of post

- Add Friends and view their profile
- Like and dislike a post
- Updation of a post only by a user who is logged-in.
- Deletion of an existing entry only by the user who created it.
- Upload Profile photo
- Creating a user (signup).
- Letting the user Login and Logout

### **3.2.2 Libraries and frameworks used**

#### **Javascript :**

An easy-to-use, interpreted, cross-platform scripting language is called JavaScript. In the past, JavaScript was solely used on websites and was executed by browsers to enhance the user experience. However, JavaScript can also be utilised to execute on the server, just as Node.js has been around since 2009 and uses the V8 engine.

- Client-side JavaScript: An addition to the fundamental JavaScript language that allows for browser and DOM management. Without regularly refreshing the page, it can also conduct some calculations, alter UI components, and validate input.
- Server-side JavaScript: An extension of the basic JavaScript language that may be viewed as regular C#, C, Python, or any other server-side programming language code and is designed to execute on a server. The second significant update to JavaScript was ECMAScript 6, commonly referred to as ES6 or ECMAScript 2015, which was published in 2015. [5] When implementing the React.js framework in any of the MERN-based projects, comprehension of ES6 is crucial. Developers will write standard JavaScript in React.js combined with capabilities from ES6.

#### **Reactjs :**

React is an open-source, free front-end library based on javascript used for creating component-based user interfaces. It is kept up-to-date by Meta and a group of independent programmers and businesses. With frameworks like Next.js, React may be used to create single-page, mobile, or server-rendered applications. Routing and other client-side functionality are frequently provided by libraries in React applications because React is

solely concerned with the user interface and rendering components to the DOM. React.JS is used to create single-page applications because it can render dynamically changing data quickly, and was used to design our web application's user interface. Developers can construct User Interface components using React and JS coding. We researched Reactjs virtual DOM objects before using them in our project. Any modifications we made to our web application for online shopping made the entire user interface render the virtual DOM again. The potential differences between the DOM Object and Virtual DOM can then be compared thanks to this. We used JSX, which made writing our code for the React application simpler and easier.[4]

Components are used by React.JS. The foundation of User-Interface is made up of components, each of which contributes to the overall User-Interface of our web application and has logic connected to our social media application. Reusing components made our web application code simpler for other developers to understand and improved the efficiency of the web application as a whole.

Installing create react-app using npm or yarn was the first step in starting our React application. `npm install yarn global adds OR create-react-app global` The two commands for using npm or yarn are `create-react-app`.

### **Nodejs :**

Node.js is a JS operating system that was created in the C++ programming language. A JS runtime environment is Node.js. For fast performance, Node.js makes advantage of the Google Chrome V8 engine. Node.js design uses the event-driven as the fundamental core concept for its environment, which gave us the various number of APIs that are event-based and asynchronous in nature which has helped us in building the website using node.js for our back-end development.[2] As we used Node.js, it used the corresponding callback function according to our web application's business logic. These callback functions are executed asynchronously, which means that although these functions appear to be registered sequentially in the logic, they do not depend on the code written in which they appear, but rather wait for the execution of the corresponding event to fire. The main advantage of Event-driven and asynchronous programming is that it uses single-threaded

architecture[1]. The restricted resources were used for other tasks that needed to be completed as part of the business logic for our web apps while the call back function code was still being executed. This layout suited our back-end development, which was another objective of our system. In server development, responding to synchronous requests was a challenging operation, and blocking played a big role in underutilizing or squandering resources. We enhanced the resource use and optimised the performance of our website using single thread architecture and asynchronous callback mechanisms, which also provided us with the necessary testing outcomes.

We can see that many of the functions, including file operations, are done asynchronously, which is different from other languages, in the supported module that Node.js provides. Node.js uses particularly big network modules, such as HTTP, DNS, NET, UDP, HTTPS, TLS, and others, to make server development easier. Developers can set up a Web server using these network modules.

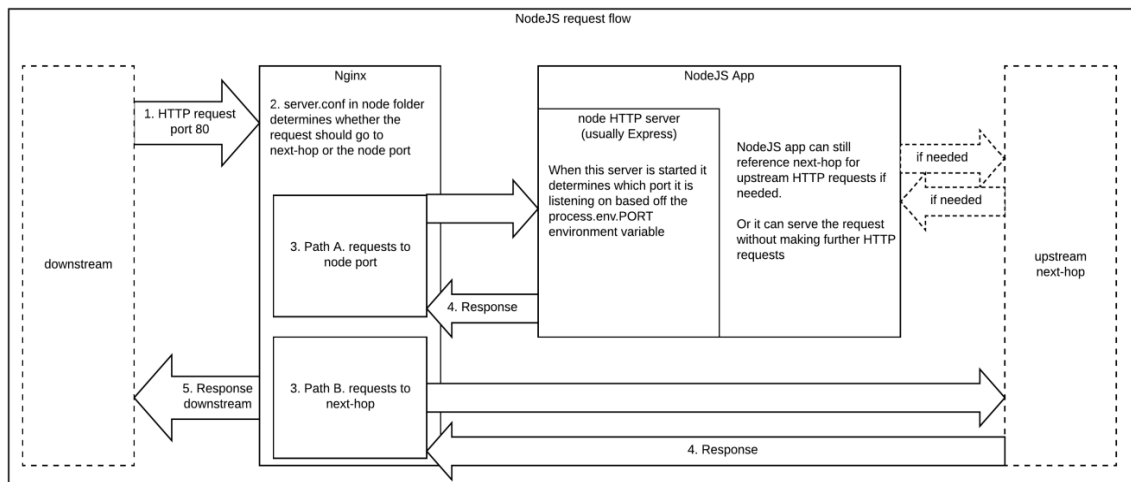


Fig 3.4 NodeJS Request Flow

**ExpressJS:**

Express is a Node.js framework, thus we used it. While developing the application, we discovered that Express made it simpler and easier to create the back-end code and implement it in an organised style rather than creating a tonne of node modules and writing the code with NodeJS.[3] We used Express to develop the web applications and APIs needed for our project because it supports a variety of middlewares that make coding

quicker and simpler. The two main benefits of adopting Express in our application are asynchronous programming and single-threaded architecture. comprehensive API for our application We had to add a command to the command prompt to initialise the package after creating a new folder to begin our express project.json file. After that, we had to accept the default settings and continue. npm init is the command to start.

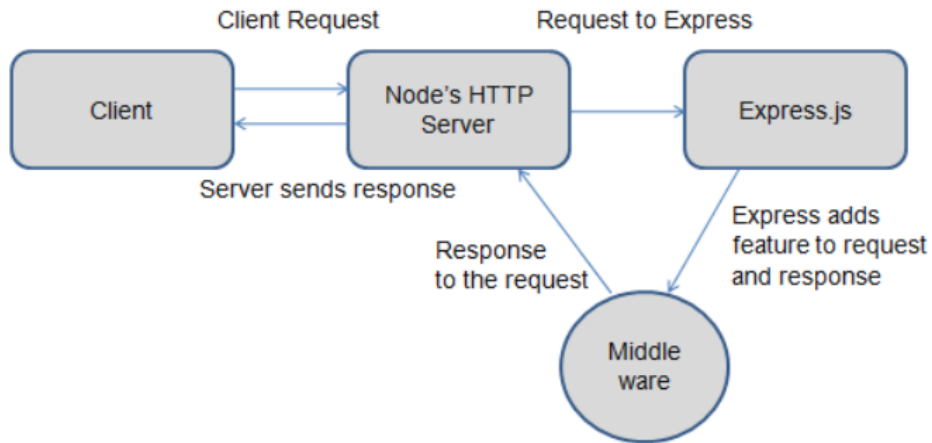


Fig 3.5 Express Js Request Flow

### **Mongoose :**

Mongoose is a mongodb library for writing concise and readable code. It handles data associations, offers validation, and translates between objects created in code and how MongoDB represents those same items. This indicates that Mongoose enables the definition of objects with strongly-typed schemas that map to MongoDB documents. Mongoose offers a staggering amount of capabilities for developing and interacting with schemas. CRUD activities that are challenging to carry out with raw MongoDB can be carried out quickly and effectively using Mongoose.

### **MongoDB:**

For our project, we chose the document-oriented database MongoDB. Every record in the MongoDB database is a document format. MongoDB transforms our JSON data into a binary version in the background on the server, which can then be stored and queried more quickly. MongoDB employs BSON for database queries. Although we can't think about MongoDB as a JSON database because it saves BSON format both internally and across



the network, it is a database nonetheless. Any data that can be natively stored in MongoDB and then simply accessed in JSON format can be represented in JSON.

We may state that MongoDB is flexible and enables users to design schema, databases, tables, etc. after studying and implementing it. After installing MongoDB, we had the choice to use Mongo shell because it provides a JavaScript interface via which users can communicate and perform any query-related tasks. Since MongoDB is a document-oriented database, indexing documents is simple. and for that reason it manages answers more quickly. Scalability of MongoDB We managed massive amounts of data in the MongoDB database by splitting it out into a nested described structure. A database server called MongoDB enables us to run several databases on it. The ER relationship of all the tables is shown in Fig 3.6.

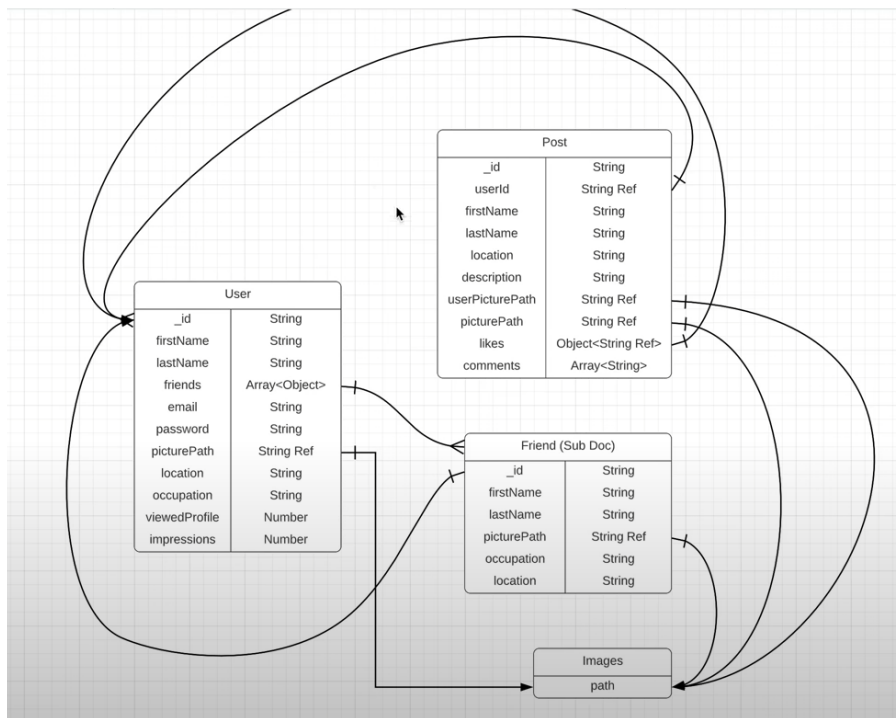


Fig 3.6 ER relationship of the MongoDB Database

**Nodemon** : If we make changes in the file and save it, nodemon starts the server automatically. Without nodemon one has to restart the server automatically after every change. It saves a lot of time and effort. While testing, the website can be run on localhost using the “**nodemon app**” command.

### 3.2.3 Technical Requirements

- **VS Code**(preferred IDE) / atom
- **Postman** api platform for building and testing APIs.
- **MongoDB** (Nosql) database.

