



ULTIMATE

Full-Stack Web Development with MERN

Design, Build, Test and Deploy
Production-Grade Web Applications
with MongoDB, Express, React
and NodeJS



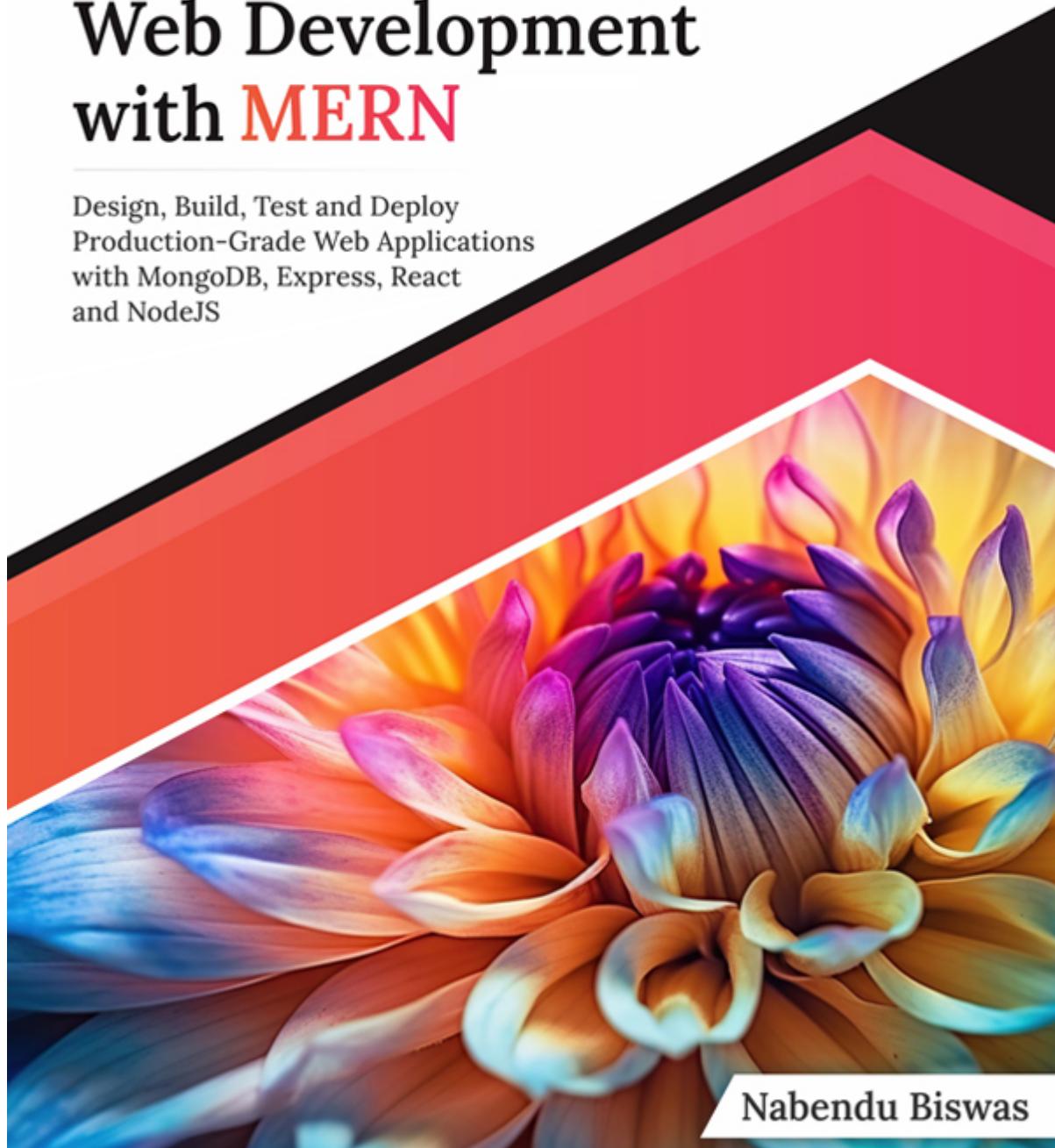
Nabendu Biswas



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Dedicated To

My wife Shikha and My Son Hriday

About the Author

Nabendu Biswas is a full-stack JavaScript developer and has been working in the IT industry for the past 19 years with some of the world's top development firms and investment banks, including J.P. Morgan, Oracle, and L&T Infotech.

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Samarth is a seasoned Full Stack Developer with over 5 years of experience in software development, specializing in multiple technology stacks, including the popular MERN (MongoDB, Express.js, React, Node.js) stack. His career journey has been marked by a diverse range of projects across industries such as Community-based apps, Legal, Crypto/Blockchain, Ed-Tech, HealthCare, and IOT.

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My gratitude also goes to the team at Orange AVA for being supportive enough and providing me with quite a long time to finish and publish the book.

Preface

This book covers all the top technologies in the JavaScript ecosystem: MongoDB, ExpressJS, ReactJS and NodeJS. With these technologies, we can create a completely functional web application that includes frontend, backend and database.

We will build a fairly large production-ready app in this book. Here, we will first learn to set up the frontend with React, then create the backend APIs with NodeJS and Express. The backend will be connected to our database which is MongoDB. We will learn to use authentication in our project by implementing JWT. We will also learn to test both frontend and backend using the Unit testing framework of Jest. Finally, we will learn how to deploy both frontend and backend with ease to use free apps.

After going through the book, the readers will be able to create any MERN app with ease and can also modify the project in the book to create other apps.

Chapter 1: This book will begin with an introduction to all technologies related to MERN (MongoDB, Express, React and NodeJS) followed by a complete project overview of the app, which we are going to build in this book. We will also cover the backend setup required for the same.

Chapter 2: This chapter covers the creation of an Express app. We will create our first routes and controllers in this chapter. We will also learn about error handling.

Chapter 3: This chapter covers connecting to the MongoDB database and creating a model in our backend app. We will also start creating routes for our task app.

Chapter 4: This chapter deals with the implementation of JWT authentication and also the implementation of hashing passwords.

Chapter 5: This chapter covers the implementation of Auth middleware and protecting routes. Here, we will learn how to allow only authorized users to access certain routes.

Chapter 6: This chapter deals with the creation of frontend in ReactJS. We will also cover the setup for React Router version 6 in the project, which is used for navigation in React. We will also create the Register and Login pages on the frontend.

Chapter 7: This chapter covers the implementation of Redux, with the latest slice in the frontend. We will also set up a reducer for the registration form.

Chapter 8: This chapter deals with the login and logout functionalities with Redux.

Chapter 9: This chapter covers the creation of a dashboard in ReactJS. We will also learn how to restrict the dashboard to authorized users.

Chapter 10: This chapter covers the implementation of thunk in tasks and also fetching tasks from the server. It also completes our app, in which we display and delete tasks.

Chapter 11: This chapter covers the testing of the frontend. We will test the frontend created in React using Jest and React Testing Library.

Chapter 12: This chapter deals with the testing of the backend. We will test the backend created in NodeJS using Jest.

Chapter 13: This chapter covers the deployment of both frontend and backend using freely available services.

Downloading the code bundles and colored images

Please follow the link to download the
Code Bundles of the book:

<https://github.com/ava-orange-education/Ultimate-Full-Stack-Web-Development-with-MERN>

The code bundles and images of the book are also hosted on
<https://rebrand.ly/bde02d>

In case there's an update to the code, it will be updated on the existing
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Table of Contents

1. Getting Started with MERN and Setup

Introduction

Structure

About MERN

MongoDB

Express

ReactJS

NodeJS

Other Popular stacks beyond MERN

REST APIs

POST

GET

PUT

DELETE

Alternatives to REST API

Complete Project Overview

Setting up a NodeJS Application

Project Folder Structure

Package installation

Running the project

Conclusion

2. Starting a NodeJS App

Introduction

Structure

Using Express

Creating Routes

Initial Routes

All Routes

Testing through Postman

Creating Controllers

Using JSON

Error Handler

Conclusion

3. MongoDB Connection and Models

Introduction

Structure

MongoDB Database

Basic Setup

Connecting through Mongoose

Model Creation

Creating Routes

POST Route

PUT Route

DELETE Route

Conclusion

Points to remember

4. JWT Authentication and Hashing Password

Introduction

Structure

User Model and Controller

Register User with Hashed Password

Login User

Understanding JWT

Using JWT

Conclusion

Points to Remember

5. Auth Middleware and Protecting Routes

Introduction

Structure

Creating Auth middleware

Understanding Protect Routes

Protecting Task Routes

GET and POST Route

PUT and DELETE Route

Conclusion

Points to remember

Multiple Choice Questions

Answers

6. Creating Frontend and React Router

Introduction
Structure
Creating Frontend with ReactJS
Basic Project Setup
React Router Setup
Creating Components and Pages
 Header Component
 Register Page
 Login Page
Conclusion
Points to remember

7. Redux Setup with Slice

Introduction
Structure
Redux setup with a toolkit
Auth service and slice
Registration form hook up
Testing user registration
Conclusion
Points to remember

8. Login and Logout Functionalities

Introduction
Structure
Implementing Logout
Implementing Login
Login form hook up
Testing user login
Conclusion
Points to remember

9. Dashboard Creation and Task Form

[Introduction](#)
[Structure](#)
[Changing Dashboard Logic](#)
[Creating Task Slice](#)
[Creating Task Form](#)
[Conclusion](#)
[Points to Remember](#)
[Multiple Choice Questions](#)
[Answers](#)

10. Using Thunk and Completing App

[Introduction](#)
[Structure](#)
[Creating task with Async Thunk](#)
[Fetching tasks from server](#)
[Displaying the tasks](#)
[Deleting tasks](#)
[Conclusion](#)
[Points to remember](#)

11. Frontend Testing

[Introduction](#)
[Structure](#)
[Setup testing in Frontend](#)
[Task Slice and Service Test with Jest](#)
[Testing with React Testing Library](#)
[Configuring and Checking Coverage](#)
[Conclusion](#)
[Points to remember](#)

12. Backend Testing

[Introduction](#)
[Structure](#)
[Setting up testing in the backend](#)
[Testing registerUser controller](#)
[Testing getTasks and setTask controller](#)
[Testing updateTask controller](#)

[Conclusion](#)

[Points to remember](#)

[13. Deployment](#)

[Introduction](#)

[Structure](#)

[Frontend code repo creation](#)

[Backend code repo creation](#)

[Backend deployment in Back4app](#)

[Backend integration with frontend](#)

[Frontend deployment in Netlify](#)

[Fixing CORS errors and final deployments](#)

[Conclusion](#)

[Points to remember](#)

[Index](#)

CHAPTER 1

Getting Started with MERN and Setup

Introduction

This chapter talks about the basic principles of MERN and REST API. We will talk about the technology stack behind MERN and also the way REST API works. Here, we will also do a complete project overview. We are going to learn about the complete project, which we are going to create in this book. Beside this, we are also going to do the basic setup of the backend part of the application. Here, we are going to set up the NodeJS application.

Structure

In this chapter, we are going to discuss the following topics:

- MERN
- REST APIs
- Complete Project Overview
- Setting up a NodeJS Application

About MERN

MERN stands for MongoDB, Express, React, and NodeJS. It is one of the most popular stacks for creating full-stack apps. Now, full-stack apps are fully functional apps in which we create both the frontend and the backend.

Traditionally, creating the backend and frontend are tasks for two different teams. But with startups coming into picture, a lot of companies have the complete app created by a single team.

Before the creation of NodeJS in 2009, most of the backend programming was done in Java. But with the creation of NodeJS, a lot of companies started using NodeJS in the backend.

The reason is that they can have a JavaScript engineer build the frontend in ReactJS, and the backend in NodeJS. Both ReactJS and NodeJS are JavaScript libraries and are coded using common JavaScript.

We will learn about each tech in MERN and its usage in the MERN stack.

MongoDB

The M in MERN stands for MongoDB. Now, MongoDB is a NoSQL database that stores the data in BSON format. The full form of BSON is Binary JSON and it is quite similar to JSON (JavaScript Object Notation).

It is an object which contains key-value pairs. The strings should be in double quotes, which is similar to JSON. But BSON also contains types like datetime.

A sample BSON document from a MongoDB database is as follows:

```
{  
  "_id": {  
    "$oid": "646c4c0b3ed1bed3064c20e2"  
  },  
  "company": "JP Morgan",  
  "position": "Architect",  
  "jobType": "full-time",  
  "createdBy": {  
    "$oid": "6450b1cbfb52c1a172e790e2"  
  },  
  "createdAt": {  
    "$date": {  
      "$numberLong": "1684245010932"  
    }  
  },  
  "updatedAt": {  
    "$date": {  
      "$numberLong": "1684245010932"  
    }  
  },  
  "__v": {  
    "$numberInt": "0"  
  }  
}
```

}

MongoDB is totally different from traditional Relational databases, which store data in rows and tables. There are also complex relations between tables, which is not required in MongoDB.

MongoDB is a very fast database, with data stored as BSON. Therefore, it is used in most modern web-apps, like an e-commerce site or ride-sharing app. These apps are less concerned about the success of a transaction, like banking apps.

They are more concerned about getting millions of concurrent connections and handling them. Here, MongoDB excels as a NoSQL database, which makes it so popular in the MERN stack.

Express

The E in MERN stands for Express. Now, Express or ExpressJS is not a JavaScript framework but a NodeJS framework, which in turn is a JavaScript backend framework.

Now, NodeJS is used for a variety of backend tasks, including socket programming. But the major task of a backend language, which is to create API endpoints, can also be done in NodeJS.

We will learn more about the REST API in the next section. But they are basically a bridge between the database and the frontend. Writing API endpoints is the main feature of Express.

But why do we need Express, when we also have NodeJS to write API endpoints? The answer is that it is easier to write API code in Express than in Vanilla NodeJS.

So, when Express was created in 2010, it always started to be used with NodeJS for API development.

Following is the express code for a GET API. Here, we are first importing the express in our app. Then we are using it. Next, we are creating the home route '/' with the simple `app.get()` function.

Lastly, we are listening at port 8000.

```
const express = require('express');
const app = express();
app.get('/', (req, res) => {
```

```

    res.send('Welcome to Express');
  });

app.listen(8000, () => console.log(`Server is up on port
8000`));

```

Once we run the app and goto <http://localhost:8000> from our browser, we will get **Welcome to Express** text.

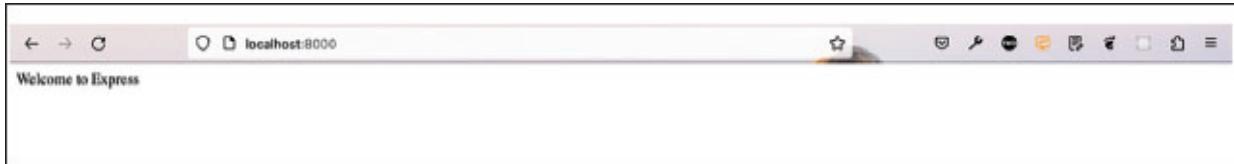


Figure 1.1: Express app on browser

ReactJS

The R in MERN stands for ReactJS. ReactJS is the world's most popular JavaScript Library/Framework. It is just a small JavaScript Library, but way more popular than the JavaScript Framework of Angular.

Almost all major sites on this planet have frontend as ReactJS or some part in ReactJS. It powers Facebook, Instagram, Netflix, Airbnb, BBC, Paypal, Reddit, and almost every other web-app on this planet.

ReactJS was released in 2013 by Facebook, and before that AngularJS was released in 2010, by Google. Angular powers most of Google web-apps and many corporate apps also.

But even after a late release, ReactJS became the de facto library for startups and most companies due to its ease of learning in comparison to Angular. Being a small library, a lot of major tasks like routing and global state management are done by external packages.

But due to its popularity, ReactJS has more than 200,000 open source packages available. You can find a package for everything, from creating beautiful forms to drag drop packages.¹

Sites made with ReactJS are very fast, even with extreme loads. The best examples are Facebook, Instagram, and Netflix. This power of ReactJS comes from using Virtual DOM instead of the real DOM.

The DOM manipulation is generally slow, so ReactJS changes the Virtual DOM at first. Later, it changes the DOM behind the scene.

Code written in ReactJS uses a special syntax called JSX (JavaScript XML). In ReactJS, we basically combine the HTML and JavaScript file into one file, called the JSX file.

In ReactJS, we divide the project into small, manageable components. This also helps to divide a large project into different teams. Following is the code for a simple Greet component.

Here, we are receiving data from a Parent component. This is called props. And after that, we are showing it using html. Notice that in a js extension file, we are directly showing html. This kind of file gets converted using the in-built Babel and web-pack to HTML, CSS and JavaScript code because the browser only understands them and not ReactJS.

```
import React from 'react'
const Greet = (props) => {
  const {lang, children} = props;
  return (
    <>
      <h1>Greet from {lang}</h1>
      <p>{children}</p>
    </>
  )
}
export default Greet
```

NodeJS

The N in MERN stands for NodeJS. It's a backend scripting language created for writing backend code. It allows you to write backend code using JavaScript.

NodeJS was created in 2009 by Ryan Dahl. It uses the famous V8 engine of Chrome, which is used to run JavaScript on the browser. But NodeJS runs JavaScript outside the browser and runs on all Windows, Linux, Unix, and MacOS machines.

It can handle a lot of concurrent connections, which is around 70,000 requests per second. When a web-app becomes popular, more users connect to it, and hence the load on the server increases.

NodeJS is the second-fastest backend language after Java, which can handle 1 million requests per second. So, NodeJS can be easily used in medium-level apps which get less than or equal to 70,000 requests per second.

NodeJS can be used in all kinds of backend programming; from creating API endpoints to creating real-time apps with socket programming. Further API programming can be done using ExpressJS.

The following is a small piece of code from socket programming. This kind of programming is used to create messaging apps like WhatsApp.

In this kind of app, we need to use a socket library. After that, the server creates the connections between different clients which emits messages from other clients through it.

```
const socketio = require('socket.io')
io.on('connection', socket => {
  socket.on('join', ({ username, room }, callback) => {
    const { error, user } = addUser({ id: socket.id,
      username, room })
    if(error) return callback(error)
    socket.join(user.room)
    socket.emit('message', generateMsg('Admin', 'Welcome to
      the Chat App!'))
    callback()
  })
})
server.listen(port, () => console.log(`Server is up on port
${port}`))
```

Other Popular stacks beyond MERN

There are two other popular stacks beyond MERN. These stacks use the same backend technologies and database. Only the frontend technology gets changed.

These are MEAN (MongoDB, Express, Angular, NodeJS) and MEVN (MongoDB, Express, VueJS, NodeJS). In these stacks, the other two popular JavaScript frontend frameworks of Angular and VueJS are used.

REST APIs

REST APIs, also known as RESTful endpoints, are the way the modern internet works in most cases. In the Internet, there is a client which nowadays is mostly a browser or a mobile app.

All web-apps like Facebook, Instagram, Netflix or mobile apps get the data from a database. But they don't read the data directly from a database. They interact with a middleware through HTTP (HyperText Transfer Protocol) protocol, using these predefined RESTful endpoints.

There are four basic REST APIs - POST, GET, PUT, and DELETE. They are used to perform the CRUD (Create, Read, Update, Delete) operation on a database.

As shown in [*Figure 1.2*](#), the client machine sends REST API requests and then gets back the response from the database. The REST APIs are created using languages like NodeJS, Spring Boot (Java), C# .NET, and many others.

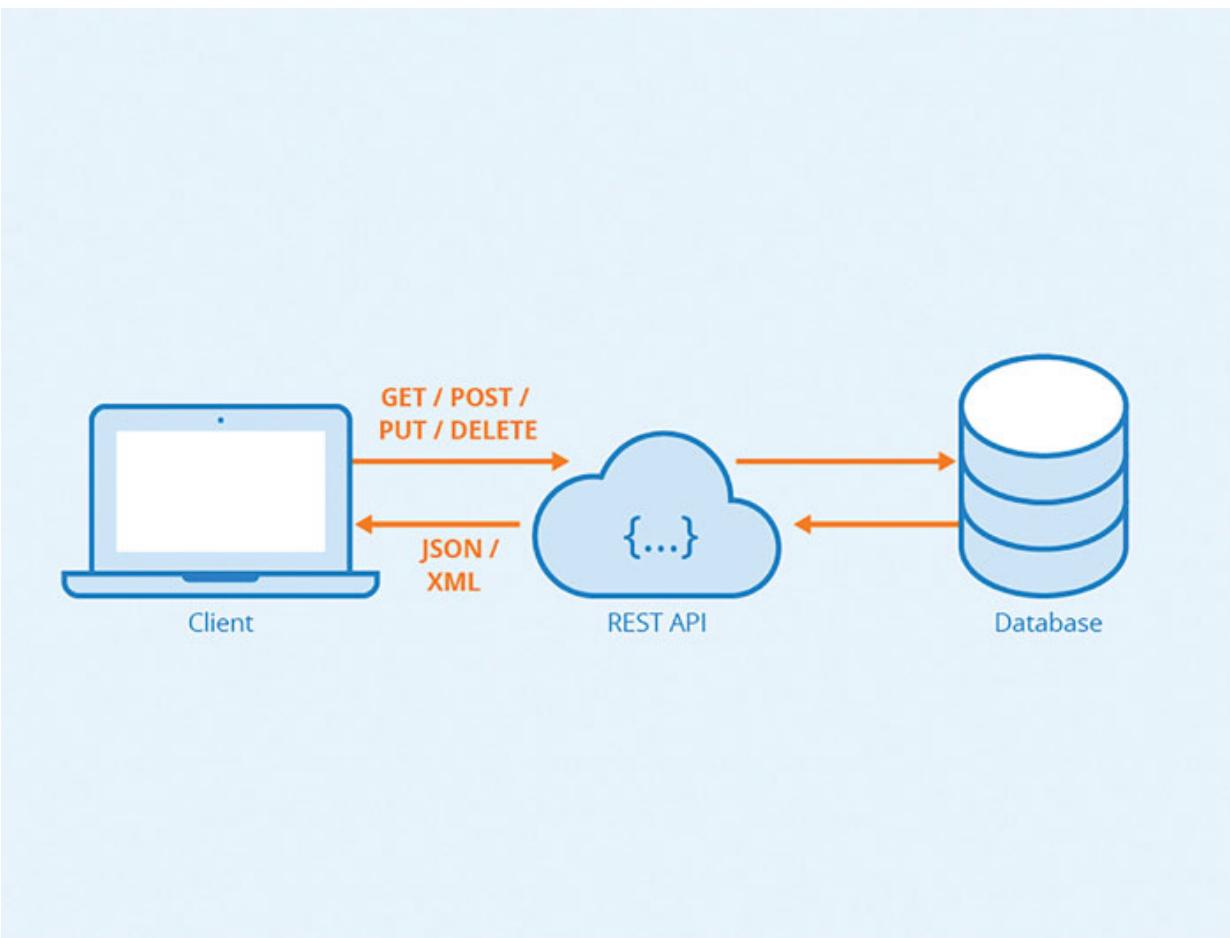


Figure 1.2: REST API

Next, we will look into each REST API endpoint in detail.

POST

The POST API is used to implement the Create operation in CRUD. It is one of the most used REST APIs, which we use from the moment we start using a web-app.

The first time you go to a social media web-app like Facebook, it asks you to register. Now, you enter your name, age, and other details in a form and hit the Register button.

The data will be sent through a POST API to the Facebook database and will be stored there. Next, once we log in, we will create a new post and hit the post button on Facebook.

Again, the POST API will come into picture and send the data to Facebook server. So, whether you purchase some products on Amazon and hit the buy button or upload some photos on Instagram, a POST API comes into picture and sends the data to the respective database.

The data is sent to the backend server in JSON format. The JSON (JavaScript Object Notation) format is similar to JavaScript objects. But here, double strings are mandatory for strings.

A sample POST API, JSON data for an e-commerce purchase is shown here:

```
[ "userID": 23,  
  "username": "Keshav",  
  {  
    "id": 1,  
    "qty": 2,  
    "price": 109.95  
  },  
  {  
    "id": 11,  
    "qty": 3,  
    "price": 119.95  
  }  
]
```

GET

The GET API is used to implement the Read operation in CRUD. It is the most commonly used API in the world.

Continuing with the Facebook example from POST, when you go to Facebook for the first time, you see a lot of posts. These posts are read from a database through the GET API.

Whether you are scrolling through your Instagram feed, or browsing through Amazon products, or checking articles on Medium, the GET API comes into picture. It reads all the data from the database and shows it in the frontend.

The data is received from the REST APIs in JSON format. Following is a sample JSON data received from an e-commerce site. Notice that most of the time the data is an array of objects. This is the case because arrays are easy to iterate and objects can store data about the items.

After receiving this data, it is the responsibility of the frontend developer to iterate over it and show it on the website. So, this is how you see those beautiful items on the Amazon home page or structured articles on the Medium home page.

Also, when we click a particular item on Amazon or a post on Medium, another GET API is done for that individual item to get all the data.

```
[  
 {  
   "id": 1,  
   "title": "Fjallraven",  
   "price": 109.95,  
   "description": "Your perfect pack for everyday use and  
 walks in the forest.",  
   "image": "https://fakestoreapi.com/img/81fPKd-  
 2AYL._AC_SL1500_.jpg",  
 },  
 {  
   "id": 2,  
   "title": "Mens Casual T-Shirts ",  
   "price": 22.3,  
   "description": "Slim-fitting style, contrast raglan long  
 sleeve",  
   "image": "https://fakestoreapi.com/img/71-  
 3HjGNDUL._AC_SX466_.SX466_.SY466_.UY466_.jpg",  
 }]
```

```

},
{
  "id": 3,
  "title": "Mens Cotton Jacket",
  "price": 55.99,
  "description": "great outerwear jackets for
Spring/Autumn/Winter, suitable for many occasions.",
  "image": "https://fakestoreapi.com/img/71li-
ujtlUL._AC_UX679_.jpg",
}
]

```

PUT

The PUT API is used to implement the Update operation in CRUD. It is used when some existing data needs to be updated.

Continuing with the Facebook example, after we create some posts. We might need to edit a post due to some mistakes So, we click the edit and make the changes.

Again we hit the post button and the update is done. But for the update to happen in the database the exact identification of the post is required. Each post contains a unique id, as in the GET example we can see the unique id for each item.

So, the PUT API sends the id along with the data to be updated to the backend server, which in turn updates the exact data in the database.

The following is a sample PUT API json, where we update our small post. Note that the id is mandatory here, since this will be used to update the correct post in the database.

```

{
  "id": 101,
  "title": "ReactJS tutorials",
  "description": "ReactJS is the most popular JavaScript
frontend library."
}
```

DELETE

The DELETE API is used to implement the Delete operation in CRUD. This API is used when we want to delete data from the database.

Continuing with the Facebook example, after we create some posts. Suppose, we want to delete one of our Facebook posts, then we hit the delete button on the post.

Now, to delete the post, we just need to send the id of the post to the Facebook server. The Delete API only needs the id to be sent to the backend server, and it gets deleted from the database.

Alternatives to REST API

In the past few years, two alternatives have emerged to the REST API. One is the tool of Firebase, in which the frontend directly interacts with the database without any need for a middleware written in language like NodeJS.

Here, instead of API endpoints we have some boiler plate code which directly does the CRUD operations. But Firebase is not as popular as REST endpoints created using backend languages.

Another technology is GraphQL, which is gaining a lot of momentum for the past two years. It also has an endpoint but we can get selective data from the database. Let's consider in the GET example, where we want only the title and price for all items.

If we are using REST then we either need to write this logic in the frontend after receiving all data or we need to create a new endpoint. But this can be easily achieved through GraphQL query.

Sample GraphQL query to achieve the same. With this query, we will only receive the title and price for each item.

```
{
  items {
    title
    price
  }
}
```

Complete Project Overview

In this book, we are going to create a complete MERN project. This will be a task app in which we will be able to add our daily tasks.

The frontend will be made in ReactJS, and we will also do authentication through JWT (JSON Web Token). Here, we will have the complete register and login functionality also.

For global state management, we will be using the latest Redux toolkit in the project. Coming to the backend, we will use ExpressJS and NodeJS. MongoDB cloud database is used to store our data.

Besides this, we are also going to Unit test our frontend using Jest and React Testing library and the backend using Jest and Supertest.

Lastly, we are going to deploy the frontend using Netlify and backend using the Heroku alternative of back4app.

Setting up a NodeJS Application

We are going to start with the backend first. So, we will create a NodeJS app. As we are not creating the front end first, so we need Postman to test our API endpoints.

We are going to learn about it later. And we are going to use the MongoDB cloud database to store our data. The MongoDB installation can be done locally as well, but then it's become difficult to deploy it.

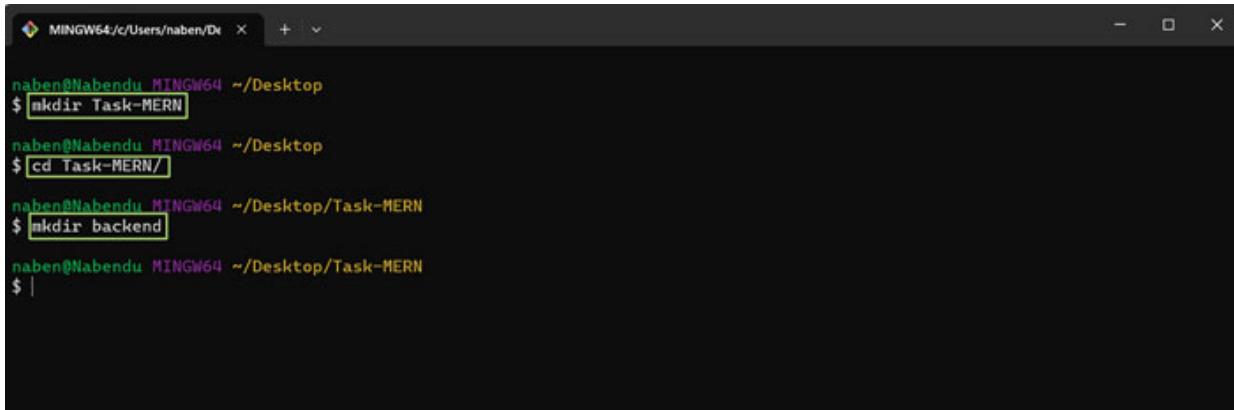
Project Folder Structure

While working with the backend, knowledge of the terminal is required. MacOS and Linux come in-built with the terminal, but now Windows also comes with a superior terminal app.

So, open up any terminal in any operating system. In Windows, the old **Command Prompt** will also work, but it's better to use the new terminal. We will be using a Windows terminal in this book.

So, open the Windows terminal app. We have opened it on the desktop. After that, create a new folder with the **mkdir** command. We have named the folder **Task-MERN**.

Next, change to the folder using the **cd** command. Now, we will be inside this folder and create another folder called **backend** with **mkdir** command here.

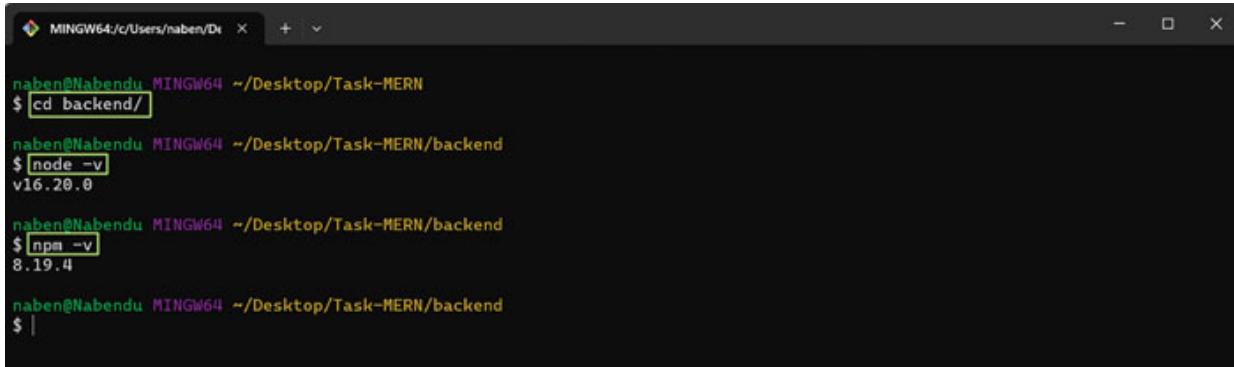


```
naben@Nabendu MINGW64 ~/Desktop
$ mkdir Task-MERN
naben@Nabendu MINGW64 ~/Desktop
$ cd Task-MERN/
naben@Nabendu MINGW64 ~/Desktop/Task-MERN
$ mkdir backend
naben@Nabendu MINGW64 ~/Desktop/Task-MERN
$ |
```

Figure 1.3: Project structure

Now, we will change to the **backend** folder first with the `cd` command. Now, since the backend in NodeJS and frontend in ReactJS require node and npm to be installed on the system.

We are checking the same with `node -v` and `npm -v` commands.



```
naben@Nabendu MINGW64 ~/Desktop/Task-MERN
$ cd backend/
naben@Nabendu MINGW64 ~/Desktop/Task-MERN/backend
$ node -v
v16.20.0
naben@Nabendu MINGW64 ~/Desktop/Task-MERN/backend
$ npm -v
8.19.4
naben@Nabendu MINGW64 ~/Desktop/Task-MERN/backend
$ |
```

Figure 1.4: Node version

If NodeJS is not installed on the system, then head over to <https://nodejs.org> to install the same. Just download the LTS version on your system and double click the package, which will be downloaded.

The installation for Mac and Windows is almost the same, just some screens and location for installation will change.

Note that when we install NodeJS on our operating system, then npm (Node Package Manager) also gets installed on the system automatically.

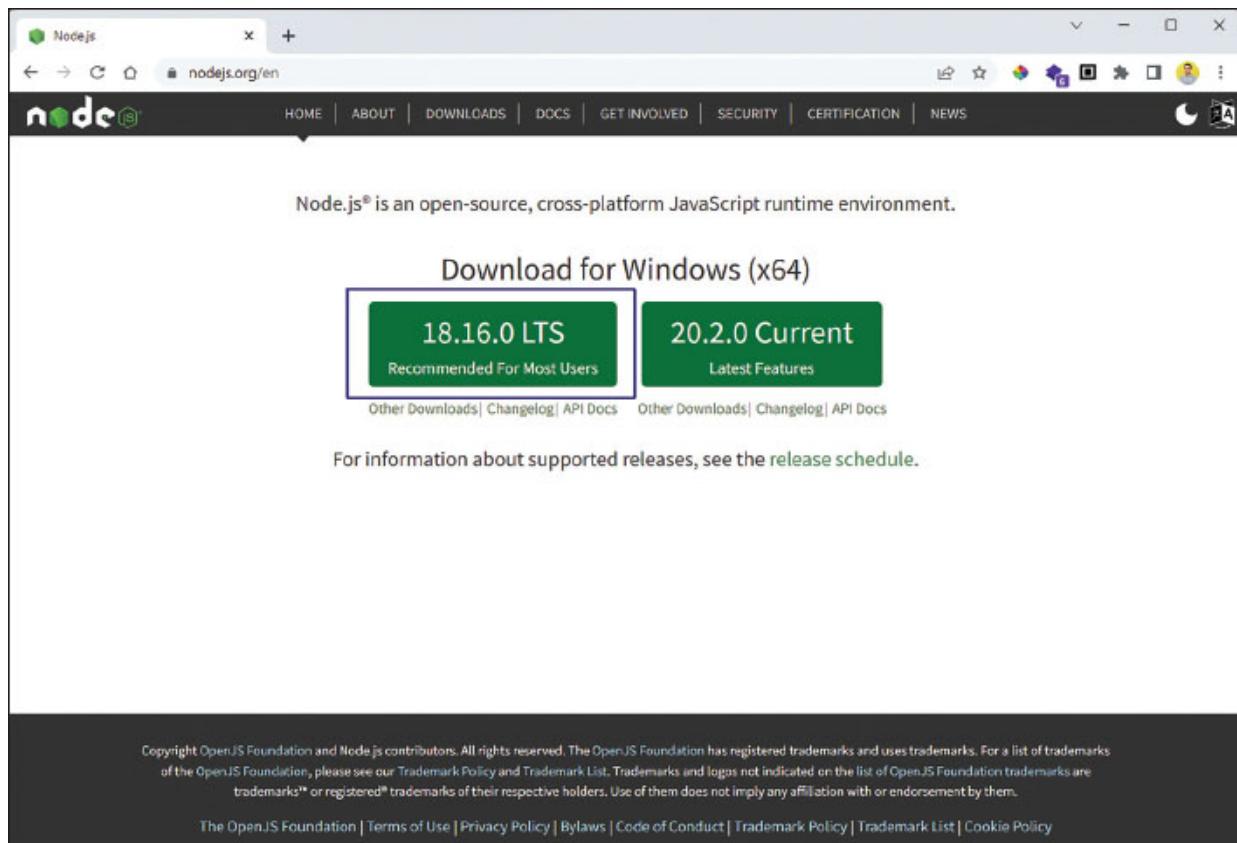


Figure 1.5: NodeJS installation

Now in the backend folder give the command `npm init -y` to create an empty **package.json** file with default options. The package.json file is a must for any modern frontend or backend project, because it is used to install node packages in the project.

Next, we will give the command `code` to open the project in **VS Code**. This is the default code editor recommended for this book. You can download it for free from <https://code.visualstudio.com/>.

```
naben@Nabendu MINGW64 ~/Desktop/Task-MERN/backend
$ npm init -y
Wrote to C:\Users\naben\Desktop\Task-MERN\backend\package.json:

{
  "name": "backend",
  "version": "1.0.0",
  "description": "",
  "main": "index.js",
  "scripts": {
    "test": "echo \"Error: no test specified\" && exit 1"
  },
  "keywords": [],
  "author": "",
  "license": "ISC"
}

naben@Nabendu MINGW64 ~/Desktop/Task-MERN/backend
$ code .

naben@Nabendu MINGW64 ~/Desktop/Task-MERN/backend
$ |
```

Figure 1.6: Creating package.json

Package installation

Once VS Code is opened, first create a `.gitignore` file. Now, whatever we put in this file will not go to the GitHub repository.

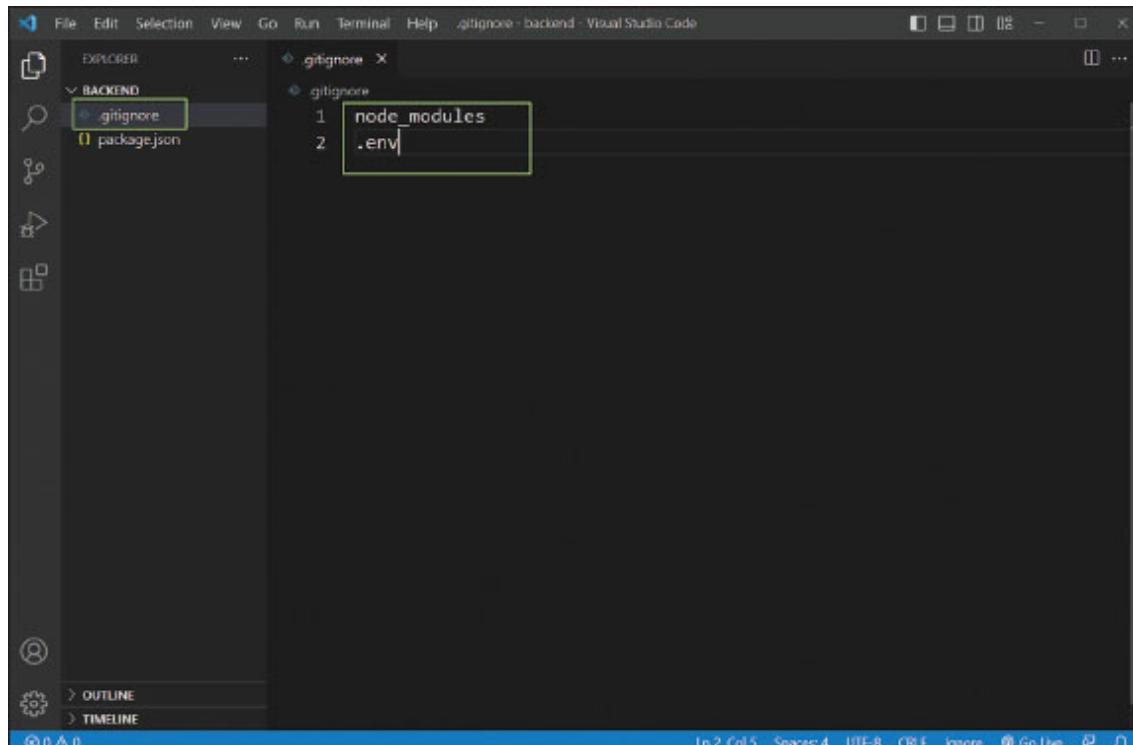


Figure 1.7: Creating .gitignore

Now, we will start installing the packages required in our project. Here, we have opened the Integrated terminal in VS Code, by pressing *Ctrl + J*. Next, we have installed the package of express, dotenv and mongoose by giving the following command in the terminal:

```
npm i express dotenv mongoose
```

Here, express is the NodeJS framework which we are going to use to create API endpoints. The package of mongoose will be used to connect to the MongoDB database. And the dotenv package uses an .env file to save secrets in a project.

The screenshot shows the Visual Studio Code interface. The left sidebar displays the file structure with 'package.json' selected. The main editor area shows the contents of the package.json file, specifically the dependencies section which includes 'dotenv', 'express', and 'mongoose'. The bottom right corner shows the integrated terminal window. The terminal output shows the command \$ npm i express dotenv mongoose being run, followed by the results of the installation: 'added 83 packages, and audited 84 packages in 11s', '9 packages are looking for funding', 'run 'npm fund' for details', and 'found 0 vulnerabilities'. The status bar at the bottom indicates the terminal is in bash mode.

```
File Edit Selection View Go Run ... package.json - backend - Visual Studio Code
package.json ×
package.json > {} dependencies
4 "description": "",
5 "main": "index.js",
6 "scripts": {
7   "test": "echo \\"Error: no test specified\\" && exit 1"
8 },
9 "keywords": [],
10 "author": "",
11 "license": "ISC",
12 "dependencies": [
13   "dotenv": "^16.0.3",
14   "express": "^4.18.2",
15   "mongoose": "^7.2.0"
16 ]
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
naben@Nabendu MINGW64 ~/Desktop/Task-MERN/backend
$ npm i express dotenv mongoose
added 83 packages, and audited 84 packages in 11s
9 packages are looking for funding
  run 'npm fund' for details
found 0 vulnerabilities
naben@Nabendu MINGW64 ~/Desktop/Task-MERN/backend
$ 
In 13, Col 25  Spaces:2  UTF-8  LF  { } JSON  Go live  ⚙  Q
```

Figure 1.8: Installing dependencies

Now, we will also install dev dependencies. These types of packages are not used in production, so they are installed through dev dependencies.

Here, we are going to install the package of **nodemon**. This package will restart our backend server the moment we make any change in the code. If we run the server code using node command, it needs to be restarted every time manually for changes to appear.

So, give the following command in the terminal. Note that we need to use the `--save-dev` flag to install a package as dev dependency:

```
npm i --save-dev nodemon
```

Notice that in `package.json` the `nodemon` package is installed as dev dependency.

The screenshot shows a Visual Studio Code interface. In the center, the `package.json` file is open, displaying the following JSON code:

```
8 },
9   "keywords": [],
10  "author": "",
11  "license": "ISC",
12  "dependencies": [
13    "dotenv": "^16.0.3",
14    "express": "4.18.2",
15    "mongoose": "^7.2.0"
16  ],
17  "devDependencies": {
18    "nodemon": "^2.0.22"
19  }
20 }
```

A yellow rectangular selection highlights the `devDependencies` object and its contents. Below the code editor, a terminal window is visible with the following output:

```
naben@Nabendu MINGW64 ~/Desktop/Task-MERN/backend
$ npm i --save-dev nodemon
added 32 packages, and audited 116 packages in 3s
12 packages are looking for funding
  run 'npm fund' for details
found 0 vulnerabilities
```

The terminal shows the command `npm i --save-dev nodemon` being run, followed by the results of the installation.

Figure 1.9: Installing dev dependencies

Running the project

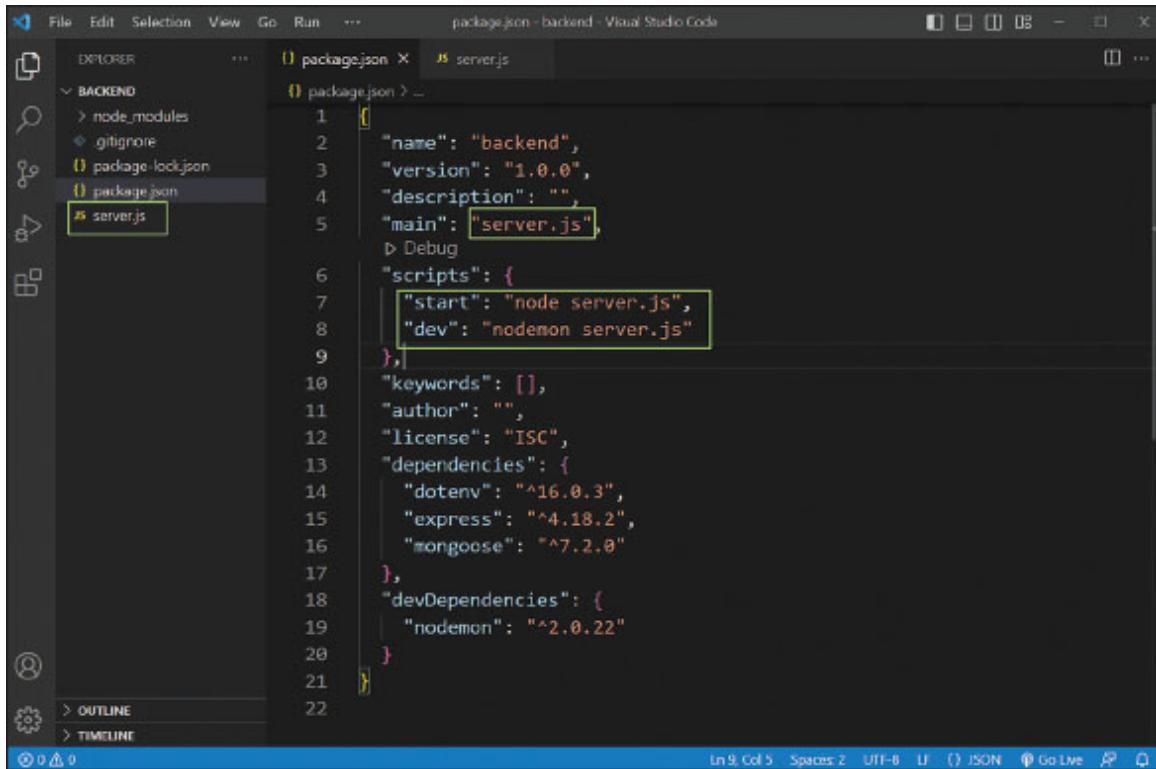
To run the project, we need to make some modifications in the `package.json` file. First, create a `server.js` file. And then in the `package.json` file change the main to `server.js`.

Next, create two scripts for production and development. Give the following lines inside scripts, as shown in [Figure 1.10](#):

```
"start": "node server.js",
"dev": "nodemon server.js"
```

Now, the production code will run on deployment server back4app(heroku alternative) and it will run the node command.

But while doing development, we will run the `nodemon` command.



The screenshot shows the Visual Studio Code interface with the file 'package.json' open in the editor. The 'scripts' section is highlighted with a yellow box, containing the following code:

```
1 [ "name": "backend", "version": "1.0.0", "description": "", "main": "server.js", "scripts": { "start": "node server.js", "dev": "nodemon server.js" }, "keywords": [], "author": "", "license": "ISC", "dependencies": { "dotenv": "^16.0.3", "express": "^4.18.2", "mongoose": "^7.2.0" }, "devDependencies": { "nodemon": "^2.0.22" } }
```

Figure 1.10: Creating Scripts

Now, open the `server.js` file and put a simple console log in this file.

```
console.log("Welcome to server");
```

After that, open the Integrated Terminal and run the command `npm run dev`, to run the `nodemon` command from `package.json` file.

Here, if everything is ok, we will see the console log of **Welcome to server**.

The screenshot shows a Visual Studio Code interface. In the top left, there's a file tree with a single file named 'server.js'. The main editor area contains the following code:

```
1 console.log("Welcome to server");
```

Below the editor is a tab bar with 'PROBLEMS', 'OUTPUT', 'DEBUG CONSOLE', and 'TERMINAL' tabs. The 'TERMINAL' tab is active, showing a terminal session:

```
naben@Nabendu MINGW64 ~/Desktop/Task-MERN/backend
$ npm run dev
> backend@1.0.0 dev
> nodemon server.js

[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 server.js'
>Welcome to server
[nodemon] clean exit - waiting for changes before restart
```

Figure 1.11: Starting Backend

Conclusion

In this chapter, we learned about MERN in detail. First, we learned about all four technologies: MongoDB, Express, ReactJS, and NodeJS. Beside this, we also learned about other popular stacks beyond MERN.

Next, we covered the REST API in detail. We learned about POST, GET, PUT, and DELETE in detail which are used to implement the CRUD operations. We also learned about two alternatives to REST API, namely, Firebase and GraphQL.

Next, we learned about the project we are going to create in this book. We ended this chapter with setting up the basic NodeJS app.

In the next chapter, we will learn about creating the Express server, then creating routes, controllers, and also error handling.

CHAPTER 2

Starting a NodeJS App

Introduction

This chapter talks about the Express server. Here, we will learn to use Express in our backend app. Next, we will be creating routes with Express. We are also going to add controllers to those routes. Lastly, we will learn to do error handling in our Express app.

Structure

In this chapter, we are going to discuss the following topics:

- Using Express
- Creating routes
- Creating Controllers
- Error Handling

Using Express

Back in the **server.js** file, we will first import **Express** which we installed in the previous chapter. After that, we will import the **dotenv** package. Then we created a variable port and gave it a value 8000.

Now, we will create an app variable and use Express in it. Next, we will use the listen function of NodeJS, which will be used next on the passed port.

Lastly, we have opened the integrated terminal and given the command **npm run dev** to run the **server.js** file. If everything is okay, we will get the message **Server listening on 8000**.

```
const express = require('express');
const dotenv = require('dotenv').config();
const port = 8000;
const app = express();
```

```
app.listen(port, () => console.log(`Server listening on ${port}`));
```

The screenshot shows the Visual Studio Code interface. In the top editor pane, there is a file named `server.js` with the following code:

```
const express = require('express');
const dotenv = require('dotenv').config();
const port = 8000;
const app = express();
app.listen(port, () => console.log(`Server listening on ${port}`));
```

In the bottom terminal pane, the command `npm run dev` is being run, and the output shows:

```
raben@laptop:~/Desktop/Task-MERN/backend$ npm run dev
> backend@1.0.0 dev
> nodemon server.js

[nodemon] 2.0.22
[nodemon] to restart at any time, enter `r`
[nodemon] watching path(s): *
[nodemon] watching extensions: js,mjs,json
[nodemon] starting `node server.js`
Server listening on 8000
```

Figure 2.1: Starting with express

Next, we will create a `.env` file. Now, this file is used to keep all the secrets that we don't want to put in GitHub or any public view.

Here, we have created two variables `NODE_ENV` and `PORT` and given them `development` and `8000` values, respectively.

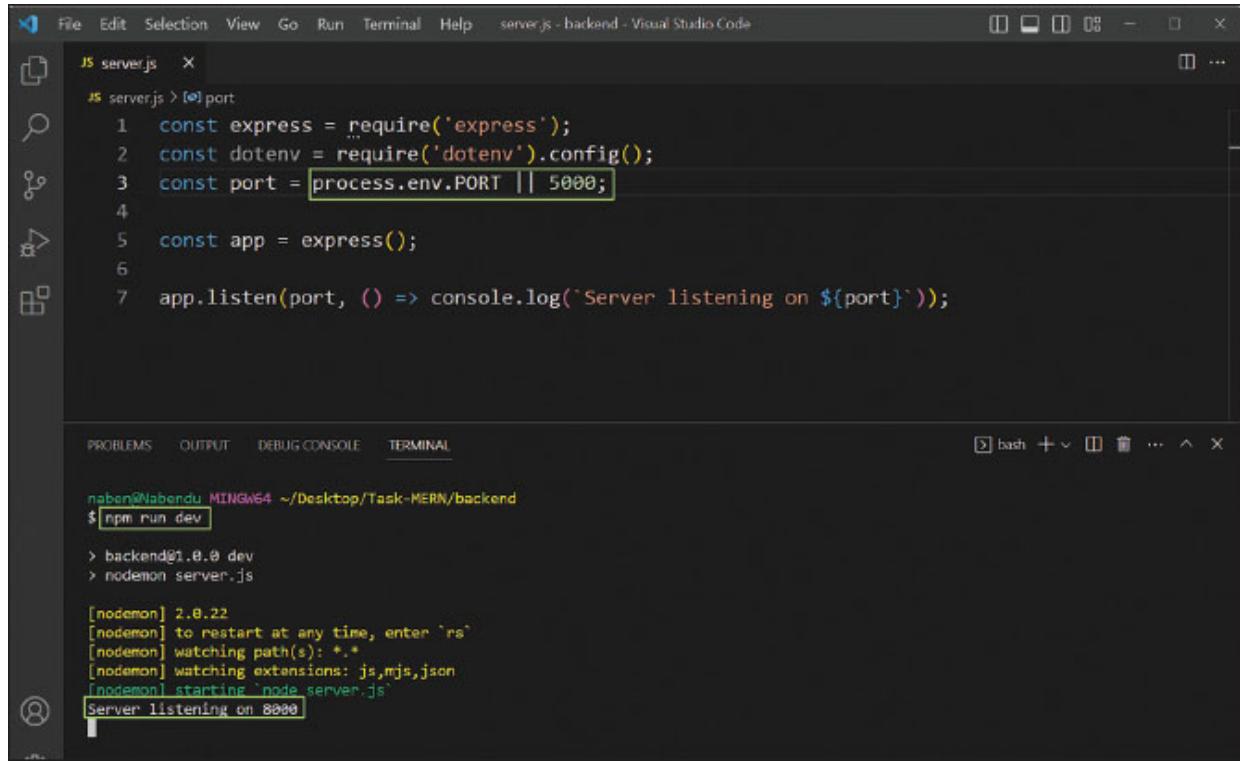
The screenshot shows the Visual Studio Code interface with the Explorer sidebar open. Inside the sidebar, under the `BACKEND` folder, there is a `.env` file highlighted with a yellow box. The main editor pane shows the contents of the `.env` file:

```
NODE_ENV = development
PORT = 8000
```

Figure 2.2: Adding environment file

Back in the `server.js` file, we have updated the port variable to use the value from the `.env` file first. Here, we have given `process.env.PORT` and also given `5000` with `||` operator.

And restarted the server by giving the **npm run dev** command. Notice that the port 8000 is taken from the **.env** file.



The screenshot shows a Visual Studio Code interface. The left sidebar has icons for file, search, and refresh. The main editor window contains the following code:

```
JS server.js  X
JS server.js > [e] port
1 const express = require('express');
2 const dotenv = require('dotenv').config();
3 const port = process.env.PORT || 5000;
4
5 const app = express();
6
7 app.listen(port, () => console.log(`Server listening on ${port}`));
```

The terminal below shows the command \$ npm run dev being run, followed by the output of the nodemon process starting and listening on port 8000.

```
naben@Nabendu MINGW64 ~/Desktop/Task-MERN/backend
$ npm run dev
> backend@1.0.0 dev
> nodemon server.js

[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 server.js`
Server listening on 8000
```

Figure 2.3: Using environment variable

Creating Routes

Now, we will create our routes. Routes are endpoints that are used by the frontend to perform the CRUD operations. This is achieved through the REST APIs of GET, POST, PUT, and DELETE.

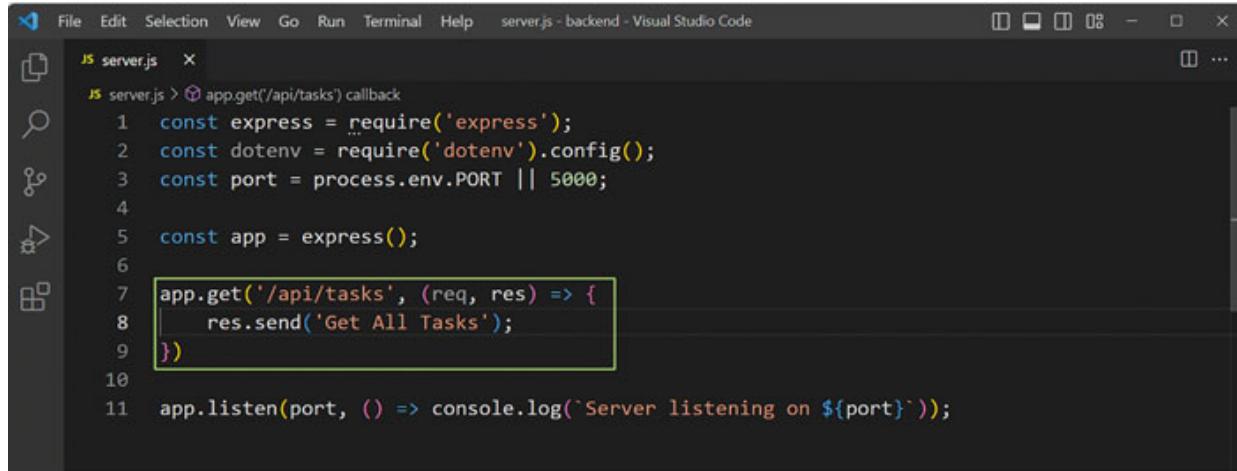
Initial Routes

Back in our **server.js** file we will first add the following code to create a simple GET route:

```
app.get('/api/tasks', (req, res) => {
  res.send('Get All Tasks');
})
```

Here, we are using the get method from Express. The first parameter is the route path and it can be anything. We have given it /api/tasks.

The second parameter is a function call with req and res. In this arrow function, we are using `res.send()` to send back **Get All Tasks** text. Later on, we are going to modify this route to get all tasks.



```
File Edit Selection View Go Run Terminal Help server.js - backend - Visual Studio Code
JS server.js x
server.js > app.get('/api/tasks') callback
1 const express = require('express');
2 const dotenv = require('dotenv').config();
3 const port = process.env.PORT || 5000;
4
5 const app = express();
6
7 app.get('/api/tasks', (req, res) => {
8   res.send('Get All Tasks');
9 })
10
11 app.listen(port, () => console.log(`Server listening on ${port}`));
```

Figure 2.4: Creating GET route

Now, head over to a browser and go to `http://localhost:8000/api/tasks` and the **Get All Tasks** will be displayed.

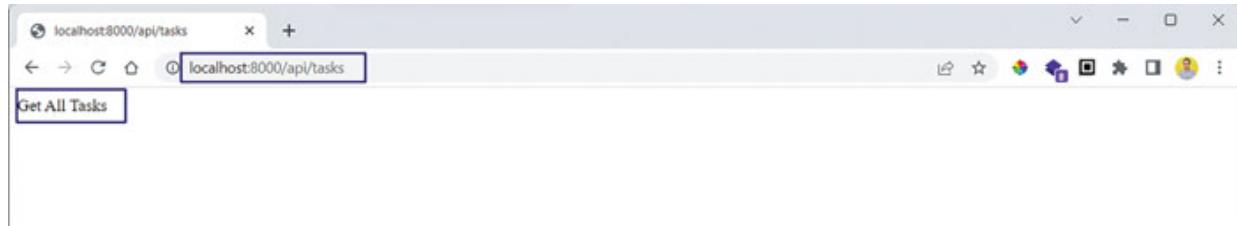
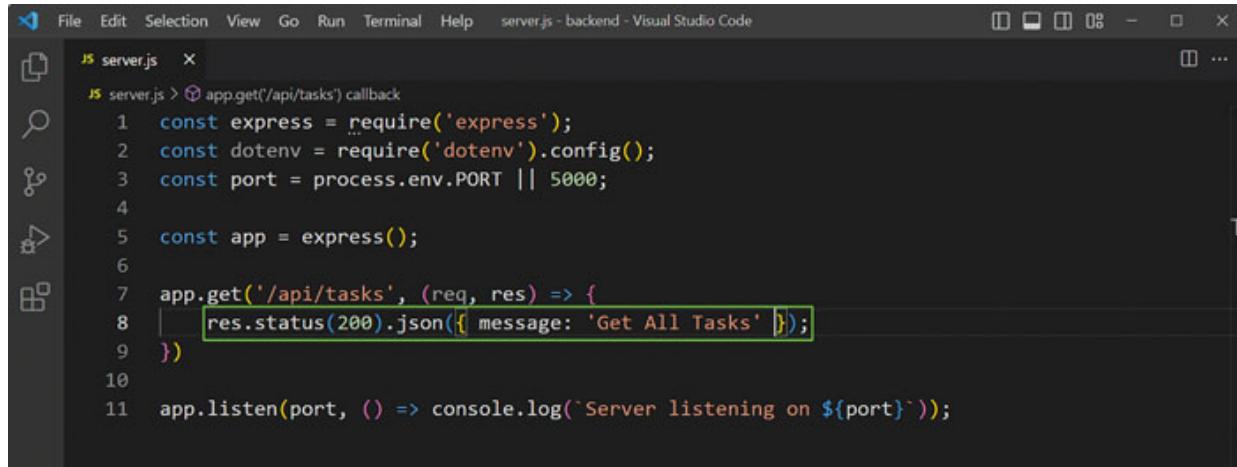


Figure 2.5: Getting back data

Now, in all cases we receive data from the server in JSON format. So, we will update the code in `server.js` file to send back a json.

Also, note that we are sending back a status code of 200.



```
File Edit Selection View Go Run Terminal Help server.js - backend - Visual Studio Code

JS server.js X
JS server.js > app.get('/api/tasks') callback
1 const express = require('express');
2 const dotenv = require('dotenv').config();
3 const port = process.env.PORT || 5000;
4
5 const app = express();
6
7 app.get('/api/tasks', (req, res) => {
8   res.status(200).json({ message: 'Get All Tasks' });
9 })
10
11 app.listen(port, () => console.log(`Server listening on ${port}`));
```

Figure 2.6: Returning JSON data

Now, again in the browser go to `http://localhost:8000/api/tasks` and we will get the JSON back.



A screenshot of a web browser window titled "localhost:8000/api/tasks". The address bar also shows "localhost:8000/api/tasks". The page content area displays the following JSON object:

```
1 + { 2   "message": "Get All Tasks" 3 }
```

The browser interface includes standard navigation buttons (back, forward, search), a theme selector set to "GitHub", and buttons for "Raw" and "Parsed" views.

Figure 2.7: Getting JSON data

All Routes

Now, we will add more routes in our project. But first, we will separate the route logic to a different file.

So, create a **routes** folder and inside it, create a **taskRoutes.js** file. Put the following content in it:

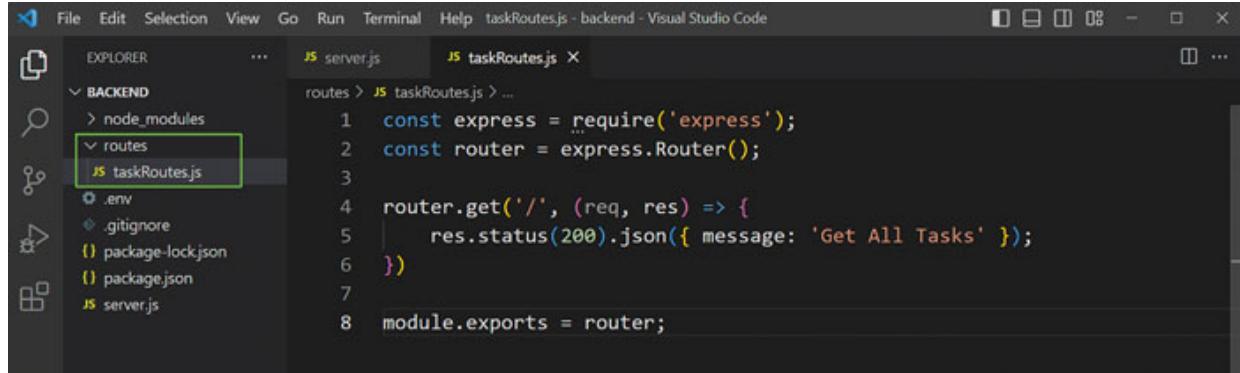
```
const express = require('express');
const router = express.Router();

router.get('/', (req, res) => {
  res.status(200).json({ message: 'Get All Tasks' });
})

module.exports = router;
```

Here, we have first imported the express package. And we have also imported the router from Express. Next, we have moved the get route created in the server.js file here.

But notice that we are using a router instead of an app. And we are exporting the router at the end.



The screenshot shows the Visual Studio Code interface with two tabs open: 'server.js' and 'taskRoutes.js'. The 'taskRoutes.js' tab is active, displaying the following code:

```
const express = require('express');
const router = express.Router();

router.get('/', (req, res) => {
  res.status(200).json({ message: 'Get All Tasks' });
})

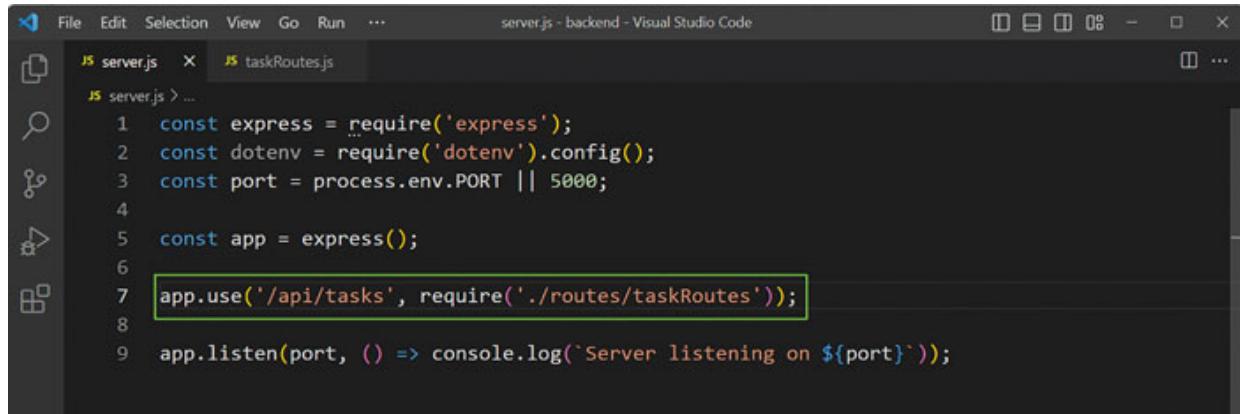
module.exports = router;
```

The 'EXPLORER' sidebar on the left shows a project structure with a 'BACKEND' folder containing 'node_modules', 'routes', and 'taskRoutes.js'. The 'taskRoutes.js' file is selected.

Figure 2.8: Separating Routes

Back in the server.js file, we have removed the get method. Also, we are using the app.use() to hit the /api/tasks route. Here, the second parameter is the taskRoutes file.

```
app.use('/api/tasks', require('./routes/taskRoutes'));
```



The screenshot shows the Visual Studio Code interface with two tabs open: 'server.js' and 'taskRoutes.js'. The 'server.js' tab is active, displaying the following code:

```
const express = require('express');
const dotenv = require('dotenv').config();
const port = process.env.PORT || 5000;

const app = express();

app.use('/api/tasks', require('./routes/taskRoutes'));

app.listen(port, () => console.log(`Server listening on ${port}`));
```

The line 'app.use('/api/tasks', require('./routes/taskRoutes'));' is highlighted with a green box.

Figure 2.9: Adding route path

Now again, in the browser, go to <http://localhost:8000/api/tasks>, and we will get the JSON back. This means our new changes are working fine.



The screenshot shows a browser window with the URL 'localhost:8000/api/tasks' in the address bar. The page content is a JSON object:

```
{ "message": "Get All Tasks" }
```

Figure 2.10: Getting all routes

Back in the **taskRoutes.js** file, we will add a POST, PUT, and DELETE route. Here, we are just using the respective methods.

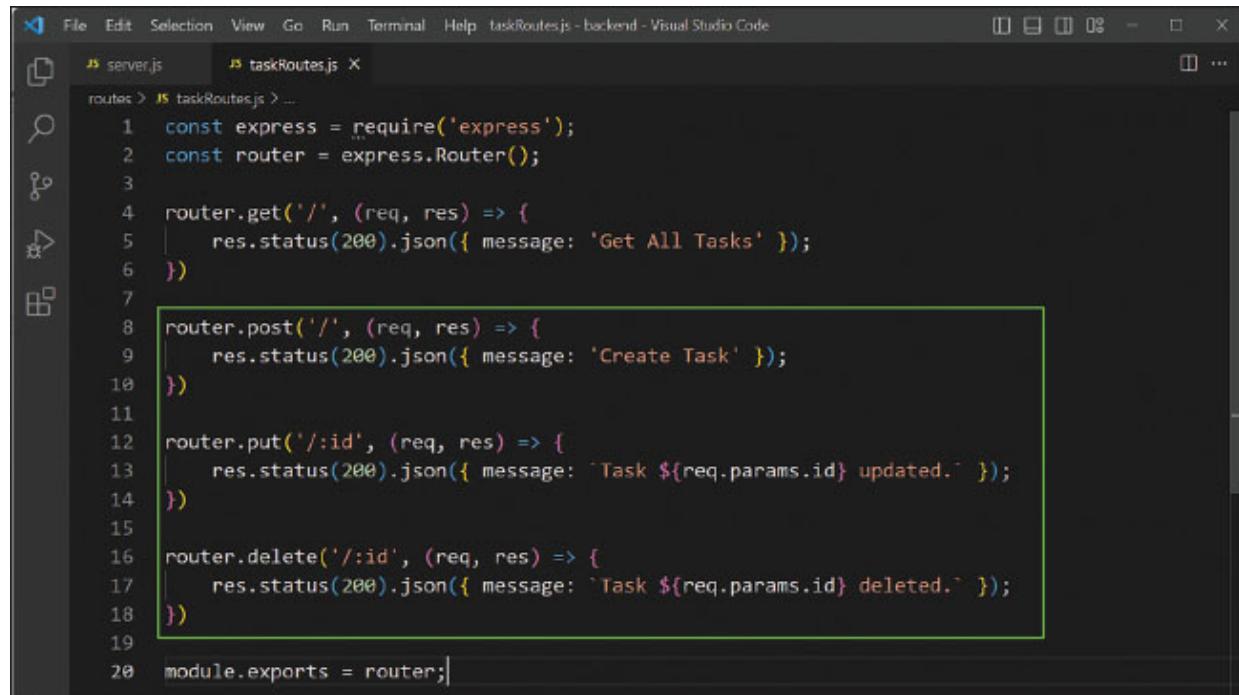
All these methods, for now, will return simple json. The real logic will be added later on. The **post()** is similar to **get()** as of now.

But the **put()** and **delete()** take a wild route of `/:id`. This special route can take any provided item. This id will be sent through the browser address bar. We can get access to it with the `req.params.id` variable.

```
router.post('/', (req, res) => {
  res.status(200).json({ message: 'Create Task' });
}

router.put('/:id', (req, res) => {
  res.status(200).json({ message: `Task ${req.params.id} updated.` });
}

router.delete('/:id', (req, res) => {
  res.status(200).json({ message: `Task ${req.params.id} deleted.` });
})
```



The screenshot shows the Visual Studio Code interface with the `taskRoutes.js` file open. The code editor displays the following content:

```
const express = require('express');
const router = express.Router();

router.get('/', (req, res) => {
  res.status(200).json({ message: 'Get All Tasks' });
}

router.post('/', (req, res) => {
  res.status(200).json({ message: 'Create Task' });
}

router.put('/:id', (req, res) => {
  res.status(200).json({ message: `Task ${req.params.id} updated.` });
}

router.delete('/:id', (req, res) => {
  res.status(200).json({ message: `Task ${req.params.id} deleted.` });
})

module.exports = router;
```

The code is organized into several sections: imports, a Router instance, and four route handlers (GET, POST, PUT, DELETE) each returning a JSON response with a message. The PUT and DELETE routes include a placeholder `:id` in the path. The entire block of code from the second `router.post` to the final `module.exports` is highlighted with a green rectangular selection.

Figure 2.11: Adding more routes

Testing through Postman

The GET route can be seen in the browser, but to check the other routes, we need the frontend. Now, since the front end has not even started, we will use the POSTMAN tool.

This tool is always used by backend engineers because they don't wait for the frontend to be completed. This tool mimics the way the request will be sent from a frontend app through the browser.

The free tool Postman can be installed from <https://www.postman.com/>. After this, once it is opened, we will make the method as **POST** and in the address bar, give `http://localhost:8000/api/tasks`.

After that, hit the **Send** button. We will receive back the correct json and also the Status of 200.

The screenshot shows the Postman application interface. On the left, there's a sidebar with 'My Workspace' containing collections like 'JobTracker', 'MERN-Task', and others. The main area shows a 'Post Task' request with the method set to 'POST' and the URL 'http://localhost:8000/api/tasks'. The 'Body' tab is selected, showing a JSON object with a single key-value pair: 'message': 'Create Task'. Below the request, the response section shows a status of '200 OK' with a timer of 18 ms and a size of 260 B. The response body is identical to the request body: 'message': 'Create Task'.

Figure 2.12: POST request

Now, for the PUT method, we also have to provide any id. So, we are visiting the endpoint `http://localhost:8000/api/tasks/23`.

Here, we are also getting back this id in the json, along with the status of 200.

The screenshot shows the Postman interface with a 'PUT' request to the endpoint `http://localhost:8000/api/tasks/23`. The 'Params' tab is selected. In the 'Body' section, the response is displayed as a JSON object:

```

1: {
2:   "message": "Task 23 updated."
3: }

```

Figure 2.13: PUT request

For the **DELETE** method also, we have to provide any id. Again, we are visiting the endpoint `http://localhost:8000/api/tasks/23`.

Here, we are also getting back this id in the json, along with status of 200.

The screenshot shows the Postman interface with a 'DELETE' request to the endpoint `http://localhost:8000/api/tasks/23`. The 'Params' tab is selected. In the 'Body' section, the response is displayed as a JSON object:

```

1: {
2:   "message": "Task 23 deleted."
3: }

```

Figure 2.14: DELETE request

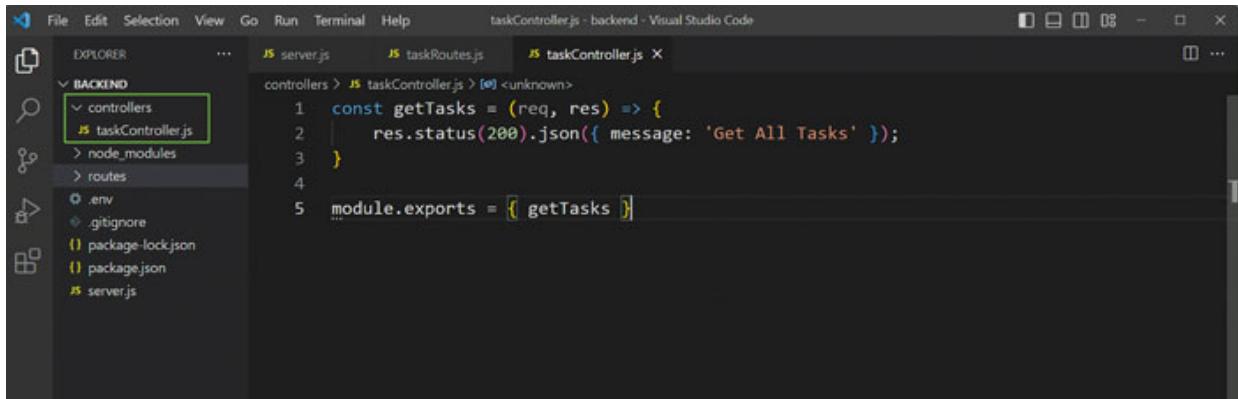
Creating Controllers

Now, we will separate the controller part. For this create a **controllers** folder. Inside it create a **taskController.js** file and add the following content:

```
const getTasks = (req, res) => {
  res.status(200).json({ message: 'Get All Tasks' });
}

module.exports = { getTasks }
```

Here, the **getTasks** function will contain the main functionality. Right now, it is sending the response json back.

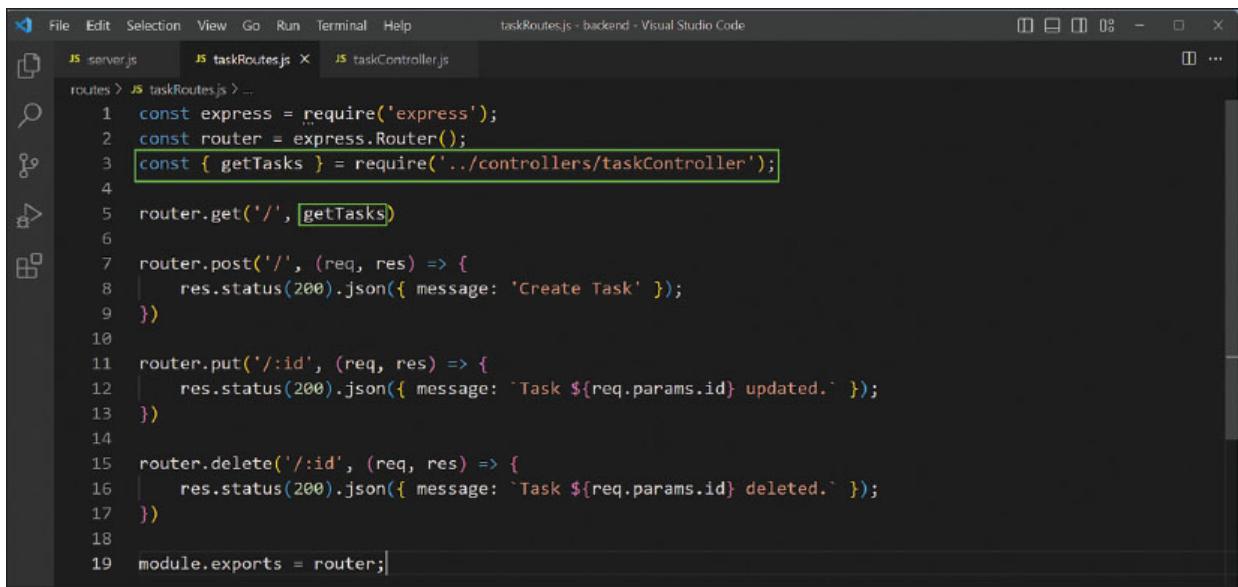


The screenshot shows the Visual Studio Code interface with the following details:

- File Explorer:** Shows the project structure. A green box highlights the **controllers** folder under the **BACKEND** section. Inside the **controllers** folder is a file named **taskController.js**.
- Code Editor:** The **taskController.js** file is open, displaying the code shown in the previous text block.
- Terminal:** Not visible in the screenshot.