### 3.2.4 Hardware Configuration

Device	Description
Processor	AMD Ryzen 7 3750h with integrated RX Vega 10 CPU@ 2.4 GHz
RAM	16 GB
System Type	64-bit Windows 11 OS

Table 3.1: Hardware requirements

### 3.2.5 Software Configuration

Operating System	Windows
Language	Javascript/JSX
Package manager	Node package manager (NPM)
Runtime environment	Node.js

Table 3.2: Software requirements

## 3.3 Website Design

### 3.3.1 Registration Page

When the user first signs up, he will be directed to the registration page to create an account. They can enter their Firstname and Lastname. Their location and occupation. There is also a functionality to upload an image from the local file system. The user can

then enter their email and password which will be stored in the backend to confirm their authentication and then login from the login page from then on. The registration page has complete validation. Fig 3.7 shows a screenshot of the registration page.

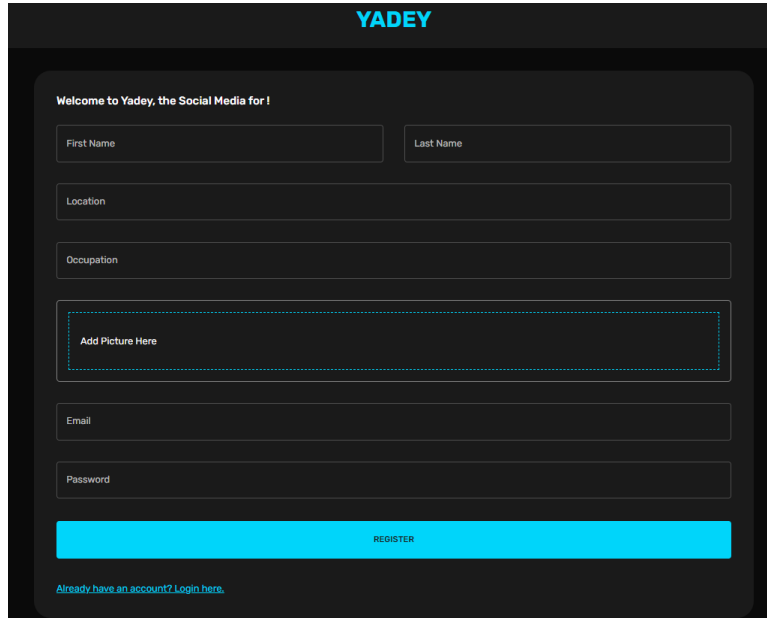


Fig 3.7 Registration page

### 3.3.1 Login Page

The user can login using the registered email address and password. The login page is shown in Fig 3.8

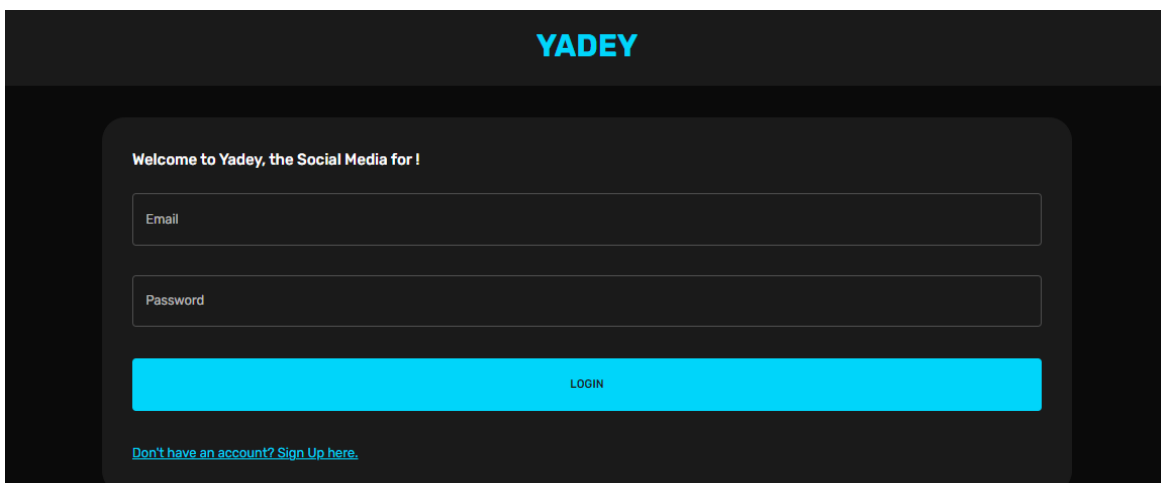


Fig 3.8 Login Page

### 3.3.2 Home Page

The Homepage consists of the option to change between dark mode and light mode. It consists of all the posts by different users. The user can upload posts with pictures. Like and unlike posts. All the user details are shown in the homepage along with ads and friend list.

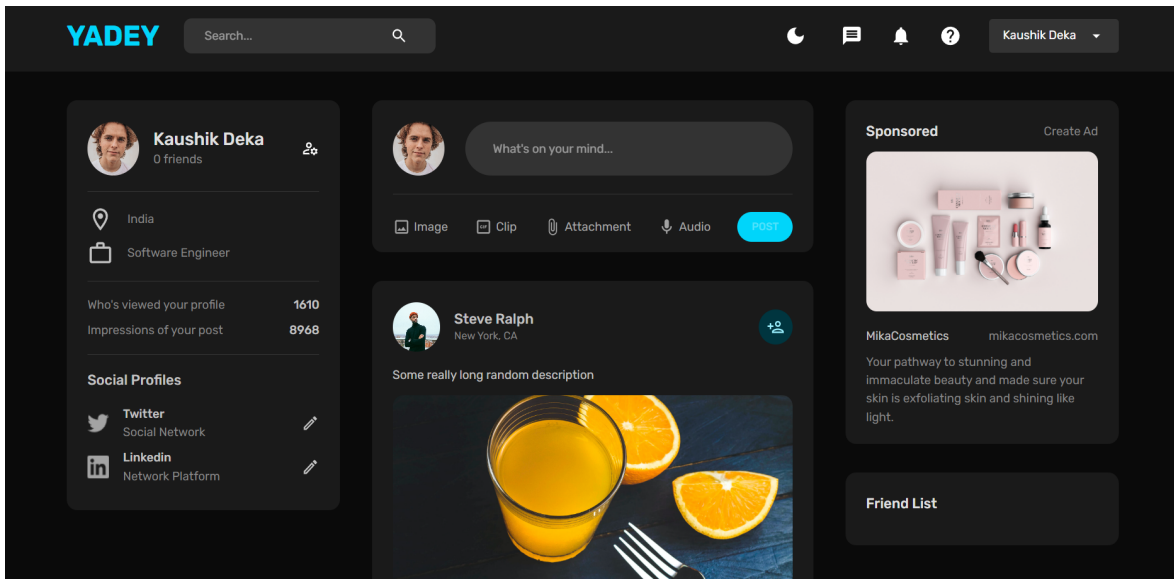


Fig 3.9 Home screen in Dark Mode

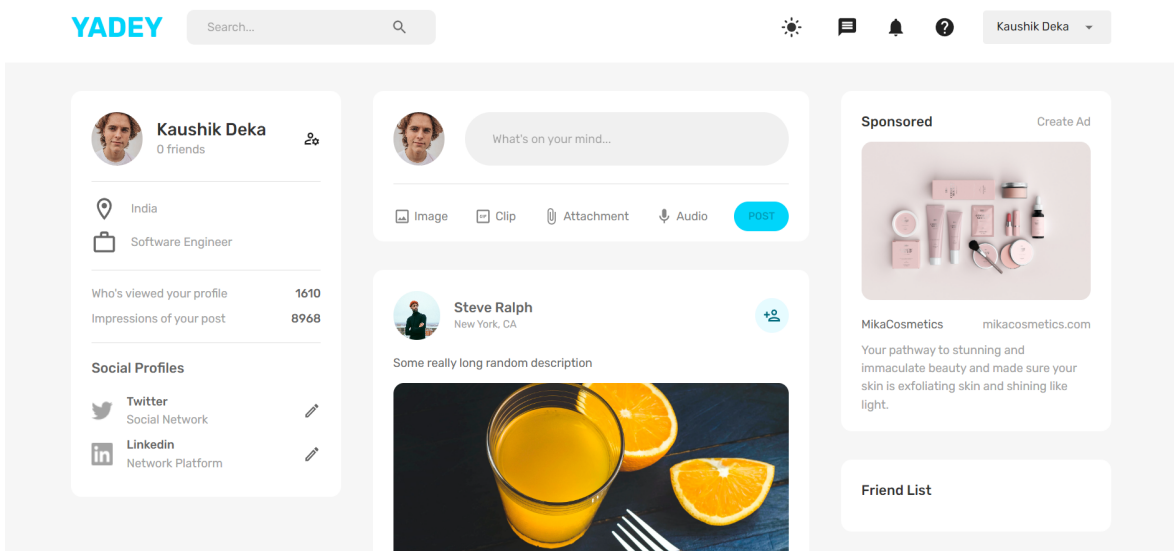


Fig 3.10 Home Screen in light mode

Fig 3.10 shows the UI in light mode and Fig 3.11 shows the UI in light mode.

## 3.4 Front-end implementation

### 3.4.1 Bootstrapping a basic react application

We need to run the command - `npx create-react-app appname` and it will automatically make a folder with all the requirements for creating a react application. Bootstrapped react app made using `npm create-react-app` command

### 3.4.2 React Workspace and folder hierarchy

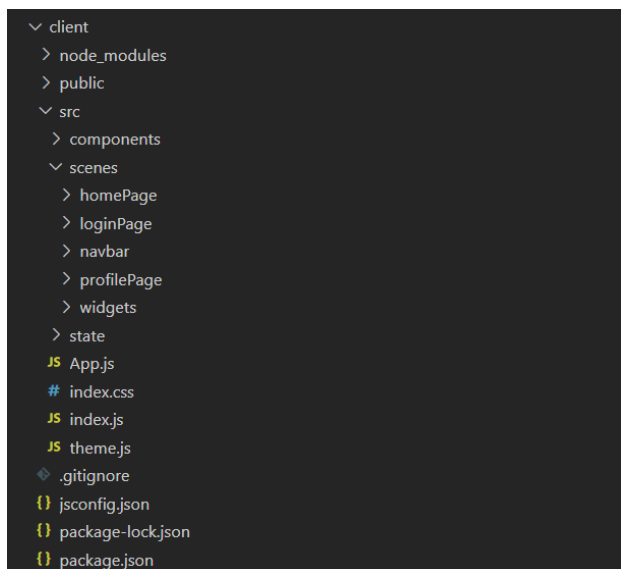


Fig 3.11: React Workspace and folder hierarchy

Fig 3.11 shows how the folders and files are structured in the client directory. It is important to keep everything organised to avoid any mistakes.

### 3.4.3 Installing packages and dependencies

In react, various packages and dependencies can be installed using the following commands:

`npm install packagename` - for installing dependencies normally.

`npm i` - for installing all the dependencies in one go.

### 3.4.4 Importing and exporting components

In react we can export a particular component and then import it in a parent component to reuse it multiple times.

#### Importing :

Importing a component - `import Gallery from './Gallery.js';`

Importing dependencies - `import axios from 'axios';`

Importing hooks - `import {useState} from 'react';`

#### Exporting :

We can export a component as follows :

```
export default function App() {  
  return (  
    <Gallery />  
  );  
}
```

### 3.4.5 How react works (JSX and Babel) :

JSX stands for JavaScript XML. JSX allows you to write html inside javascript. It is this feature that makes react so powerful and clean.