Figure 2.15: Creating controllers

Back, in **taskRoutes.js** file we will remove the code for the controller. And add the function of **getTasks** in it. We have also imported the **getTasks** file.



The screenshot shows the Visual Studio Code interface with the following details:

- File Explorer:** Shows the project structure. A green box highlights the **routes** folder under the **BACKEND** section. Inside the **routes** folder is a file named **taskRoutes.js**.
- Code Editor:** The **taskRoutes.js** file is open, showing the following code:

```
const express = require('express');
const router = express.Router();
const { getTasks } = require('../controllers/taskController');

router.get('/', [getTasks])

router.post('/', (req, res) => {
  res.status(200).json({ message: 'Create Task' });
})

router.put('/:id', (req, res) => {
  res.status(200).json({ message: `Task ${req.params.id} updated.` });
})

router.delete('/:id', (req, res) => {
  res.status(200).json({ message: `Task ${req.params.id} deleted.` });
})

module.exports = router;
```

A green box highlights the line `const { getTasks } = require('../controllers/taskController');`, indicating where the controller function was imported.
- Terminal:** Not visible in the screenshot.

Figure 2.16: Adding Controller in Routes

Now, again in the browser, go to <http://localhost:8000/api/tasks> and we will get the JSON back. This means our new changes are working fine.

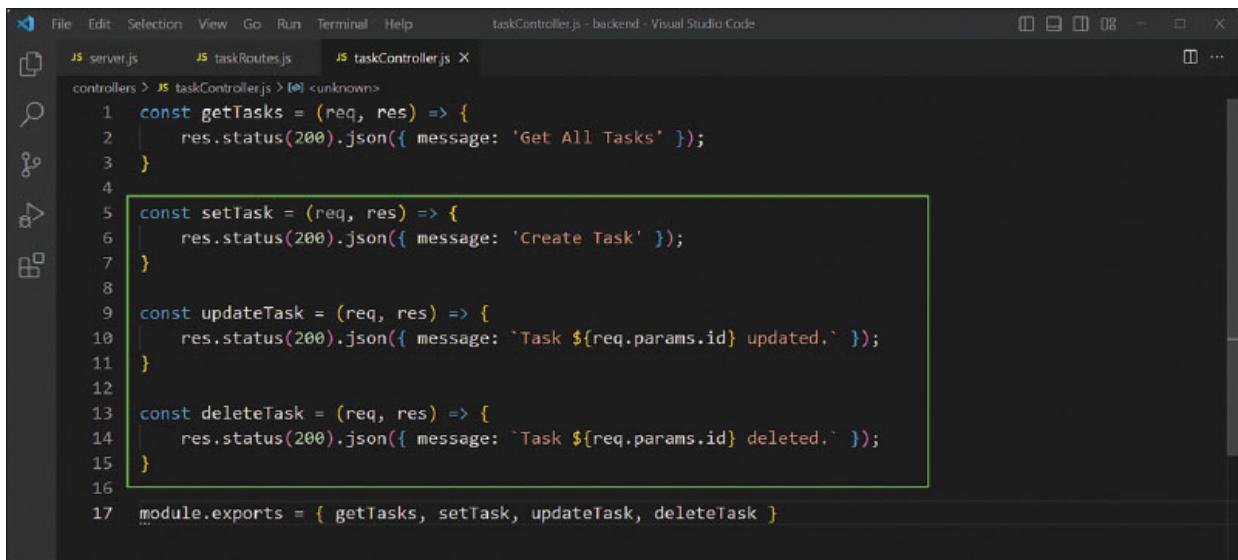
A screenshot of a web browser window titled "localhost:8000/api/tasks". The address bar shows the same URL. The main content area displays a JSON object: { "message": "Get All Tasks" }. There are buttons for "Theme: GitHub", "Raw", and "Parsed".

```
1 {  
2     "message": "Get All Tasks"  
3 }
```

Figure 2.17: Getting JSON back

Now, in the `taskController.js` file, we will add the rest of the controllers for `setTask`, `updateTask` and `deleteTask`. We have also added the exports for the same.

```
const setTask = (req, res) => {  
    res.status(200).json({ message: 'Create Task' });  
}  
  
const updateTask = (req, res) => {  
    res.status(200).json({ message: `Task ${req.params.id}`  
        updated. `});  
}  
  
const deleteTask = (req, res) => {  
    res.status(200).json({ message: `Task ${req.params.id}`  
        deleted. `});  
}
```

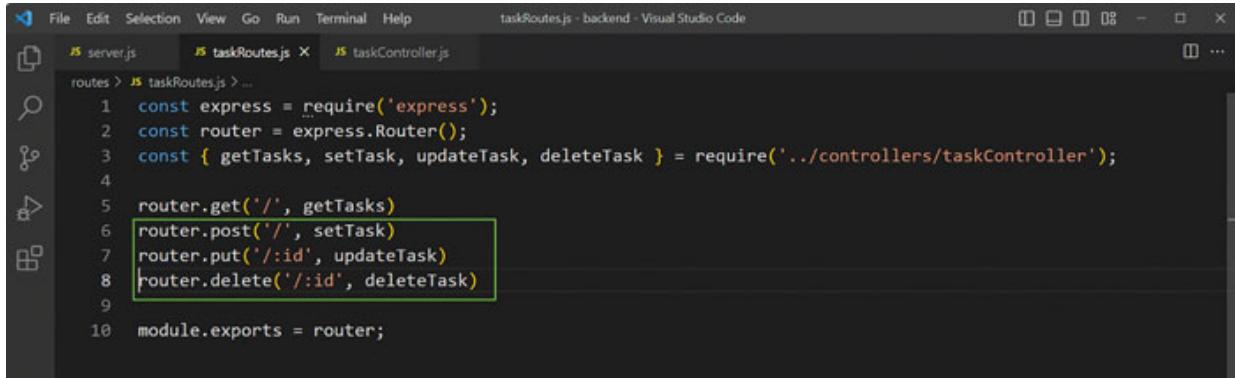
A screenshot of the Visual Studio Code interface. The title bar says "taskController.js - backend - Visual Studio Code". The editor shows three files: server.js, taskRoutes.js, and taskController.js. The taskController.js tab is active. The code is identical to the one above, with the addition of three new functions: setTask, updateTask, and deleteTask, which are highlighted with a green rectangular selection. The last line of the code, "module.exports = { getTasks, setTask, updateTask, deleteTask };" is also highlighted.

```
1 const getTasks = (req, res) => {  
2     res.status(200).json({ message: 'Get All Tasks' });  
3 }  
4  
5 const setTask = (req, res) => {  
6     res.status(200).json({ message: 'Create Task' });  
7 }  
8  
9 const updateTask = (req, res) => {  
10    res.status(200).json({ message: `Task ${req.params.id}` updated. `});  
11 }  
12  
13 const deleteTask = (req, res) => {  
14    res.status(200).json({ message: `Task ${req.params.id}` deleted. `});  
15 }  
16  
17 module.exports = { getTasks, setTask, updateTask, deleteTask }
```

Figure 2.18: Adding more controllers

Back in the **taskRoutes.js** file, we will add these function calls. Now, our taskRoutes file has become small and manageable.

```
router.post('/', setTask)
router.put('/:id', updateTask)
router.delete('/:id', deleteTask)
```



A screenshot of Visual Studio Code showing the `taskRoutes.js` file. The code defines a Router and adds three methods: `get()`, `post()`, `put()`, and `delete()`. The `post()`, `put()`, and `delete()` lines are highlighted with a yellow box.

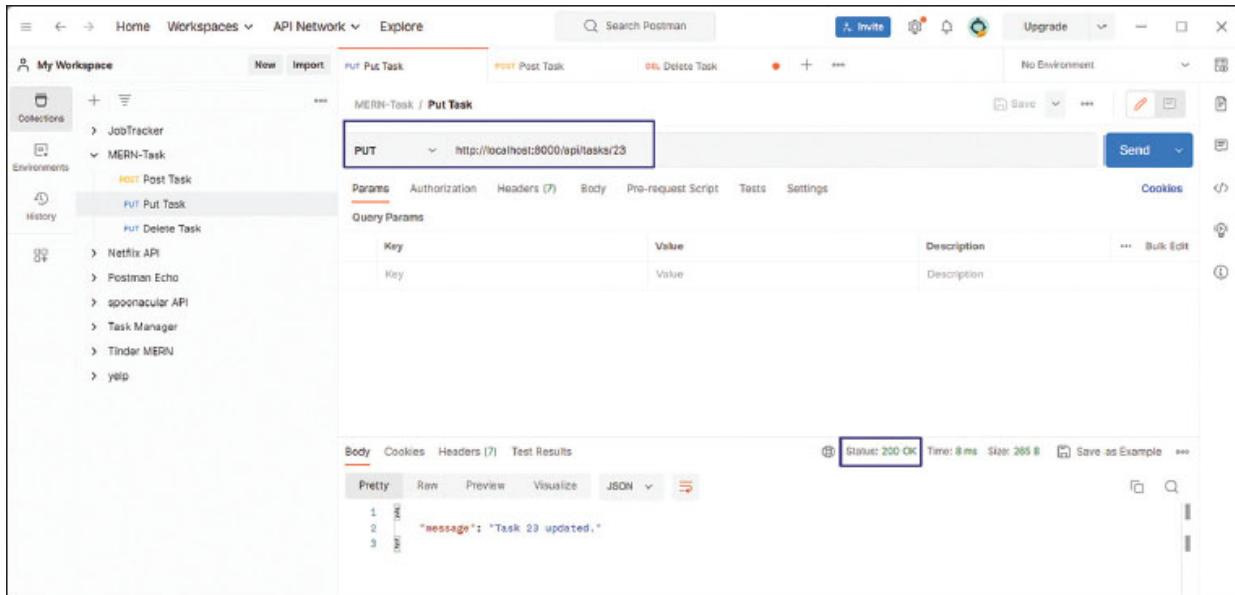
```
const express = require('express');
const router = express.Router();
const { getTasks, setTask, updateTask, deleteTask } = require('../controllers/taskController');

router.get('/', getTasks)
router.post('/', setTask)
router.put('/:id', updateTask)
router.delete('/:id', deleteTask)

module.exports = router;
```

Figure 2.19: Updating task routes

We are also checking the **PUT** route through Postman, to check if everything is working fine.



A screenshot of the Postman application. It shows a collection named "MERN-Task" with a "PUT Put Task" request. The request is configured to "PUT" to the URL `http://localhost:8000/api/tasks/23`. The response status is 200 OK, and the body contains the message "Task 23 updated."

PUT http://localhost:8000/api/tasks/23

| Key | Value | Description |
|-----|-------|-------------|
| Key | Value | Description |

Status: 200 Ok Time: 8 ms Size: 265 B Save as Example

```
1: {
  2:   "message": "Task 23 updated."
}
```

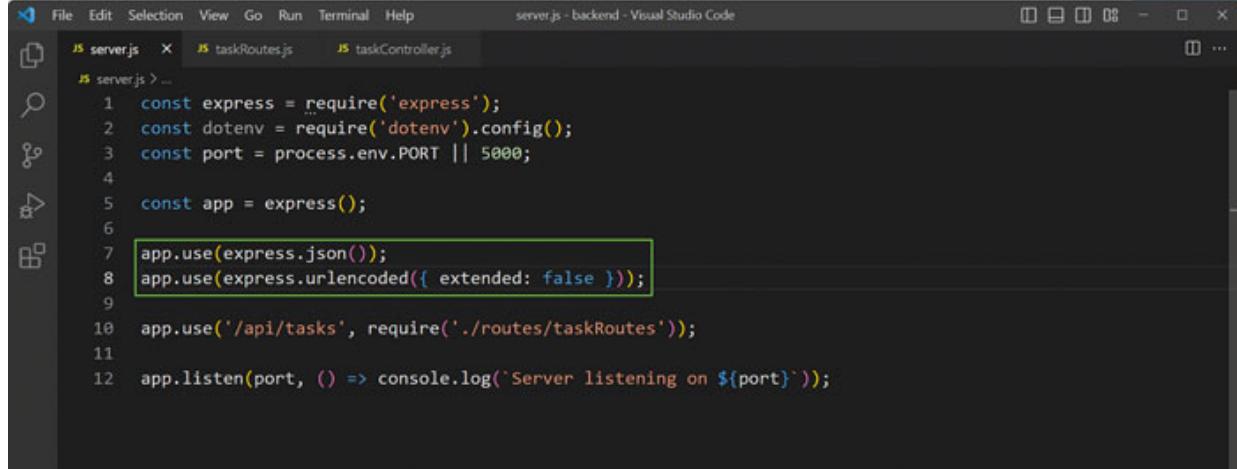
Figure 2.20: PUT route

Using JSON

We will add the logic to use JSON in our project. Here in the **server.js** file, we will add the following code:

```
app.use(express.json());
app.use(express.urlencoded({ extended: false }));
```

Here, through **app.use()** we have added the functions to use json and urlencoded bodies.



The screenshot shows the Visual Studio Code interface with the **server.js** file open. The code is as follows:

```
const express = require('express');
const dotenv = require('dotenv').config();
const port = process.env.PORT || 5000;

const app = express();

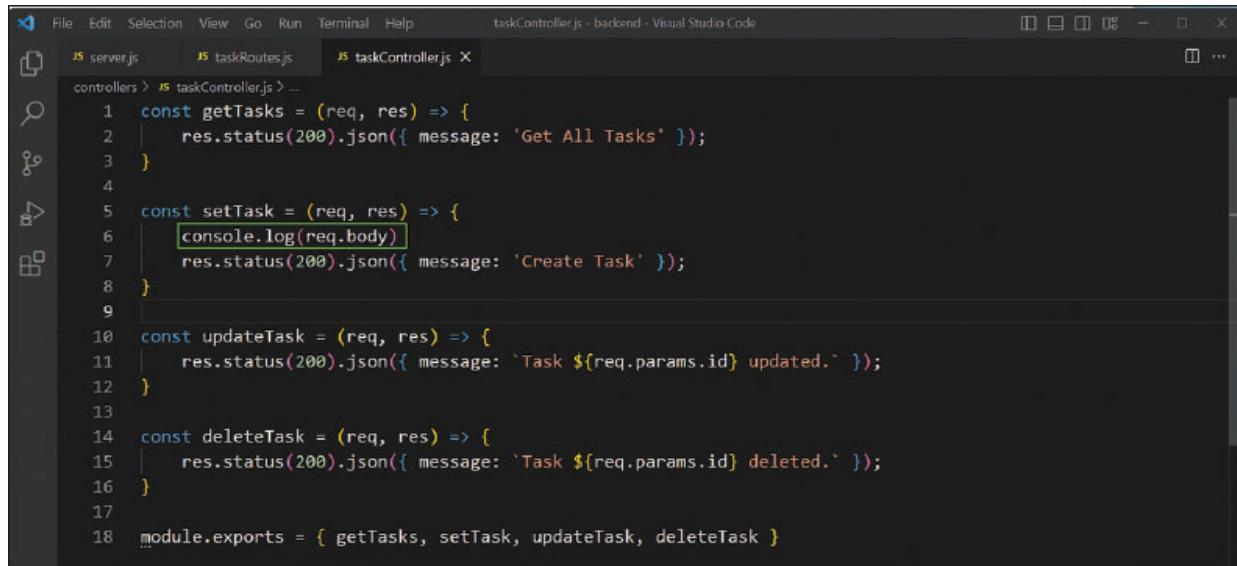
app.use(express.json());
app.use(express.urlencoded({ extended: false }));

app.use('/api/tasks', require('./routes/taskRoutes'));

app.listen(port, () => console.log(`Server listening on ${port}`));
```

Figure 2.21: Using JSON

Back in the **taskController.js** file, in the **setTask** function, we are console logging the **req.body**.



The screenshot shows the Visual Studio Code interface with the **taskController.js** file open. The code is as follows:

```
const getTasks = (req, res) => {
  res.status(200).json({ message: 'Get All Tasks' });
}

const setTask = (req, res) => {
  console.log(req.body);
  res.status(200).json({ message: 'Create Task' });
}

const updateTask = (req, res) => {
  res.status(200).json({ message: `Task ${req.params.id} updated.` });
}

const deleteTask = (req, res) => {
  res.status(200).json({ message: `Task ${req.params.id} deleted.` });
}

module.exports = { getTasks, setTask, updateTask, deleteTask }
```

Figure 2.22: Console log in controller

Now, in Postman we will update our POST request. Here, first go to Body and then select **x-www-form-urlencoded**. After that, make a key as **text**. Also, give any value and we are giving Learn Flutter.

Also, make sure the checkbox is selected and then click the **Send** button.

The screenshot shows the Postman interface with a POST request to `http://localhost:3005/api/tasks`. The 'Body' tab is selected, showing the `x-www-form-urlencoded` option. A key `text` is defined with the value `Learn Flutter`. The response tab shows a status of 200 OK with the message `Create Task`.

Figure 2.23: JSON message in POST

Now, in the terminal where the server is running, we will get `{ "text": "Learn Flutter" }` as shown in [Figure 2.24](#):

```
C:\WINDOWS\system32\cmd. x + - x

Server listening on 8000
[nodemon] restarting due to changes...
[nodemon] starting 'node server.js'
Server listening on 8000
[nodemon] restarting due to changes...
[nodemon] starting 'node server.js'
Server listening on 8000
[nodemon] restarting due to changes...
[nodemon] starting 'node server.js'
Server listening on 8000
[nodemon] restarting due to changes...
[nodemon] starting 'node server.js'
Server listening on 8000
[nodemon] restarting due to changes...
[nodemon] starting 'node server.js'
Server listening on 8000
[nodemon] restarting due to changes...
[nodemon] starting 'node server.js'
Server listening on 8000
[nodemon] restarting due to changes...
[nodemon] starting 'node server.js'
Server listening on 8000
[nodemon] restarting due to changes...
[nodemon] starting 'node server.js'
Server listening on 8000
[nodemon] restarting due to changes...
[nodemon] starting 'node server.js'
Server listening on 8000
[Object: null prototype] { text: 'Learn Flutter' }
```

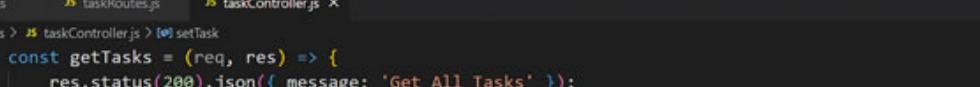
Figure 2.24: JSON message console log

Error Handler

Lastly, in this chapter we will add error handling in our project. So, in the `setTask.js` in **taskController.js** file we will add the following code:

```
if(!req.body.text) {
  res.status(400).json({ message: 'Please enter a task' })
}
```

Here we are checking if `req.body.text` doesn't exist, then we are sending back the error message:



The screenshot shows the Visual Studio Code interface with the title bar "taskController.js - backend - Visual Studio Code". The left sidebar shows files: "server.js", "taskRoutes.js", and "taskController.js" (the active tab). The main editor area contains the following code:

```
const getTasks = (req, res) => {
  res.status(200).json({ message: 'Get All Tasks' });
}

const setTask = (req, res) => {
  if(!req.body.text){
    res.status(400).json({ message: 'Please enter a task' })
  }
  res.status(200).json({ message: 'Create Task' });
}
```

Figure 2.25: Error handling in controller

Now, back in Postman, remove the checkbox beside the text. Then click the **Send** button. We will get the **400 Bad Request** and the following JSON.

```
{ "message": "Please enter a task" }
```

The screenshot shows the Postman interface. A POST request is being made to `http://localhost:8000/api/tasks`. The body contains a single key-value pair: `text: Learn Flutter`. The response status is **400 Bad Request**, and the response body is `{"message": "Please enter a task"}`.

Figure 2.26: Error in Postman

Now, we have updated the code in **taskController.js** file. Here, we will be using the in-built error handler in NodeJS. In the following code, we are throwing the error from the if statement:

```
res.status(400)
throw new Error('Please enter a task')
```

The screenshot shows the `taskController.js` file in Visual Studio Code. The code defines a `setTask` function that checks if `req.body.text` is present. If it's not, it throws an `Error` with the message `'Please enter a task'`.

```
const setTask = (req, res) => {
  if(!req.body.text){
    res.status(400)
    throw new Error('Please enter a task')
  }
  res.status(200).json({ message: 'Create Task' });
}
```

Figure 2.27: Throwing error from controller

But in Postman, we are not getting the correct error result after hitting the **Send** button.

We are getting a big HTML back. Next, we will update the code to fix this issue.

The screenshot shows the Postman application interface. At the top, there are tabs for 'PUT Put Task', 'POST Post Task' (which is selected), and 'Delete Task'. Below the tabs, there's a 'Collections' section with 'MERN-Task / Post Task'. The main area shows a 'POST' request to 'http://localhost:8000/api/tasks'. Under the 'Body' tab, the 'raw' option is selected, and the value is 'Learn Flutter'. The 'Headers' tab shows 'Content-Type: application/json'. The 'Test Results' tab is active, displaying an error message in HTML format:

```

4 <html>
5   <meta charset="utf-8">
6   <title>Error</title>
7 </head>
8
9 <body>
10   <pre>Error: Please enter a task</pre>
11   <script>window.scrollTo(0, document.body.scrollHeight);</script>
12 </body>
13 </html>

```

The error message is: 'Error: Please enter a task'. The status bar at the bottom indicates 'Status: 400 Bad Request'.

Figure 2.28: Wrong data in Postman

To fix the same we need to have middleware in our NodeJS code. So, create a **middleware** folder and inside it a file **errorMiddleware.js** file, add the following code:

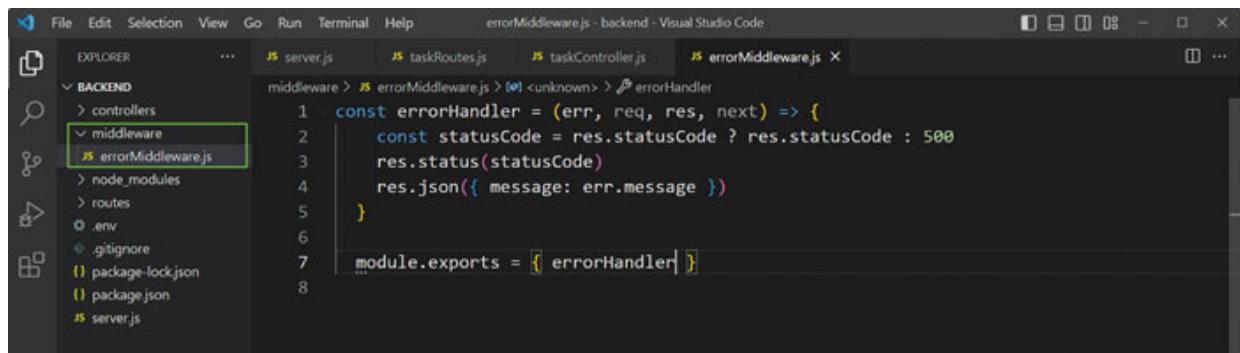
```

const errorHandler = (err, req, res, next) => {
  const statusCode = res.statusCode ? res.statusCode : 500
  res.status(statusCode)
  res.json({ message: err.message })
}

module.exports = { errorHandler }

```

Here, we have an **errorHandler** function, which we are exporting also. Inside the function, we will take the passed status code or by default 500. We are also setting the error to the json object.

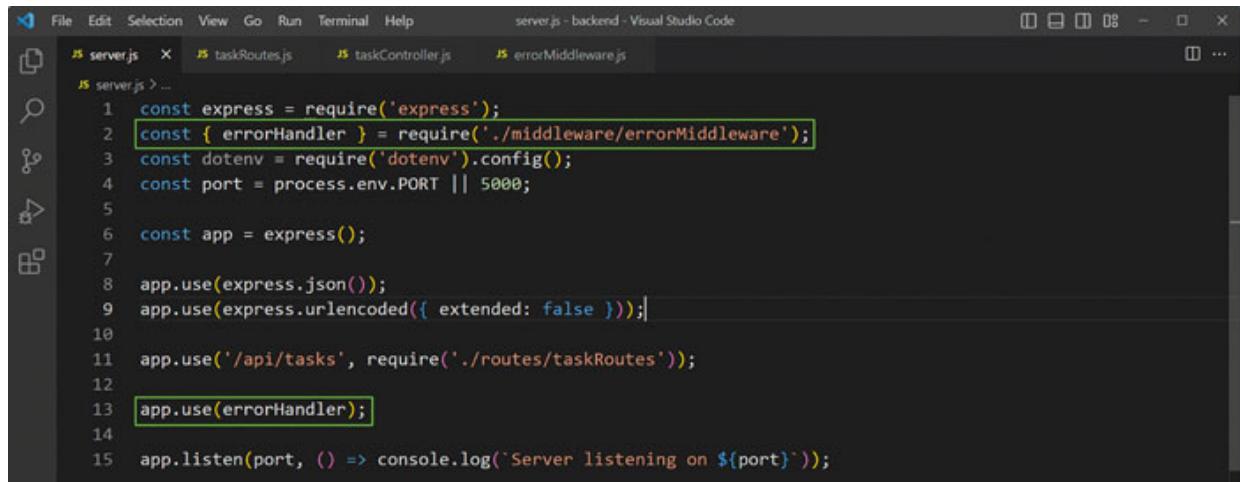


```
const errorHandler = (err, req, res, next) => {
  const statusCode = res.statusCode ? res.statusCode : 500
  res.status(statusCode)
  res.json({ message: err.message })
}

module.exports = { errorHandler }
```

Figure 2.29: Error Middleware

Back in the `server.js` file, we are first importing the error middleware. After that, we are using it with `app.use()`:



```
const express = require('express');
const { errorHandler } = require('../middleware/errorMiddleware');
const dotenv = require('dotenv').config();
const port = process.env.PORT || 5000;

const app = express();

app.use(express.json());
app.use(express.urlencoded({ extended: false }));

app.use('/api/tasks', require('./routes/taskRoutes'));

app.use(errorHandler);

app.listen(port, () => console.log(`Server listening on ${port}`));
```

Figure 2.30: Using error handler

Back to Postman, we will again send the `Post` request. This time we will get the correct error response back.

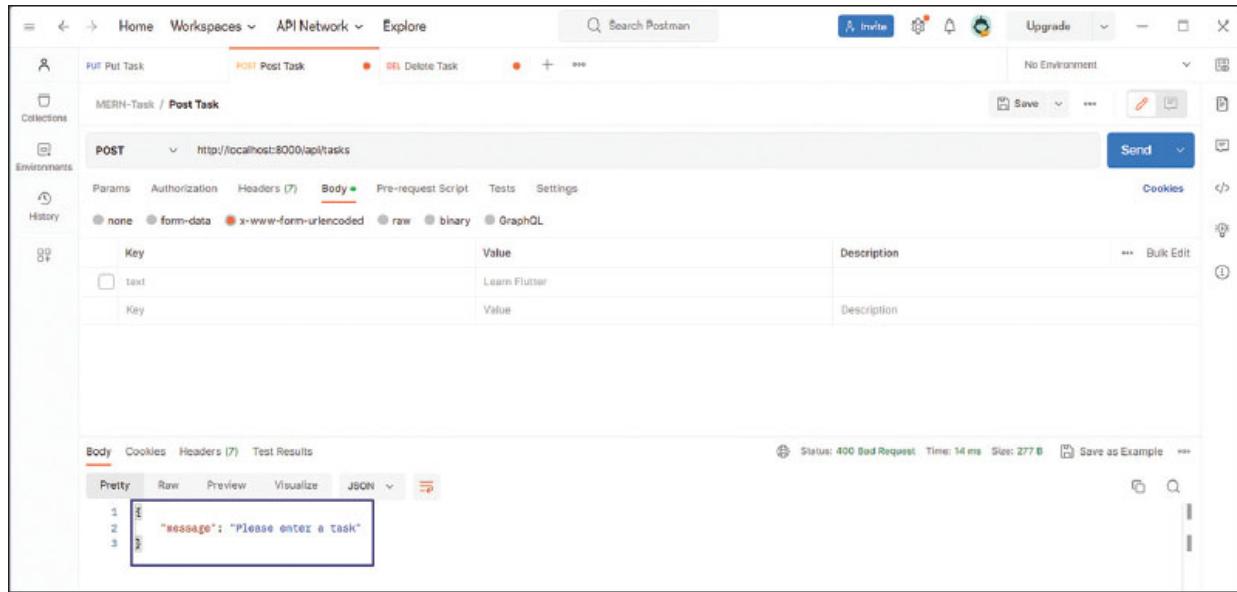


Figure 2.31: Perfect Error message

Conclusion

In this chapter, we have learned about using Express in our app. After that, we created routes in our project, which included the GET, POST, PUT, and DELETE routes. Next, we learned to test routes through Postman.

Next, we separated the controller part and created a controller for getting the tasks, creating the tasks, updating the tasks, and deleting the tasks. Then, we learned to use JSON in our project. Finally, we learned to use the in-built NodeJS error handler in our project.

In the next chapter, we will learn about the MongoDB database, and how to connect our server to MongoDB using Mongoose. We will also learn about Model creation and more routes.

CHAPTER 3

MongoDB Connection and Models

Introduction

This chapter talks about the MongoDB database. Here, we will first learn to use the MongoDB database in our backend app. Next, we will be connecting MongoDB to the backend NodeJS code through the package of mongoose. Lastly, we will learn to create routes in our Express app.

Structure

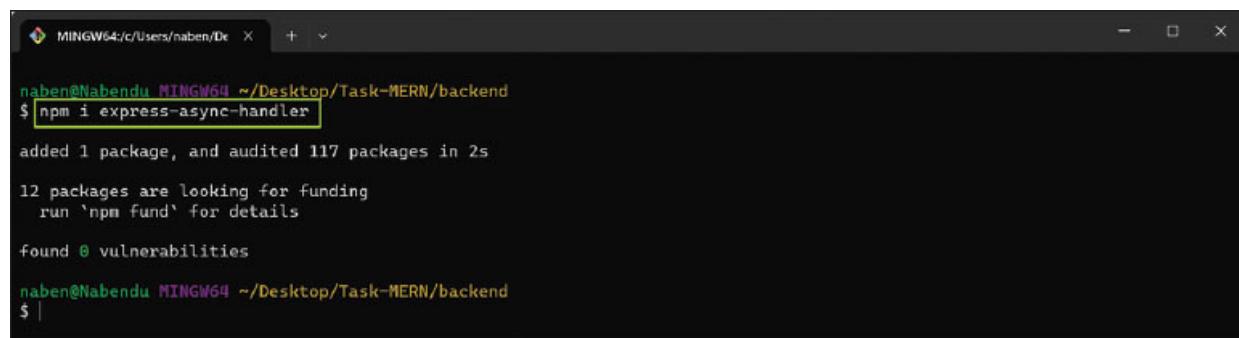
In this chapter, we are going to discuss the following topics:

- MongoDB database
- Connecting through Mongoose
- Model creation
- Creating routes

MongoDB Database

Before creating the MongoDB database, we have a small task remaining. We will add the package of express-async-handler. Now this package helps us to get rid of `try..catch` block, which is common express code.

```
npm i express-async-handler
```



The screenshot shows a terminal window titled 'MINGW64:/c/Users/naben/Desktop/Task-MERN/backend'. The user runs the command 'npm i express-async-handler'. The output indicates that 1 package was added and audited, with 117 packages in total. It also shows 12 packages looking for funding and 0 vulnerabilities found. The terminal prompt '\$ |' is visible at the bottom.

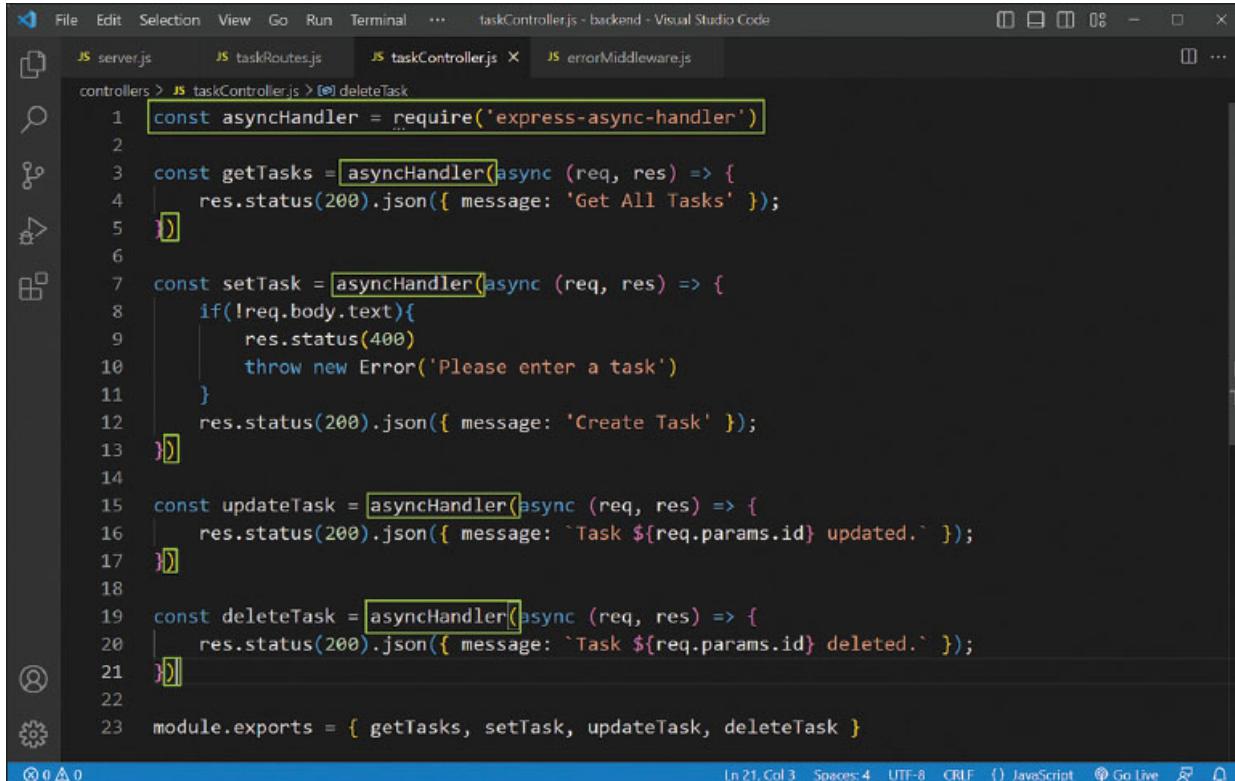
```
naben@Nabendu MINGW64 ~/Desktop/Task-MERN/backend
$ npm i express-async-handler
added 1 package, and audited 117 packages in 2s
12 packages are looking for funding
  run 'npm fund' for details
found 0 vulnerabilities

naben@Nabendu MINGW64 ~/Desktop/Task-MERN/backend
$ |
```

Figure 3.1: Installing express async handler

Now, we will first import the express-async-handler in our project. After that, we will wrap all functions in **taskController.js** file with `asyncHandler`.

```
const asyncHandler = require('express-async-handler')
```



```
JS server.js JS taskRoutes.js JS taskController.js X JS errorMiddleware.js
controllers > JS taskController.js > deleteTask
1 const asyncHandler = require('express-async-handler')
2
3 const getTasks = [asyncHandler(async (req, res) => {
4   res.status(200).json({ message: 'Get All Tasks' });
5 })
6
7 const setTask = [asyncHandler(async (req, res) => {
8   if(!req.body.text){
9     res.status(400)
10    throw new Error('Please enter a task')
11  }
12  res.status(200).json({ message: 'Create Task' });
13 })
14
15 const updateTask = [asyncHandler(async (req, res) => {
16   res.status(200).json({ message: `Task ${req.params.id} updated.` });
17 })
18
19 const deleteTask = [asyncHandler(async (req, res) => {
20   res.status(200).json({ message: `Task ${req.params.id} deleted.` });
21 })
22
23 module.exports = { getTasks, setTask, updateTask, deleteTask }
```

Figure 3.2: Adding express async handler

Now, we will use MongoDB on the cloud. So, go to <https://cloud.mongodb.com/>, and click Google and sign in or sign up with your Gmail account.

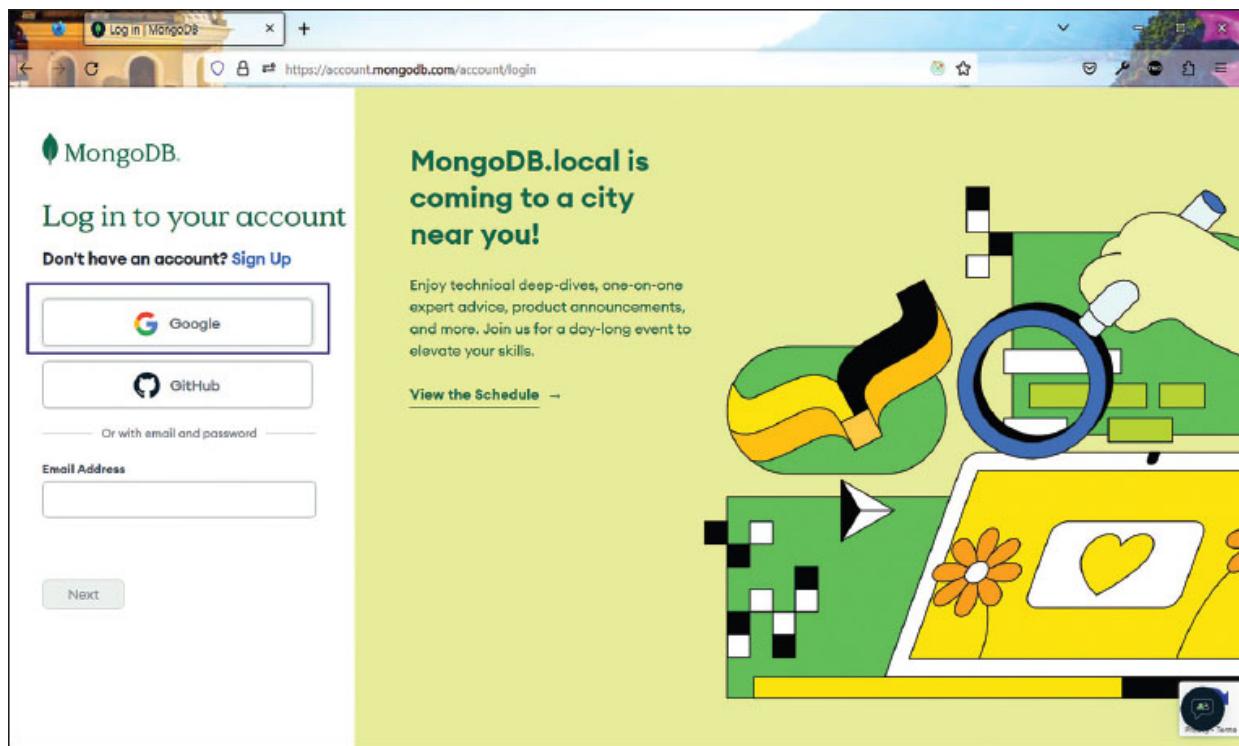


Figure 3.3: MongoDB Cloud

Basic Setup

If you have a lot of projects, then it will open a screen as follows. Here, click the **New Project** button. Even if you are logging into the MongoDB cloud for the first time, then also find the **New Project** button and click it.