An expression in JSX : `const myElement = <h1>Current version of React is {9+9}</h1>;`

A block of html in react can be written as :

```
const myElement = (  
  <div>  
    <p>First paragraph.</p>  
    <p>Second paragraph</p>  
  </div>  
);
```

### 3.4.6 States in React

In react, any change made by the user is considered as a change in state. A state contains information about the component in which it is present. Whenever we change the state of a component, it renders again with a new state. The `setState()` constructor is used to change the state of a component. For example, if we type something in the search bar, with each letter the state is changing and the component has to re-render. Example :

```
Class MyClass extends React.Component {  
  constructor(props) {  
    super(props);  
    this.state = { attribute : "value" };  
  }  
}
```

### 3.4.7 Props in react

Props is a shorthand notation for properties. It works similar to HTML attributes. A prop in react may seem similar to state but the major difference between a state and a prop is that a prop can be passed from a parent component to the child component. This process is known as ‘prop drilling’.

Eg:-

Adding an attribute called ‘brand’ to ‘Vehicle’ component :

```
const Ele = <Vehicle brand="Tata" />;
```

Passing the prop to the component :

```
function Truck(data) {  
  return <h1>The price is : { data.price }</h1>;  
}
```

SN	Props	State
1.	Props are read-only.	State changes can be asynchronous.
2.	Props are immutable.	State is mutable.
3.	Props allow you to pass data from one component to other components as an argument.	State holds information about the components.
4.	Props can be accessed by the child component.	State cannot be accessed by child components.
5.	Props are used to communicate between components.	States can be used for rendering dynamic changes with the component.

Table 3.3 : Props vs State in react

### 3.4.8 React Hooks

React version 16.8 introduced hooks. It was done to replace the class components. Hooks allow us to access the state of a component and other react features. States can be changed via hooks. It also helps us to ‘hook’ into the lifecycle methods. The programmer needs to import the hook before using it. Hooks can be imported by the following line of code :

- import {useState} from ‘react’;

Below is the list of the most frequently used react hooks :

**1. useState hook :** used to set and modify the state of a component.

Used to change / update the state of a component. Basically if anything changes in a react application, its state is said to be changed. If we type anything in a search bar, its state changes and everytime a state changes, the page reloads.



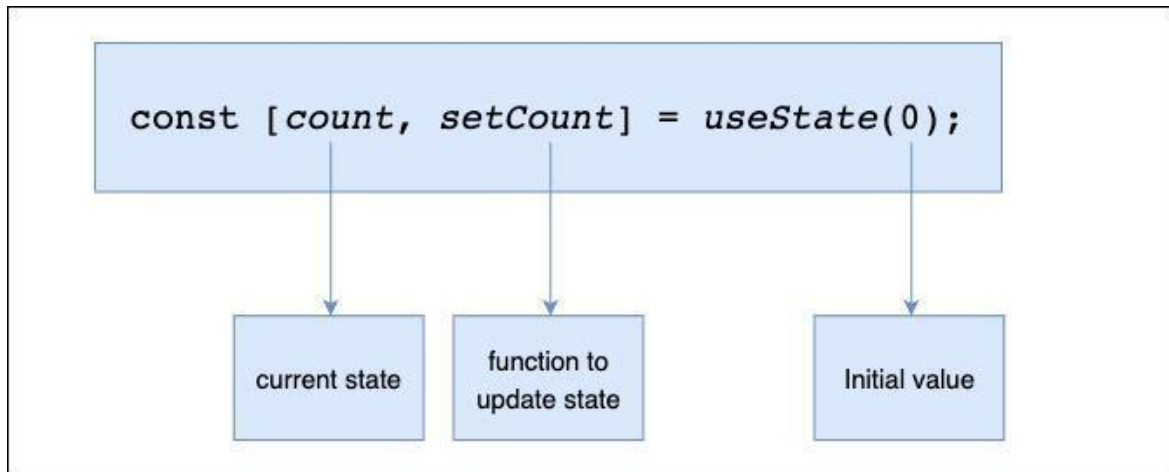


Fig 3.12 : Working of useState hook

2. **useEffect hook** : used to perform a specific task once an event is triggered.

useEffect hook takes 2 arguments: an anonymous function and an array. The code inside the anonymous function will be executed once the argument in the array is triggered. Here we are increasing the value of the count variable once a certain state changes.

**Syntax of useEffect hook :**

```

useEffect( () => {

}, [dependency_if_any]

)
  
```

3. **useContext hook** : used to avoid prop drilling. A context has states which can be accessed by any component no matter how many parent components are present above it.

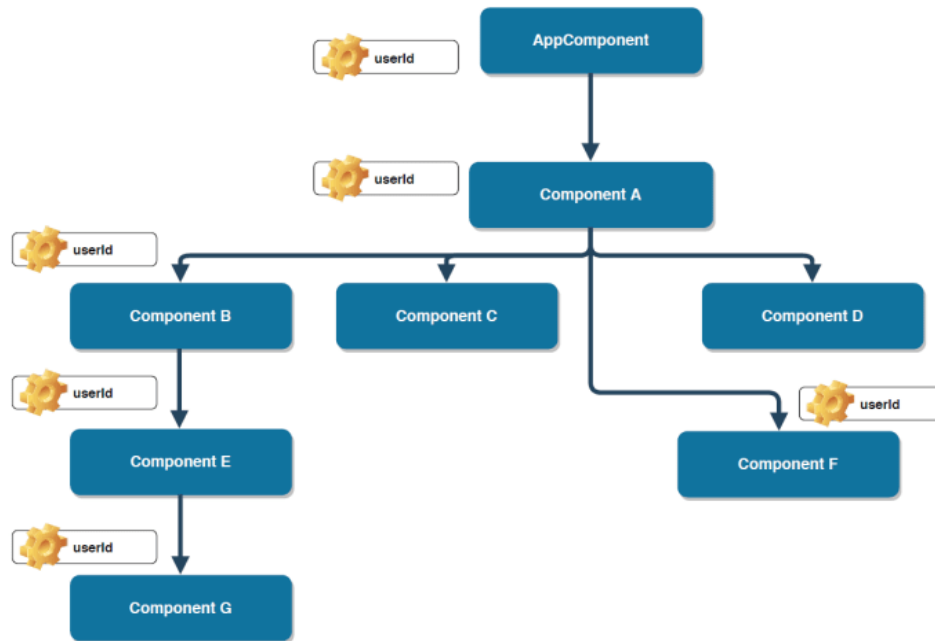


Fig 3.13 : Working of useContext hook

4. **useRef hook** : Introduces the concept of uncontrolled components. Uncontrolled components are not controlled by react state but by the DOM itself. Refs are used to interact directly with real DOM(document object model) not the virtual one. Refs don't cause re-renders. Suppose we want to use the 'focus' property which is present in javascript but not in JSX. By using Refs, we can get hold of the original DOM node and use the focus property on it. When a button is clicked and you want an input to become the focus as a result, this is a very typical use case for useRef. In order to accomplish this, we would first need to access the input DOM element and then call its focus() function. To accomplish this with JavaScript, all that is required is to choose the input using the querySelector or by id/class, after which the focus() function is called. However, React does not come with a built-in method for accomplishing this.

5. **useMemo hook** : used to stop the unnecessary re-renders. When the state of a parent component changes, the child component also has to re-render despite the fact that it's state hasn't been changed. This causes unnecessary memory loss. This behaviour can be prevented by useMemo hook. Consider a static Welcome Card that will be shown inside an application. Other states, such a counter, are also included in the application. The

Welcome Card is a child of the primary parent App, therefore once the counter is raised, the static card will be updated as a result of any changes to the app's internal state.

- 6. **useCallback hook** : Similar to useMemo. It returns the memoized function while useMemo returns the memoized value. UseMemo doesn't work when a prop is passed from parent to child. In such cases useCallback hook is preferred.

Pass an array of dependencies along with an inline callback. A memoized version of the callback that only changes if one of the dependencies has changed is what useCallback returns. This is helpful for sending callbacks to optimised child components that don't need to render everything because they rely on reference equality.

**React hooks lifecycle :**

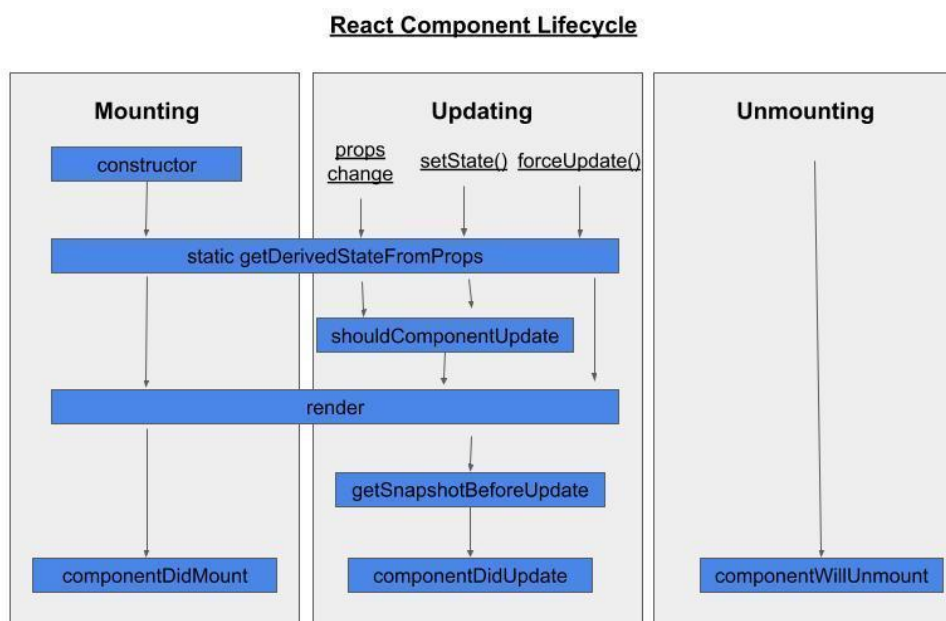


Fig 3.14 : React hooks lifecycle

Mounting, updating, and unmounting are the three phases that make up a React component's lifetime. Each phase has unique methods in charge of a certain stage in a

component's lifetime. Technically speaking, these methods are not intended for functional components and are only applicable to class-based components.

However, because the Hooks concept was introduced in React, you can now use abstracted variations of these lifecycle methods when working with functional component state. Simply put, React Hooks are functions that enable "hooking into" React states and lifecycle elements from within function components.

### **Phases of React component lifecycle :**

A new component is produced and added to the DOM during the mounting step, which also marks the start of a component's life. This is frequently referred to as the "initial render" and can only occur once.

The component updates or re-renders during the updating process. When the state or the props are updated, this reaction is triggered. Multiple occurrences of this phase are possible, which is sort of React's purpose.

The unmounting step, in which the component is taken out of the DOM, is the final stage of a component's lifetime.

For each phase of the life cycle, a class-based component can call a different method (more on this below). These lifecycle methods, which can only be produced by or included in classes, are obviously not used by functional components. On the other hand, when employing React hooks, functional components can benefit from states.

### **3.4.9 Styling using Material-ui**

It is one of the most popular React-ui component frameworks maintained by the react community. Google's Material Design is implemented through a free and open-source React component bundle called Material UI. It comes with a wide range of prebuilt components that are employed right away in production.

**Installation :** `npm install @material-ui/core`

We use material-ui by making an object for styling a particular component in a separate file usually named 'styles.css' and the using the styles inside the component as follows :

**Initialising Class using useStyle hook :** `const classes = useStyles();`

**Providing style to a component :** `<Avatar className={classes.avatar}>`

Here 'avatar' is an object present in the 'styles.css' page

### 3.5 State Management using React-redux

Redux is one of the most important tools present in react. It is an open-source javascript library used for storing all the states at a centralised location. It is mainly used for state management. When there are a large number of states, redux stores all of them at a centralised location called Redux Store. From there, the 'actions' are dispatched to update the data. Redux provides a simplified and sensible way to manage the states. It works on the principle of 'unidirectional data flow'. It helps to scale the application and manage it more efficiently.

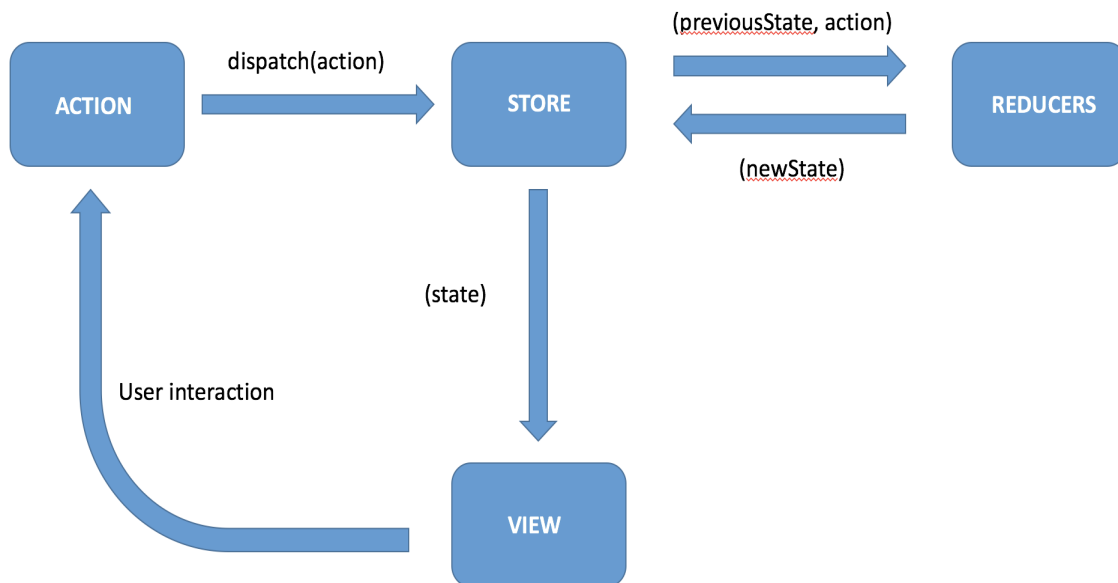


Fig 3.15 : The flow control of redux

**The three main components of Redux are :**

**Redux Store :** Stores the current states of all the components. Whenever the data is needed, we need to access the Store. The reducers then update the data and an action is dispatched. The updated data is then stored in the Redux Store.

## Creating a Redux Store :

```
const store = createStore(reducers)

ReactDOM.render(
  <Provider store={store}>
    <App />
  </Provider>,
  document.getElementById('root')
);
```

**Action** : Actions are straightforward objects with the typical two properties of type and payload. The payload property is an optional property that holds some data that is necessary to complete any given task, whereas the type property is often a text that specifies the action. Sending information from the application to the Redux store is the primary purpose of an action.

**Reducers** : Reducers are pure functions that adjust the application's state in response to user input. Reducers accept an action and a previous state as input and output a modified state. Due to the immutability of the state, a reducer always produces a new state that represents an updated version of the prior state. Basically it is used to perform some action and update data/state present in the Redux Store.

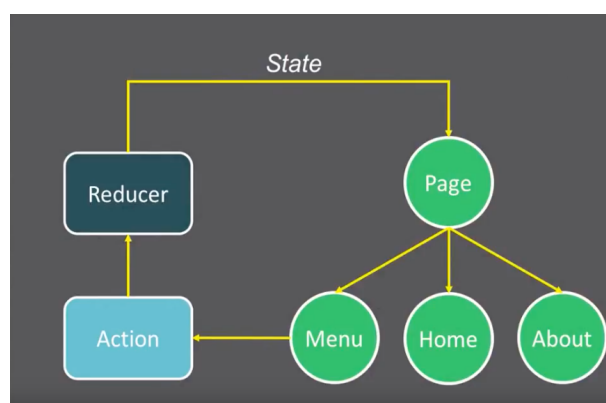


Fig 3.16 Redux state management

case AUTH:

```
localStorage.setItem('profile', JSON.stringify({ ...action?.data }));

return { ...state, authData:action?.data };
```

case LOGOUT:

```
localStorage.clear();  
return { ...state, authData: null, loading: false, errors: null };
```

Here the reducers are updating the state when a user tries to login and logout.

### **Data flow in a Redux application :**

- The flow of data is triggered when a user interacts with a component. The action creators dispatch an 'action' due to this interaction.
- Once an action is dispatched, it is received by the application's root reducer and distributed to all other reducers. Therefore, based on the dispatched action, it is the producer's responsibility to decide whether it needs to update the state.
- This is verified by filtering out the necessary actions using a straightforward switch statement. Each (smaller) reducer in the application accepts the dispatched action and returns a newly updated state if the type of the dispatched action matches.
- It is important to remember that with redux, the state never actually changes. Instead, the reducer always creates a new state that is an exact duplicate of the old state but has undergone some changes.
- The component is then notified by the store of the altered state, which causes it to retrieve it and render the component again.
- The fact that data flow in a React-Redux application is unidirectional, or only going in one direction, is another crucial finding in this context.

## **3.6 Routing**

A frequently used tool for making custom routes in React is React Router. It allows switching between multiple pages made by various React components, permits changing the browser's URL and maintains UI synchronisation with the URL.

**Installation :** npm install react-router-dom

**Importing :**

```
import {  
  BrowserRouter as Router,  
  Routes,  
  Route,  
  Link  
} from 'react-router-dom';
```

**Usage :** This application has five main routes. Home, Auth, Posts, Search, :id. The exact paths are as follows :

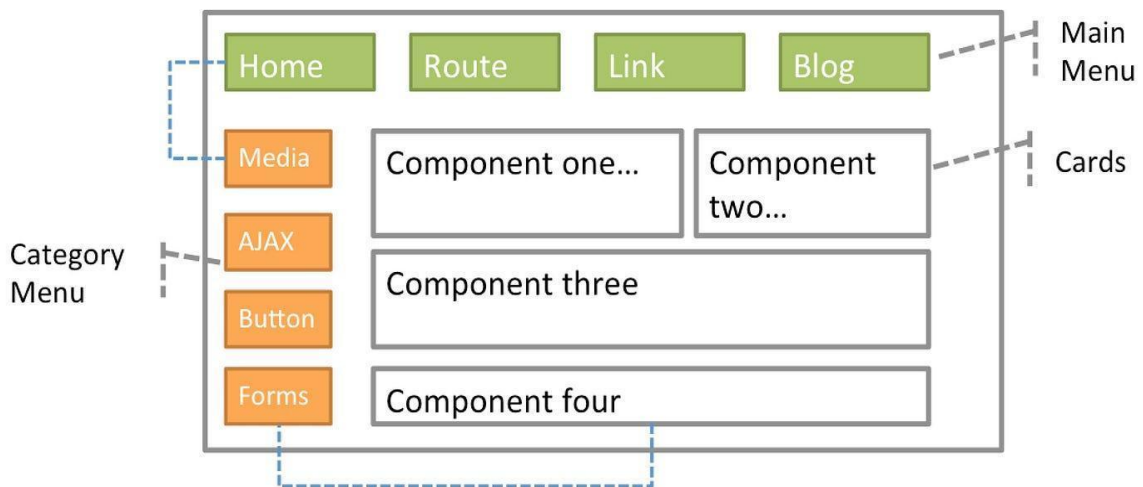


Fig 3.17 : Working of react router

### 3.7 Connecting Front-end and Back-end through APIs

Workspace of a typical react application is divided in two folders : Client and Server. This



way of developing an application makes the development process clean, easy and the code is more readable. This is called ‘separation of concerns’. Client side directory’s main concern is user interface while the server side handles database, authentication and routing.

To connect these two directories, we use APIs. This file is present in the client side inside the ‘src’ folder (shown in Fig 3.19):

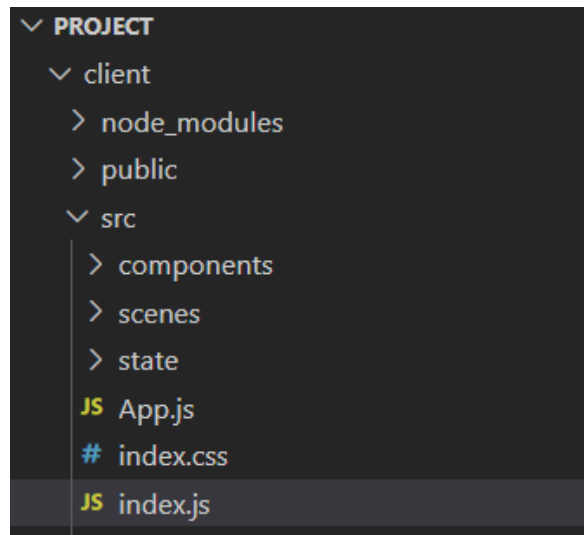


Fig 3.18 : Location of API file

### Types of requests :

Get request : To get the data from the database.

Post request : To send data from frontend to the database.

Patch request : To update an existing data / some part of an existing data. The request body only needs the part which needs to be updated.

Put request : Same functionality as Patch request. The only difference is that the body of put request needs to have the complete new data and not just the part which needs updating.

## 3.8 React Formik

Formik is a third-party library for React forms. Basic form programming and validation are offered. It is built on controlled components and drastically cuts down on form

programming time. Let's use the Formik library to replicate the expenditure form as shown in Fig 3.20.

First, use the Create React App or Rollup bundler to create a new React application, such as React-formik-app, and then follow the instructions in the chapter on Creating a React application.

```
cd /go/to/workspace npm install formik --save
```

```
1 import React from "react";
2 import ReactDOM from "react-dom";
3 import { Formik, Field, Form } from "formik";
4 import "./styles.css";
5
6 function App() {
7   return (
8     <div className="App">
9       <h1>Contact Us</h1>
10      <Formik
11        initialValues={{ name: "", email: "" }}
12        onSubmit={async (values) => {
13          await new Promise((resolve) => setTimeout(resolve, 500));
14          alert(JSON.stringify(values, null, 2));
15        }}
16      >
17        <Form>
18          <Field name="name" type="text" />
19          <Field name="email" type="email" />
20          <button type="submit">Submit</button>
21        </Form>
22      </Formik>
23    </div>
24  );
25 }
```

Fig 3.19 Form creation using react formik

### 3.9 React Dropzone

```
npm install --save react-dropzone
```

Simply enough, the useDropzone hook binds the required handlers to establish a drag-and-drop zone. To obtain the props needed for drag and drop, use the getRootProps() function on any element. Use the getInputProps() fn and the returned props on an input> to get click and keydown behaviour.

```

import React, {useCallback} from 'react'
import {useDropzone} from 'react-dropzone'

function MyDropzone() {
  const onDrop = useCallback(acceptedFiles => {
    // Do something with the files
  }, [])
  const {getRootProps, getInputProps, isDragActive} = useDropzone({onDrop})

  return (
    <div {...getRootProps()}>
      <input {...getInputProps()} />
      {
        isDragActive ?
          <p>Drop the files here ...</p> :
          <p>Drag 'n' drop some files here, or click to select files</p>
      }
    </div>
  )
}

```

Fig 3.20 React dropzone using hooks

### 3.10 The Back-end implementation

**Frameworks required :** Expressjs and Mongoose

**External Packages :** dotenv and CORS

- Dotevn is a npm package for loading environment variables without manual programming.
- CORS or Cross-Origin Resource Sharing in Node. js is a mechanism by which a front-end client can make requests for resources to an external back-end server.