The screenshot shows the MongoDB Cloud Atlas interface. The top navigation bar includes links for 'Atlas', 'Nabendu's...', 'Access Manager', 'Billing', 'All Clusters', 'Get Help', and 'Nabendu'. The main title is 'NABENDU'S ORG - 2020-12-15' under the 'Projects' section. A green 'New Project' button is located in the top right corner. On the left, there is a sidebar with links for 'Alerts', 'Activity Feed', 'Settings', 'Integrations', 'Access Manager', 'Billing', 'Support', and 'Live Migration'. The main content area displays a table of existing projects:

| Project Name | Database Deployments | Users | Teams | Alerts | Actions |
|------------------------|----------------------|---------|---------|----------|----------------|
| JobTrackerInitial | 1 Deployment | 2 Users | 0 Teams | 0 Alerts | [More, Delete] |
| MEAN | 1 Deployment | 1 User | 0 Teams | 0 Alerts | [More, Delete] |
| blog-nextjs | 1 Deployment | 1 User | 0 Teams | 0 Alerts | [More, Delete] |
| dating-app-mern | 1 Deployment | 1 User | 0 Teams | 0 Alerts | [More, Delete] |
| ecommerce-backend-db | 1 Deployment | 1 User | 0 Teams | 0 Alerts | [More, Delete] |
| employeeDB | 1 Deployment | 1 User | 0 Teams | 0 Alerts | [More, Delete] |
| facebook-mern-backend | 1 Deployment | 1 User | 0 Teams | 0 Alerts | [More, Delete] |
| graphql-react | 1 Deployment | 1 User | 0 Teams | 0 Alerts | [More, Delete] |
| instagram-mern-backend | 1 Deployment | 1 User | 0 Teams | 0 Alerts | [More, Delete] |
| mean-sequatche | 1 Deployment | 1 User | 0 Teams | 0 Alerts | [More, Delete] |
| mern-netflix-db | 1 Deployment | 1 User | 0 Teams | 0 Alerts | [More, Delete] |

Figure 3.4: New Project

On the next screen, we need to give the project a name, which is **MERN-Task-App** in our case. After that, click the **Next** button.

The screenshot shows the 'Create a Project' step in the MongoDB Cloud Atlas interface. The top navigation bar is identical to the previous screenshot. The main title is 'NABENDU'S ORG - 2020-12-15 > PROJECTS' under the 'Create a Project' section. On the left, there is a sidebar with links for 'Alerts', 'Activity Feed', 'Settings', 'Integrations', 'Access Manager', 'Billing', 'Support', and 'Live Migration'. The main content area displays the 'Name Your Project' step:

Name Your Project
Project names have to be unique within the organization (and other restrictions).

A text input field contains 'MERN-Task-App'. To the right of the input field are two buttons: 'Cancel' and 'Next'. The 'Next' button is highlighted with a green border.

At the bottom of the page, there is footer text: 'System Status: All Good Last Login: 17:49:53,240 ©2023 MongoDB, Inc. Status Terms Privacy Atlas Blog Contact Sales'.

Figure 3.5: Project Name

On the next screen, it will confirm your email id. Here, just click the **Create Project** button.

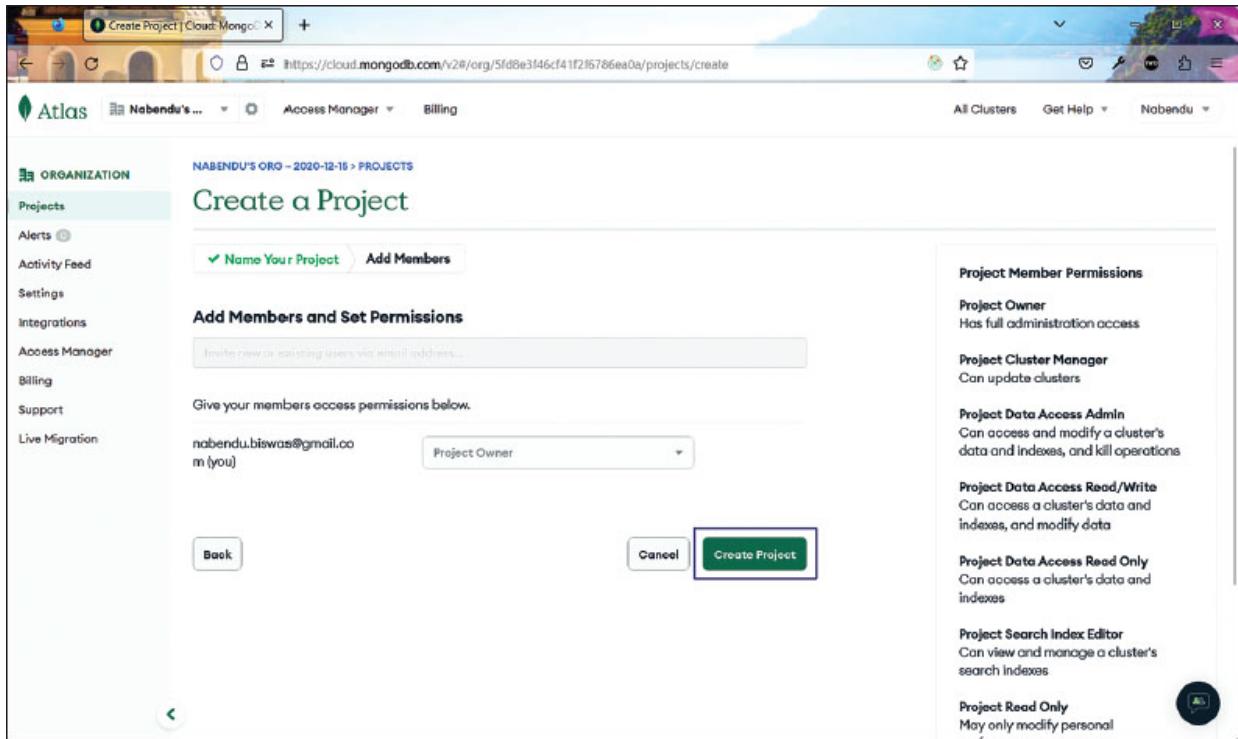


Figure 3.6: Project Permissions

The next screen will allow us to create a database. Here, click the **Build a Database** button.

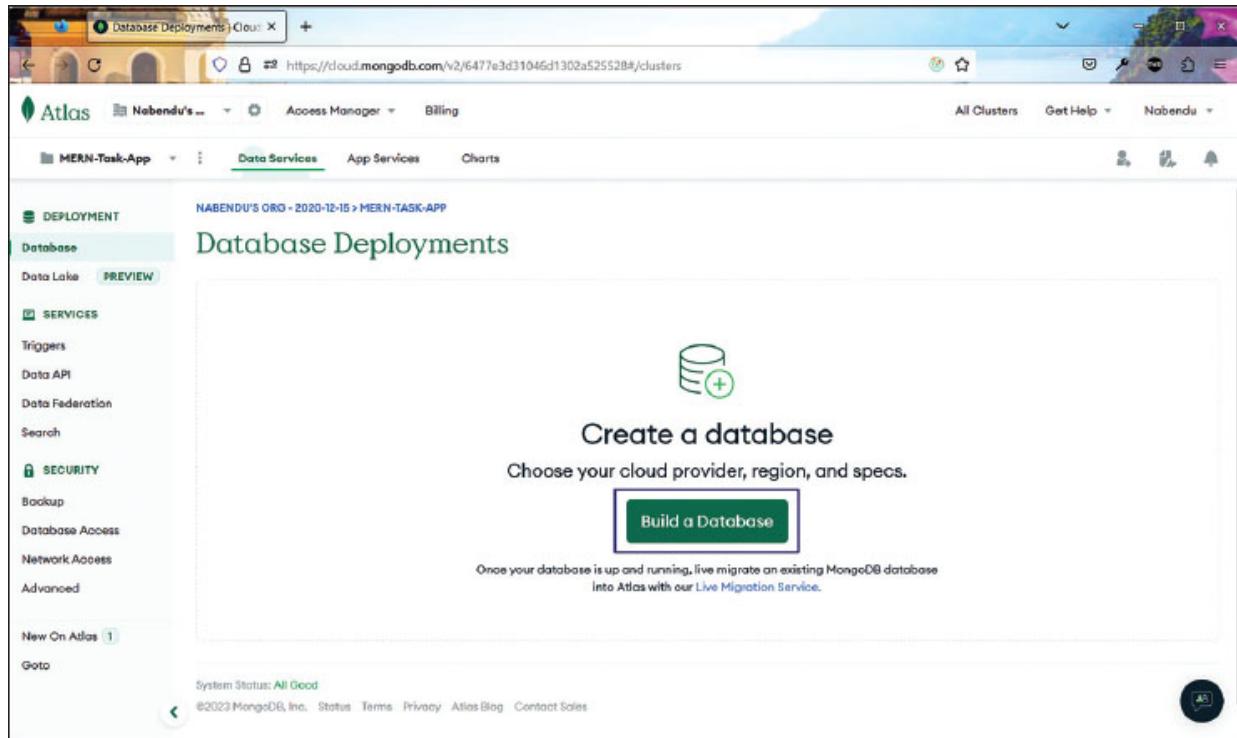


Figure 3.7: Build a Database

On the next screen, click the **m0** tier which is free. Also, keep the provider as **AWS**.

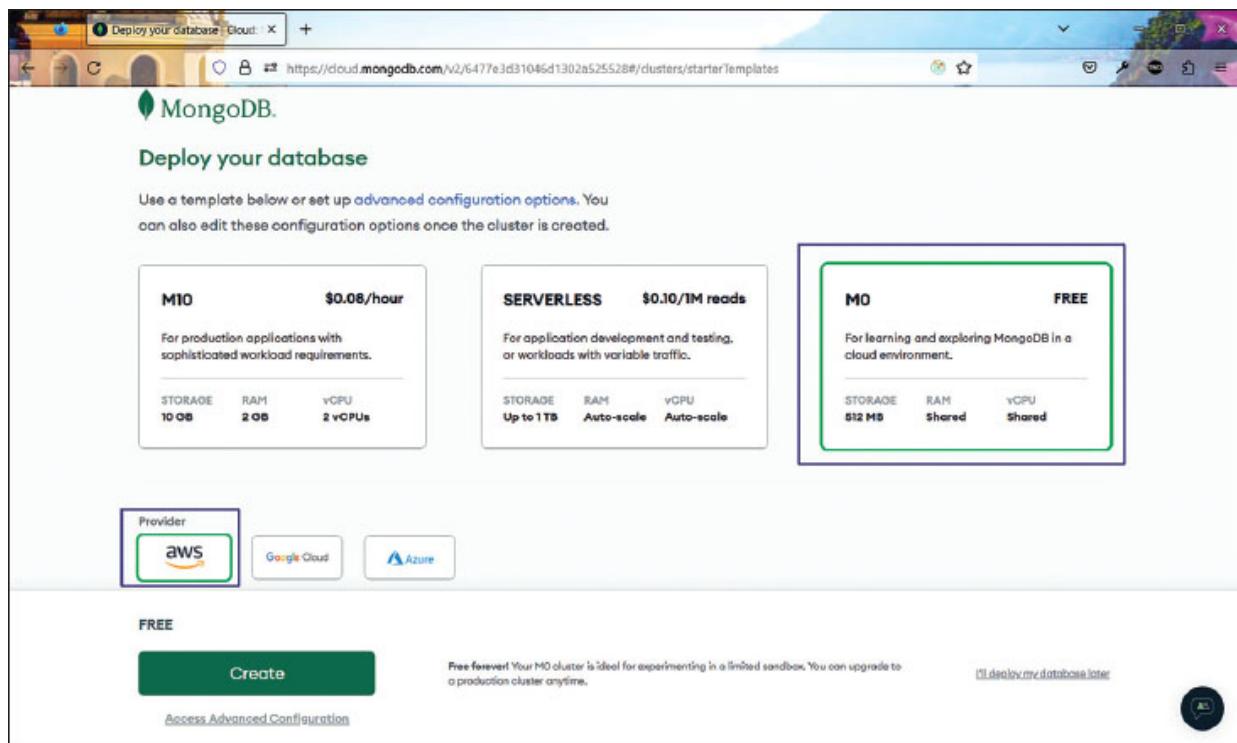


Figure 3.8: Deploy a Database

Scroll a bit down and choose the Region in your country. We have chosen Mumbai as we are located in India. We have also changed the Name to **NabenduCluster**. After that, click the **Create** button.

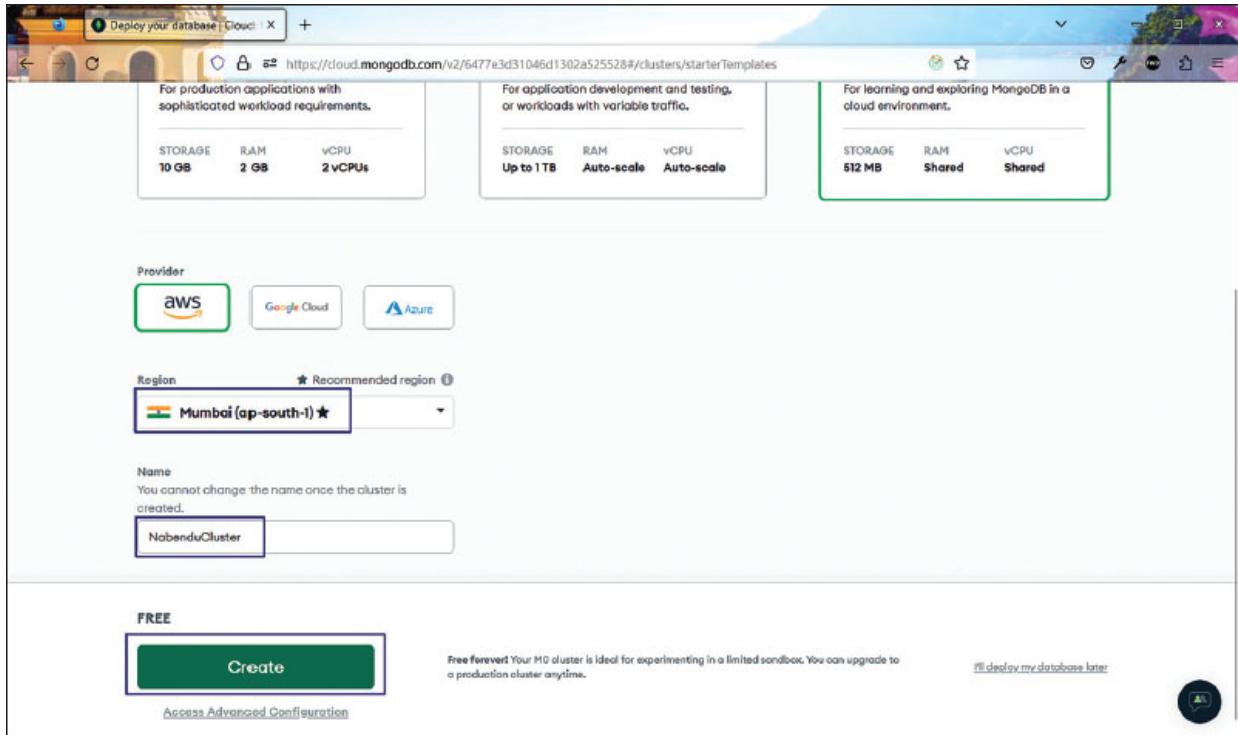


Figure 3.9: Region of Database

On the next screen, it will ask for username and password. To keep it simple for the tutorial we have given it as admin. After that, click the **Create User** button.

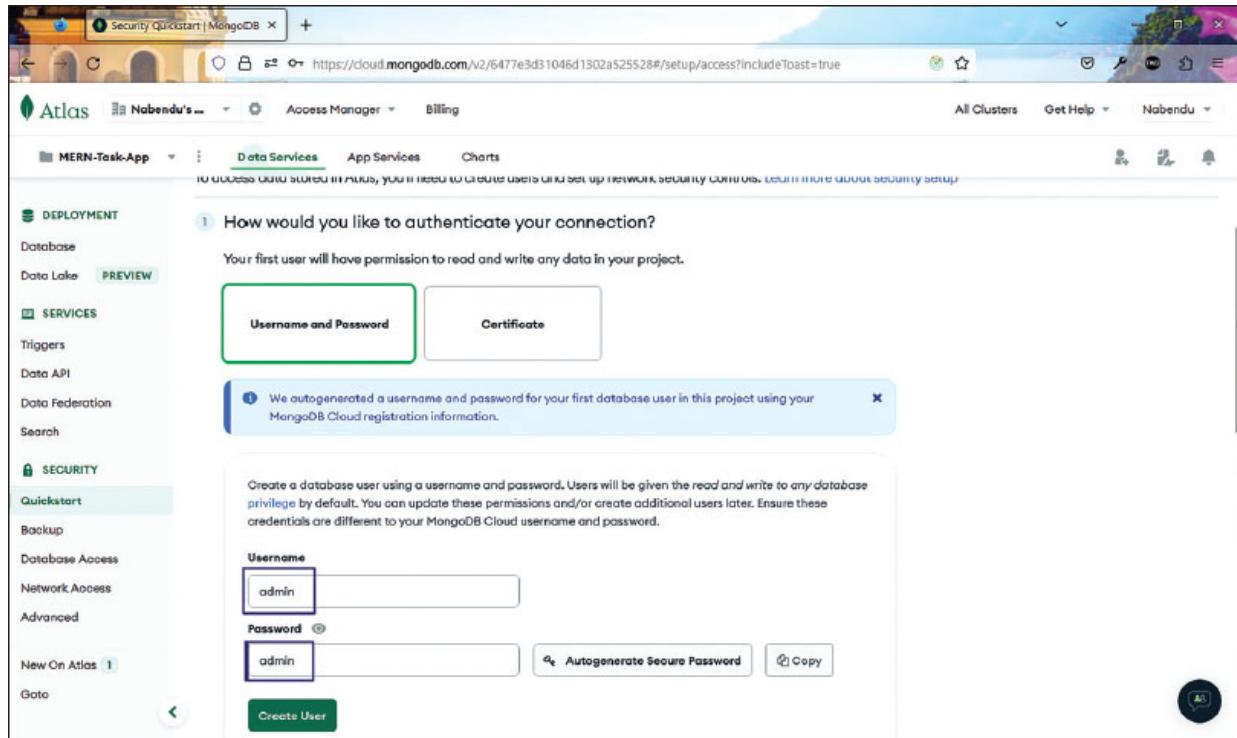


Figure 3.10: Create User

Creating the user, will automatically add your current IP address. If you try to click Add Entry, it will give an error that **This IP address has already been added**. Lastly, click the **Finish and Close** button.

The screenshot shows the MongoDB Atlas interface for managing IP access lists. On the left, a sidebar menu includes options like Deployment, Services (Triggers, Data API, Data Federation, Search), Security (Quickstart, Backup, Database Access, Network Access, Advanced), and a New On Atlas section. The main content area is titled "Add entries to your IP Access List". It contains two sections: "IP Address" and "IP Access List". In the "IP Address" section, there is a form with fields for "Enter IP Address" and "Enter description", a button "Add Entry", and a message "This IP address has already been added.". In the "IP Access List" section, there is a table with one entry: "1/32" under "IP Address", "My IP Address" under "Description", and buttons for "EDIT" and "REMOVE". A green "Finish and Close" button is located at the bottom right of this section. At the very bottom of the page, there is a footer with links for Goto, System Status: All Good, and copyright information: ©2023 MongoDB, Inc. Status Terms Privacy Atlas Blog Contact Sales.

Figure 3.11: IP Address

Now, we need to do one more setup for our application to run properly. Click the **Network Access** tab. After that click the **+ADD IP ADDRESS** button.

The screenshot shows the MongoDB Atlas interface for managing network access. The left sidebar is identical to the previous screenshot. The main content area is titled "NABENDU'S ORG - 2020-12-15 > MERN-TASK-APP" and "Network Access". It features three tabs: "IP Access List" (selected), "Peering", and "Private Endpoint". A yellow callout box says "You will only be able to connect to your cluster from the following list of IP Addresses:". Below this is a table with one row: "IP Address" (1/32 (includes your current IP address)), "Comment" (My IP Address), "Status" (Active), and "Actions" (Edit, Delete). A blue "+ ADD IP ADDRESS" button is located at the top right of the table. The footer is identical to the previous screenshot.

Figure 3.12: Network Address Configuration

In the pop-up, click on **ALLOW ACCESS FROM ANYWHERE** button and then the **Confirm** button.

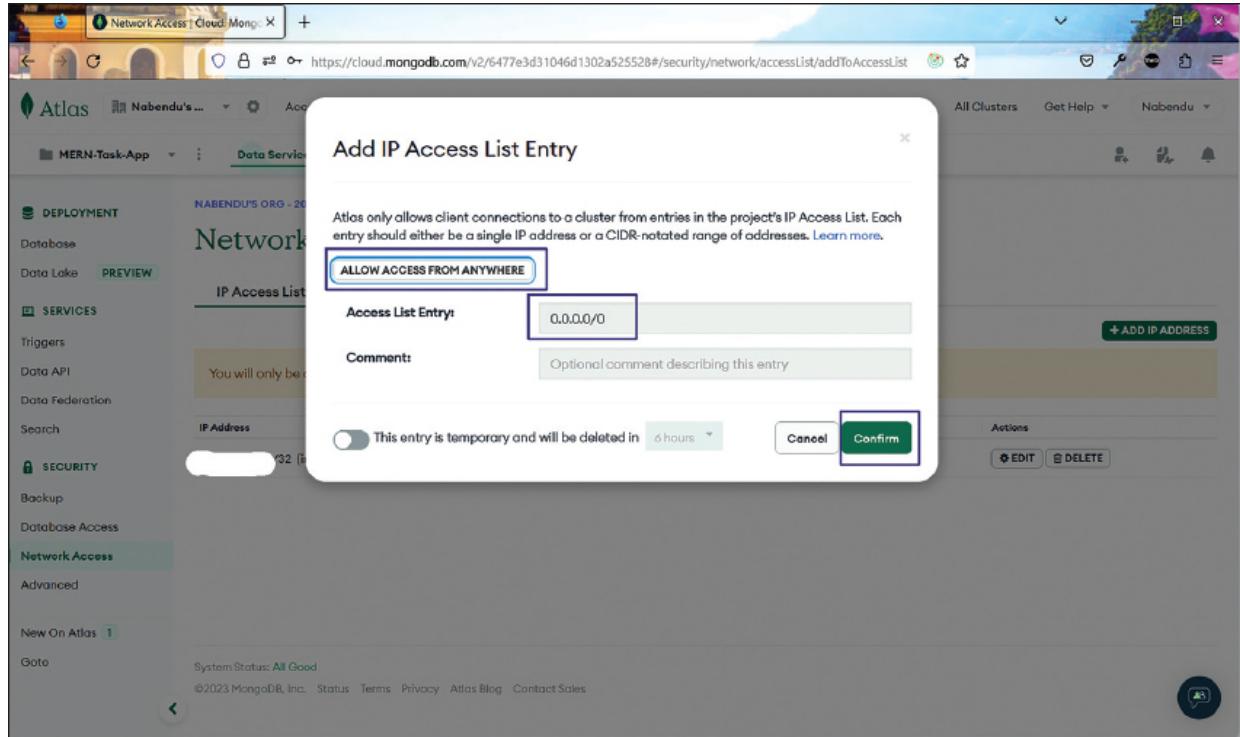


Figure 3.13: Allow access from Anywhere

Adding Collection and Connection URL

Now, we will add a Collection in our project. For this, click the **Database** tab and after that click **Browse Collections** button.

The screenshot shows the MongoDB Cloud Atlas interface. The top navigation bar includes 'Atlas', 'Nabendu's ...', 'Access Manager', 'Billing', 'All Clusters', 'Get Help', and 'Nabendu'. Below the navigation is a secondary header with 'MERN-Task-App', 'Data Services', 'App Services', and 'Charts'. The main content area is titled 'Database Deployments' under 'NABENDU'S ORG - 2020-12-15 > MERN-TASK-APP'. On the left, a sidebar lists 'DEPLOYMENT' (Database selected), 'SERVICES' (Triggers, Data API, Data Federation, Search, SECURITY, Backup, Database Access, Network Access, Advanced), and 'New On Atlas'. The main panel shows 'NabenduCluster' with metrics: R: 0, W: 0, Connections: 0, In: 0.0 B/s, Out: 0.0 B/s, Data Size: 0.0 B. It also displays 'Visualize Your Data' and a table of cluster details: VERSION 6.0.6, REGION AWS / Mumbai (ap-south-1), CLUSTER TIER M0 Sandbox (General), TYPE Replica Set - 3 nodes, BACKUPS Inactive, LINKED APP SERVICES None Linked, ATLAS SQL Connect, and ATLAS SEARCH Create Index. A green 'Create' button is at the top right. At the bottom, there's a 'System Status: All Good' message and a footer with links to MongoDB Inc., Status, Terms, Privacy, Atlas Beta, Contact Sales.

Figure 3.14: Browse Collections

On the next screen, click the **Add My Own Data** button.

The screenshot shows the MongoDB Cloud Atlas interface. The top navigation bar and secondary header are identical to Figure 3.14. The main content area is titled 'NABENDU'S ORG - 2020-12-15 > MERN-TASK-APP > DATABASES' and shows 'NabenduCluster'. The sidebar on the left is identical to Figure 3.14. The main panel has tabs for Overview, Real Time, Metrics, Collections (selected), Search, Profiler, Performance Advisor, Online Archive, and Cmd Line Tools. Below the tabs, it says 'DATABASES: 0 COLLECTIONS: 0' and features a 'REFRESH' button. The central area is titled 'Explore Your Data' with a magnifying glass icon. It lists four actions: 'Find: run queries and interact with documents', 'Indexes: build and manage indexes', 'Aggregation: test aggregation pipelines', and 'Search: build search indexes'. At the bottom are two buttons: 'Load a Sample Dataset' (green) and 'Add My Own Data' (highlighted with a red box). A link 'Learn more in Docs and Tutorials' is at the bottom right.

Figure 3.15: Add My Own Data

In the pop-up, give the database name and collection name. We have given it **taskApp** and **tasks**, respectively.

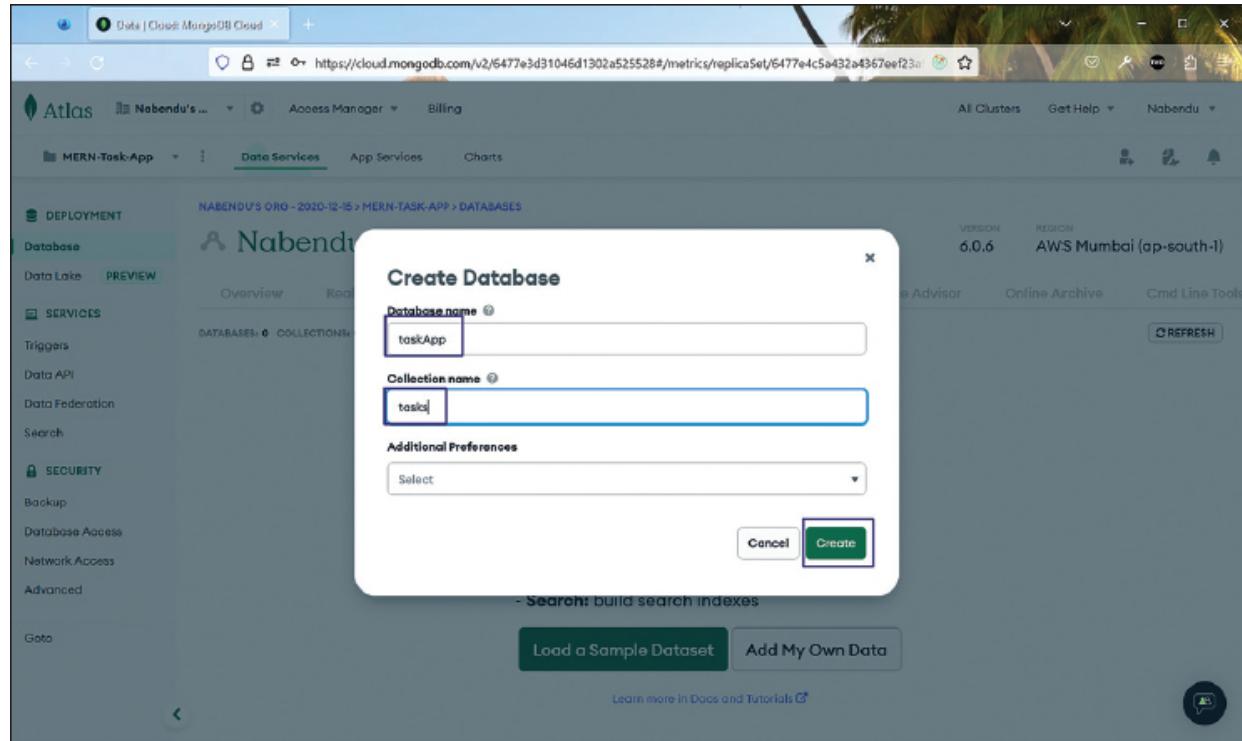


Figure 3.16: Create Database

Now, click the **Overview** tab again and then the **Connect** button.

The screenshot shows the MongoDB Atlas interface for a cluster named 'NabenduCluster'. The top navigation bar includes 'Atlas', 'Nabendu's...', 'Access Manager', 'Billing', 'All Clusters', 'Get Help', and 'Nabendu'. Below the navigation is a menu bar with 'MERN-Task-App' (selected), 'Data Services' (selected), 'App Services', and 'Charts'. The main content area displays the 'DEPLOYMENT' tab for 'Database'. It shows the cluster version as 6.0.6, region as 'AWS Mumbai (ap-south-1)', and cluster tier as 'M0 Sandbox (General)'. The 'Overview' tab is selected, showing a summary of the cluster's status. It lists three shards: '00-shard-00-00.a...', '00-shard-00-01.a...', and '00-shard-00-02.a...'. A callout box highlights 'This is a Shared Tier Cluster' with the note: 'If you need a database that's better for high-performance production applications, upgrade to a dedicated cluster.' Below this are sections for 'Operations', 'Logical Size', and 'Connections', each with a timeline from 'Last 6 Hours'. On the right side, there are 'Connect', 'Configuration', and '...' buttons.

Figure 3.17: Connect to cluster

Now, in the pop-up click the **MongoDB for VS Code** button.

The screenshot shows a 'Connect to your application' pop-up window. The background is dimmed to show the cluster overview. The pop-up has three tabs: 'Set up connection security', 'Choose a connection method' (selected), and 'Connect'. Under 'Choose a connection method', there are several options: 'Drivers' (native drivers like Node.js, Go, etc.), 'Compass' (MongoDB's GUI), 'Shell' (command-line interface), 'MongoDB for VS Code' (selected and highlighted with a blue border), and 'Atlas SQL' (SQL tools for analysis). At the bottom of the pop-up are 'Go Back' and 'Close' buttons.

Figure 3.18: MongoDB for VS Code

In the next screen, we will get the Connection String. This connection string will be used to connect to MongoDB from the backend in the next section.

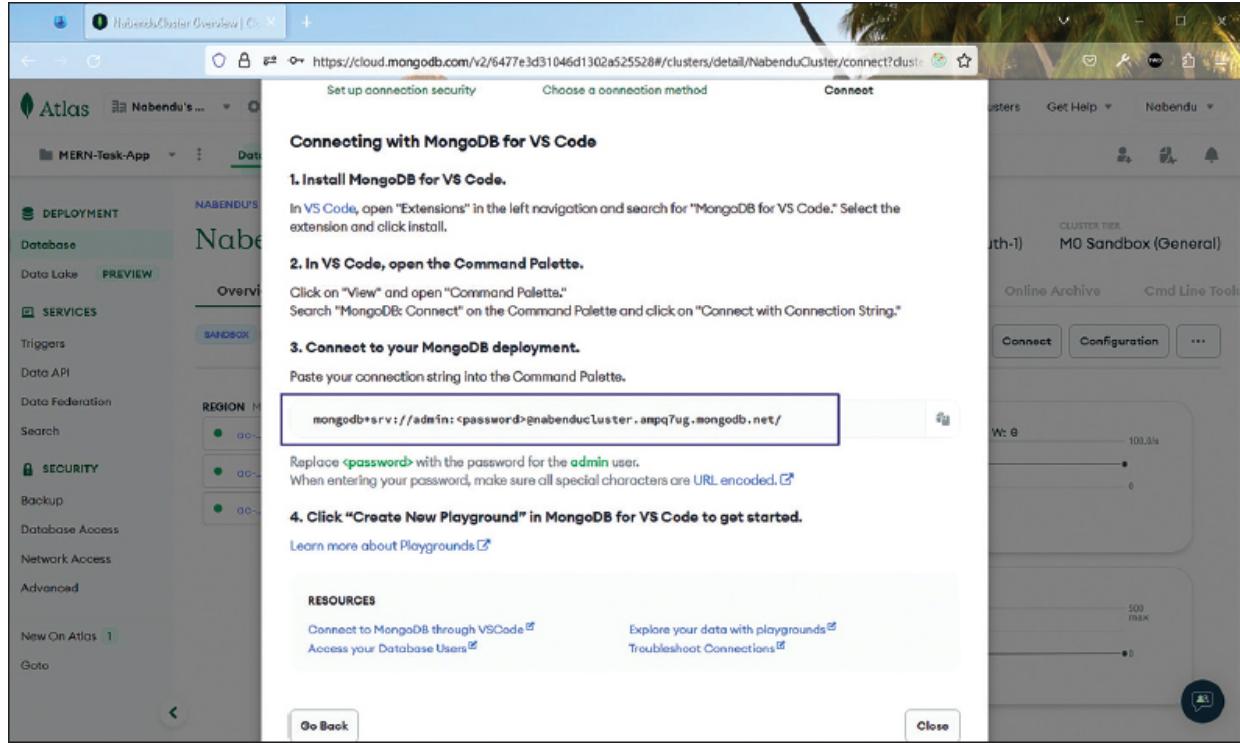


Figure 3.19: MongoDB Connection url

Connecting through Mongoose

Back to VS Code, open the `.env` file and create a variable **MONGO_URI**. Put the connection url in it, which we have got in the previous section. Notice that we have added the password and the correct database name, which is **taskApp** in it.

The screenshot shows the Visual Studio Code editor with the `.env` file open. The file contains the following content:

```

NODE_ENV = development
PORT = 8000
MONGO_URI = mongodb+srv://admin:admin@nabenducluster.ampq7ug.mongodb.net/taskApp
  
```

Figure 3.20: MONGO_URI in env file

Now, create a new folder called **connect** and new file **database.js** inside **connect**. Then place the following content in **database.js** file:

```

const mongoose = require('mongoose')

const connectDB = async () => {
  try {
    const connect = await
    mongoose.connect(process.env.MONGO_URI)
    console.log(`MongoDB Connected:
    ${connect.connection.host}`)
  } catch (err) {
    console.log(err)
    process.exit(1)
  }
}

module.exports = connectDB

```

Here, we are first importing mongoose. After that, we have a `connectDB` function, inside which we have a `try...catch` block. Here, in the try block we are first connecting through mongoose to our `MONGO_URI` stored in the `.env` file. We are also console logging the connected message.

In the catch block, we are just showing the error and exit the process.