-

**Backend setup**

**Initialising Express and setting up bodyparser :**

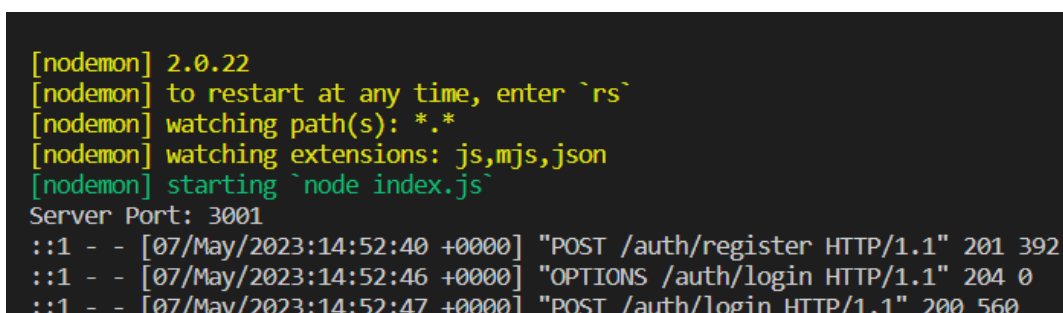
```
const app = express();  
  
dotenv.config();  
  
app.use(bodyParser.json({limit: "30mb", extended: true}));  
  
app.use(bodyParser.urlencoded({limit: "30mb", extended: true}));
```

Here we are initialising express and assigning it to a variable named ‘app’. Now this app variable can be used for routing.

### **Connecting to mongodb atlas :**

```
const PORT = process.env.PORT || 3001;  
  
const app = express();  
  
mongoose.connect(process.env.CONNECTION_URL, {useNewUrlParser:true,useUnified  
Topology:true})  
  
  .then(()=> app.listen(PORT, ()=> console.log(`server running on ${PORT}`)))  
  
  .catch((error)=>console.log(error.message));
```

Here we are setting our port as port 3001. This means that our client runs on localhost: 3000 while the server runs on localhost: 3001. After these set-ups, we can start our app by running ‘npm start’ command . The terminal is shown in Fig 3.22 and 3.23



```
[nodemon] 2.0.22  
[nodemon] to restart at any time, enter `rs`  
[nodemon] watching path(s): *.*  
[nodemon] watching extensions: js,mjs,json  
[nodemon] starting `node index.js`  
Server Port: 3001  
:::1 - - [07/May/2023:14:52:40 +0000] "POST /auth/register HTTP/1.1" 201 392  
:::1 - - [07/May/2023:14:52:46 +0000] "OPTIONS /auth/login HTTP/1.1" 204 0  
:::1 - - [07/May/2023:14:52:47 +0000] "POST /auth/login HTTP/1.1" 200 560
```

Fig 3.21 : Server running on port 3001

```
Compiled successfully!

You can now view client in the browser.

Local:           http://localhost:3000
On Your Network: http://192.168.0.127:3000

Note that the development build is not optimized.
To create a production build, use npm run build.
```

Fig 3.22 : Client running on port 3000

### 3.11 MongoDB and Mongoose

Mongoose is an ODM library for MongoDB and Nodejs. It offers many different kinds of validation and also manages relationships between data. Some features of MongoDB are :

- Schema-less NoSQL
- Data stored in the form of json objects.
- No fixed structure.
- Fast as it is written in C++.
- Reduces complexity of deployment.

#### Terminologies

- 1. Collections** : Multiple json documents together are called a collection. Collections are equivalent to tables in relational databases.
- 2. Documents** : Documents can be compared to records / rows in a relational database. There is no concept of referencing data like SQL does in MongoDB. Mongo documents usually combine them in a document.
- 3. Fields** : They are commonly known as properties or attributes. Fields are similar to columns in a table.
- 4. Models** : Models are higher-order constructors that take a schema and create an instance of a document equivalent to records in a relational database.
- 5. Schema Types** : SchemaTypes indicate the anticipated data type for specific fields, whereas Mongoose schemas define the overall form or shape of a document. Example : String, Number, Boolean.

## MongoDB Atlas vs MongoDB Compass

Developers made MongoDB atlas so that people could scale and" deploy clusters with just a few clicks. The MongoDB team also developed and manages MongoDB Atlas, a global cloud database service. Enjoy the ease of use and automation of a fully managed service on your favourite cloud along with the flexibility and scalability of a document database. On the other hand, MongoDB Compass is described as "A GUI for MongoDB". Investigate your data visually. Ad hoc queries can be run quickly. Utilise all of the CRUD functionality to interact with your data. View and improve the performance of your queries.

### Example :

```
const Schema = new mongoose.Schema({
  name: {
    type: String,
    required: true
  },
  age: Number
});
const Sname = mongoose.model('Sch', Schema);
```

In the code above, Sch defines the shape of the document which has two fields, name, and age. you can define the SchemaType for a field by using an object with a type property like the one used with the name field.

‘Name’ has two fields. Type denotes the data type while setting ‘required’ field to true makes it mandatory for the user to enter his name. This is not the same for the ‘age’ field. The data type for the ‘age’ field is a number but the absence of the ‘required’ field means that the user can continue without entering his age in the database / prompt.

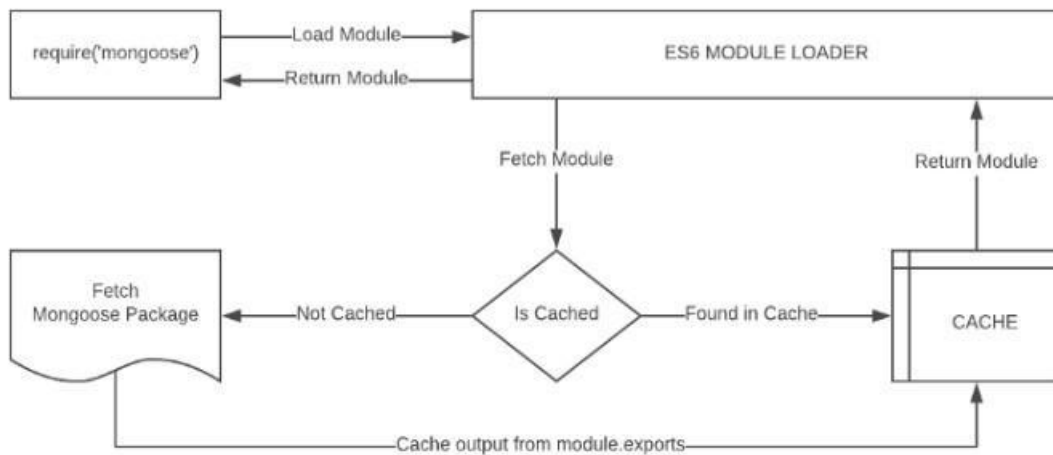


Fig 3.23 : Module import/require workflow

**This project has two models : The user model and the post model.**

**User model :** Made for letting the users Register and login. It has four fields : name, email, password and id. Name, email and password are the required fields while title is not mandatory.

Name is required as a user might create a post which requires his/her username to be displayed along with the post.

Email is required as the user may sign in again after registering and we need to make sure that his id is saved in the database.

Password is required for validation.

Title is not a required field as the user may not create a post in the session in which he logged-in.

### 3.11.1 Schemas

#### 1. The User Schema

Holding a user collection where a user profile is saved and updated will be a basic strategy.

Afterward, each contact document may include owner information. These specifics vary depending on how the programme views the data and whether it needs to be provided or filtered. The basic minimum appears to be maintaining a `userId` for each contact or, if numerous users share the same contact information, perhaps an array of users. You can index and provide this `userId` to the contact collection query after logging in and identifying the user to retrieve only the necessary contacts as shown in Fig 3.25.

```
1 import mongoose from "mongoose";
2
3 const UserSchema = new mongoose.Schema(
4   {
5     firstName: {
6       type: String,
7       required: true,
8       min: 2,
9       max: 50,
10    },
11    lastName: {
12      type: String,
13      required: true,
14      min: 2,
15      max: 50,
16    },
17    email: {
18      type: String,
19      required: true,
20      max: 50,
21      unique: true,
22    },
23    password: {
24      type: String,
25      required: true,
26      min: 5,
27    },
28    picturePath: {
29      type: String,
30      default: "",
31    },
32    friends: {
33      type: Array,
34      default: [],
35    },
36    location: String,
37    occupation: String,
38    viewedProfile: Number,
39    impressions: Number,
40  },
41  { timestamps: true }
42 );
43
44 const User = mongoose.model("User", UserSchema);
45 export default User;
```

Fig 3.24 User Schema



## 2. The Post Schema

This schema is for the post a user might create. The fields present in this schema are title, name, message, createdAt, likes, tags.

None of the fields are required but likes and createdAt are 'default' fields which means they will always be present. The like field is an empty array by default while the date is set to the current date as shown in Fig 3.26.

```
server > models > JS Post.js > ...
 1  import mongoose from "mongoose";
 2
 3  const postSchema = mongoose.Schema(
 4    {
 5      userId: {
 6        type: String,
 7        required: true,
 8      },
 9      firstName: {
10        type: String,
11        required: true,
12      },
13      lastName: {
14        type: String,
15        required: true,
16      },
17      location: String,
18      description: String,
19      picturePath: String,
20      userPicturePath: String,
21      likes: {
22        type: Map,
23        of: Boolean,
24      },
25      comments: {
26        type: Array,
27        default: [],
28      },
29    },
30    { timestamps: true }
31  );
32
33  const Post = mongoose.model("Post", postSchema);
34
35  export default Post;
```

Fig 3.25 : Post schemas

### 3.11.2 Middleware

```
server > middleware > JS auth.js > ...
1  import jwt from "jsonwebtoken";
2
3  export const verifyToken = async (req, res, next) => {
4    try {
5      let token = req.header("Authorization");
6
7      if (!token) {
8        return res.status(403).send("Access Denied");
9      }
10
11     if (token.startsWith("Bearer ")) {
12       token = token.slice(7, token.length).trimLeft();
13     }
14
15     const verified = jwt.verify(token, process.env.JWT_SECRET);
16     req.user = verified;
17     next();
18   } catch (err) {
19     res.status(500).json({ error: err.message });
20   }
21 };
22
```

Fig 3.26 : Middleware code for authentication

In the request-response cycle of an application, the middleware function in node.js is a function with complete access for making an object request, receiving an object response, and moving on to the next middleware function(as shown in Fig 3.27).

### 3.12 Controllers

The logic for sending data from the backend to be displayed in the frontend is handled by the controllers. The user requests to perform certain actions through API. The API sends the request to the backend where the controllers handle the logic to send data to the frontend. In this website we have two controller files. One to handle the requests related to a particular post and the other to handle the requests regarding security.

## The Post Controller

It handles all the requests related to a particular post. The requests include :

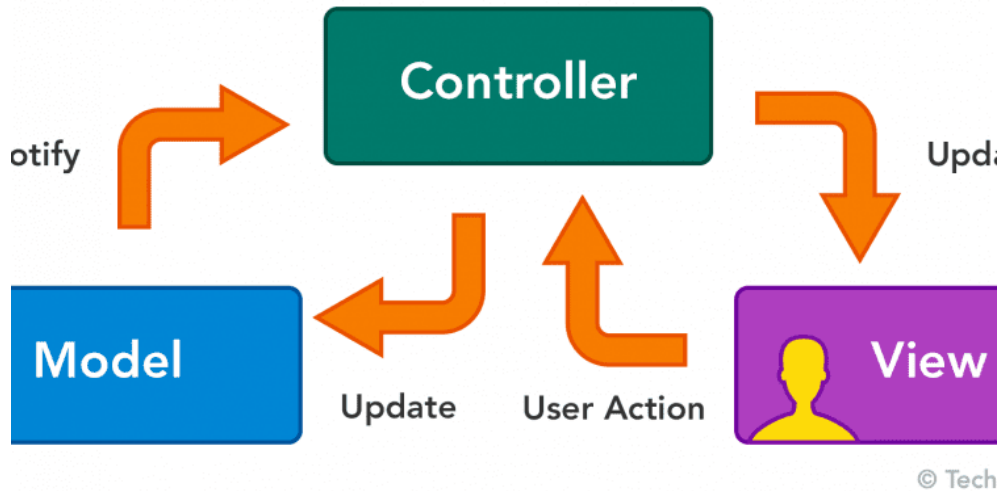


Fig 3.27 : Controllers

### 1. Getting a post :

This function is called when the website is loading and all the available posts have to be displayed at once. The 'LIMIT' variable is set to 8 which means on a single page only 8 posts will be displayed. The remaining posts will be displayed on the next page. This is achieved through pagination.

```
/* READ */
export const getFeedPosts = async (req, res) => {
  try {
    const post = await Post.find();
    res.status(200).json(post);
  } catch (err) {
    res.status(404).json({ message: err.message });
  }
};

export const getUserPosts = async (req, res) => {
  try {
    const { userId } = req.params;
    const post = await Post.find({ userId });
    res.status(200).json(post);
  } catch (err) {
    res.status(404).json({ message: err.message });
  }
};
```

Fig 3.28 Getting a post

## 2. Updating a post

```
/* UPDATE */
export const likePost = async (req, res) => {
  try {
    const { id } = req.params;
    const { userId } = req.body;
    const post = await Post.findById(id);
    const isLiked = post.likes.get(userId);

    if (isLiked) {
      post.likes.delete(userId);
    } else {
      post.likes.set(userId, true);
    }

    const updatedPost = await Post.findByIdAndUpdate(
      id,
      { likes: post.likes },
      { new: true }
    );

    res.status(200).json(updatedPost);
  } catch (err) {
    res.status(404).json({ message: err.message });
  }
};
```

Fig 3.29 Updating a Post

This is an asynchronous function which means it will take some time to execute but won't block other functions' execution. We are receiving 'id' from the database and storing it in the 'id' variable. If the status is 404, we are sending an error message otherwise we are updating the post by finding it by its id inside the database as shown in Fig 3.30.

### 3. Creating a post

```
import Post from "../models/Post.js";
import User from "../models/User.js";

/* CREATE */
export const createPost = async (req, res) => {
  try {
    const { userId, description, picturePath } = req.body;
    const user = await User.findById(userId);
    const newPost = new Post({
      userId,
      firstName: user.firstName,
      lastName: user.lastName,
      location: user.location,
      description,
      userPicturePath: user.picturePath,
      picturePath,
      likes: {},
      comments: [],
    });
    await newPost.save();

    const post = await Post.find();
    res.status(201).json(post);
  } catch (err) {
    res.status(409).json({ message: err.message });
  }
};
```

Fig 3.30 Creating a Post

This code defines an asynchronous function `createPost` that handles the creation of a new post. It expects a request (`req`) and a response (`res`) object as parameters. It extracts the `userId`, `description`, and `picturePath` from the request body. It retrieves the user information from the database using the `User.findById(userId)` method. It creates a new `Post` object with the extracted and retrieved data, including the user's name, location, and profile picture. The new post is saved to the database using `newPost.save()`. Finally, it fetches all posts from the database using `Post.find()` and sends the resulting posts as a JSON response with status 201 (Created). If any errors occur, it sends a JSON response with status 409 (Conflict) and an error message.

## 4. Deleting a post

```
export const deletePost = async (req, res) => {  
  
  const { id } = req.params;  
  
  if(!mongoose.Types.ObjectId.isValid(id)) return res.status(404).send('No post found');  
  
  await PostMessage.findByIdAndRemove(id);  
  
  res.json({ message: 'Post deleted successfully'});  
  
}
```

The process is the same as updating the post. We are simply extracting the id from the request and then finding it inside the database and deleting it. The method used is ‘findByIdAndRemove’ which is a standard function provided by mongoose.

## The User Controller

### 1. Getting User and user friends

```
server > controllers > JS users.js > ...  
1  import User from "../models/User.js";  
2  
3  /* READ */  
4  export const getUser = async (req, res) => {  
5    try {  
6      const { id } = req.params;  
7      const user = await User.findById(id);  
8      res.status(200).json(user);  
9    } catch (err) {  
10     res.status(404).json({ message: err.message });  
11    }  
12  };  
13  
14  export const getUserFriends = async (req, res) => {  
15    try {  
16      const { id } = req.params;  
17      const user = await User.findById(id);  
18  
19      const friends = await Promise.all(  
20        user.friends.map((id) => User.findById(id))  
21      );  
22      const formattedFriends = friends.map(  
23        ({ _id, firstName, lastName, occupation, location, picturePath }) => {  
24          return { _id, firstName, lastName, occupation, location, picturePath };  
25        }  
26      );  
27      res.status(200).json(formattedFriends);  
28    } catch (err) {  
29      res.status(404).json({ message: err.message });  
30    }  
31  };
```

Fig 3.31 Getting User and user friends

Fig 3.32 shows that This code snippet exports two controller functions: `getUser` and `getUserFriends`. `getUser` retrieves a user's data by their id from the `User` model using `User.findById(id)`. It then sends the user data as a JSON response with a status code of 200 (success) or 404 (not found) if an error occurs. `getUserFriends` follows a similar pattern as `getUser`. It retrieves the user's data and then fetches the data of their friends based on the `user.friends` array. The code uses `Promise.all` to perform parallel database queries to fetch each friend's data. The retrieved friend data is then formatted to include specific properties. Finally, the formatted friend data is sent as a JSON response with a status code of 200 or 404 if an error occurs. These controller functions assume the presence of a `User` model, which is imported from the `../models/User.js` file. The code demonstrates how to use the model's `findById` method to retrieve user data and manipulate the friend data before sending the responses.

## 2. Updating and removing user friends

```
32
33  /* UPDATE */
34  export const addRemoveFriend = async (req, res) => {
35    try {
36      const { id, friendId } = req.params;
37      const user = await User.findById(id);
38      const friend = await User.findById(friendId);
39
40      if (user.friends.includes(friendId)) {
41        user.friends = user.friends.filter((id) => id !== friendId);
42        friend.friends = friend.friends.filter((id) => id !== id);
43      } else {
44        user.friends.push(friendId);
45        friend.friends.push(id);
46      }
47      await user.save();
48      await friend.save();
49
50      const friends = await Promise.all(
51        user.friends.map((id) => User.findById(id))
52      );
53      const formattedFriends = friends.map(
54        ({ _id, firstName, lastName, occupation, location, picturePath }) => {
55          return { _id, firstName, lastName, occupation, location, picturePath };
56        }
57      );
58
59      res.status(200).json(formattedFriends);
60    } catch (err) {
61      res.status(404).json({ message: err.message });
62    }
63  };
64
```

Fig 3.32 Updating and removing user friends

This code is an example of an `addRemoveFriend` controller in JavaScript. It handles adding or removing friends for a given user based on the provided `id` and `friendId` parameters. The code performs the following steps: Retrieves the user and friend objects from the database using their respective IDs. Checks if the friend is already in the user's friend list. If so, it removes the friend from both the user's and friend's friend list arrays. Otherwise, it adds the friend to both arrays. Saves the updated user and friend objects back to the database. Retrieves the updated friend list for the user, including only the necessary fields. Sends a JSON response containing the formatted friend list or an error message if an error occurs.

## The Authentication Controller

First we are finding a specific user by his email address. If the user doesn't exist, we send an error message along with 404 status. Then we check if the password entered by the user matches with the password saved in the database. If the password matches, we send a token for the user to remain signed in for some specific amount of time. If the credentials are wrong, we send an error message with the 400 status code. This shows in Fig 3.34.

```
1 import bcrypt from "bcrypt";
2 import jwt from "jsonwebtoken";
3 import User from "../models/User.js";
4
5 /* REGISTER USER */
6 export const register = async (req, res) => {
7   try {
8     const {
9       firstName,
10      lastName,
11      email,
12      password,
13      picturePath,
14      friends,
15      location,
16      occupation,
17    } = req.body;
18
19     const salt = await bcrypt.genSalt();
20     const passwordHash = await bcrypt.hash(password, salt);
21
22     const newUser = new User({
23       firstName,
24       lastName,
25       email,
26       password: passwordHash,
27       picturePath,
28       friends,
29       location,
30       occupation,
31       viewedProfile: Math.floor(Math.random() * 10000),
32       impressions: Math.floor(Math.random() * 10000),
33     });
34     const savedUser = await newUser.save();
35     res.status(201).json(savedUser);
36   } catch (err) {
37     res.status(500).json({ error: err.message });
38   }
39 }
```

Fig 3.33 Registering User



This code(Fig 3.35) is an implementation of a login functionality in a JavaScript controller. Here's an explanation in 5 lines The code receives a request (req) containing the user's email and password from the frontend. It searches for a user in the database (User.findOne({ email: email })) based on the provided email. If the user is not found, it returns a 400 status with a JSON response indicating that the user does not exist. If the user is found, it compares the provided password with the stored password using bcrypt's compare method.

If the passwords match, a JSON Web Token (JWT) is generated (jwt.sign({ id: user.\_id }, process.env.JWT\_SECRET)), and the token, along with the user object (with the password field removed), is returned as a JSON response with a 200 status. Otherwise, it returns a 400 status indicating invalid credentials or a 500 status in case of any server error.

```
40
41  /* LOGGING IN */
42  export const login = async (req, res) => {
43    try {
44      const { email, password } = req.body;
45      const user = await User.findOne({ email: email });
46      if (!user) return res.status(400).json({ msg: "User does not exist. " });
47
48      const isMatch = await bcrypt.compare(password, user.password);
49      if (!isMatch) return res.status(400).json({ msg: "Invalid credentials. " });
50
51      const token = jwt.sign({ id: user._id }, process.env.JWT_SECRET);
52      delete user.password;
53      res.status(200).json({ token, user });
54    } catch (err) {
55      res.status(500).json({ error: err.message });
56    }
57  };
58
```

Fig 3.34 Logging user

### 3.13 Overall flow of data in the web application

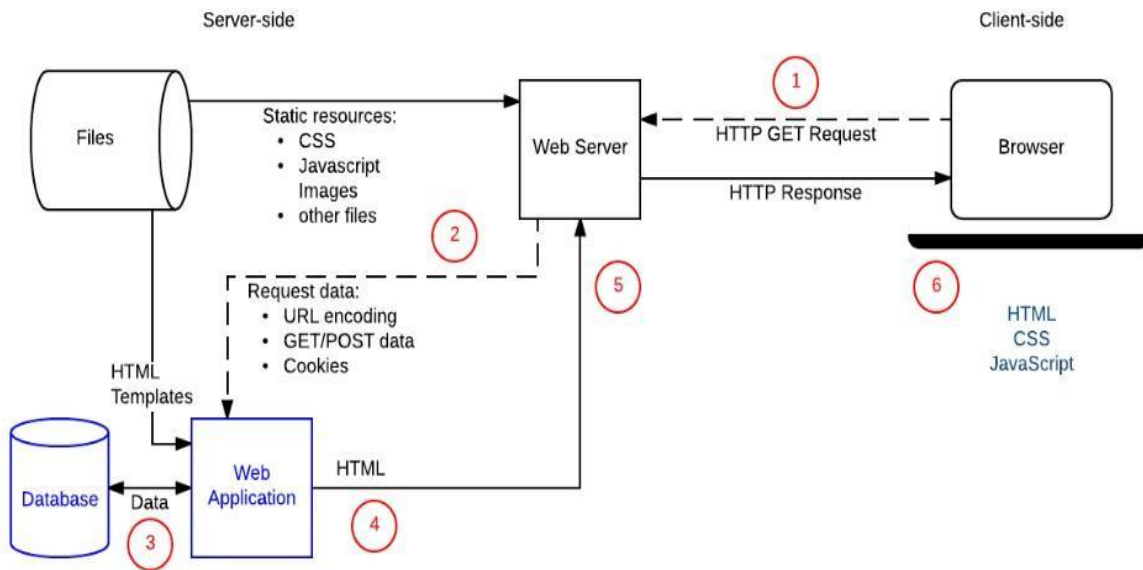


Fig 3.35 : Data flow in a typical web application

The flow of a web application is characterised by the systematic organisation of web pages, page data, page actions, and mappings to business logic and the interconnection of these components. The web diagram tools provide you with a visual way to create and manage the flow of your web application as shown in Fig 3.36.