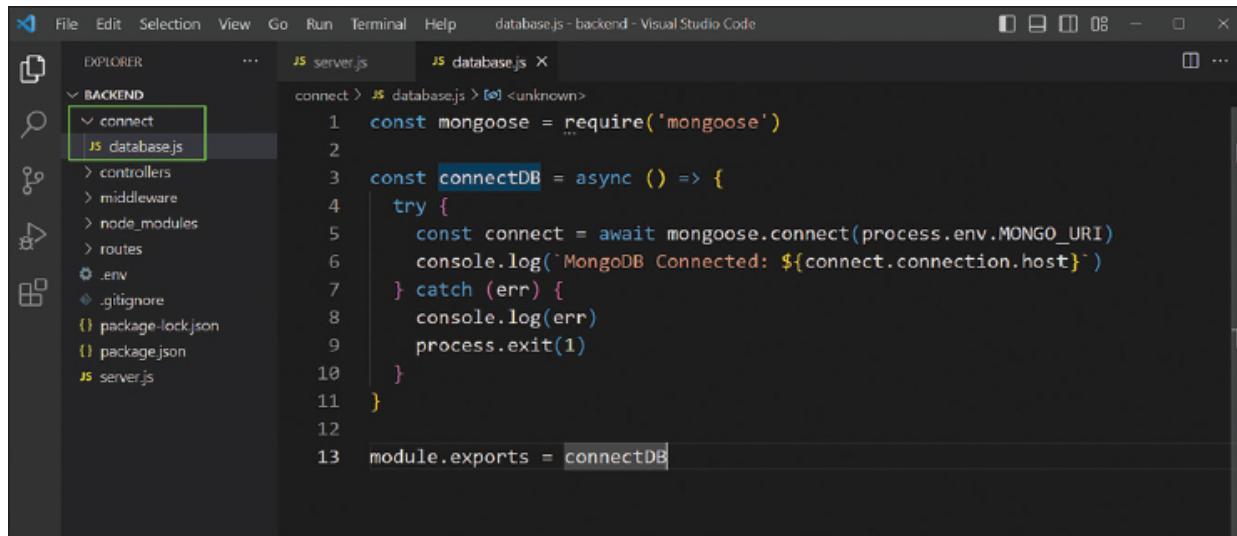
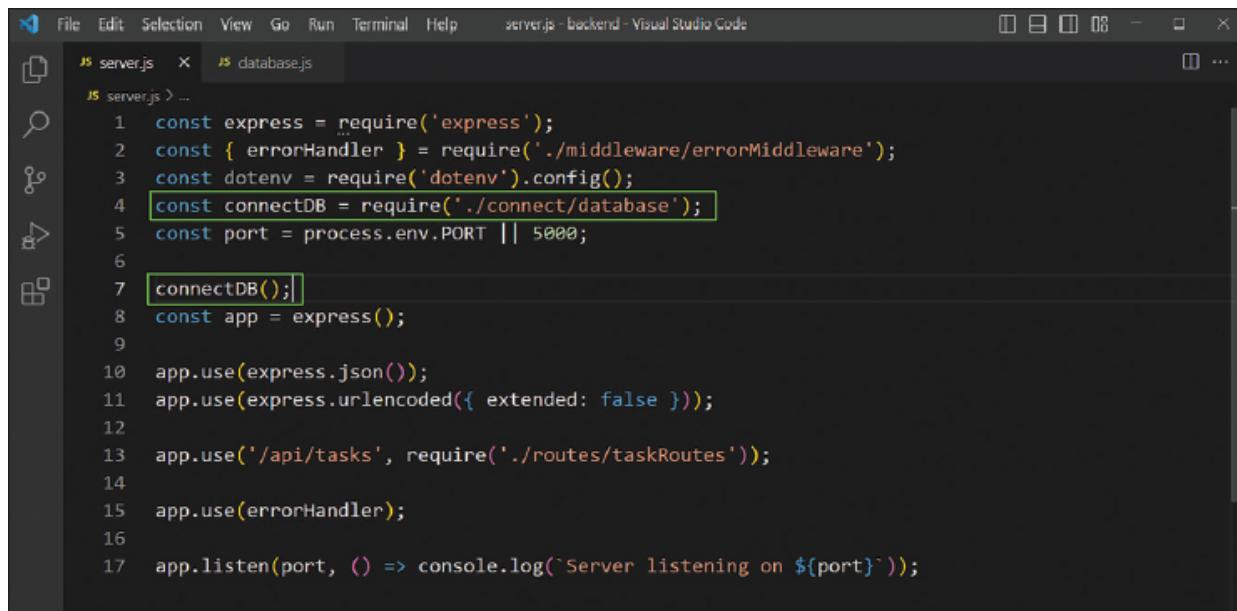


Figure 3.21: database.js file

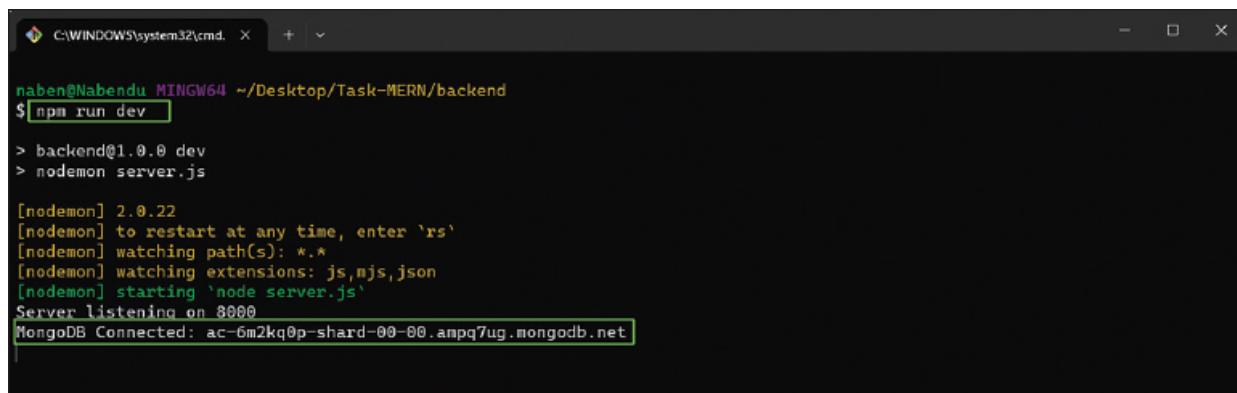
Next, go to `server.js` file and first import the `connectDB` function. Next, we are just calling it.



```
File Edit Selection View Go Run Terminal Help server.js - backend - Visual Studio Code
JS server.js X JS database.js
JS server.js > ...
1 const express = require('express');
2 const { errorHandler } = require('../middleware/errorMiddleware');
3 const dotenv = require('dotenv').config();
4 const connectDB = require('../connect/database');
5 const port = process.env.PORT || 5000;
6
7 connectDB();
8 const app = express();
9
10 app.use(express.json());
11 app.use(express.urlencoded({ extended: false }));
12
13 app.use('/api/tasks', require('../routes/taskRoutes'));
14
15 app.use(errorHandler);
16
17 app.listen(port, () => console.log(`Server listening on ${port}`));
```

Figure 3.22: Using database in server.js

Back in the terminal, restart the server with the `npm run dev` command. If everything is right we will also get the MongoDB Connected with the server name log.



```
C:\WINDOWS\system32\cmd. X + -
naben@Nabendu_MINGW64 ~/Desktop/Task-MERN/backend
$ npm run dev
> backend@1.0.0 dev
> nodemon server.js
[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 server.js'
Server listening on 8000
MongoDB Connected: ac-6m2kq0p-shard-00-00.ampq7ug.mongodb.net
```

Figure 3.23: Command line

Model Creation

Models are required for the backend to interact with the database. They are used to do the CRUD operation in the database. The Models are the way to represent the data in the database. So, create a new folder **models** in the project and a file **taskModel.js** in **models** folder. Then, place the following content in **taskModel.js** file to create Task model:

```

const mongoose = require('mongoose')
const taskSchema = mongoose.Schema(
{
  text: { type: String, required: [true, 'Please add a text value'] }
},
{
  timestamps: true
}
)

module.exports = mongoose.model('Task', taskSchema)

```

Here, we have a **taskSchema**, where we have a field of text. This field is of type String and also required. It will give the error **Please add a text value** if we don't send it on request.

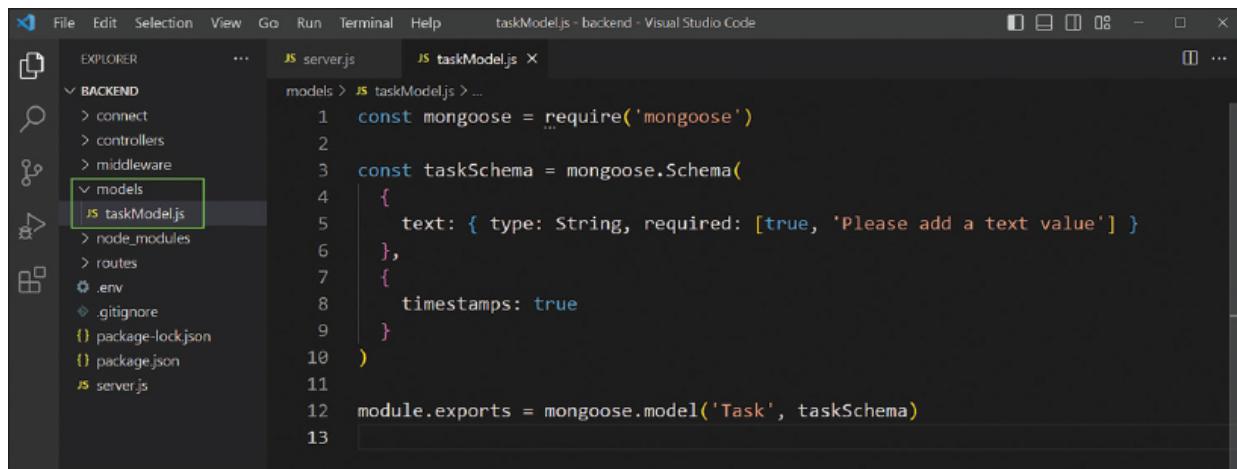


Figure 3.24: Creating models

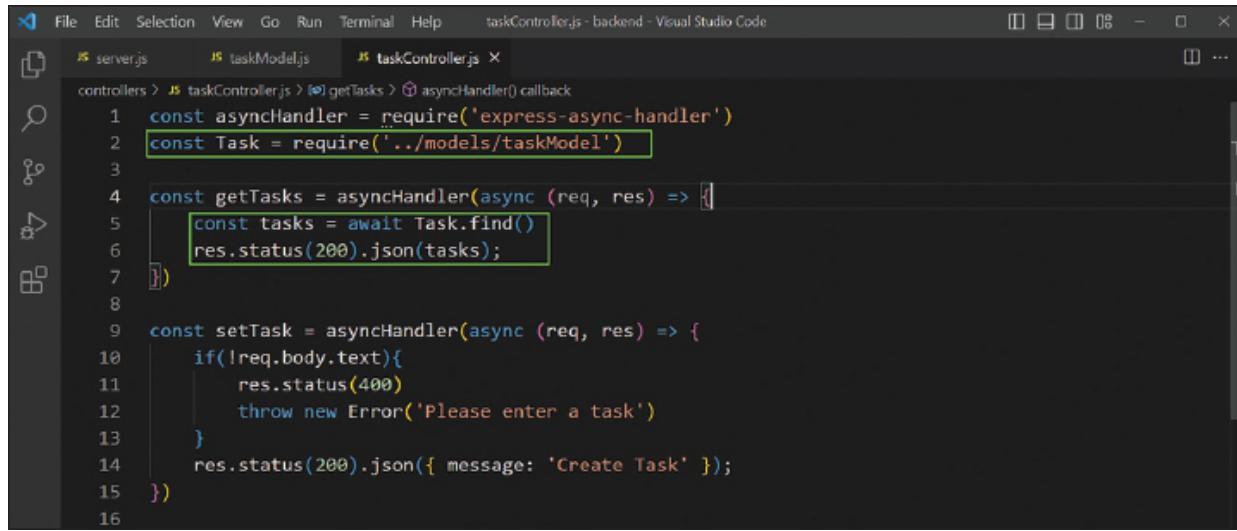
Now, in the **taskController.js** file we will first import the **taskModel**. And after that in the **getTasks()** method, we will use the **find()** function of mongoose to get all tasks from the database. Lastly, we are sending the status 200 and the tasks back.

```

const Task = require('../models/taskModel')

const tasks = await Task.find()
res.status(200).json(tasks);

```



```
const asyncHandler = require('express-async-handler')
const Task = require('../models/taskModel')

const getTasks = asyncHandler(async (req, res) => {
  const tasks = await Task.find()
  res.status(200).json(tasks)
})

const setTask = asyncHandler(async (req, res) => {
  if(!req.body.text){
    res.status(400)
    throw new Error('Please enter a task')
  }
  res.status(200).json({ message: 'Create Task' });
})
```

Figure 3.25: Updating getTasks

Now, in any browser go to `http://localhost:8000/api/tasks`, and we will get an empty array, since we don't have any tasks.



Figure 3.26: Checking all Tasks

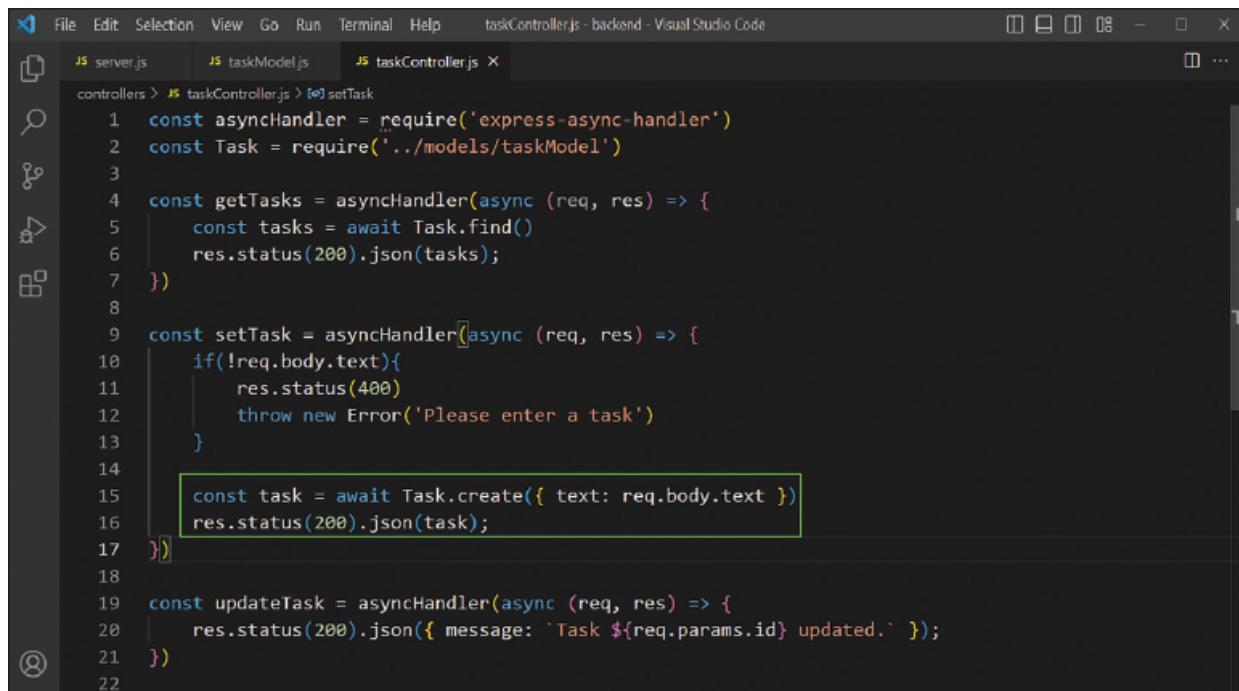
Creating Routes

We have already updated the `getTasks` route and now we will create more routes. Now, we will update the rest of the routes, so that we get basic working routes.

POST Route

First, we will update the PUT route. So, in the `setTask()` function we will use the `create()` method from mongoose and pass the text. Notice, that we have to use the Task model to run the `create()` method. Lastly, we are sending the status 200 and the task back.

```
const task = await Task.create({ text: req.body.text })
res.status(200).json(task);
```



```
const asyncHandler = require('express-async-handler')
const Task = require('../models/taskModel')

const getTasks = asyncHandler(async (req, res) => {
  const tasks = await Task.find()
  res.status(200).json(tasks)
})

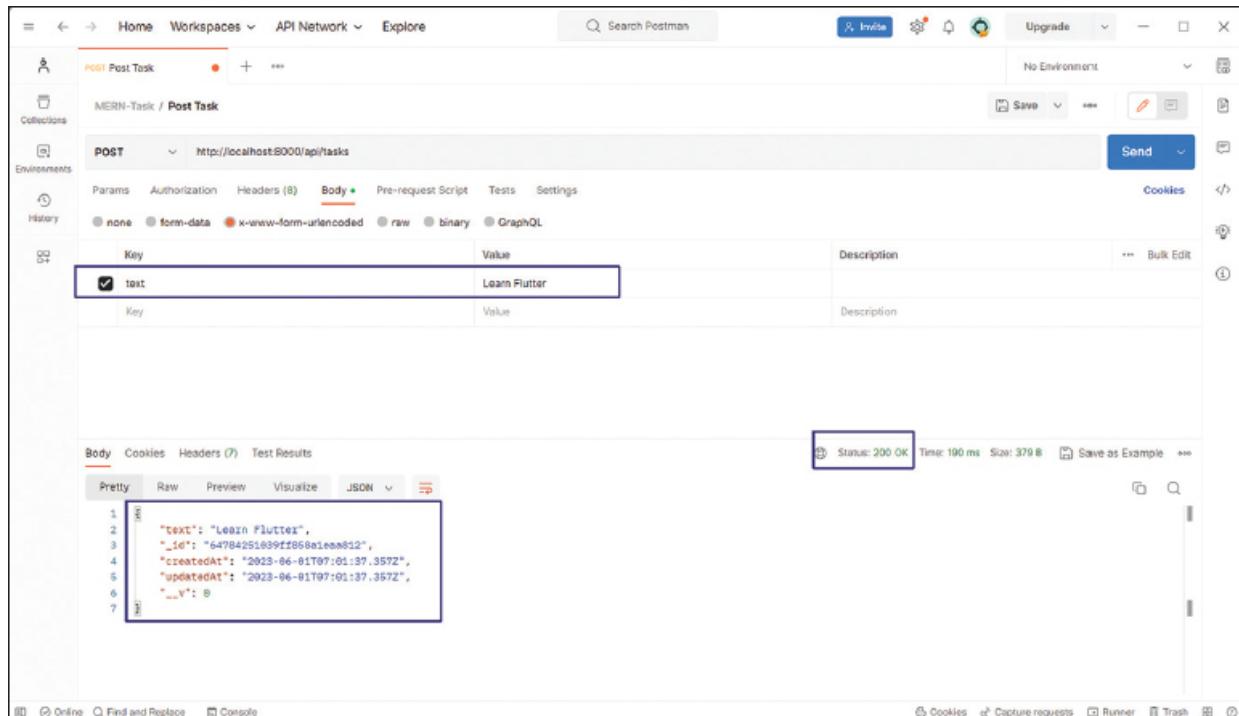
const setTask = asyncHandler(async (req, res) => {
  if(!req.body.text){
    res.status(400)
    throw new Error('Please enter a task')
  }

  const task = await Task.create({ text: req.body.text })
  res.status(200).json(task)
})

const updateTask = asyncHandler(async (req, res) => {
  res.status(200).json({ message: `Task ${req.params.id} updated.` })
})
```

Figure 3.27: Updating setTasks

Back in Postman, we will send a text with value and we will get back a Status of 200. Also, the json will be returned back to us.



POST Post Task

MERN-Task / Post Task

POST http://localhost:8000/api/tasks

Body

| Key | Value | Description |
|------|---------------|-------------|
| text | Learn Flutter | |

Body

```
1:   "text": "Learn Flutter",
2:   "_id": "64784251639ff868a1eaa812",
3:   "createdAt": "2023-06-01T07:01:37.357Z",
4:   "updatedAt": "2023-06-01T07:01:37.357Z",
5:   "__v": 0
```

Status: 200 OK Time: 190 ms Size: 379 B Save as Example

Figure 3.28: Sending Post Request

We have also added one more task through Postman. And after that, we checked in the MongoDB Cloud database. Here, we can find both tasks being saved in the database.

The screenshot shows the MongoDB Atlas interface. On the left, there's a sidebar with 'DEPLOYMENT', 'Database' (selected), 'Data Lake', 'SERVICES', 'Triggers', 'Data API', 'Data Federation', 'Search', 'SECURITY', 'Backup', 'Database Access', 'Network Access', and 'Advanced' sections. The main area shows a 'taskApp' deployment with a 'tasks' collection. A search bar at the top says 'Search Namespaces'. Below it, there are tabs for 'Find', 'Indexes', 'Schema Anti-Patterns', 'Aggregations', and 'Search indexes'. A query builder is present with the placeholder 'Type a query: { field: "value" }'. The results section shows 'QUERY RESULTS: 1-2 OF 2' with two documents:

```

{
  "_id": ObjectId("64784251039ff858a1aaa812"),
  "text": "Learn Flutter",
  "createdAt": "2023-06-01T07:01:37.357Z",
  "updatedAt": "2023-06-01T07:01:37.357Z",
  "__v": 0
}

{
  "_id": ObjectId("647842d889ff858a1aaa814"),
  "text": "Learn Blockchain",
  "createdAt": "2023-06-01T07:03:52.693Z",
  "updatedAt": "2023-06-01T07:03:52.693Z",
  "__v": 0
}

```

Figure 3.29: Checking Tasks in MongoDB

Again, in any browser goto <http://localhost:8000/api/tasks> and we will get an array of objects. It contains the two tasks saved previously.

The screenshot shows a browser window with the URL 'localhost:8000/api/tasks'. The page displays a JSON array of two task objects:

```

[{"_id": "64784251039ff858a1aaa812", "text": "Learn Flutter", "createdAt": "2023-06-01T07:01:37.357Z", "updatedAt": "2023-06-01T07:01:37.357Z", "__v": 0}, {"_id": "647842d889ff858a1aaa814", "text": "Learn Blockchain", "createdAt": "2023-06-01T07:03:52.693Z", "updatedAt": "2023-06-01T07:03:52.693Z", "__v": 0}]

```

Figure 3.30: Checking Tasks in Browser

PUT Route

Now, we will update the complete code for the PUT route. In the `updateTask()` function, add the following code:

```

const task = await Task.findById(req.params.id)

if (!task) {

```

```

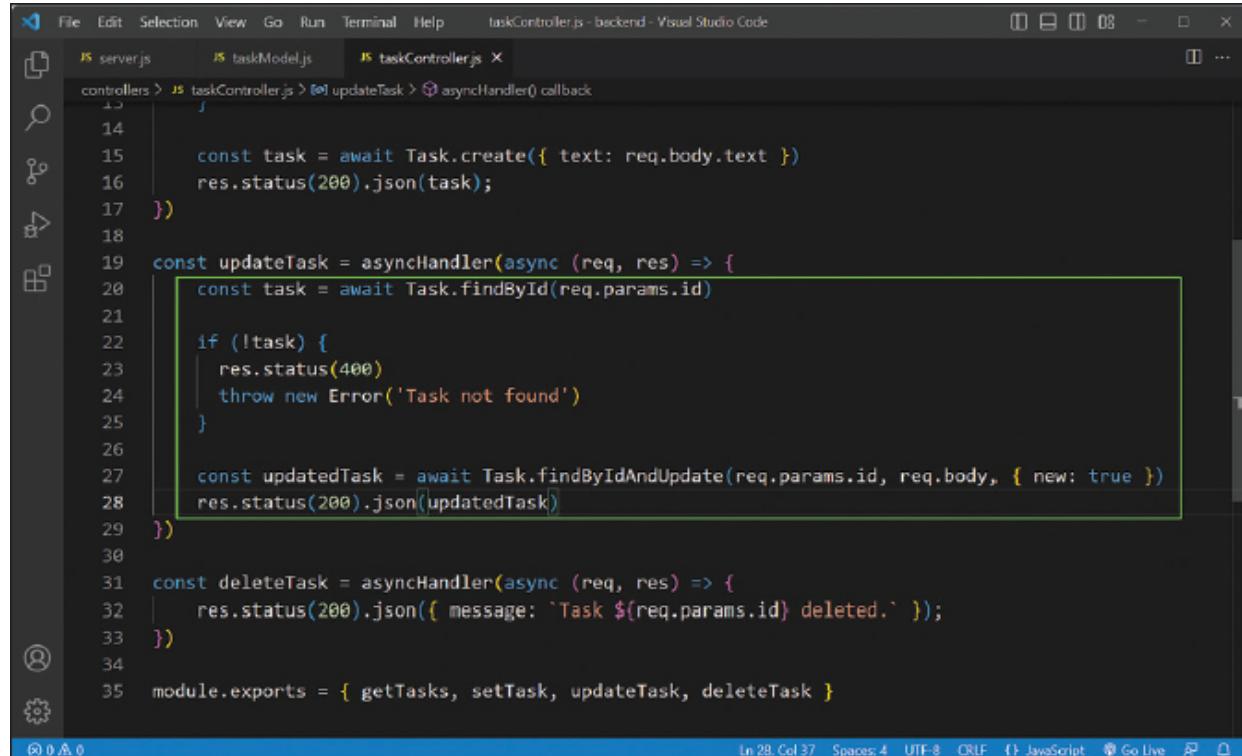
    res.status(400)
    throw new Error('Task not found')
}

[SEP] const updatedTask = await
Task.findByIdAndUpdate(req.params.id, req.body, { new: true
})
res.status(200).json(updatedTask)

```

Here, we are first using the `findById` method to find the task. Here, we are passing the `req.params.id` in it, which we get from the request header. After that, we are checking if no task is there and here we are throwing an error.

Next, we are updating the task with `findByIdAndUpdate` method. Here, we are passing the params, body and also `new: true`. The `new: true` returns us the latest updated value from the database. Lastly, we are sending the status 200 and the `updatedTask` back.



```

File Edit Selection View Go Run Terminal Help taskController.js - backend - Visual Studio Code
server.js taskModel.js taskController.js
controllers > taskController.js > updateTask > asyncHandler() callback
14
15     const task = await Task.create({ text: req.body.text })
16     res.status(200).json(task);
17 }
18
19 const updateTask = asyncHandler(async (req, res) => {
20     const task = await Task.findById(req.params.id)
21
22     if (!task) {
23         res.status(400)
24         throw new Error('Task not found')
25     }
26
27     const updatedTask = await Task.findByIdAndUpdate(req.params.id, req.body, { new: true })
28     res.status(200).json(updatedTask)
29 }
30
31 const deleteTask = asyncHandler(async (req, res) => {
32     res.status(200).json({ message: `Task ${req.params.id} deleted.` });
33 }
34
35 module.exports = { getTasks, setTask, updateTask, deleteTask }

```

Figure 3.31: Updating updateTask

Back in Postman, we are sending a `PUT` request. Here, we have updated the text of a task. On sending it we are getting a Status 200 and also the updated task back.

The screenshot shows the Postman interface with a collection named 'MERN-Task / Put Task'. A PUT request is being made to the URL `http://localhost:8000/api/tasks/647842d8039ff858a1ee814`. The 'Body' tab is selected, showing a key-value pair where the key is 'text' and the value is 'Learn Solidity'. The response status is 200 OK, and the JSON body of the response is displayed:

```

1 {
2   "_id": "647842d8039ff858a1ee814",
3   "text": "Learn Solidity",
4   "createdAt": "2023-06-01T07:03:52.693Z",
5   "updatedAt": "2023-06-01T07:11:36.236Z",
6   "__v": 0
7 }

```

Figure 3.32: Sending PUT Request

We can also confirm the same by getting all tasks at `http://localhost:8000/api/tasks` and we are getting the updated task.

The screenshot shows a browser window displaying the JSON response from the GET request to `http://localhost:8000/api/tasks`. The response contains two tasks, with the second task's 'text' field highlighted:

```

1 [
2   {
3     "_id": "64784251039ff858a1ee812",
4     "text": "Learn Flutter",
5     "createdAt": "2023-06-01T07:01:57.357Z",
6     "updatedAt": "2023-06-01T07:01:57.357Z",
7     "__v": 0
8   },
9   {
10    "_id": "647842d8039ff858a1ee814",
11    "text": "Learn Solidity",
12    "createdAt": "2023-06-01T07:03:52.693Z",
13    "updatedAt": "2023-06-01T07:11:36.236Z",
14    "__v": 0
15  }
16 ]
17
18

```

Figure 3.33: Checking Updated data in Browser

DELETE Route

Now, we will update the complete code for the DELETE route. In the `deleteTask()` function, add the following code:

```

const task = await Task.findById(req.params.id)

if (!task) {
  res.status(400)
}

```

```

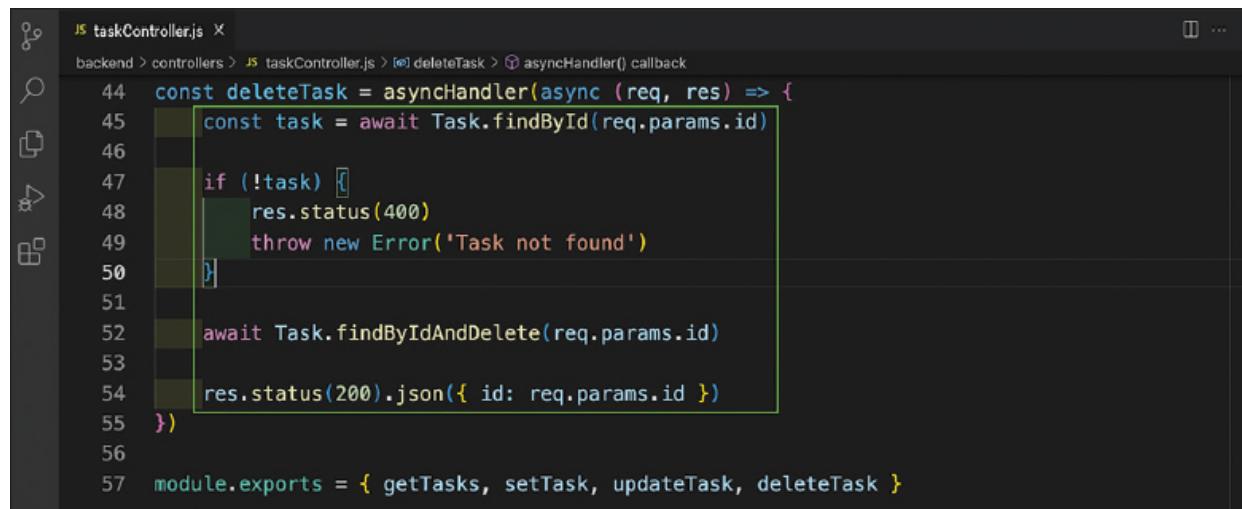
        throw new Error('Task not found')
    }

    await Task.findByIdAndDelete(req.params.id)
    res.status(200).json({ id: req.params.id })

```

Here, we are first using the `findById` method to find the task. After that, we are checking if no task is there and here we are throwing an error.

Next, we are deleting the task with `findByIdAndDelete` method. Here, we are passing the params. Lastly, we are sending the status 200 and the delete id back.



```

JS taskController.js ×
backend > controllers > JS taskController.js > ⚡ deleteTask > ⓘ asyncHandler() callback
44 const deleteTask = asyncHandler(async (req, res) => {
45     const task = await Task.findById(req.params.id)
46
47     if (!task) [
48         res.status(400)
49         throw new Error('Task not found')
50     ]
51
52     await Task.findByIdAndDelete(req.params.id)
53
54     res.status(200).json({ id: req.params.id })
55 }
56
57 module.exports = { getTasks, setTask, updateTask, deleteTask }

```

Figure 3.34: Updating deleteTask

Back in Postman we are sending a Delete request with a task id. The task is successfully deleted and we are getting a Status 200 and also the id back.

The screenshot shows the Postman interface. A DELETE request is made to `http://localhost:8000/api/tasks/64784251039ff858aleaa812`. The response body contains a single key-value pair: `"_id": "64784251039ff858aleaa812"`. The status bar at the bottom indicates `Status: 200 OK`, `Time: 96 ms`, and `Size: 268 B`.

Figure 3.35: Sending *DELETE* Request

We can also confirm the same by getting all tasks at `http://localhost:8000/api/tasks` and we are getting only one task back. The deleted task is not there anymore.

The screenshot shows a browser window with the URL `localhost:8000/api/tasks`. The response is a JSON object containing a single task:

```
{
  "_id": "647842d8039ff858aleaa814",
  "text": "Learn solidity",
  "createdAt": "2023-06-01T07:03:52.693Z",
  "updatedAt": "2023-06-01T07:11:38.236Z",
  "__v": 0
}
```

Figure 3.36: Confirming deleted data in Browser

Conclusion

In this chapter, we have learned about creating a MongoDB database through MongoDB Cloud. After that, we connected MongoDB to the backend code through the package of mongoose. Next, we did model creation which is required for CRUD operation in MongoDB through Mongoose.

Next, we have updated the GET, POST, PUT, and DELETE routes to work and do CRUD operations in the database.

In the next chapter, we will learn about JWT authentication. We will also create user model, routes, and controllers. Lastly, we will learn about hashing passwords.

Points to remember

- We use the folder structure consisting of connect, controllers, middleware, routes and a server.js file, when using Express.
- We are using MongoDB in the Cloud, which is easily setup using the GUI.
- Routes are created using different functions from Express, like `create()`, `findById()`, `findByIdAndUpdate()`, `findById()`, and `Delete()` in the Controller file.
- We test the different routes through the Postman app, because our frontend is not yet created.

CHAPTER 4

JWT Authentication and Hashing Password

Introduction

This chapter talks about JWT(JSON Web Token) and Hashing passwords. Here, we will first create a new user model in our backend app. We will create the routes and the controller for the same. Next, we learn to hash the password with the library of `bcrypt`. Lastly, we use the package of `jsonwebtoken` to generate JWT and add authentication to our app.

Structure

In this chapter, we are going to discuss the following topics:

- User Model and Controller
- Register User with Hashed Password
- Login User
- Understanding JWT
- Using JWT

User Model and Controller

Now, we will create the user model because we are going to store the User data also in our database. So, create a new file `userModel.js` inside the `models` folder and add the following code in `userModel.js`:

```
const mongoose = require('mongoose')

const userSchema = mongoose.Schema(
{
  name: {
    type: String,
```

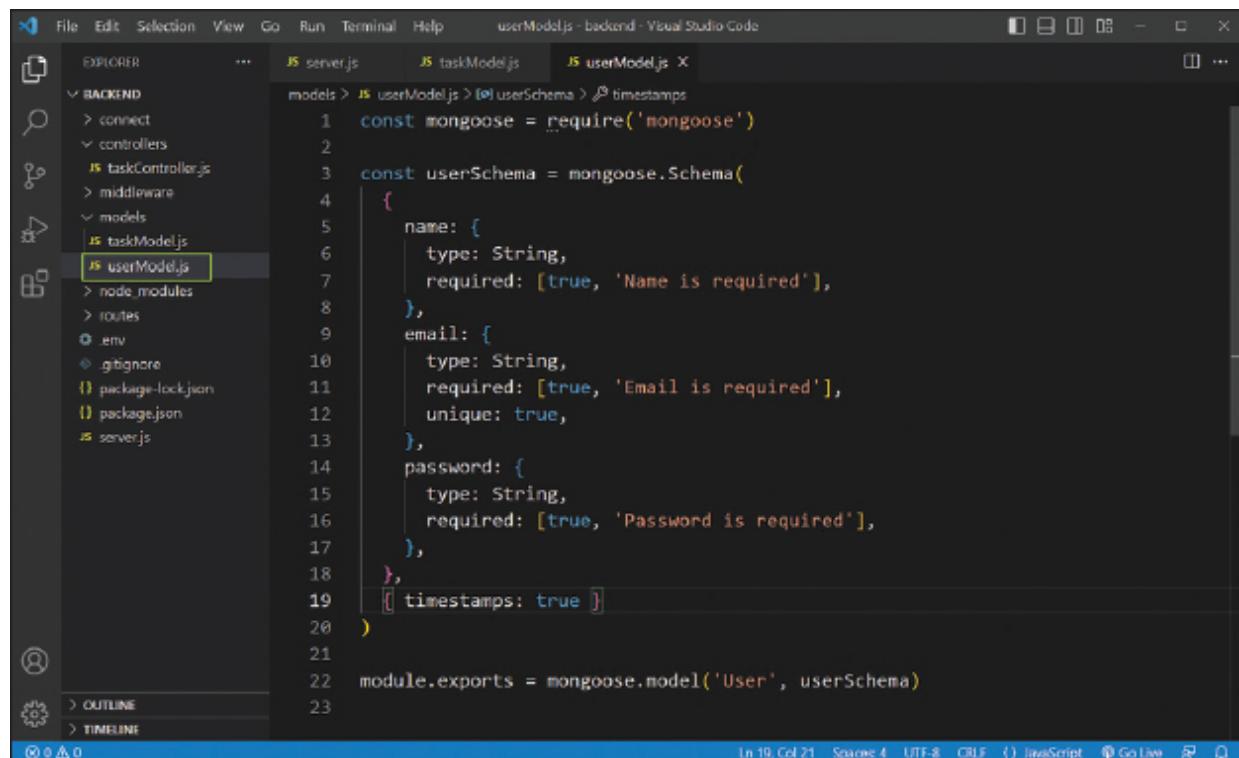
```

        required: [true, 'Name is required'],
    },
    email: {
        type: String,
        required: [true, 'Email is required'],
        unique: true,
    },
    password: {
        type: String,
        required: [true, 'Password is required'],
    },
},
{ timestamps: true }

)
module.exports = mongoose.model('User', userSchema)

```

Here, in the **userSchema** we have three fields of name, email, and password. All of them are strings and required. The email is also unique, which means we can't have the same email twice.



```

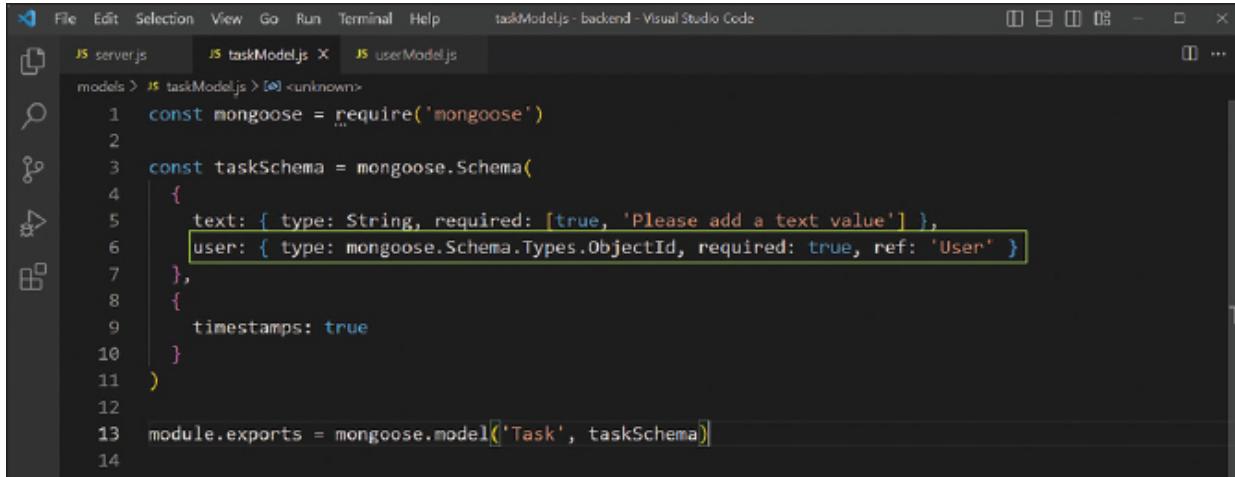
File Edit Selection View Go Run Terminal Help userModel.js - backend - Visual Studio Code
EXPLORER ... JS server.js JS taskModel.js JS userModel.js
BACKEND
> connect
controllers
JS taskController.js
> middleware
models
JS taskModel.js
JS userModel.js
> node_modules
> routes
.env
.gignore
package-lock.json
package.json
JS userModel.js
models > userModel.js > userSchema > timestamps
1 const mongoose = require('mongoose')
2
3 const userSchema = mongoose.Schema(
4   {
5     name: {
6       type: String,
7       required: [true, 'Name is required'],
8     },
9     email: {
10       type: String,
11       required: [true, 'Email is required'],
12       unique: true,
13     },
14     password: {
15       type: String,
16       required: [true, 'Password is required'],
17     },
18   },
19   { timestamps: true }
20 )
21
22 module.exports = mongoose.model('User', userSchema)
23

```

Figure 4.1: Creating User Model

Now, each of the tasks will also be associated with a user. So, we will update our **taskModel.js** file to have a field of the user. The type of it will be the **objectId** and it will refer to the User.

```
user: { type: mongoose.Schema.Types.ObjectId, required: true,  
ref: 'User' }
```



```
File Edit Selection View Go Run Terminal Help taskModel.js - backend - Visual Studio Code  
server.js taskModel.js userModel.js  
models > taskModel.js > <unknown>  
1 const mongoose = require('mongoose')  
2  
3 const taskSchema = mongoose.Schema(  
4 {  
5   text: { type: String, required: [true, 'Please add a text value'] },  
6   user: { type: mongoose.Schema.Types.ObjectId, required: true, ref: 'User' }  
7 },  
8 {  
9   timestamps: true  
10 }  
11 )  
12  
13 module.exports = mongoose.model('Task', taskSchema)
```

Figure 4.2: Updating Task Model

Next, we will create the new **userRoutes.js** file in the **routes** folder. In it, we are first importing express and router.

After that, we are also importing some functions from the **userController** file, which we are going to create next. Using the router, we have created two POST routes and one GET route.

```
const express = require('express')  
const router = express.Router()  
const { registerUser, loginUser, getCurrentUser } =  
require('../controllers/userController')  
  
router.post('/', registerUser)  
router.post('/login', loginUser)  
router.get('/current', getCurrentUser)  
  
module.exports = router
```

The screenshot shows the Visual Studio Code interface. The Explorer sidebar on the left displays a project structure under 'BACKEND' with files like 'connect.js', 'controllers', 'middleware.js', 'models', 'taskModel.js', 'userModel.js', 'node_modules', 'routes', 'taskRoutes.js', 'userRoutes.js', '.env', '.gitignore', 'package-lock.json', 'package.json', and 'server.js'. The 'routes' folder is expanded. The 'userRoutes.js' file is open in the editor tab, showing the following code:

```
1 const express = require('express')
2 const router = express.Router()
3 const { registerUser, loginUser, getCurrentUser } = require('../controllers/userController')
4
5 router.post('/', registerUser)
6 router.post('/login', loginUser)
7 router.get('/current', getCurrentUser)
8
9 module.exports = router
```

Figure 4.3: Creating User Routes

Now, in the **controllers** folder, we will create a file **userController.js** file. Here, we are right now creating the three functions of **registerUser**, **loginUser**, and **getCurrentUser** and returning simple json messages.

```
const asyncHandler = require('express-async-handler')

const registerUser = asyncHandler(async (req, res) => {
    res.json({ message: 'Register User successful' })
}

const loginUser = asyncHandler(async (req, res) => {
    res.json({ message: 'Login User successful' })
}

const getCurrentUser = asyncHandler(async (req, res) => {
    res.json({ message: 'Current user data' })
}

module.exports = { registerUser, loginUser, getCurrentUser }
```

```
const asyncHandler = require('express-async-handler')

const registerUser = asyncHandler(async (req, res) => {
  res.json({ message: 'Register User sucessful' })
})

const loginUser = asyncHandler(async (req, res) => {
  res.json({ message: 'Login User sucessful' })
})

const getCurrentUser = asyncHandler(async (req, res) => {
  res.json({ message: 'Current user data' })
})

module.exports = [registerUser, loginUser, getCurrentUser]
```

Figure 4.4: Creating User Controllers

Finally, we are going to create a new `/api/users` route in the `server.js` file.

```
app.use('/api/users', require('./routes/userRoutes'));
```

```
const express = require('express');
const { errorHandler } = require('../middleware/errorMiddleware');
const dotenv = require('dotenv').config();
const connectDB = require('../connect/database');
const port = process.env.PORT || 5000;

connectDB();
const app = express();

app.use(express.json());
app.use(express.urlencoded({ extended: false }));

app.use('/api/tasks', require('./routes/taskRoutes'));
app.use('/api/users', require('./routes/userRoutes'));

app.use(errorHandler);

app.listen(port, () => console.log(`Server listening on ${port}`));
```

Figure 4.5: Updating server.js

In Postman do a `POST` request to `http://localhost:8000/api/users` and we will get back the correct JSON back and 200 status.

The screenshot shows the Postman interface with the following details:

- Request:** POST /api/users
- Status:** 200 OK
- Body (JSON):**

```

1: {
2:   "message": "Register User sucessful"
3: }

```

Figure 4.6: Register route in Postman

Similarly, a **POST** request to `http://localhost:8000/api/users/login` will give back the correct JSON back and 200 status.

The screenshot shows the Postman interface with the following details:

- Request:** POST /api/users/login
- Status:** 200 OK
- Body (JSON):**

```

1: {
2:   "message": "Login User sucessful"
3: }

```

Figure 4.7: Login route in Postman

To check the **GET** request, we can use a browser. So, in a browser go to `http://localhost:8000/api/users/current`, and we will get the correct JSON data.



Figure 4.8: Get users in browser

Register User with Hashed Password

Before updating the register user function, we will install the package of **bcryptjs** and **jsonwebtoken**. These packages are used for password hashing and creating JWT respectively.

```
npm i bcryptjs jsonwebtoken
```

We are also importing **jwt**, **bcrypt**, and **userModel** in our **userController.js** file.

```
const jwt = require('jsonwebtoken')
const bcrypt = require('bcryptjs')
const User = require('../models/userModel')
```

```
File Edit Selection View Go Run Terminal Help UserController.js - Backend - Visual Studio Code
server.js UserController.js ...
controllers > UserController.js > ...
1 const asyncHandler = require('express-async-handler')
2 const jwt = require('jsonwebtoken')
3 const bcrypt = require('bcryptjs')
4 const User = require('../models/userModel')
5
6 const registerUser = asyncHandler(async (req, res) => {
7   res.json({ message: 'Register User sucessful' })
8 })
9
10 const loginUser = asyncHandler(async (req, res) => {
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL

naben@Nabendu MINGW64 ~/Desktop/Task-MERN/backend \$ npm i bcryptjs jsonwebtoken

added 11 packages, and audited 128 packages in 4s

12 packages are looking for funding
run `npm fund` for details

found 0 vulnerabilities

naben@Nabendu MINGW64 ~/Desktop/Task-MERN/backend \$

Figure 4.9: Adding bcryptjs and jsonwebtoken

Now, in the **userController.js** file, we will update the **registerUser()**. Add the following code in the function:

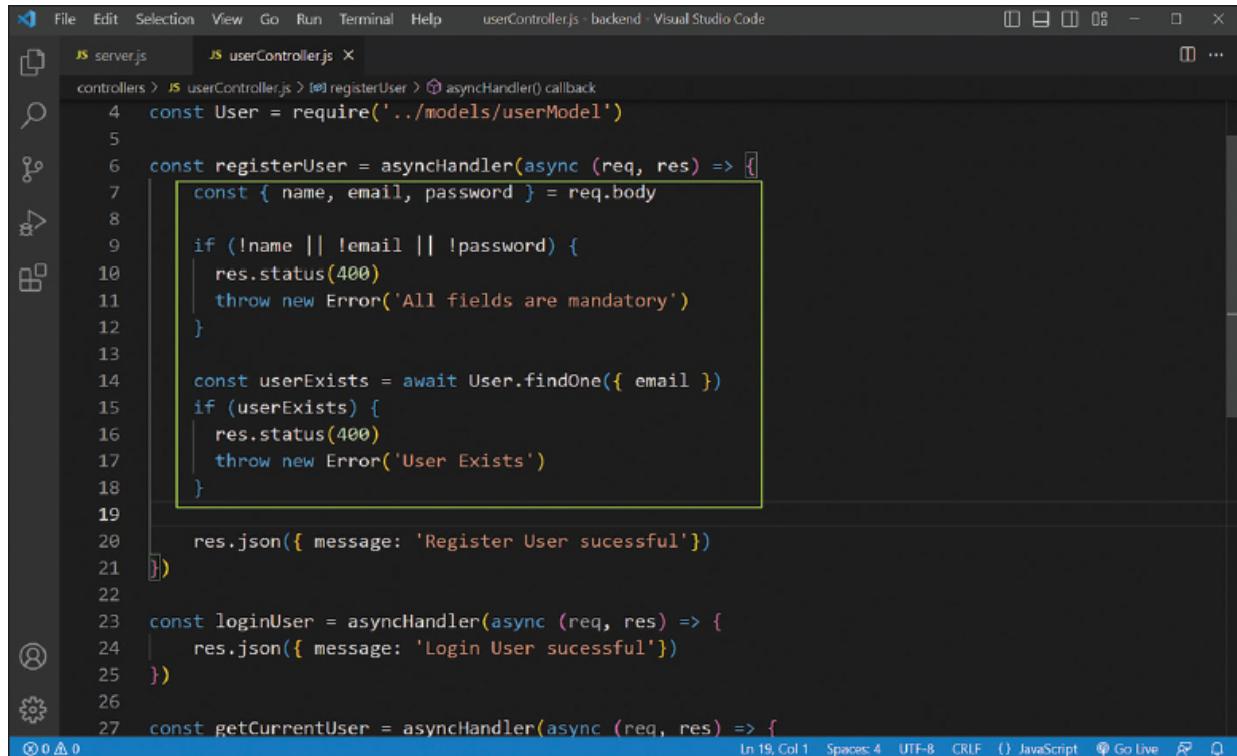
```
const { name, email, password } = req.body

if (!name || !email || !password) {
  res.status(400)
  throw new Error('All fields are mandatory')
}

const userExists = await User.findOne({ email })
if (userExists) {
  res.status(400)
  throw new Error('User Exists')
}
```

Here, we are first destructuring the name, email, and password from the `req.body`. After that, we are checking if any field is missing and throwing an error, if that is the case.

We are using the `findOne()` on the User model to get the user data. Here, we are giving the email. Now, if the user already exists, we are throwing an error.



The screenshot shows the Visual Studio Code interface with the `userController.js` file open. The code editor displays the following JavaScript code:

```
File Edit Selection View Go Run Terminal Help userController.js - backend · Visual Studio Code
JS server.js JS userController.js X
controllers > JS userController.js > registerUser > asyncHandler() callback
4 const User = require('../models/userModel')
5
6 const registerUser = asyncHandler(async (req, res) => [
7   const { name, email, password } = req.body
8
9   if (!name || !email || !password) {
10     res.status(400)
11     throw new Error('All fields are mandatory')
12   }
13
14   const userExists = await User.findOne({ email })
15   if (userExists) {
16     res.status(400)
17     throw new Error('User Exists')
18   }
19
20   res.json({ message: 'Register User sucessful'})
21 ])
22
23 const loginUser = asyncHandler(async (req, res) => {
24   res.json({ message: 'Login User sucessful'})
25 })
26
27 const getCurrentUser = asyncHandler(async (req, res) => {
```

The code is annotated with a yellow rectangular highlight around the block of code that checks for missing fields and user existence. The status bar at the bottom of the code editor shows: In 19, Col 1, Spaces: 4, UTF-8, CRLF, {}, JavaScript, Go Live.

Figure 4.10: Updating Register User

In Postman, if we pass the `name`, `email`, and `password` fields, we will get back `status 200` and the correct JSON back.

The screenshot shows the Postman interface with a POST request to 'http://localhost:8000/api/users'. The request body contains 'name' (Nabendu), 'email' (nabendu@gmail.com), and 'password' (nabendu12345). The response status is 200 OK, and the message is "Register User successful".

Figure 4.11: Checking Register User in Postman

Now, we don't want to save a plain password in our database for the user. Because if someone hacks the database, they get all username and passwords. So, we are going to use `bcrypt` now in `registerUser()` in the `userController.js` file. Update the file with the following code:

```
const salt = await bcrypt.genSalt(10)
const hashedPassword = await bcrypt.hash(password, salt)

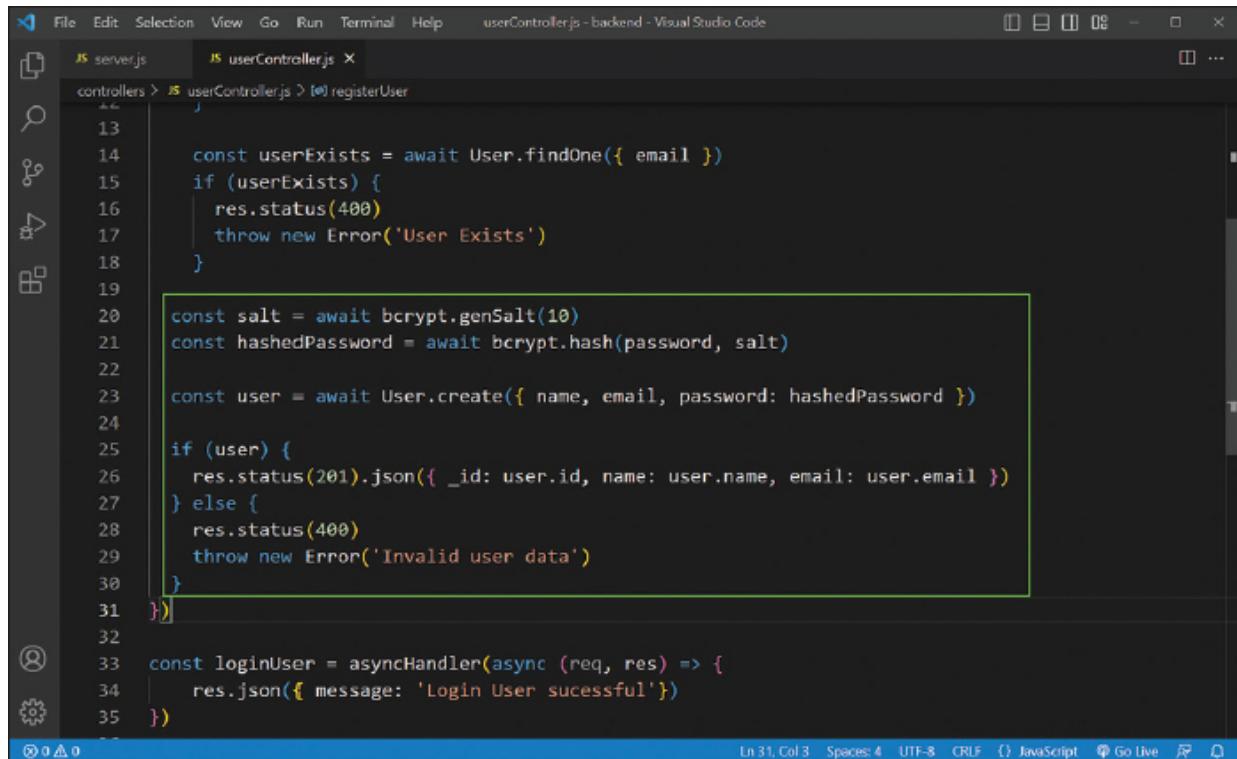
const user = await User.create({ name, email, password:
  hashedPassword })

if (user) {
  res.status(201).json({ _id: user.id, name: user.name,
    email: user.email })
} else {
  res.status(400)
  throw new Error('Invalid user data')
}
```

Here, we are first creating a random variable with the `gensalt()` method. After that, we are using the `hash()` method to generate a hash password. Here, we are passing the password and the salt value.

Now, we are using the mongoose create method on the User model to add the name, email, and `hashedPassword` of the user in the database.

If the user was saved successfully, we are sending back the `id`, `name`, and `email`. And if there is some error, we are throwing it back with an `Invalid user data` message.



The screenshot shows a Visual Studio Code interface with the file `userController.js` open. The code is as follows:

```
File Edit Selection View Go Run Terminal Help userController.js - backend - Visual Studio Code
JS server.js JS userController.js X
controllers > JS userController.js > registerUser
13
14     const userExists = await User.findOne({ email })
15     if (userExists) {
16         res.status(400)
17         throw new Error('User Exists')
18     }
19
20     const salt = await bcrypt.genSalt(10)
21     const hashedPassword = await bcrypt.hash(password, salt)
22
23     const user = await User.create({ name, email, password: hashedPassword })
24
25     if (user) {
26         res.status(201).json({ _id: user.id, name: user.name, email: user.email })
27     } else {
28         res.status(400)
29         throw new Error('Invalid user data')
30     }
31
32
33     const loginUser = asyncHandler(async (req, res) => {
34         res.json({ message: 'Login User sucessful' })
35     })

```

The code handles user registration. It first checks if a user with the same email already exists. If so, it returns a 400 status and an error message. Otherwise, it generates a salt and hashes the password. It then creates a new User document with the name, email, and hashed password. If successful, it returns a 201 status with the user's ID, name, and email. If there's an error during creation, it throws an 'Invalid user data' error. Finally, it defines an `loginUser` function using `asyncHandler` to handle login requests and return a success message.

Figure 4.12: Adding hashed password

Back in Postman if we give all data again and hit the `Send` button, we will get a `Status 201`. And the correct JSON will also be returned back.

The screenshot shows the Postman interface with a collection named 'MERN-Task / RegisterUser'. A POST request is made to 'http://localhost:8000/api/users' with the following body parameters:

| Key | Value | Description |
|----------|-------------------|-------------|
| name | Nabendu | |
| email | nabendu@gmail.com | |
| password | nabendu12345 | |

The response status is 201 Created, and the JSON data returned is:

```

1: {
2:   "_id": "6478878aff59c7ed7cbf5671",
3:   "name": "Nabendu",
4:   "email": "nabendu@gmail.com"
5: }

```

Figure 4.13: Registering user with Postman

We can also confirm the same in the MongoDB cloud database. Here, in the users the new user with the hashed password will be saved.

The screenshot shows the MongoDB Atlas interface for the 'taskApp' database. The 'users' collection has one document, which is displayed in the 'taskApp.users' section. The document details are:

```

_id: ObjectId('6478878aff59c7ed7cbf5671')
name: "Nabendu"
email: "nabendu@gmail.com"
password: "$2e$10$3NHf2IMhjTqphrA5A2v.8aqz0gf8NmksD3BCJ3IkmToH0zK"
createdAt: 2023-06-01T11:54:58.100+00:00
updatedAt: 2023-06-01T11:54:58.100+00:00
__v: 0

```

Figure 4.14: Saved user in database

Login User

Now, we will update the Login user functionality. So, in the `loginUser` function of the `userController.js` file, add the following code:

```
const { email, password } = req.body
const user = await User.findOne({ email })

if (user && (await bcrypt.compare(password, user.password)))
{
  res.json({ _id: user.id, name: user.name, email: user.email })
}
else {
  res.status(400)
  throw new Error('Invalid data')
}
```

Here, we are first destructuring the `email` and `password` from the `req.body`. We are using the `findOne()` on the `User` model to get the user data. Here, we are giving the `email`.

Now, if the user exists and password matched, we are sending back the `id`, `name`, and `email`. Notice that since the password is hashed in the database, we are using `bcrypt.compare()` to compare the passwords.

If the user doesn't exist or the password doesn't match, we are throwing an error with '**Invalid data**' message.

```
JS server.js JS UserController.js
controllers > JS UserController.js > [o] loginUser > [o] asyncHandler() callback
27     } else {
28         res.status(400)
29         throw new Error('Invalid user data')
30     }
31 }
32
33 const loginUser = asyncHandler(async (req, res) => {
34     const { email, password } = req.body
35     const user = await User.findOne({ email })
36
37     if (user && (await bcrypt.compare(password, user.password))) {
38         res.json({ _id: user.id, name: user.name, email: user.email })
39     } else {
40         res.status(400)
41         throw new Error('Invalid data')
42     }
43 })
44
45 const getCurrentUser = asyncHandler(async (req, res) => {
46     res.json({ message: 'Current user data' })
47 })
48
49 module.exports = { registerUser, loginUser, getCurrentUser }
```

Figure 4.15: Updating Login User

Back in Postman, a POST request to `http://localhost:8000/api/users/login` with no data, will give us an error JSON back.

POST Register User POST Login User

MERN-Task / Login User

POST http://localhost:8000/api/users/login

Params Authorization Headers (7) Body Pre-request Script Tests Settings

none form-data x-www-form-urlencoded raw binary GraphQL

| Key | Value | Description | Bulk Edit |
|-----|-------|-------------|-----------|
| Key | Value | Description | |

Status: 400 Bad Request Time: 56 ms Size: 270 B Save as Example

Pretty Raw Preview Visualize JSON

```
1: {<empty>
2:   "message": "Invalid data"
3: }
```

Figure 4.16: Login User with no data

Even a **POST** request to `http://localhost:8000/api/users/login` with the wrong password, will give us an error JSON back.

The screenshot shows the Postman interface with a POST request to `http://localhost:8000/api/users/login`. The request body contains `email: nabendu@gmail.com` and `password: 12345`. The response status is `400 Bad Request`, and the response body is `{"message": "Invalid date"}`.

Figure 4.17: Login User with wrong password

Only a POST request to `http://localhost:8000/api/users/login` with all correct data, will give us Status 200 and id, `name` and `email` back.

The screenshot shows the Postman interface with a POST request to `http://localhost:8000/api/users/login`. The request body contains `email: nabendu@gmail.com` and `password: nsbendu12345`. The response status is `200 OK`, and the response body is a JSON object containing `_id: "6478870aff59c7ed7cbf6671"`, `name: "Nabendu"`, and `email: "nabendu@gmail.com"`.

Figure 4.18: Login User successfully

Understanding JWT

JWT(JSON Web Token) is often used to add authentication in web apps. The official site for JWT is <https://jwt.io/> and as per it, the JWT token consists of three parts. The first part is the Header, the second is the Payload, and the third is the Verify Signature.

Out of these, the second is the most important, because it contains the details of the payload. But the third one also contains the signature without which the token cannot be verified.

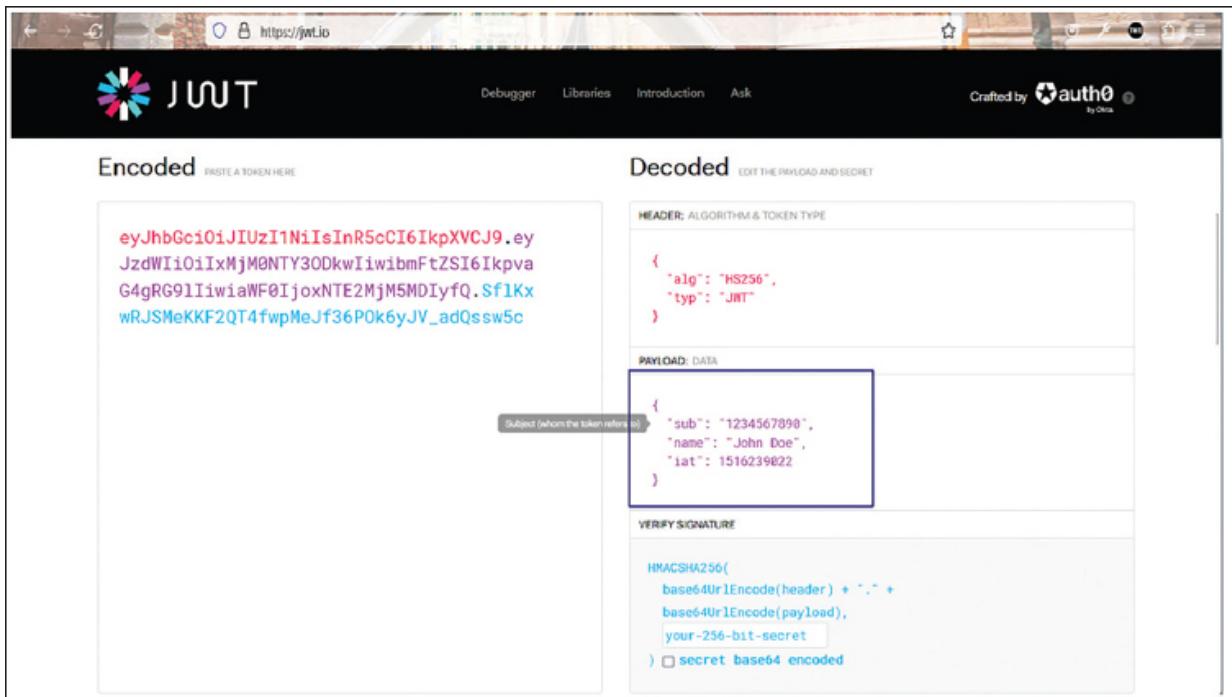


Figure 4.19: The JWT Token

Using JWT

To use JWT, we will first add **JWT_SECRET** in the **.env** file. The secret can be anything and we have kept it **thewebdev**.

A screenshot of Visual Studio Code showing an .env file. The file contains the following content: NODE_ENV = development, PORT = 8000, MONGO_URI = mongodb+srv://admin:admin@nabenducluster.ampq7ug.mongodb.net/taskApp, and JWT_SECRET = thewebdev. The JWT_SECRET line is highlighted with a green background.

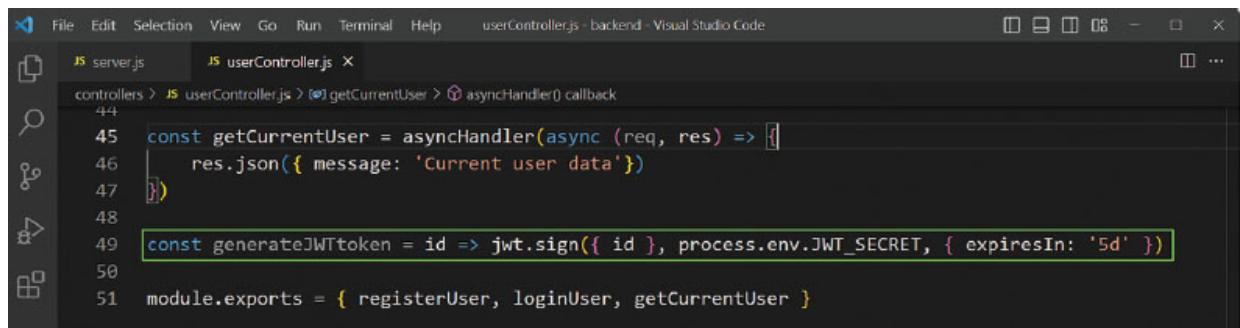
Figure 4.20: The JWT Secret

Then, in the **userController.js** file, we will add the following function:

```
const generateJWTtoken = id => jwt.sign({ id },
process.env.JWT_SECRET, { expiresIn: '5d' })
```

Now, the function **generateJWTtoken** is taking an id. And it is using the **jwt.sign()** method. Here, it is taking the id and secret from the environment file as the first two parameters.

In the third parameter, we are giving the expiresIn parameter. Here, we can specify after how much time our JWT will expire, and we need to generate a new one. We have kept it for five days.



```
File Edit Selection View Go Run Terminal Help UserController.js - backend Visual Studio Code
server.js UserController.js
controllers > UserController.js > getCurrentUser > asyncHandler() callback
44
45 const getCurrentUser = asyncHandler(async (req, res) => {
46   res.json({ message: 'Current user data' })
47 }
48
49 const generateJWTtoken = id => jwt.sign({ id }, process.env.JWT_SECRET, { expiresIn: '5d' })
50
51 module.exports = { registerUser, loginUser, getCurrentUser }
```

Figure 4.21: The generate token method

Then, in the **registerUser** and **loginUser** function in the **userController.js** file, we are also passing back the token when the request is successful. The token is generated by passing the id in the **generateToken()** function.

```

13     const userExists = await User.findOne({ email })
14     if (userExists) {
15       res.status(400)
16       throw new Error('User Exists')
17     }
18
19     const salt = await bcrypt.genSalt(10)
20     const hashedPassword = await bcrypt.hash(password, salt)
21
22     const user = await User.create({ name, email, password: hashedPassword })
23
24     if (user) {
25       res.status(201).json({ _id: user.id, name: user.name, email: user.email, token: generateJWTToken(user._id) })
26     } else {
27       res.status(400)
28       throw new Error('Invalid user data')
29     }
30   }
31 }
32
33 const loginUser = asyncHandler(async (req, res) => {
34   const { email, password } = req.body
35   const user = await User.findOne({ email })
36
37   if (user && (await bcrypt.compare(password, user.password))) {
38     res.json({ _id: user.id, name: user.name, email: user.email, token: generateJWTToken(user._id) })
39   } else {
40     res.status(400)
41     throw new Error('Invalid data')
42   }
43 })

```

Figure 4.22: Using generate token method

Now, in Postman the login route `http://localhost:8000/api/users/login` with all correct data, will give us Status 200. It will also return back id, name, email, and JWT token.

| Key | Value | Description | ... Bulk Edit |
|----------|-------------------|-------------|---------------|
| email | nabendu@gmail.com | | |
| password | nabendu12345 | | |

```

1 {
2   "_id": "64788704d1f99c7ed7cbf5472",
3   "name": "Nabendu",
4   "email": "nabendu@gmail.com",
5   "token": "eyJhbGciOiJIUzI1NiIsInR5cCI6Ikx0XCVJ9.eyJ0aWQiOiMzZW03Y2JmWTY3MSIsImhlbCI6MTY4NTYzNTYzMjMwIjoxNjg2MDUzNjMyfQ.
6   axiLSEIdzBHUcg1-BV53IeZ2F_-7gyr4a51idvQ0dcw"

```

Figure 4.23: Login route getting JWT Token

Similarly, the register route `http://localhost:8000/api/users` with all correct data, will give us `status 200`. It will also return back `id`, `name`, `email`, and JWT `token`.

The screenshot shows the Postman interface with a POST request to `http://localhost:8000/api/users`. The request body is set to `x-www-form-urlencoded` and contains three fields: `name` (Shikha), `email` (shikha@gmail.com), and `password` (shikha12345). The response status is `201 Created`, and the JSON body includes an `id`, `name`, `email`, and a long `token`.

```

1 {
2   "_id": "64788bc630f4acea644e6601b",
3   "name": "Shikha",
4   "email": "shikha@gmail.com",
5   "token": "eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJpZCI6IjYGNzg4VmM2NzYmNGFjYTt0NGE2NjAxMSIsInlhGCI6MTY4NTY4NTc0MjIjoxNjg2MDUzNzAyEQ.58jxclavg099fTEfAygfsRqQ097aLshaxL_d9ta-o"
6 }

```

Figure 4.24: Register route getting JWT Token

But, if we try to Register with the same details, we will get back the error of `User Exists` in the Register route:

The screenshot shows the Postman interface with a POST request to `http://localhost:8000/api/users`. The request body is set to `x-www-form-urlencoded` and contains three fields: `name` (Shikha), `email` (shikha@gmail.com), and `password` (shikha12345). The response status is `400 Bad Request`, and the JSON body includes a `message` field with the value `"User Exists"`.

```

1 {
2   "message": "User Exists"
3 }

```

Figure 4.25: Register route getting error

Conclusion

In this chapter, we have learned about JWT tokens and hashing passwords. Here, we have first created a user model and controller. Next, we have created the register user functionality. Here, while saving the password, we used the `bcrypt` package to hash it.

Next, we created the login functionality. Here, to compare the passed password to the saved password, we had to use `bcrypt` again. Then, we learned about JWT tokens and implemented them in our project.

In the next chapter, we will use JWT to protect routes.

Points to Remember

- We have created the user model with name, email, and password as String. We have also added basic validation in it.
- We have used the library of `bryptjs` to hash the password, before saving it to the database. JWT(JSON Web Token) is used to authenticate web-apps. We are using the library of `jsonwebtoken` in our project.
- We have generated a JWT token using the method of `jwt.sign()` in which we can also give the days after which this token will expire.

CHAPTER 5

Auth Middleware and Protecting Routes

Introduction

This chapter talks about Auth middleware and Protecting routes. Here, we will first create an Auth middleware using the JWT created in the last chapter. After that, we will protect some of the routes using this Auth middleware, which require the JWT token to be verified.

Structure

In this chapter, we are going to discuss the following topics:

- Creating Auth middleware
- Understanding Protect Routes
- Protecting Task Routes

Creating Auth middleware

We will create a file **authMiddleware.js** in the middleware folder and add the following content in **authMiddleware.js** file:

```
const jwt = require('jsonwebtoken')
const asyncHandler = require('express-async-handler')
const User = require('../models/userModel')

const protect = asyncHandler(async (req, res, next) => {
  let token;

  if (req.headers.authorization &&
    req.headers.authorization.startsWith(<Bearer>)) {
    try {
      token = req.headers.authorization.split(' ')[1]
```

```

const decoded = jwt.verify(token, process.env.JWT_SECRET)
req.user = await User.findById(decoded.id).select('-password')
next()
} catch (error) {
  console.log(error)
  res.status(401)
  throw new Error('You are not authorized')
}
}
}

module.exports = { protect }

```

Here, we are importing the required imports of `jwt`, `asyncHandler`, and `user` model. After that, we wrote a function called `protect`. Inside the function, we are checking if the authorization header is present with an `if` statement.

Inside the `if` statement, we have a `try..catch` block. In the `try`, we are first splitting the token with the `split` command because it will be like “Bearer XXXXYYYYMM”. Next, we are using the `verify` method from `jwt` and passing the token and Secret. After that, we are getting the user details back with `findById()`. Notice that we are omitting the password here. After that, the required `next()` of the middleware is there.

In the `catch` part, we are returning a 401 and also throwing an error `You are not authorized`.

```
File Edit Selection View Go Run Terminal Help authMiddleware.js - backend - Visual Studio Code
EXPLORER JS server.js JS UserController.js JS authMiddleware.js
BACKEND
> connect
controllers
JS taskController.js JS UserController.js
middleware
JS authMiddleware.js JS errorMiddleware.js
models
JS taskModel.js JS userModel.js
> node_modules
routes
JS taskRoutes.js JS userRoutes.js
env
.gitignore
package-lock.json
package.json
JS server.js
authMiddleware.js
middleware > JS authMiddleware.js > @@ protect > @ asyncHandler() callback
1 const jwt = require('jsonwebtoken')
2 const asyncHandler = require('express-async-handler')
3 const User = require('../models/userModel')
4
5 const protect = asyncHandler(async (req, res, next) => {
6   let token;
7
8   if (req.headers.authorization && req.headers.authorization.startsWith('Bearer')) {
9     try {
10       token = req.headers.authorization.split(' ')[1]
11       const decoded = jwt.verify(token, process.env.JWT_SECRET)
12       req.user = await User.findById(decoded.id).select('-password')
13       next()
14     } catch (error) {
15       console.log(error)
16       res.status(401)
17       throw new Error('You are not authorized')
18     }
19   }
20 }
21
22 module.exports = { protect }
```

Figure 5.1: Creating authMiddleware.js file

Next, we will also add the following code in **authMiddleware.js** file:

```
if (!token) {
  res.status(401)
  throw new Error('Not authorized, no token')
}
```

Here, we are checking if the token is not available. Then we are sending a **401** and also an error **Not authorized, no token**.

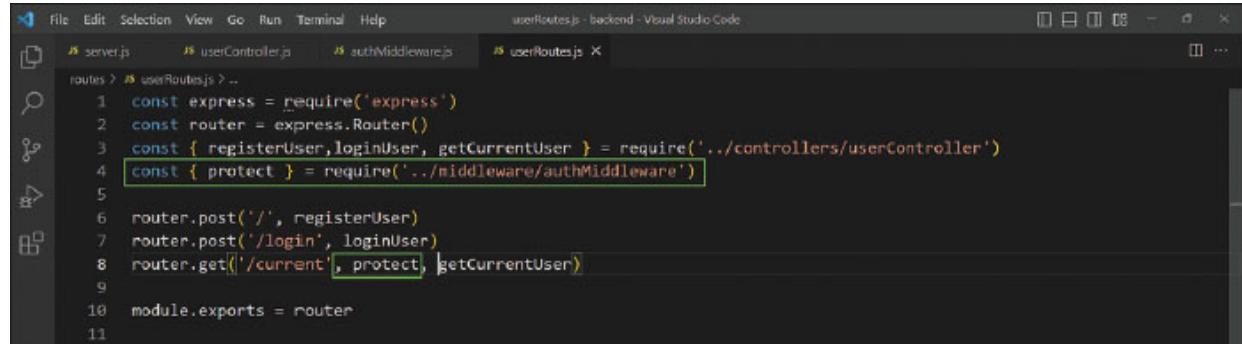
```
File Edit Selection View Go Run Terminal Help authMiddleware.js - backend - Visual Studio Code
EXPLORER JS server.js JS UserController.js JS authMiddleware.js
middleware > JS authMiddleware.js > @@ protect > @ asyncHandler() callback
try {
  token = req.headers.authorization.split(' ')[1]
  const decoded = jwt.verify(token, process.env.JWT_SECRET)
  req.user = await User.findById(decoded.id).select('-password')
  next()
} catch (error) {
  console.log(error)
  res.status(401)
  throw new Error('You are not authorized')
}
if (!token) {
  res.status(401)
  throw new Error('Not authorized, no token')
}
module.exports = { protect }
```

Figure 5.2: Updating authMiddleware.js file

Understanding Protect Routes

To protect a route, we need to add the `protect` function in the route. So, we will go to the `userRoutes.js` file and import the `protect` function. After that, in the get route for `/current`, we will add the `protect` function.

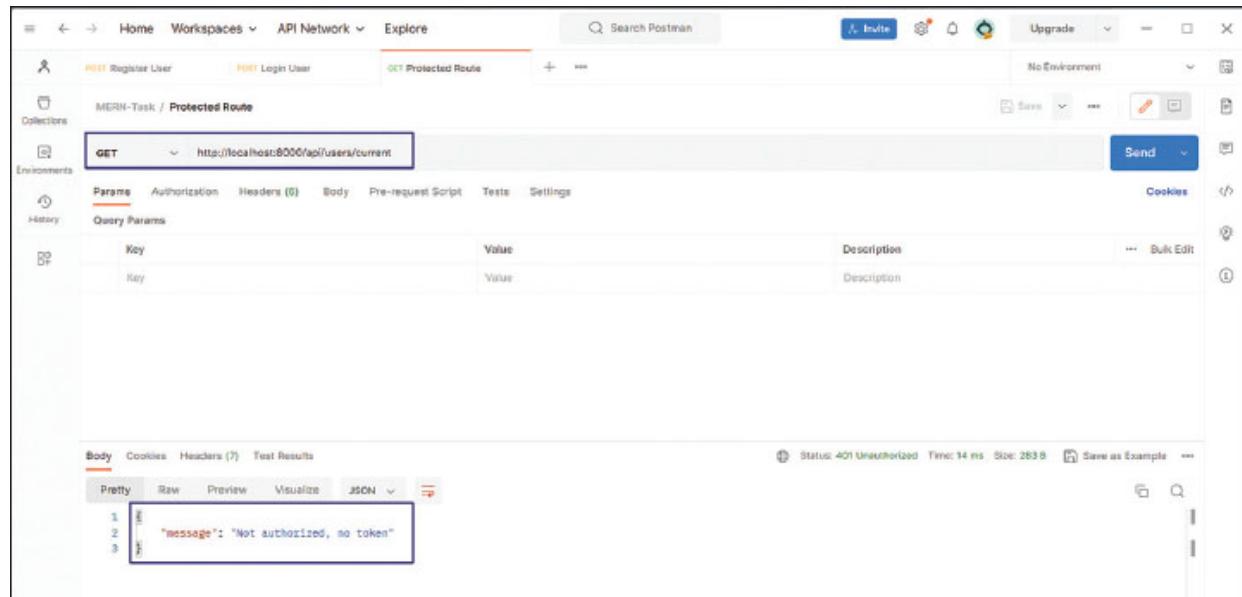
```
const { protect } = require('../middleware/authMiddleware')
```



```
File Edit Selection View Go Run Terminal Help userRoutes.js - backend - Visual Studio Code
routes > userRoutes.js > ...
1 const express = require('express')
2 const router = express.Router()
3 const { registerUser, loginUser, getCurrentUser } = require('../controllers/userController')
4 const { protect } = require('../middleware/authMiddleware')
5
6 router.post('/', registerUser)
7 router.post('/login', loginUser)
8 router.get('/current', protect, getCurrentUser)
9
10 module.exports = router
11
```

Figure 5.3: Adding protect in userRoutes.js

Now, in Postman go to `http://localhost:8000/api/users/current` and we will get the `Not authorized, no token` message. This message is from the `authMiddleware.js` file because we didn't provide a token that was required.



MERN-Task / Protected Route

GET http://localhost:8000/api/users/current

Params Authorization Headers (0) Body Pre-request Script Tests Settings

Key Value Description

Body Cookies Headers (?) Test Results

Pretty Raw Preview Visualize JSON

Status: 401 Unauthorized Time: 14 ms. Size: 263 B. Save as Example

```
1 "message": "Not authorized, no token"
```

Figure 5.4: Current user route with error

Now, in Postman to add a token, we will first go to the **Authorization** tab. Here, in the Type select **Bearer Token**. And after that, in the Token field add the token, which we have got from the Login User POST request in the previous chapter.

After that click the **Send** button and we will get a status 200 with successful message of **Current user data**.

The screenshot shows the Postman interface with a 'Protected Route' selected. In the 'Authorization' tab, the 'Type' is set to 'Bearer Token' and the token value is 'eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJ...'. The response body shows a JSON object with a single key 'message': "Current user data". The status bar at the bottom indicates a 200 OK status.

Figure 5.5: Current user route with token

Now, in the **userController.js** file and inside the **getCurrentUser()** add the following code:

```
const { _id, name, email } = await User.findById(req.user.id)
res.status(200).json({ id: _id, name, email })
```

Here, we are using the **findById()** on the User and then getting back the **id**, **name**, and **email**. We are sending this back as a success.

The screenshot shows the Visual Studio Code editor with the **userController.js** file open. The code editor highlights the line where the **findById()** method is used to retrieve the user's information. The code is as follows:

```
const { _id, name, email } = await User.findById(req.user.id)
res.status(200).json({ id: _id, name, email })
```

Figure 5.6: Updating getCurrentUser

Again, in Postman go to <http://localhost:8000/api/users/current>, and we get the current user data back.

The screenshot shows the Postman interface with a collection named 'MERN-Task / ProtectedRoute'. A GET request is made to <http://localhost:8000/api/users/current>. In the Authorization tab, the type is set to 'Bearer Token' with the value 'Token' and a placeholder token value. The response status is 200 OK, and the JSON body contains the user's ID, name, and email.

| | |
|---|-----------------------------------|
| 1 | "id": "647b070aef09c7ed7cbf5673", |
| 2 | "name": "Abendu", |
| 3 | "email": "abendu@gmail.com" |

Figure 5.7: Getting User data back

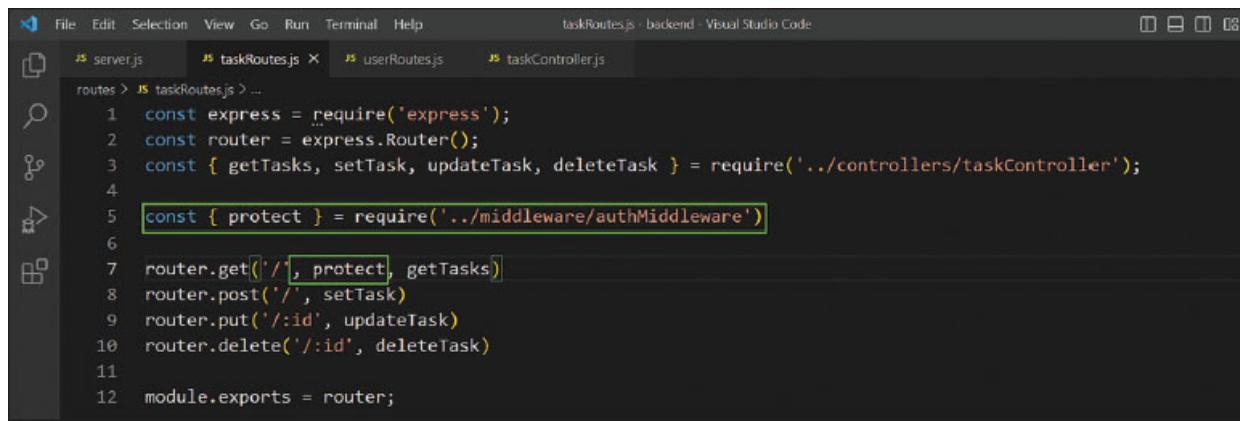
Protecting Task Routes

Now, we will protect all of our task routes that we created earlier. Here, again we will follow the same process as in the earlier section.

GET and POST Route

We will first protect the GET and POST route in Task. First, in the **taskRoutes.js** file, we will protect the **GET** route. Here, again we are importing the **protect** function and adding it to the get route.