### 3.14 Three-tier architecture

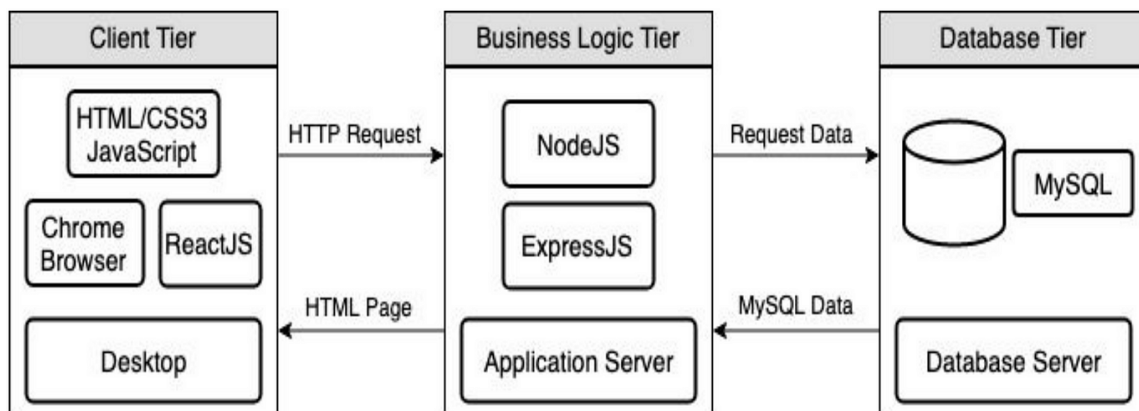


Fig 3.36 : The web dev architecture(three-tier)

**Presentation tier :** The user interface and communication layer of the application, or presentation tier, is where end users engage with the software. Information display to and data collection from the user are its primary goals. This top-level tier can function, for instance, on a desktop application, a web browser, or a graphical user interface (GUI). Tiers of web presentation are often created with HTML, CSS, and JavaScript. Depending on the platform, a variety of languages can be used to create apps as shown in Fig 3.37.

**Application tier :** This layer is usually developed using languages such as PHP, Ruby, Java or Pearl. The core of the application is the application tier, sometimes referred to as the logic tier or middle tier. In this tier, data gathered in the presentation tier is processed using business logic, or a particular set of business rules, sometimes in comparison to data gathered in the data tier. Data in the data tier may also be added, removed, or modified by the application tier.

**Data tier :** The application manages and stores the information it processes. This could be a NoSQL database server like Cassandra, CouchDB, or MongoDB, or a relational database management system like PostgreSQL, MySQL, MariaDB, Microsoft SQL Server.

**Benefits of three-tier architecture :**

1. Faster development as multiple developers can work on different tiers.
2. Improved Scalability for the same reasons mentioned above.
3. Improved Reliability
4. Improved Security.

## CHAPTER 4 : RESULT AND ANALYSIS

### 4.1 Login and Registration

YADEY

Welcome to Yadey, the Social Media for!

Email  
abc@gmail.com

Password  
.....

LOGIN

[Don't have an account? Sign Up here.](#)

Fig 4.1 Log in page

If the user is not already registered in the server they can click on the “Don't have an account? Sign Up here.” link and they will then be directed to the registration page. The user can then enter their details there along with the functionality to upload the profile picture.

## YADEY

Welcome to Yadey, the Social Media for !

First Name: Kaushik

Last Name: Deka

Location: India

Occupation: Software Engineer

Profile Picture: p3.jpeg

Email: kdeka@gmail.com

Password: .....

[REGISTER](#)

[Already have an account? Login here.](#)

Fig 4.2 Registration Page.

When the user has filled in all the information, they can click on the registration page which will send the data in JSON format along with the JWT authentication to the MongoDB running in the backend server. The user will then be redirected to the login page where they can login using the registered email address and password.

```
_id: ObjectId('6457bb3765e5d480ccd84d70')
firstName: "Kaushik"
lastName: "Deka"
email: "kdekagr7@gmail.com"
password: "$2b$10$o0nEwnHsdwhRLlqkeLzvVul0LxMuZos9i8tP.wKwqVU5GTq2ZLqbc"
picturePath: "p4.jpeg"
friends: Array
location: "India"
occupation: "Software Engineer"
viewedProfile: 1610
impressions: 8968
createdAt: 2023-05-07T14:52:39.988+00:00
updatedAt: 2023-05-07T14:52:39.988+00:00
__v: 0
```

Fig 4.3 User info in the MongoDB database

So the user info they just entered is now registered in the database. Every user gets a unique hash id along with their password which is being encrypted by JWT.

## 4.2 Home Page

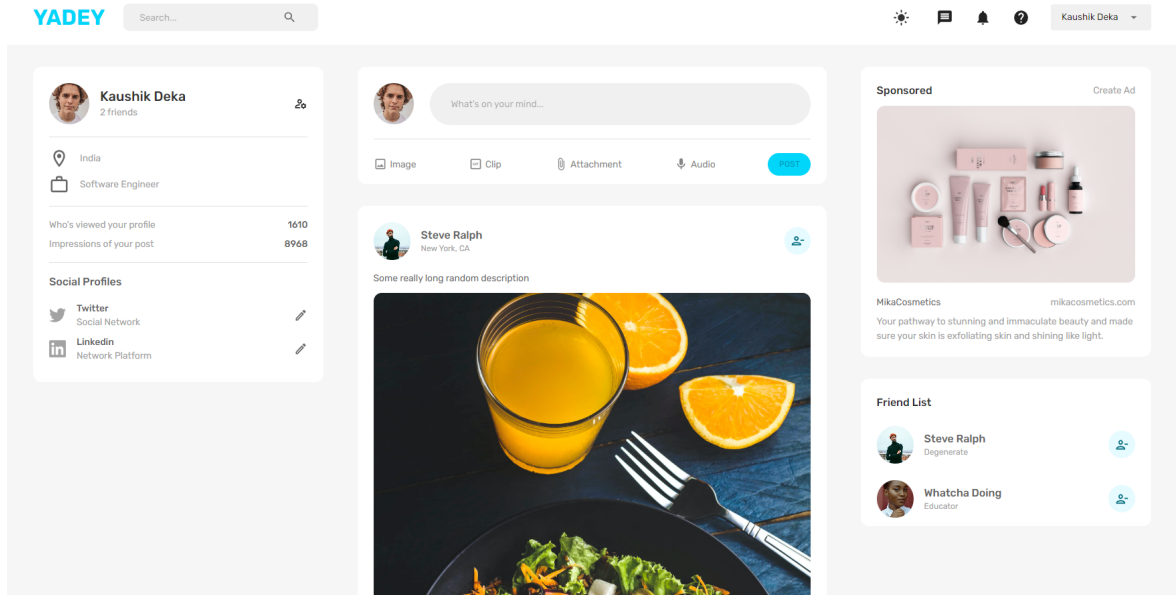


Fig 4.4 Clean looking homepage in Light Mode

The homepage contains all the information with all the widgets. The user can view the user information on the left side. Ads can be seen on the right side along with the friend list shown below. The user can write posts. They can see and like others' posts as well. They can also add friends using the add friend button. It is a clean looking UI with the option to change to dark mode as well using the button shown in Fig 4.5. The user can log out as well by clicking on the drop down on the navbar as shown in Fig 4.6. The dark mode UI is shown in Fig 4.7.

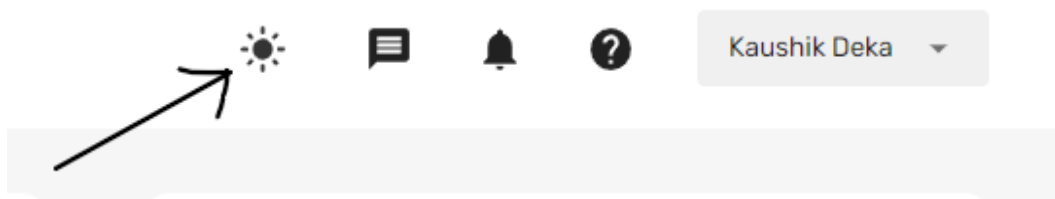


Fig 4.5 Button to change to Dark Mode.

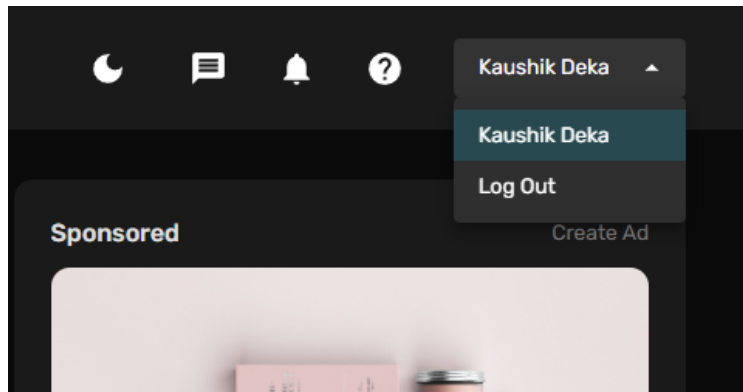


Fig 4.6 Logout option

There is the logout option as shown in Fig 4.6. This will deauthorize the users log in id from the backend server and change the value to null. logOut method takes no arguments and clears the currentUser data stored locally automatically. Create this function in the UserLogin component and call it in the onClick attribute of the logout button:

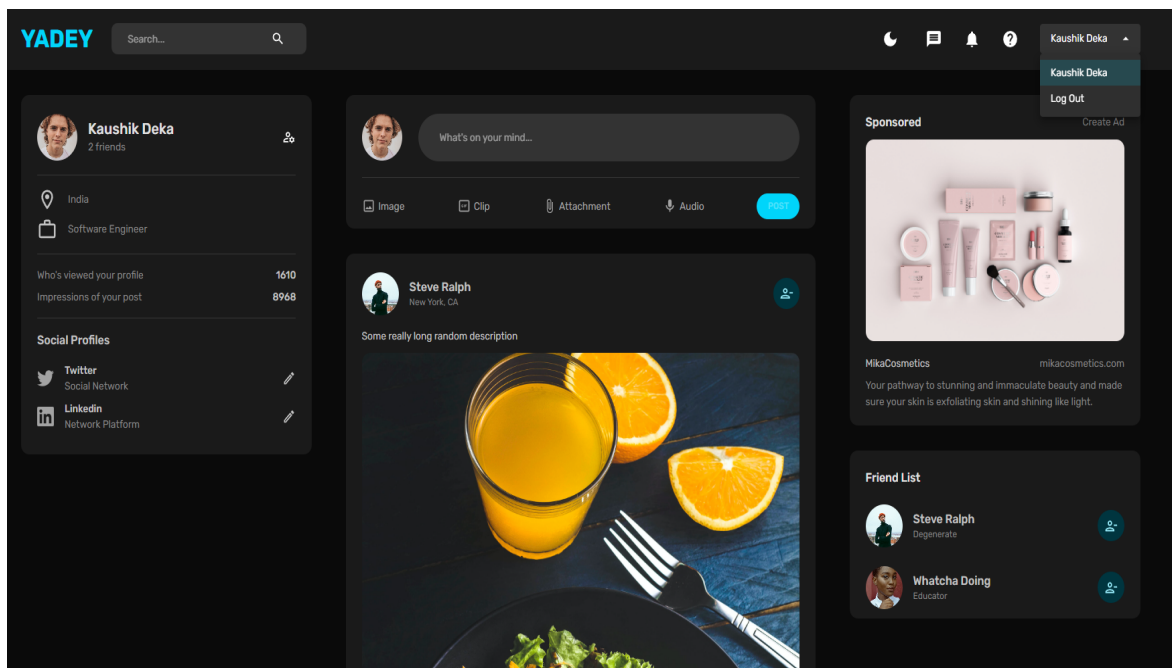


Fig 4.7 Homepage in Dark mode

The dark mode looks clean with contrasting colours to help viewers to distinguish the text and everything. It is a neat little feature added as most of the modern applications nowadays has this feature

### 4.3 Creating and Searching a post

For creating a post, the user needs to enter many fields like title, tags, post message, image in jpg format. Along with these fields, the email id of the user and time of creation of the post is also entered in the database. The posts shown in Fig 4.8 and Fig 4.9 will be registered in the mongoDb database as shown in Fig 4.10.