```
const { protect } = require('../middleware/authMiddleware')
```

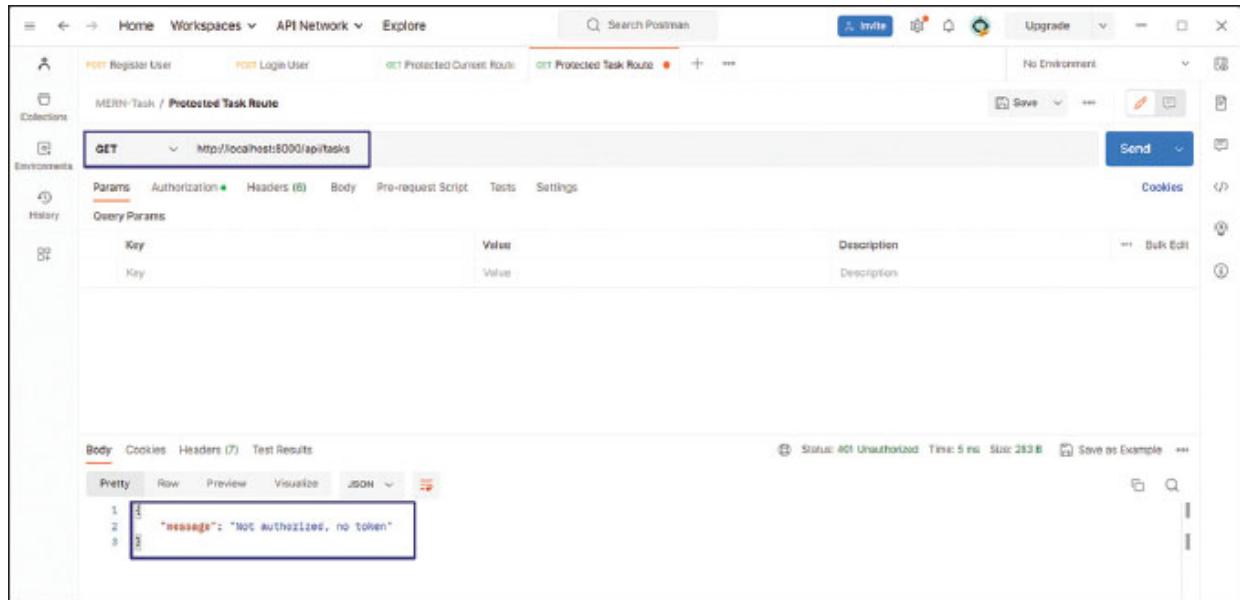


```
File Edit Selection View Go Run Terminal Help
taskRoutes.js - backend - Visual Studio Code
server.js taskRoutes.js userRoutes.js taskController.js

routes > taskRoutes.js > ...
1 const express = require('express');
2 const router = express.Router();
3 const { getTasks, setTask, updateTask, deleteTask } = require('../controllers/taskController');
4
5 const { protect } = require('../middleware/authMiddleware')
6
7 router.get('/', protect, getTasks)
8 router.post('/', setTask)
9 router.put('/:id', updateTask)
10 router.delete('/:id', deleteTask)
11
12 module.exports = router;
```

Figure 5.8: Protecting GET route for task

Now, in Postman we will go to the GET route `http://localhost:8000/api/tasks`, and hit the **Send** button. We will get an error since we have not given any token.



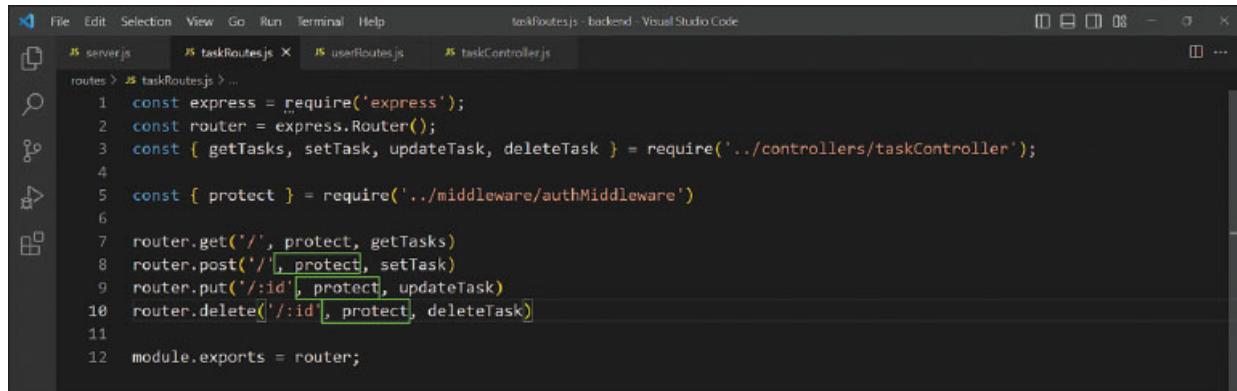
The screenshot shows the Postman interface with a request configuration for a protected task route. The method is set to **GET** and the URL is `http://localhost:8000/api/tasks`. The **Authorization** tab is selected, indicating no token was provided. The response body shows an error message: "message": "Not authorized, no token".

| Key | Value | Description |
|-----|-------|-------------|
| Key | Value | Description |

Body: {"message": "Not authorized, no token"}

Figure 5.9: GET route for task error in Postman

Now, we will also add the **protect** function to all the routes in **taskRoutes.js** file.

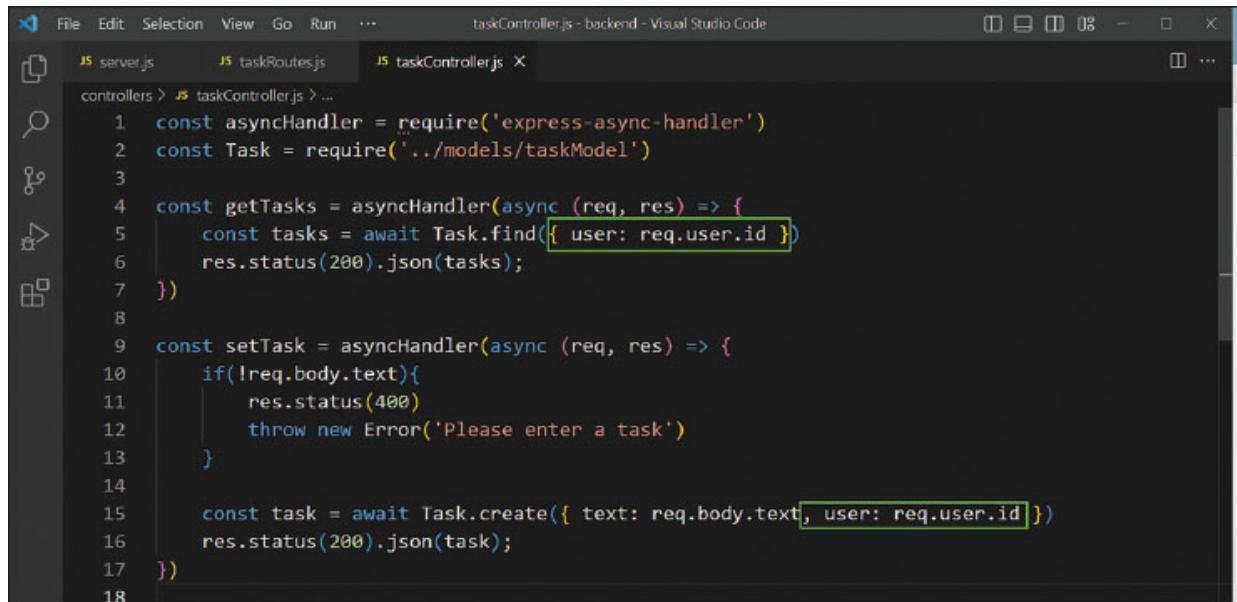


```
File Edit Selection View Go Run Terminal Help taskRoutes.js - backend - Visual Studio Code
server.js taskRoutes.js userRoutes.js taskController.js

routes > taskRoutes.js > ...
1 const express = require('express');
2 const router = express.Router();
3 const { getTasks, setTask, updateTask, deleteTask } = require('../controllers/taskController');
4
5 const { protect } = require('../middleware/authMiddleware')
6
7 router.get('/', protect, getTasks)
8 router.post('/[protect]', setTask)
9 router.put('/:id', protect, updateTask)
10 router.delete('/:id', protect, deleteTask)
11
12 module.exports = router;
```

Figure 5.10: Protecting all Task routes

We will modify the `getTask` and `setTask` functions in `taskController.js` file. Here, we are finding by the user's id and also saving the user's id in through the POST request.



```
File Edit Selection View Go Run ... taskController.js - backend - Visual Studio Code
server.js taskRoutes.js taskController.js

controllers > taskController.js > ...
1 const asyncHandler = require('express-async-handler')
2 const Task = require('../models/taskModel')
3
4 const getTasks = asyncHandler(async (req, res) => {
5   const tasks = await Task.find({ user: req.user.id })
6   res.status(200).json(tasks);
7 })
8
9 const setTask = asyncHandler(async (req, res) => {
10   if(!req.body.text){
11     res.status(400)
12     throw new Error('Please enter a task')
13   }
14
15   const task = await Task.create({ text: req.body.text, user: req.user.id })
16   res.status(200).json(task);
17 })
18
```

Figure 5.11: Updating getTasks function

Back, in Postman we will go to the POST route `http://localhost:8000/api/tasks`, add a task and hit the Send button. We will get an error since we have not given any token.

The screenshot shows the Postman interface with a collection named "MERN-Task / Post Task". A POST request is configured to "http://localhost:8000/api/tasks". The "Body" tab is selected, showing a key-value pair where the key is "text" and the value is "Learn Blockchain". The "Headers" tab contains a "Content-Type" header set to "application/x-www-form-urlencoded". The "Authorization" tab is empty. The "Tests" and "Settings" tabs are also visible. Below the request, the "Test Results" section shows a status of "401 Unauthorized" with a message: "message": "Not authorized, no token".

Figure 5.12: POSTMAN with POST route without token

Now in the **Authorization** tab, we will add a Bearer token and we will be able to successfully add the task.

The screenshot shows the Postman interface with the same collection and request setup as Figure 5.12. However, in the "Authorization" tab, the "Type" dropdown is set to "Bearer Token" and a token value is entered in the "Token" field. The "Test Results" section now shows a successful response with a status of "200 OK" and a JSON payload containing task details like text, user ID, and timestamps.

Figure 5.13: POSTMAN with POST route with token

We have added one more task for the same user. Now, in Postman, go to the GET route `http://localhost:8000/api/tasks`, and add the token of the user in the **Authorization** tab. Now, on clicking the **Send** button, we will get the tasks of this user.

The screenshot shows the Postman interface with the following details:

- URL:** http://localhost:8000/api/tasks
- Method:** GET
- Authorization:** Bearer Token (selected)
- Token:** eyJhbGciOiJIUzI1NiJ9.RScCI8IkpxVCJ9.eyJ...
- Body:** JSON response (Pretty) showing two tasks for a different user:

```

1 [
2   {
3     "_id": "64790c6d389911439d8b460a",
4     "Text": "Learn Blockchain",
5     "user": "6478879af1f59c7ed7cb5671",
6     "createdAt": "2023-06-02T06:29:56.978Z",
7     "updatedAt": "2023-06-02T06:29:56.978Z",
8     "__v": 0
9   },
10  {
11    "_id": "64790c6f389911439d8b466d",
12    "Text": "Learn ChatGPT",
13    "user": "6478879af1f59c7ed7cb5671",
14    "createdAt": "2023-06-02T06:30:55.772Z",
15    "updatedAt": "2023-06-02T06:30:55.772Z",
16    "__v": 0
17  }
18 ]

```

Figure 5.14: POSTMAN with GET route with token

We have added two more tasks for a different user through the **POST** route. Now in the **GET**, when we use this user's token, we will get back this user's tasks.

The screenshot shows the Postman interface with the following details:

- URL:** http://localhost:8000/api/tasks
- Method:** GET
- Authorization:** Bearer Token (selected)
- Token:** eyJhbGciOiJIUzI1NiJ9.RScCI8IkpxVCJ9.eyJ...
- Body:** JSON response (Pretty) showing two tasks for a different user:

```

1 [
2   {
3     "_id": "64790d5e389911439d8b4615",
4     "Text": "Learn IELTS",
5     "user": "647880c63fdaaca6dd4a66915",
6     "createdAt": "2023-06-02T06:33:30.543Z",
7     "updatedAt": "2023-06-02T06:33:30.543Z",
8     "__v": 0
9   },
10  {
11    "_id": "64790d5e389911439d8b4615",
12    "Text": "Learn US English",
13    "user": "647880c63fdaaca6dd4a66915",
14    "createdAt": "2023-06-02T06:34:02.629Z",
15    "updatedAt": "2023-06-02T06:34:02.629Z",
16    "__v": 0
17  }
18 ]

```

Figure 5.15: Added more tasks for Users

PUT and DELETE Route

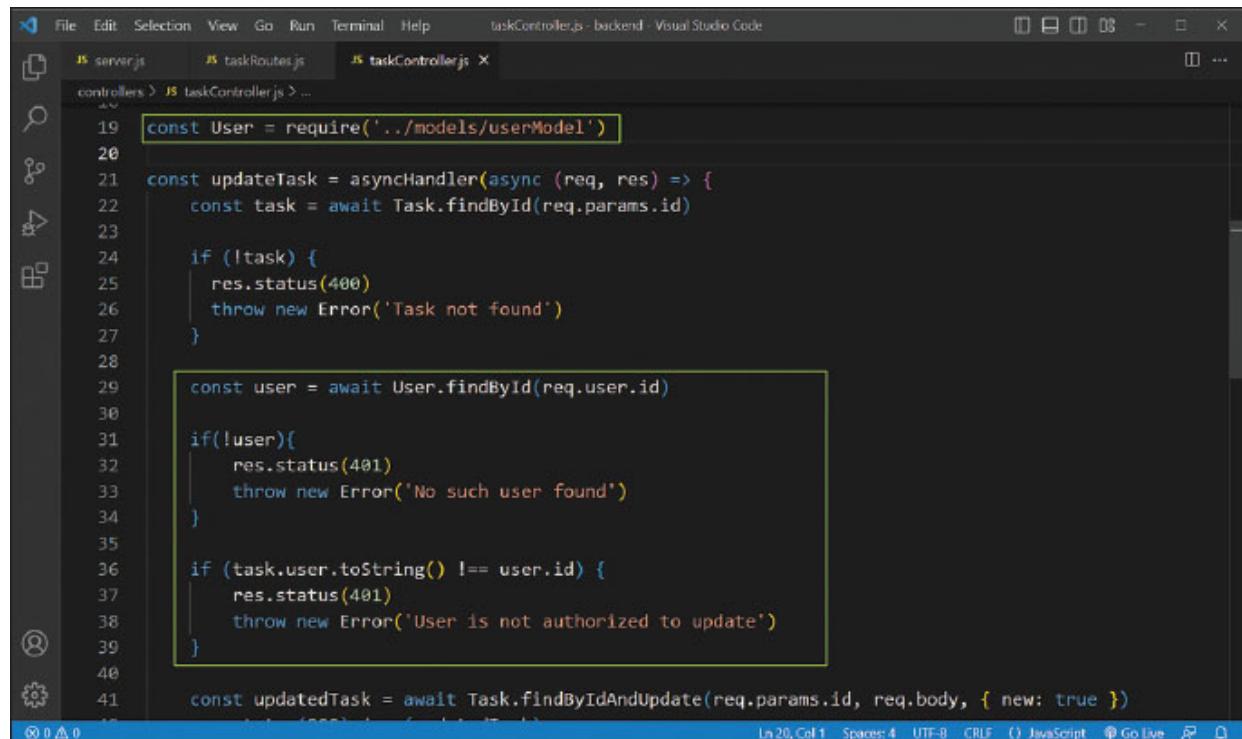
First, we are going to update the PUT route. This is done in the `updateTask` function in the `taskController.js` file. Here, we are first finding the user with `findById()` method, by passing the user id.

Next, if we do not find any user, we are throwing an error. We are also throwing an error if a wrong token is used to update the task.

```
const user = await User.findById(req.user.id)

if(!user) {
  res.status(401)
  throw new Error('No such user found')
}

if (task.user.toString() !== user.id) {
  res.status(401)
  throw new Error('User is not authorized to update')
}
```



The screenshot shows the Visual Studio Code interface with the `taskController.js` file open. The code is as follows:

```
const User = require('../models/userModel')

const updateTask = asyncHandler(async (req, res) => {
  const task = await Task.findById(req.params.id)

  if (!task) {
    res.status(400)
    throw new Error('Task not found')
  }

  const user = await User.findById(req.user.id)

  if(!user){
    res.status(401)
    throw new Error('No such user found')
  }

  if (task.user.toString() !== user.id) {
    res.status(401)
    throw new Error('User is not authorized to update')
  }

  const updatedTask = await Task.findByIdAndUpdate(req.params.id, req.body, { new: true })
  res.status(200).json(updatedTask)
})

module.exports = updateTask
```

A green rectangular box highlights the code from line 29 to line 38, which checks if the user is authorized to update the task. The status code and error message for unauthorized users are also highlighted.

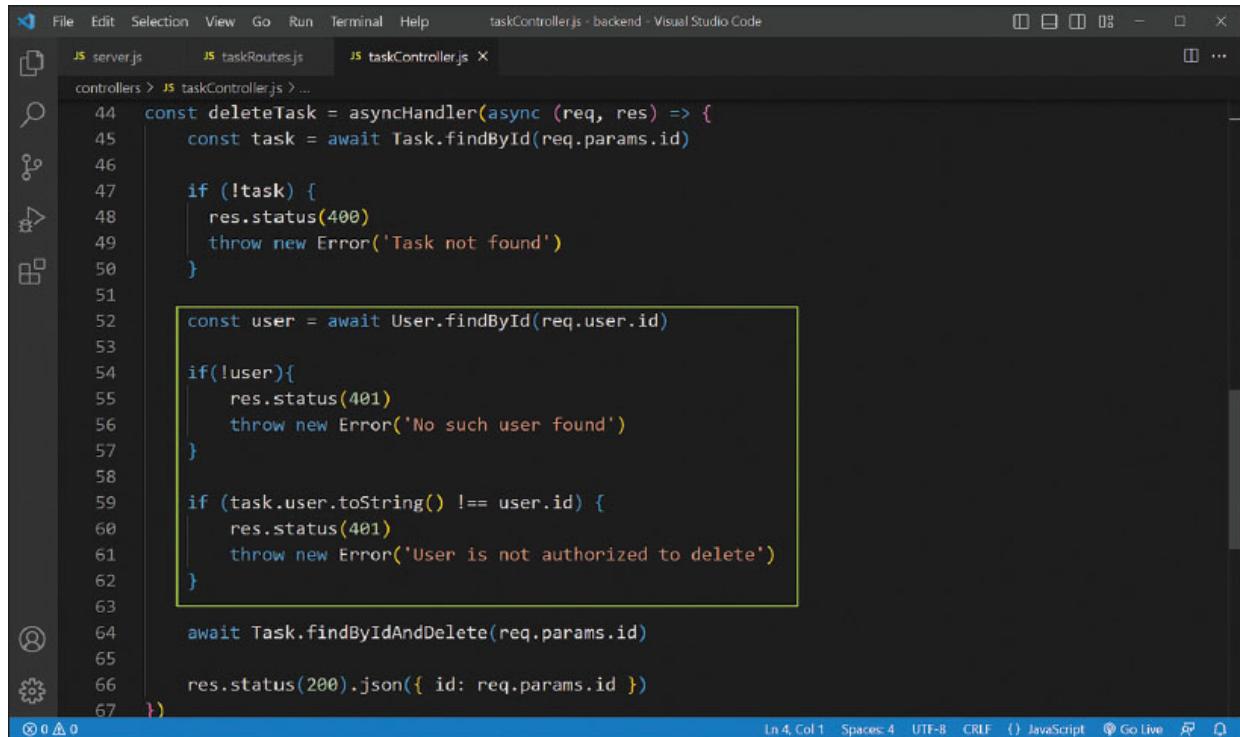
Figure 5.16: Updating updateTask function

Now we are going to update the DELETE route. This is done in the **deleteTask** function in the **taskController.js** file. Here, we are again using the same logic as the **updateTask** function.

```
const user = await User.findById(req.user.id)

if(!user) {
  res.status(401)
  throw new Error('No such user found')
}

if (task.user.toString() !== user.id) {
  res.status(401)
  throw new Error('User is not authorized to update')
}
```



The screenshot shows the Visual Studio Code interface with the file `taskController.js` open. The code editor displays several files in the sidebar: `server.js`, `taskRoutes.js`, and `taskController.js`. The `taskController.js` file contains the following code:

```
const deleteTask = asyncHandler(async (req, res) => {
  const task = await Task.findById(req.params.id)

  if (!task) {
    res.status(400)
    throw new Error('Task not found')
  }

  const user = await User.findById(req.user.id)

  if(!user){
    res.status(401)
    throw new Error('No such user found')
  }

  if (task.user.toString() !== user.id) {
    res.status(401)
    throw new Error('User is not authorized to delete')
  }

  await Task.findByIdAndUpdateAndDelete(req.params.id)

  res.status(200).json({ id: req.params.id })
})
```

A yellow rectangular box highlights the code from line 54 to line 67, which corresponds to the logic for updating the `deleteTask` function.

Figure 5.17: Updating deleteTask function

Now, in Postman, we will put a DELETE request with a url like `http://localhost:8000/api/tasks/64798d42389011439d8b4613`. Here, take any task id of a user. Now, when we hit the **Send** button, we will get an error, since we have not provided any token.

The screenshot shows the Postman interface with a DELETE request to `http://localhost:8000/api/tasks/64798d42389011439d8b4613`. The Authorization tab is selected, showing 'Type: Bearer Token'. The response status is 401 Unauthorized, and the message is "User is not authorized to delete".

Figure 5.18: POSTMAN with DELETE route without token

Now, we will add a token in the Authorization tab. But this token will be of a different user. Now, when we hit **Send**, we will get the **User is not authorized to delete** error.

The screenshot shows the Postman interface with a DELETE request to `http://localhost:8000/api/tasks/64798d42389011439d8b4613`. The Authorization tab is selected, showing 'Type: Bearer Token' with a placeholder token. The response status is 401 Unauthorized, and the message is "User is not authorized to delete".

Figure 5.19: POSTMAN with DELETE route with wrong token

We will give the correct token of the user, who has this task. Now, we are able to delete the task and get the correct message back with **status 200**.

The screenshot shows the Postman interface with a collection named "MERN-Task / Delete Task". A DELETE request is made to `http://localhost:8000/api/tasks/64798d42389011439d8b4613`. The "Authorization" tab is selected, showing "Bearer Token" as the type. The token value is `eyJhbGciOiJIUzI1NiJ9.R5cChkpkXVCJ9.eyJpZC18YDNg4YmM2MzVmNGFjTY0NGE2NjAxMjB1mlnC08MTY4NTY4NzU4OCwzKhwlfcxNjgzMTE5NTg4IQ.oCLWcd62DMYt8soR8fI4z2rauceRFjc8kuw0SU1bsQI`. The response status is 200 OK, time 143 ms, size 268 B. The JSON response body is:

```

1 {
2   "_id": "64798d42389011439d8b4613",
3   "text": "Learn US English",
4   "user": "647880c635148ce644866e15",
5   "createdAt": "2023-06-02T06:34:02.609Z",
6   "updatedAt": "2023-06-02T06:34:02.609Z",
7   "__v": 0
8 }
9
10

```

Figure 5.20: POSTMAN with DELETE route with right token

Also, we are confirming the same by going to `http://localhost:8000/api/tasks` and giving this user's token. Here, we can see only one task, with the other being deleted.

The screenshot shows the Postman interface with a collection named "MERN-Task / Protected Tasks Route". A GET request is made to `http://localhost:8000/api/tasks`. The "Authorization" tab is selected, showing "Bearer Token" as the type. The token value is the same as in Figure 5.20. The response status is 200 OK, time 58 ms, size 416 B. The JSON response body is:

```

1 {
2   "_id": "64798d42389011439d8b4616",
3   "text": "Learn US English",
4   "user": "647880c635148ce644866e15",
5   "createdAt": "2023-06-02T06:34:02.609Z",
6   "updatedAt": "2023-06-02T06:34:02.609Z",
7   "__v": 0
8 }
9
10

```

Figure 5.21: POSTMAN with GET route with right token

Now, in Postman we will do a PUT request with a url like `http://localhost:8000/api/tasks/64798d5a389011439d8b4616`. Here, take any

task id of a user. Now, when we hit the **Send** button, we will get an error, since we have not provided any token.

The screenshot shows the Postman interface with a PUT request to `http://localhost:3000/api/tasks/64798d5a389011439d8b4616`. The 'Body' tab is selected, containing a single key-value pair: `text: Learn United States English`. The 'Headers' tab shows the 'Content-Type' header set to 'application/json'. The 'Authorization' tab is not selected. The 'Test Results' tab shows a response status of 401 Unauthorized with the message: `"message": "Not authorized, no token"`.

Figure 5.22: POSTMAN with PUT route with wrong token

This time we will give the correct token for the user and the task will be updated.

The screenshot shows the Postman interface with a PUT request to the same URL. The 'Authorization' tab is selected, showing 'Type: Bearer Token' and a token value: `eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJ...`. The 'Body' tab is selected, containing the same key-value pair as before. The 'Test Results' tab shows a response status of 200 OK with a JSON payload containing task details like ID, text, user, creation date, update date, and version.

Figure 5.23: POSTMAN with PUT route with right token

Also, we are confirming the same by going to `http://localhost:8000/api/tasks` and giving this user's token. Here, we can see that the task has been updated.

The screenshot shows the Postman interface with the following details:

- Request Method:** GET
- URL:** `http://localhost:8000/api/tasks`
- Authorization:** Bearer Token
- Body:** JSON response showing a task document:

```
_id": "64798d5a380011a19d8b4616",
"text": "Learn United States English",
"user": "64788dc5514c6e44a80815",
"createdAt": "2023-06-02T06:54:14.855Z",
"updatedAt": "2023-06-02T06:54:14.855Z",
"_v": 0
```
- Status:** 200 OK
- Time:** 86 ms
- Size:** 429 B

Figure 5.24: POSTMAN with GET route with right token

Conclusion

In this chapter, we have learned about creating Auth middleware. Here, we used the JWT token created in the previous chapter to do authentication. Next, we learned to protect routes using this Auth middleware.

Here, we first protected the current route. After that, we protected all Task routes, which include **GET**, **POST**, **PUT**, and **DELETE** routes.

In the next chapter, we will start with the frontend with ReactJS. We are also going to do React Router setup and create **Register** and **Login** pages.

Points to remember

- We have created auth middleware using json web token. Here, we have verified it using the passed token and the JWT secret.
- We have protected various routes using the auth middleware. Now, routes can be accessed only after providing a valid token.

- We generated the token in Postman and used the token through Postman in protected routes.

Multiple Choice Questions

1. Authorization tokens start with the Keyword.
 - a. Header
 - b. Creator
 - c. Bearer
 - d. Berer
2. To protect routes we add _____ to it.
 - a. Middle Layer
 - b. Middleware
 - c. Tailware
 - d. Headware
3. In Postman, we add Token in which tab?
 - a. Params
 - b. Headers
 - c. Authorization
 - d. Test
4. In PUT route, we add both _____ and _____ in Postman.
 - a. body, params
 - b. headers, tests
 - c. params, Authorization
 - d. body, tests
5. In DELETE route, we add only _____ in Postman.
 - a. body
 - b. headers
 - c. params

d. tests

Answers

1. c

2. b

3. c

4. a

5. c

CHAPTER 6

Creating Frontend and React Router

Introduction

This chapter talks about the creation of frontend using ReactJS. We will also cover the setup for React Router version 6 in the project, which is used for navigation in React. We will also create the Header, Register, and Login components in the frontend.

Structure

In this chapter, we are going to discuss the following topics:

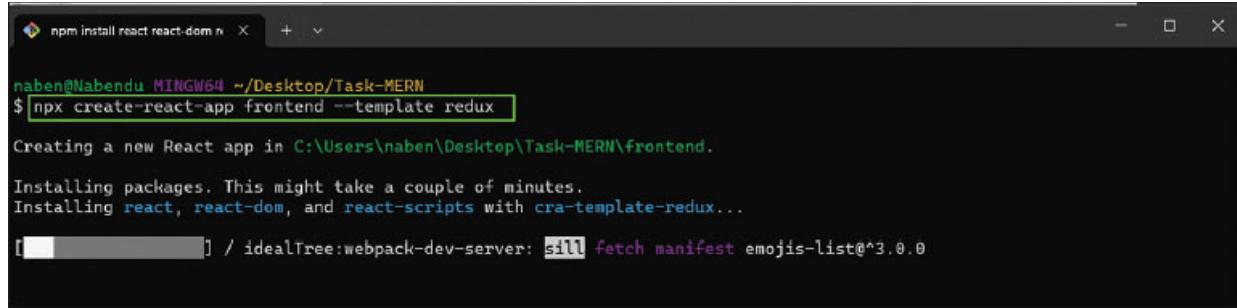
- Creating Frontend with ReactJS
- Basic Project setup
- React Router setup
- Creating Components and Pages

Creating Frontend with ReactJS

The browser that shows the HTML, CSS, and JavaScript site doesn't understand ReactJS. So, we installed React with the famous `create-react-app` from Facebook. Here, we are also adding the template to add the basic structure of Redux in our application.

Note that we have to run the following command inside the app:

```
npx create-react-app frontend --template redux
```



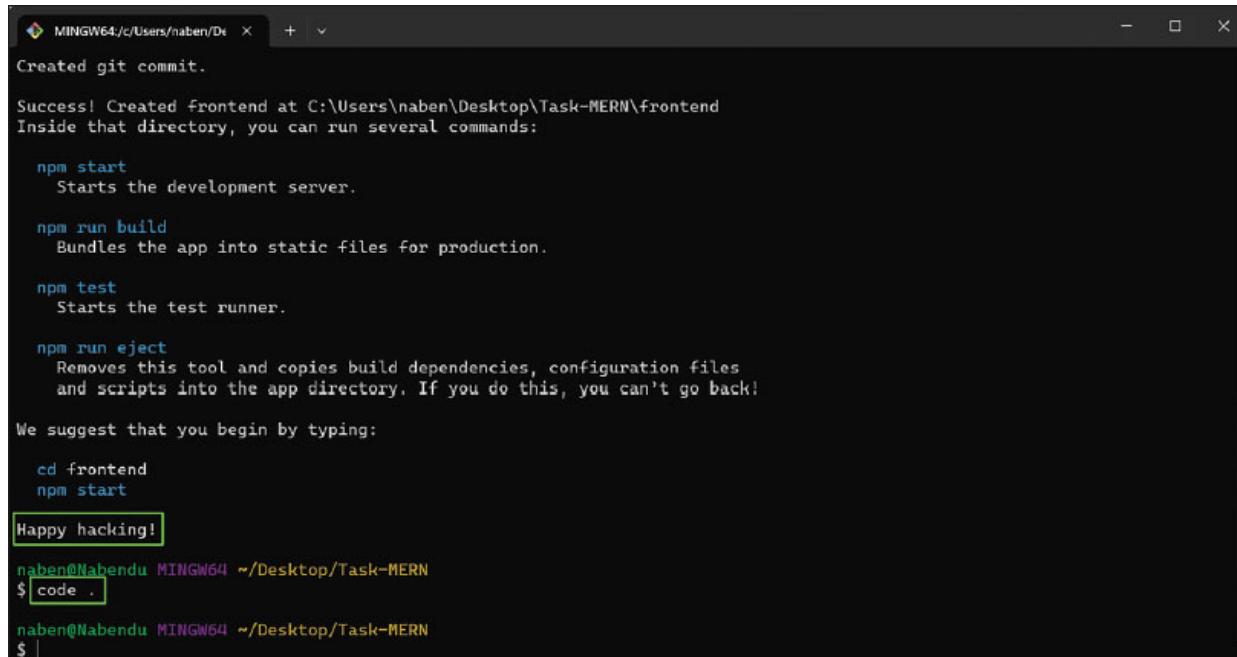
```
naben@Nabendu MINGW64 ~/Desktop/Task-MERN
$ npx create-react-app frontend --template redux

Creating a new React app in C:\Users\naben\Desktop\Task-MERN\frontend.

Installing packages. This might take a couple of minutes.
Installing react, react-dom, and react-scripts with cra-template-redux...
[██████████] / idealTree:webpack-dev-server: sill fetch manifest emojis-list@^3.0.0
```

Figure 6.1: Creating React app

If everything is perfect, we will get the message, **Happy hacking!**. After that, we also opened the whole app in VS Code by giving the command **code**.



```
Created git commit.

Success! Created Frontend at C:\Users\naben\Desktop\Task-MERN\frontend
Inside that directory, you can run several commands:

  npm start
    Starts the development server.

  npm run build
    Bundles the app into static files for production.

  npm test
    Starts the test runner.

  npm run eject
    Removes this tool and copies build dependencies, configuration files
    and scripts into the app directory. If you do this, you can't go back!

We suggest that you begin by typing:

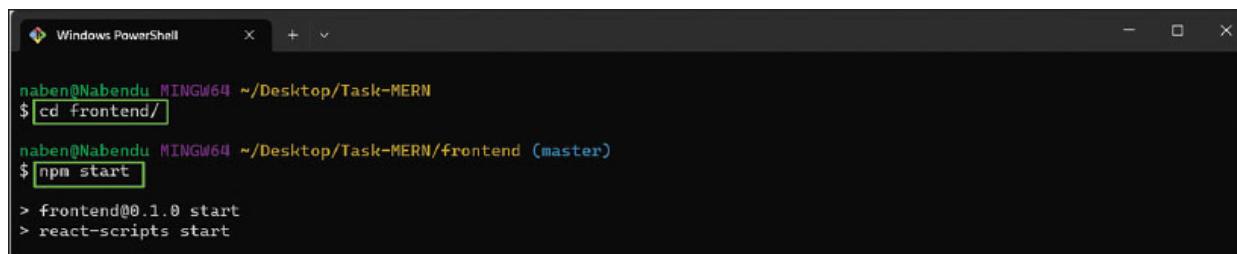
  cd frontend
  npm start

[Happy hacking!]

naben@Nabendu MINGW64 ~/Desktop/Task-MERN
$ code .
```

Figure 6.2: Successful React app

Now, as per the instructions, we will change to the new folder of frontend with the **cd** command. Also, run **npm start** to start our frontend app.



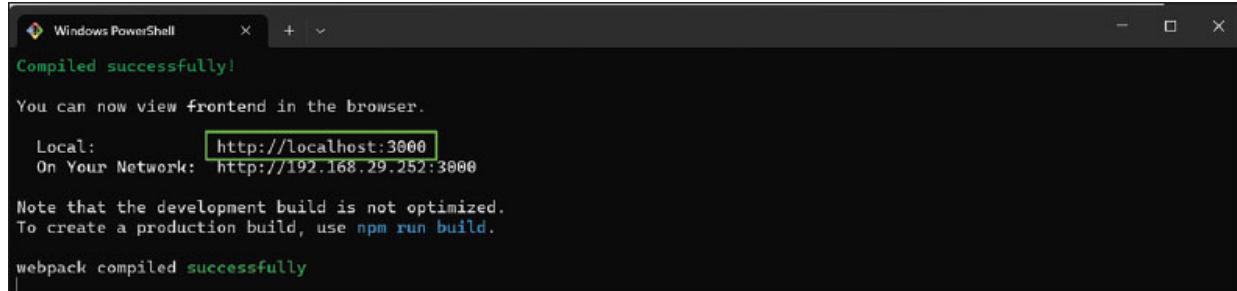
```
naben@Nabendu MINGW64 ~/Desktop/Task-MERN
$ cd frontend/

naben@Nabendu MINGW64 ~/Desktop/Task-MERN/frontend (master)
$ npm start

> frontend@0.1.0 start
> react-scripts start
```

Figure 6.3: Starting React app

After some statements, we will get a message of frontend been started on `http://localhost:3000/`.



```
Windows PowerShell

Compiled successfully!

You can now view frontend in the browser.