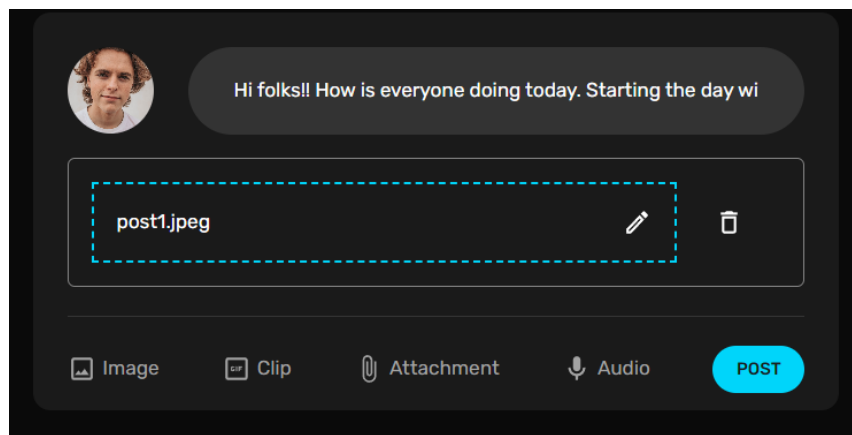


Fig 4.8 Post creation design

The Post button sends a request to the database to save the new post and the user credentials through the API. The clear button will clear all the fields at once.

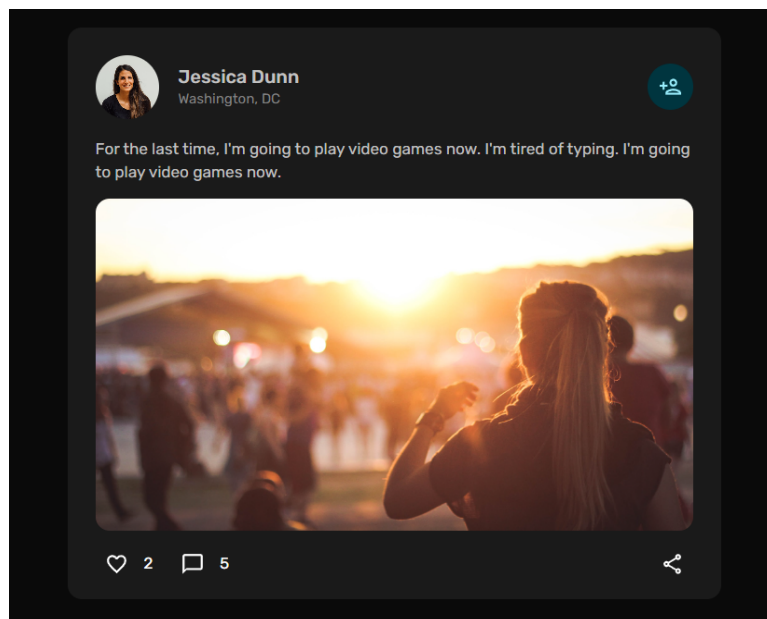


Fig 4.9 Post on homepage



```
Type a query: { field: 'value' } Reset Apply

{
  _id: ObjectId('64568624032aef8795ee8f44')
  userId: "64568624032aef8795ee8f3e"
  firstName: "Jessica"
  lastName: "Dunn"
  location: "Washington, DC"
  description: "For the last time, I'm going to play video games now. I'm tired of typ..."
  picturePath: "post6.jpeg"
  userPicturePath: "p9.jpeg"
  likes: Object
  comments: Array
  __v: 0
  createdAt: 2023-05-06T16:53:56.632+00:00
  updatedAt: 2023-05-06T16:53:56.632+00:00
}
```

Fig 4.10 Post logged in the MongoDB database

We can see posts in the form of an array of objects with different fields like ‘\_id’, description, firstname, last name, location, image etc.

```
▼ [{_id: "64568624032aef8795ee8f3f", userId: "64568624032aef8795ee8f38", firstName: "Steve",...}]
  ▼ 0: {_id: "64568624032aef8795ee8f3f", userId: "64568624032aef8795ee8f38", firstName: "Steve",...}
    ▶ comments: ["random comment", "another random comment", "yet another random comment"]
    createdAt: "2023-05-06T16:53:56.631Z"
    description: "Some really long random description"
    firstName: "Steve"
    lastName: "Ralph"
    ▶ likes: {64568624032aef8795ee8f37: true, 64568624032aef8795ee8f39: true, 64568624032aef8795ee8f3a: true,...}
    location: "New York, CA"
    picturePath: "post1.jpeg"
    updatedAt: "2023-05-08T15:09:10.580Z"
    userId: "64568624032aef8795ee8f38"
    userPicturePath: "p3.jpeg"
    __v: 0
    _id: "64568624032aef8795ee8f3f"
```

Fig 4.11 The post’s metadata on the console

Above is the console view of the posts which will appear on the homepage once the website loads. We can see posts in the form of an array of objects with different fields like ‘\_id’, created at, description, picture path etc.

A particular post is a separate component called ‘Post’. Many of these components

combine to make a component for all the posts of a single page called 'Posts'. A single post has all the fields that the user enters manually like title, username, tags, message and the image. Apart from the manually entered fields, it has some automatically generated fields like the time of post creation and the email address of the user creating the post.

It also has a couple of buttons namely the like button and the delete button. The like button is available to all the logged in users while the delete button is available only to the creator of the post.

#### 4.4 Performance analysis

Performed a **linter check** which makes sure that the program is properly formatted and follows standard code guidelines. There were **no** linter errors found in this project.

#### 4.5 Final list of dependencies

```
{
  "dependencies": {
    "bcrypt": "^5.1.0",
    "body-parser": "^1.20.2",
    "cors": "^2.8.5",
    "dotenv": "^16.0.3",
    "express": "^4.18.2",
    "gridfs-stream": "^1.1.1",
    "helmet": "^6.1.5",
    "jsonwebtoken": "^9.0.0",
    "mongoose": "^7.1.0",
    "morgan": "^1.10.0",
    "multer": "^1.3.0",
    "multer-gridfs-storage": "^1.3.0"
  },
  "name": "server",
  "version": "1.0.0",
  "main": "index.js",
  "type": "module",
  "devDependencies": {},
  "scripts": {
    "test": "echo \\\"Error: no test specified\\\" && exit 1",
    "start": "nodemon index.js"
  },
  "keywords": [],
  "author": "",
  "license": "ISC",
  "description": ""
}
```

Fig 4.12 : The package.json file

The package.json file stores the list of all the dependencies along with their version in json format which is a list of key-value pairs.

## 4.6 Mobile View

The entire social media application is completely responsive on any device. The view from an Iphone device is shown in Fig 4.12

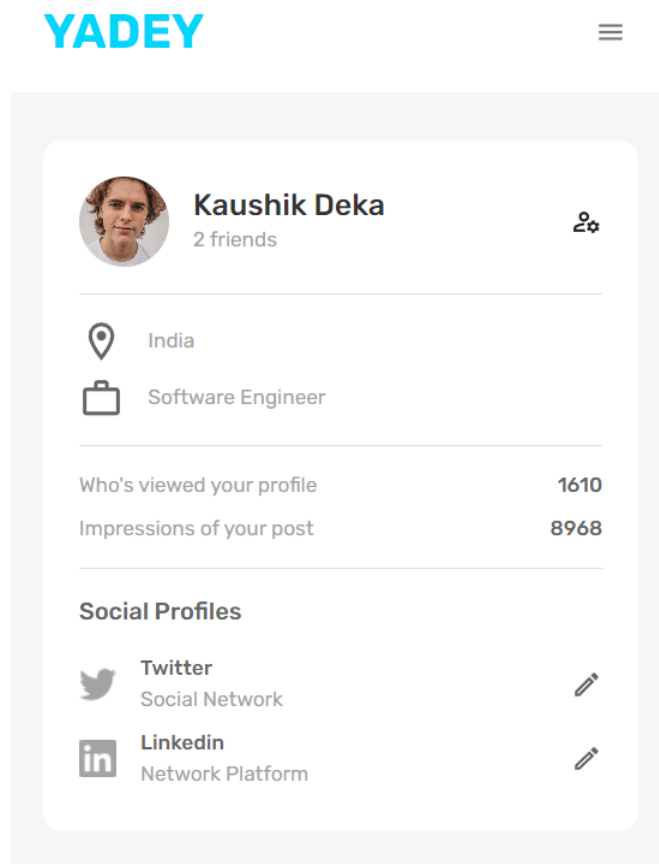


Fig 4.13 The app in mobile view

## CHAPTER 4 : CONCLUSION

### 5.1 Conclusions

The main aim of the training was to be able to understand and implement the concepts of Reactjs, MongoDB, ExpressJs and to be able to create a web application which could perform CRUD operations and can be tested using postman using the three layered architecture.

In this undergraduate project, the MERN stack and its features are examined and used to create a complete social media web application. The history of JavaScript, the foundation of the MERN stack, as well as the underlying theories, key ideas, and key methods of each individual technology have all been thoroughly covered in this essay. With the aid of a NoSQL database engine, the author has shown the benefits of those technologies and how they powerfully integrate to create an application with a connected backend and frontend. Following that, specific instructions for putting the social media application into practice were provided, demonstrating the viability of putting the aforementioned theories to use in solving a real-world issue. All things considered, the project's outcome can be deemed successful because all goals have been met. Given the project's time constraints, the application that was created satisfies all essential criteria for a social platform.

Through this project, I was able to achieve these goals. Doing this project has taught me that a developer should not only care about code but also keep in mind the users can make their experience better. The interface should be constant and smooth to allow the users to navigate through the website easier. Apart from that, writing clean and readable code is also important so that the other developers find it easier to understand and find bugs if there are any. We should try to write code which can be reused in future. Scope of enhancement is always there and we should try to learn from the feedback received.

## 5.2 Future Work

1. Through a graphical web user interface, users may interact with each other through chats while taking use of a secure login and authorisation approach.
2. Users can share their own own stories which can stay active for 24 hours
3. Adding the option of commenting on a particular post.
4. Adding 'related posts' section. This section will have all the posts related to the original post by location. To identify the location we will use either the title of the post or the tags provided by the user. Location refers to the country / continent.
5. Providing a separate and better 'compose' page.
6. The ability for users to add videos in posts.
7. The integration of NLP to group posts with similar hashtags.
8. The ability to integrate graph algorithms for friend recommendation systems similar to what Facebook has achieved.
9. The functionality of having an in app feature to take photos and videos with filters.
10. Providing third-party authentication.

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