Local: http://localhost:3000
On Your Network: http://192.168.29.252:3000

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

webpack compiled successfully
```

Figure 6.4: React App started

Open any browser and go to `http://localhost:3000/` url and we will see the default content for a React app with Redux template.

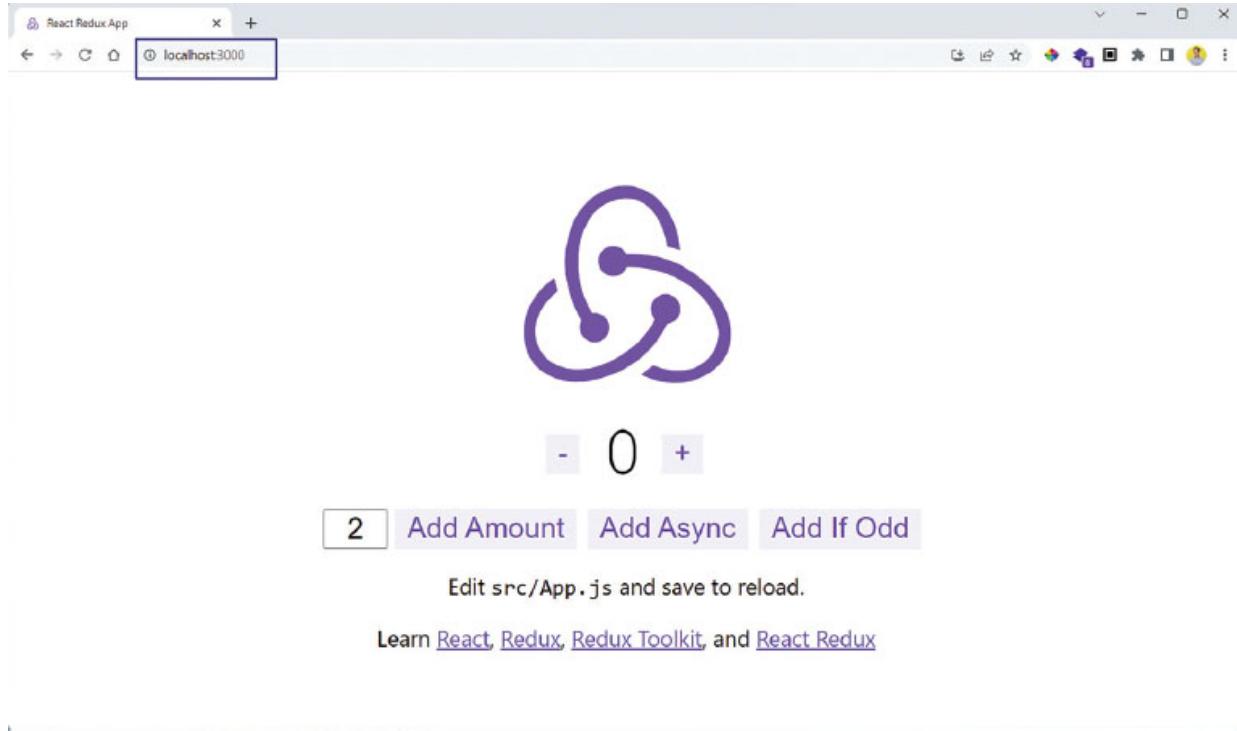


Figure 6.5: React Redux app on browser

Basic Project Setup

First, we will remove this basic boilerplate code to start with our project setup. So, in VS Code delete the following files in the screenshot.

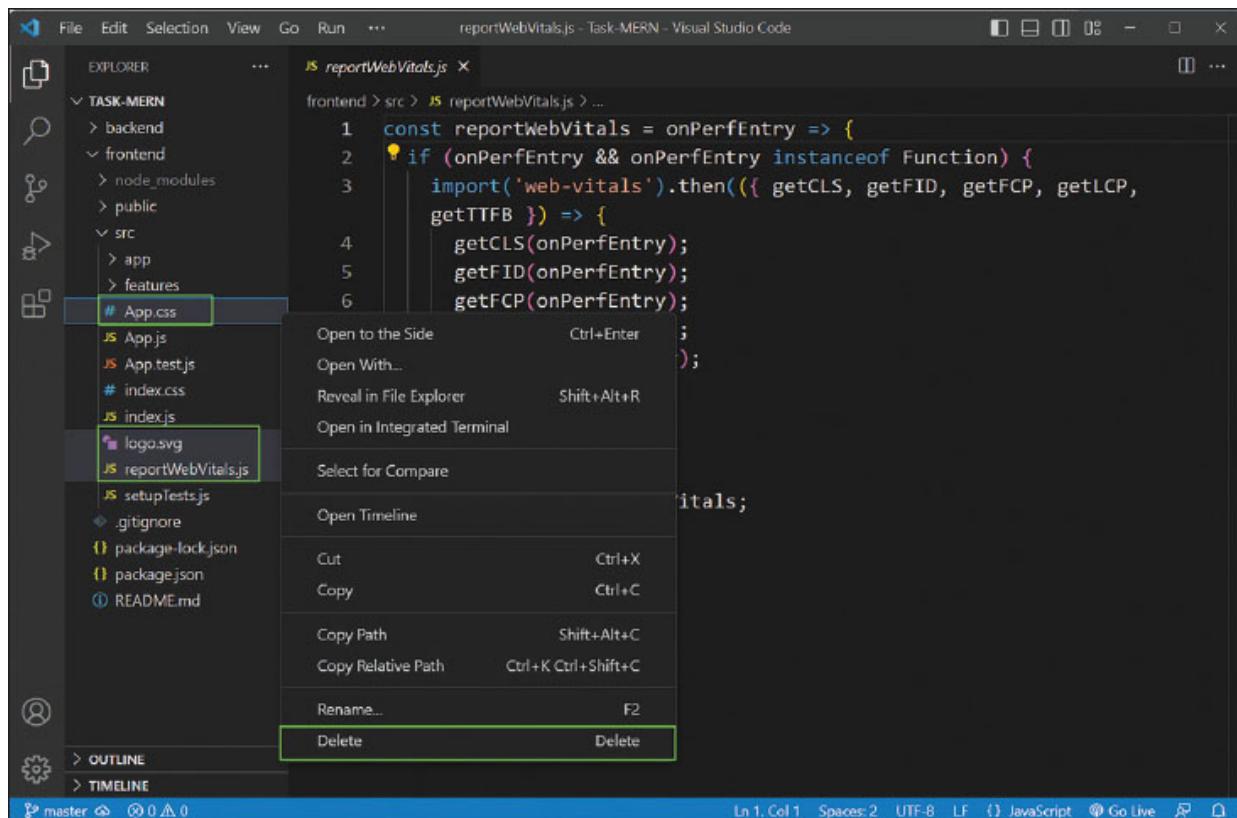


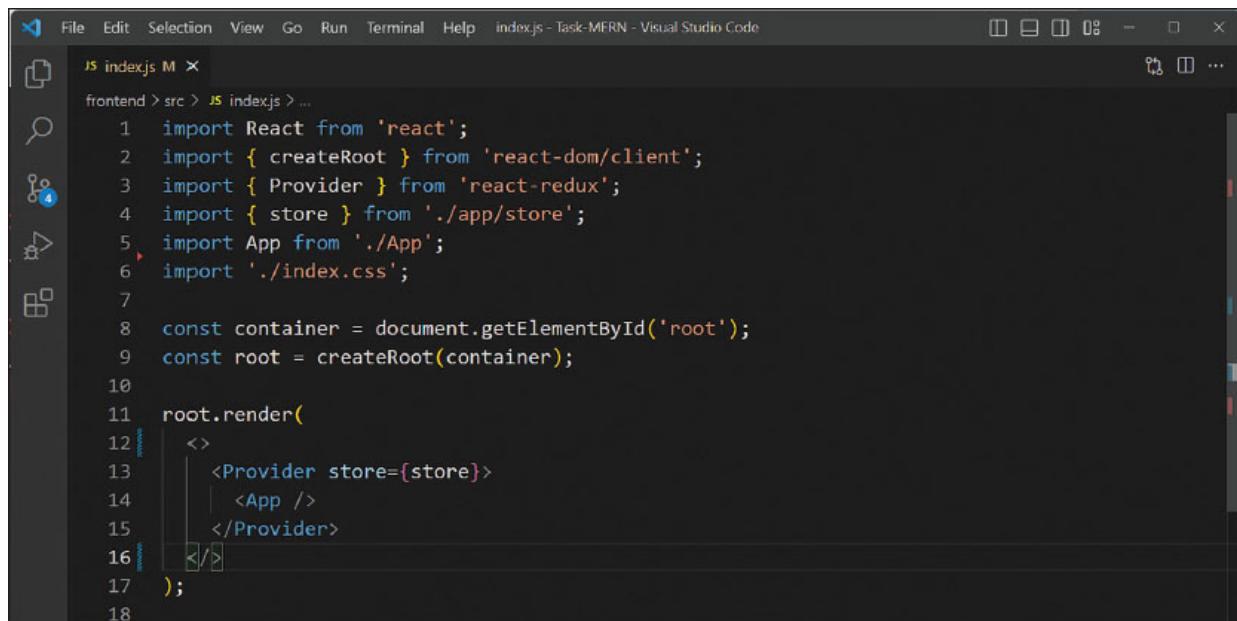
Figure 6.6: Removing boilerplate files

Next, we will remove some code referring to the preceding deleted items and update our **index.js** file as follows:

```

import React from 'react';
import { createRoot } from 'react-dom/client';
import { Provider } from 'react-redux';
import { store } from './app/store';
import App from './App';
import './index.css';

const container = document.getElementById('root');
const root = createRoot(container);
root.render(
  <>
    <Provider store={store}>
      <App />
    </Provider>
  </>
);
  
```



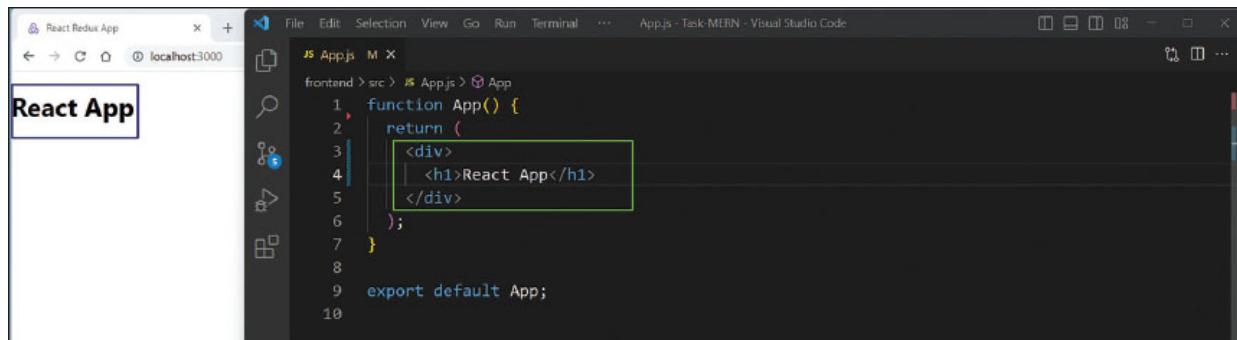
```
index.js M ...
frontend > src > index.js > ...
1 import React from 'react';
2 import { createRoot } from 'react-dom/client';
3 import { Provider } from 'react-redux';
4 import { store } from './app/store';
5 import App from './App';
6 import './index.css';
7
8 const container = document.getElementById('root');
9 const root = createRoot(container);
10
11 root.render(
12   <>
13     <Provider store={store}>
14       <App />
15     </Provider>
16   </>
17 );
18
```

Figure 6.7: Basic index.js file

We will also delete all code from the **App.js** file and only keep the following code. It will update our app running in the browser on <http://localhost:3000/> as shown in the screenshot.

```
function App() {
  return (
    <div>
      <h1>React App</h1>
    </div>
  );
}

export default App;
```



```
App.js M ...
frontend > src > App.js > App
1 function App() {
2   return (
3     <div>
4       <h1>React App</h1>
5     </div>
6   );
7
8   export default App;
9
```

Figure 6.8: Basic App.js file

We will also remove the earlier content from the **store.js** file inside the **app** folder and add the following content. This is the basic code for **store** of reducer in our app.

```
import { configureStore } from '@reduxjs/toolkit';

export const store = configureStore({
  reducer: {
    },
  });
}
```

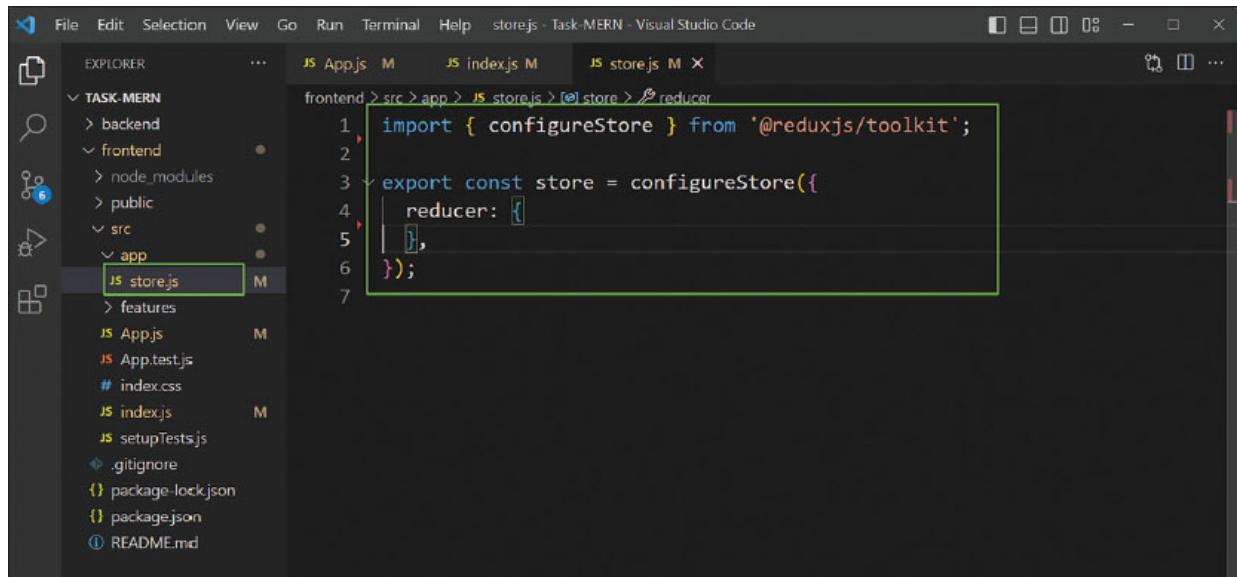


Figure 6.9: Basic store.js file

Also, delete the whole content of the **index.css** file and add the following content to it. This will contain all of our styles for the project.

```
@import url('https://fonts.googleapis.com/css2?
family=Karla:wght@300;400;600;700&display=swap');

* {
  margin: 0;
  padding: 0;
  box-sizing: border-box;
}

body {
  font-family: 'Karla', sans-serif;
  height: 100vh;
}
```

```
a {
  text-decoration: none;
  color: #....;
}

p {
  line-height: 1.1;
}

ul {
  list-style: none;
}

li {
  line-height: 1.1;
}

h1,
h2,
h3 {
  font-weight: 100;
  margin-bottom: 10px;
}

.container {
  width: 100%;
  max-width: 960px;
  margin: auto;
  padding: 10px;
  text-align: center;
}

.header {
  display: flex;
  justify-content: space-between;
  align-items: center;
  padding: 10px 0;
  border-bottom: 1px solid #e1e1e1;
  margin-bottom: 10px;
}

.header ul {
```

```
display: flex;
align-items: center;
justify-content: space-between;
}

.header ul li {
margin-left: 1px;
}

.header ul li a {
display: flex;
align-items: center;
}

.header ul li a:hover {
color: #fff;
}

.header ul li a svg {
margin-right: 0px;
}

.heading {
font-size: 1rem;
font-weight: 100;
margin-bottom: 0px;
padding: 10px;
}

.heading p {
color: #888888;
}

.goals {
display: grid;
grid-template-columns: repeat(1, 1fr);
gap: 1px;
}

.goal {
background-color: #f1f1f1;
margin: 1px 0;
padding: 10px 10px;
}
```

```
    position: relative;
}

.goal .close {
    position: absolute;
    top: 1px;
    right: 10px;
    cursor: pointer;
    border: none;
    background: none;
}

.form,
.content {
    width: 100%;
    margin: auto;
}

.form-group {
    margin-bottom: 10px;
}

.form-group input,
.form-group textarea,
.form-group select {
    width: 100%;
    padding: 10px;
    border: 1px solid #e1e1e1;
    border-radius: 10px;
    margin-bottom: 10px;
    font-family: inherit;
}

.form-group label {
    text-align: left;
    display: block;
    margin: 0 0 10px 0;
}

.btn {
    padding: 10px 20px;
    border: 1px solid #ccc;
```

```
border-radius: 0px;
background: #fff;
color: #fff;
font-size: 11px;
font-weight: 400;
cursor: pointer;
text-align: center;
appearance: button;
display: flex;
align-items: center;
justify-content: center;
}

.btn svg {
margin-right: 4px;
}

.btn-reverse {
background: #fff;
color: #fff;
}

.btn-block {
width: 100%;
margin-bottom: 4px;
}

.btn:hover {
transform: scale(1.05);
}

.loadingSpinnerContainer {
position: fixed;
top: 0;
right: 0;
bottom: 0;
left: 0;
background-color: rgba(0, 0, 0, 0.5);
z-index: 1000;
display: flex;
justify-content: center;
```

```
    align-items: center;
}

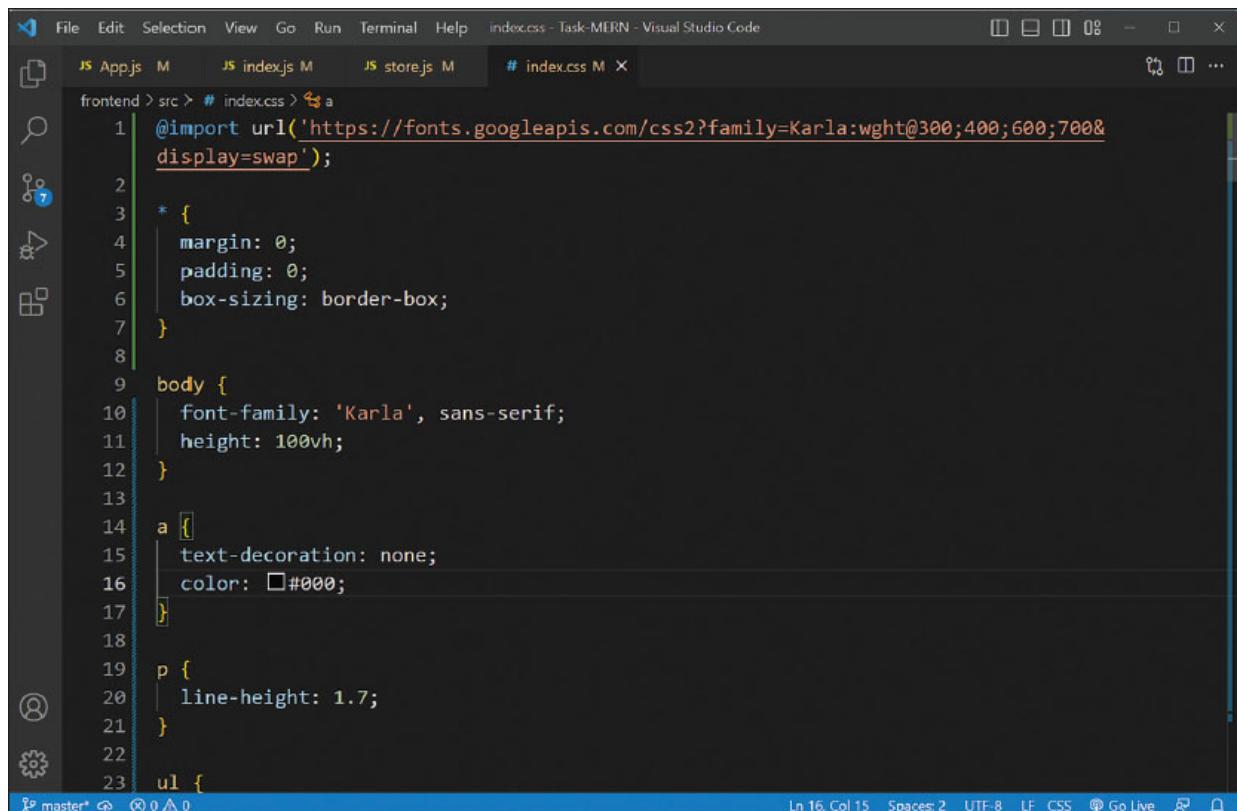
.loadingSpinner {
  width: 14px;
  height: 14px;
  border: 1px solid;
  border-color: #ccc transparent #000 transparent;
  border-radius: 50%;
  animation: spin 1.2s linear infinite;
}

@keyframes spin {
  0% {
    transform: rotate(0deg);
  }
  100% {
    transform: rotate(360deg);
  }
}

@media (max-width: 600px) {
  .form {
    width: 90%;
  }

  .heading h1 {
    font-size: 1rem;
  }

  .heading p {
    font-size: 1.0rem;
  }
}
```



The screenshot shows the Visual Studio Code interface with the following details:

- File Explorer:** On the left, it shows a tree view of the project structure: `frontend > src > # index.css > a`. There are 7 pending changes indicated by a blue circle with a '7'.
- Editor:** The main area displays the `index.css` file content. The code includes a font import rule, global styles for the root element, and specific styles for `a`, `p`, and `ul` elements.
- Terminal:** At the bottom, the terminal shows the command `npm start` and the output "Starting development server".
- Status Bar:** The status bar at the bottom right shows the current file path as `index.css`, line 16, column 15, and other details like spaces, tabs, encoding, and Go Live.

```
@import url('https://fonts.googleapis.com/css2?family=Karla:wght@300;400;600;700&display=swap');

* {
  margin: 0;
  padding: 0;
  box-sizing: border-box;
}

body {
  font-family: 'Karla', sans-serif;
  height: 100vh;
}

a {
  text-decoration: none;
  color: #000;
}

p {
  line-height: 1.7;
}

ul {
```

Figure 6.10: Styles in index.css file

We will also delete the counter folder, which contains most of our default Redux code.

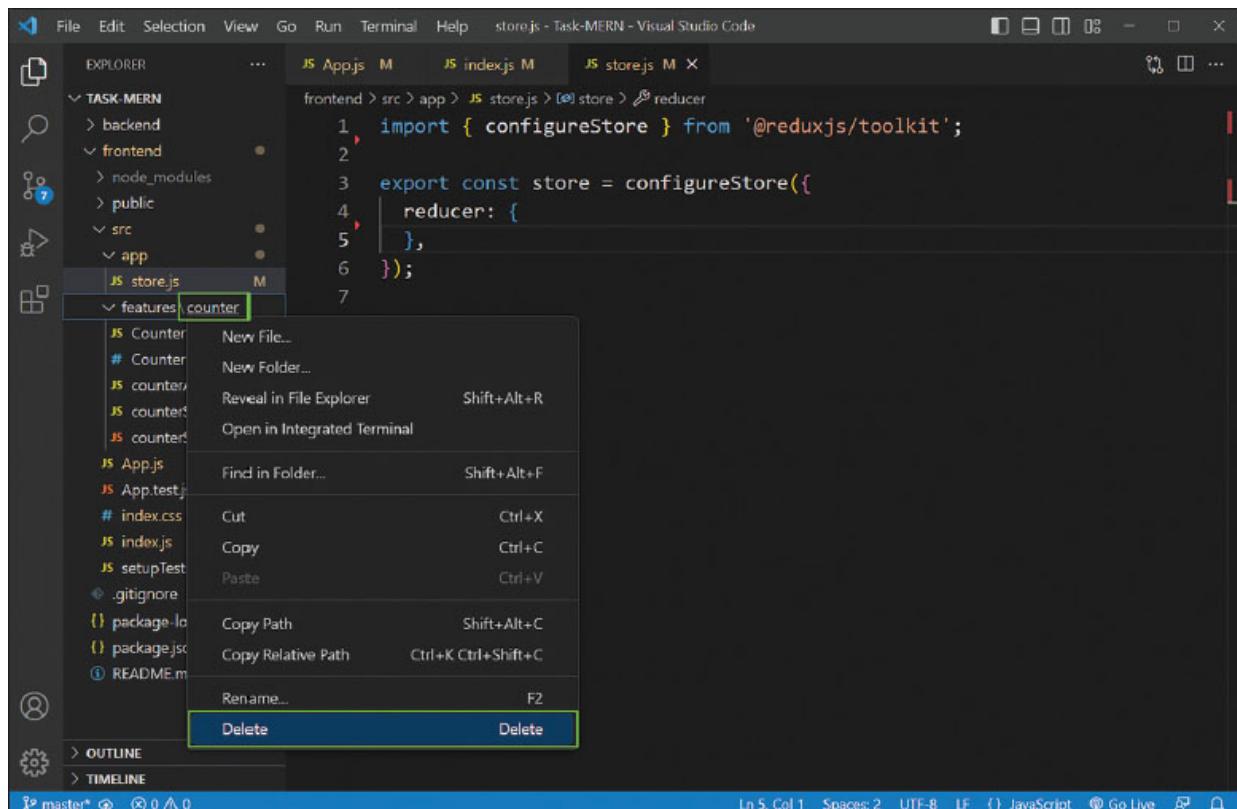


Figure 6.11: Removing counter folder

Now, we will create some of the components which we will use in our project. So, first create a **components** folder inside **src** and add a **Dashboard.js** file in it. Add the following basic content to it:

```
import React from 'react'

const Dashboard = () => {
  return (
    <div>Dashboard</div>
  )
}

export default Dashboard
```

The screenshot shows the Visual Studio Code interface. The left sidebar (Explorer) displays a project structure for 'TASK-MERN' with folders like 'backend', 'frontend', 'src', and 'components'. Inside 'components', 'Dashboard.js' is selected. The right pane shows the code editor with the following content:

```
import React from 'react'
const Dashboard = () => {
  return (
    <div>Dashboard</div>
  )
}
export default Dashboard
```

Figure 6.12: Creating Dashboard.js file

Next, create a **Login.js** file inside the **components** folder and add the basic code to it.

```
import React from 'react'
const Login = () => {
  return (
    <div>Login</div>
  )
}
export default Login
```

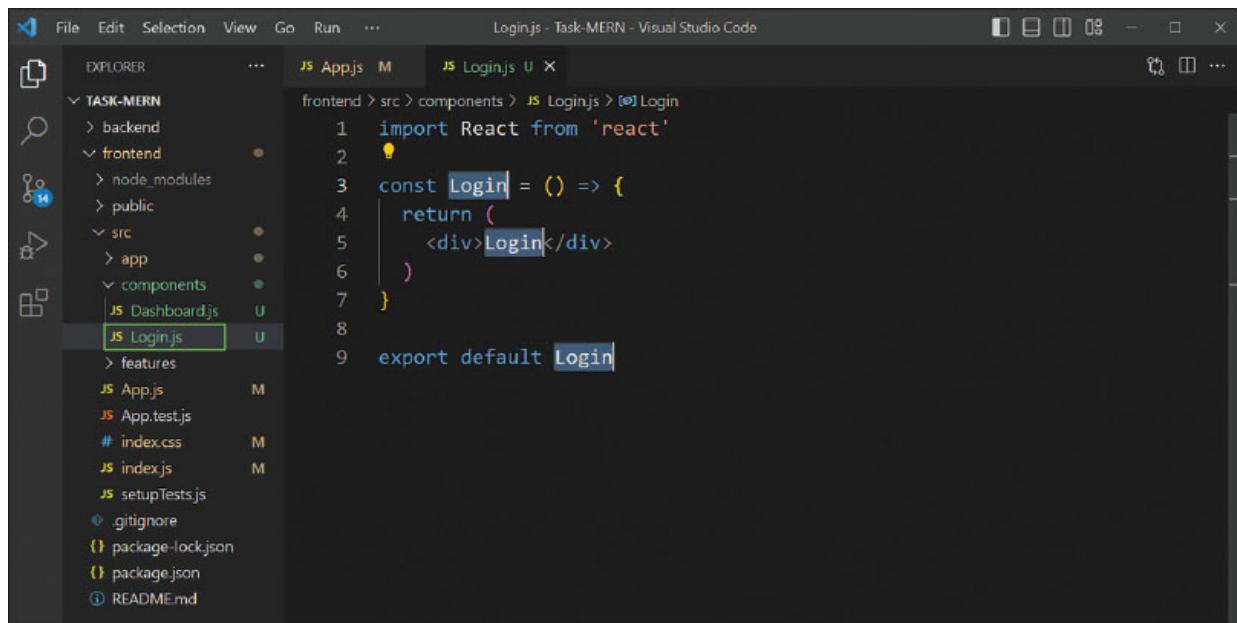


Figure 6.13: Creating Login.js file

Lastly, create a **Register.js** file inside the **components** folder and add the basic code to it.

```
import React from 'react'

const Register = () => {
    return (
        <div>Register</div>
    )
}

export default Register
```

The screenshot shows the Visual Studio Code interface with a dark theme. The Explorer sidebar on the left displays a project structure for 'TASK-MERN' with folders like 'backend', 'frontend', 'src', and 'components'. Inside 'components', files 'Dashboard.js', 'Login.js', and 'Register.js' are listed. 'Register.js' is currently selected and highlighted with a green border. The main editor area shows the code for 'Register.js':

```
1 import React from 'react'
2
3 const Register = () => {
4   return (
5     <div>Register</div>
6   )
7 }
8
9 export default Register
```

Figure 6.14: Creating Register.js file

React Router Setup

Now, we will set up a react router in our project. React router is an external package that needs to be installed in the project, because react doesn't come in-built with routing functionalities.

So, in the frontend folder in the terminal install react router using the following command:

```
npm i react-router-dom
```

Also, we will update our App.js file as follows. Here, we are first importing BrowserRouter, Routes and Route from **react-router-dom**. After that, we are using it inside the return statement as shown here:

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

function App() {
  return (
    <Router>
      <div className=>container >
        <Routes>
          </Routes>
        </div>
    </Router>
  )
}

export default App
```

```
        </Router>
    );
}

export default App;
```

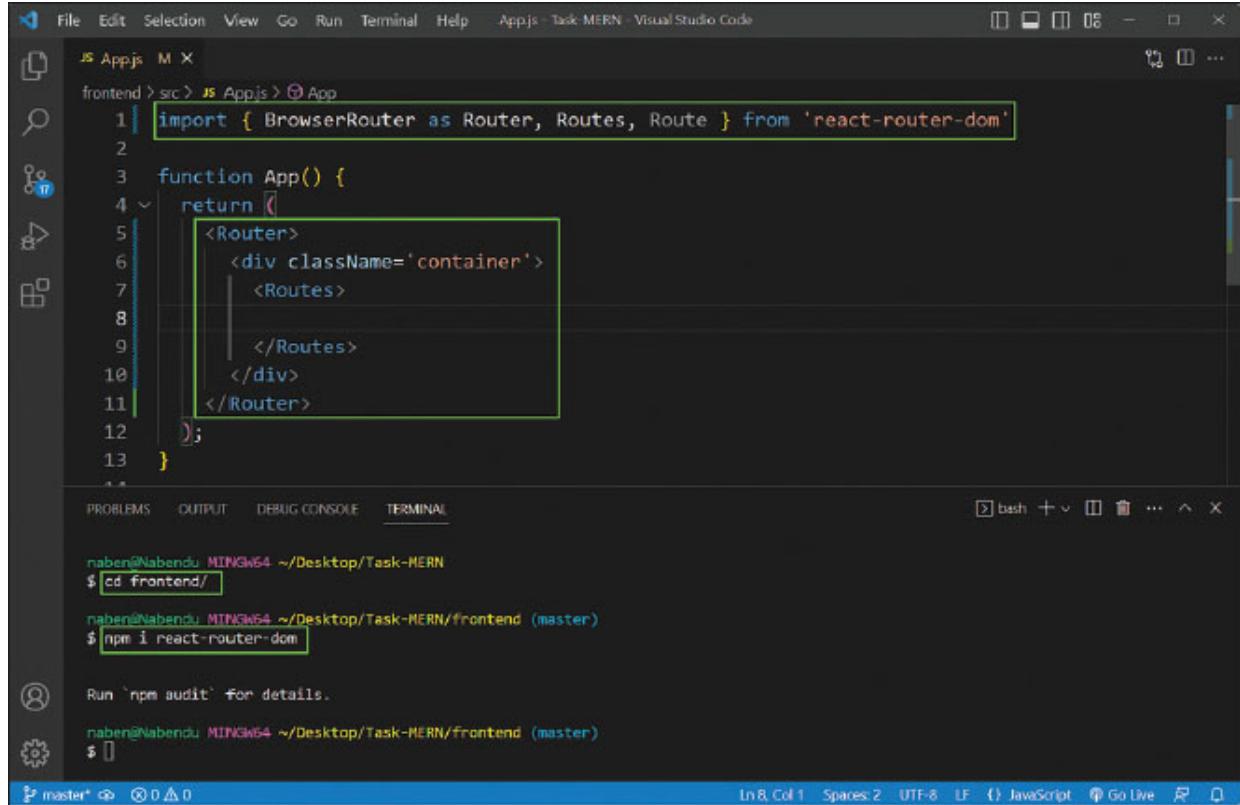


Figure 6.15: Adding react router

Next, we will import the three components of `Dashboard`, `Login`, and `Register` in `App.js`. After that, inside the `<Routes>`, we will add the three components with different paths.

```
import Dashboard from './components/Dashboard';
import Login from './components/Login';
import Register from './components/Register';

...
...

<Route path='/' element={<Dashboard />} />
<Route path='/login' element={<Login />} />
<Route path='/register' element={<Register />} />
```

The screenshot shows the code editor interface of Visual Studio Code. The file being edited is `App.js`. The code defines a `Router` component with three nested `Route` components. The first route at the root path '/' points to the `Dashboard` component. The second route at the path '/login' points to the `Login` component. The third route at the path '/register' points to the `Register` component. The code is written in JSX.

```
1 import { BrowserRouter as Router, Routes, Route } from 'react-router-dom'
2 import Dashboard from './components/Dashboard';
3 import Login from './components/Login';
4 import Register from './components/Register';
5
6 function App() {
7   return (
8     <Router>
9       <div className='container'>
10         <Routes>
11           <Route path='/' element={<Dashboard />} />
12           <Route path='/login' element={<Login />} />
13           <Route path='/register' element={<Register />} />
14         </Routes>
15       </div>
16     </Router>
17   );
18 }
19
20 export default App;
21
```

Figure 6.16: Basic routes

Now, in `http://localhost:3000/` we will see our basic Dashboard component.



Figure 6.17: Dashboard route

In `http://localhost:3000/login`, we will see our Login component code.



Figure 6.18: Login route

And in `http://localhost:3000/register` we will see our Register component code.



Figure 6.19: Register route

Creating Components and Pages

Now, we will create some of the components in our project. First, we will create the common component of the Header, which will be shown on all pages. Following that, we will create the pages for Register and Login.

Header Component

We will first create the common Header component. So, create a file called **Header.js** inside the **components** folder. Here, we have first opened the integrated terminal and installed the icon package of react-icons, using the following command.

```
npm i react-icons
```

Next, we have created the basic structure of the Header component. Here, first, we are importing some icons from react-icons. And we are also importing Link from react-router-dom. Inside the return statement, we have the basic header with a Link showing Task Creator to the home route.

```
import { FaSignInAlt, FaSignOutAlt, FaUser } from 'react-icons/fa'  
import { Link } from 'react-router-dom'  
  
const Header = () => {  
  return (  
    <header className=>header<>  
      <div className=>logo</div>  
      <Link to=>/</Link>Task Creator</Link>  
    </div>  
  </header>  
)  
}  
  
export default Header
```

```
import { FaSignInAlt, FaSignOutAlt, FaUser } from 'react-icons/fa'
import { Link } from 'react-router-dom'

const Header = () => [
  return (
    <header className='header'>
      <div className="logo">
        <Link to="/">Task Creator</Link>
      </div>
    </header>
  )
]

export default Header
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL

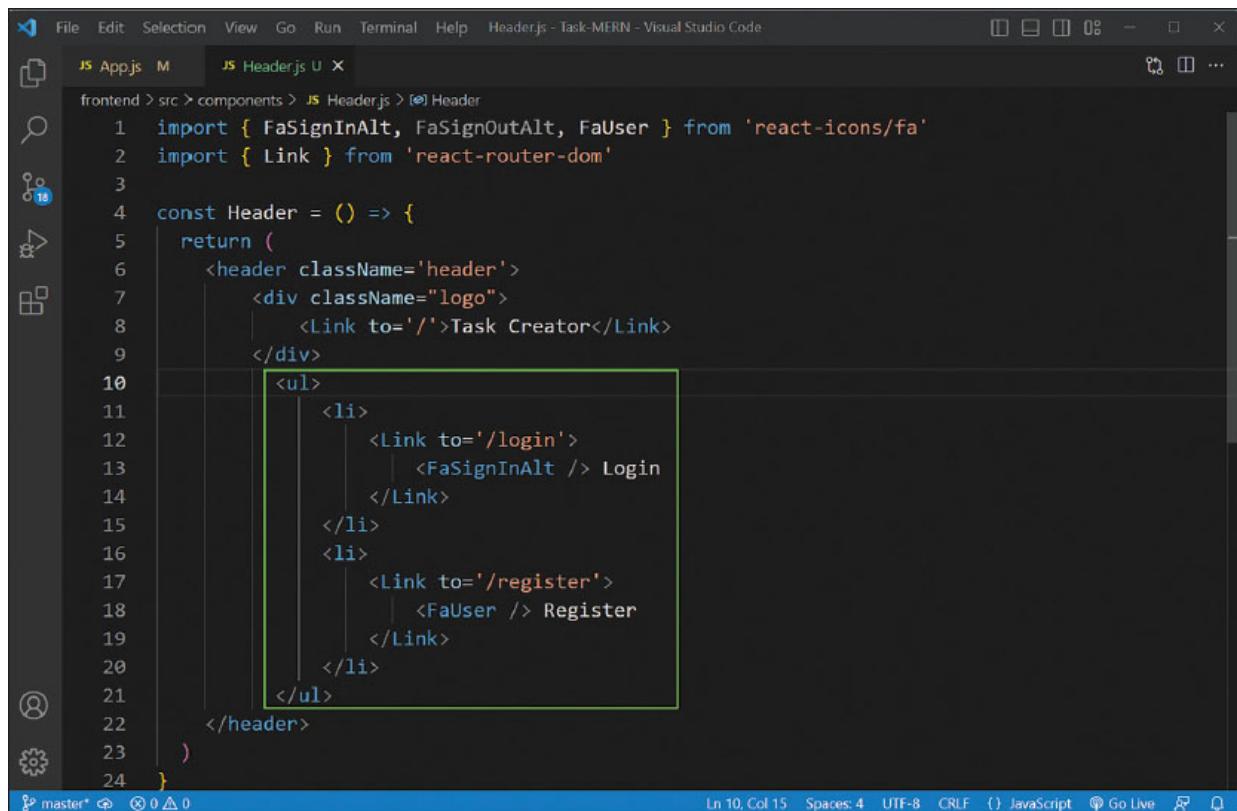
```
naben@Nabendu MINGW64 ~/Desktop/Task-MERN/frontend (master)
$ npm i react-icons
added 1 package, and audited 1514 packages in 4s
235 packages are looking for funding
  run `npm fund` for details
6 high severity vulnerabilities

To address all issues (including breaking changes), run:
  npm audit fix --force
```

Figure 6.20: Creating header component

Next, in the **Header.js** file, we will also add the other Links for **/login** and **/register** route, inside an ul tag. Here, we are also using the icons imported earlier. Note that on clicking these links, we will be taken to the respective route, showing that component.

```
<ul>
  <li>
    <Link to="/login">
      <FaSignInAlt /> Login
    </Link>
  </li>
  <li>
    <Link to="/register">
      <FaUser /> Register
    </Link>
  </li>
</ul>
```

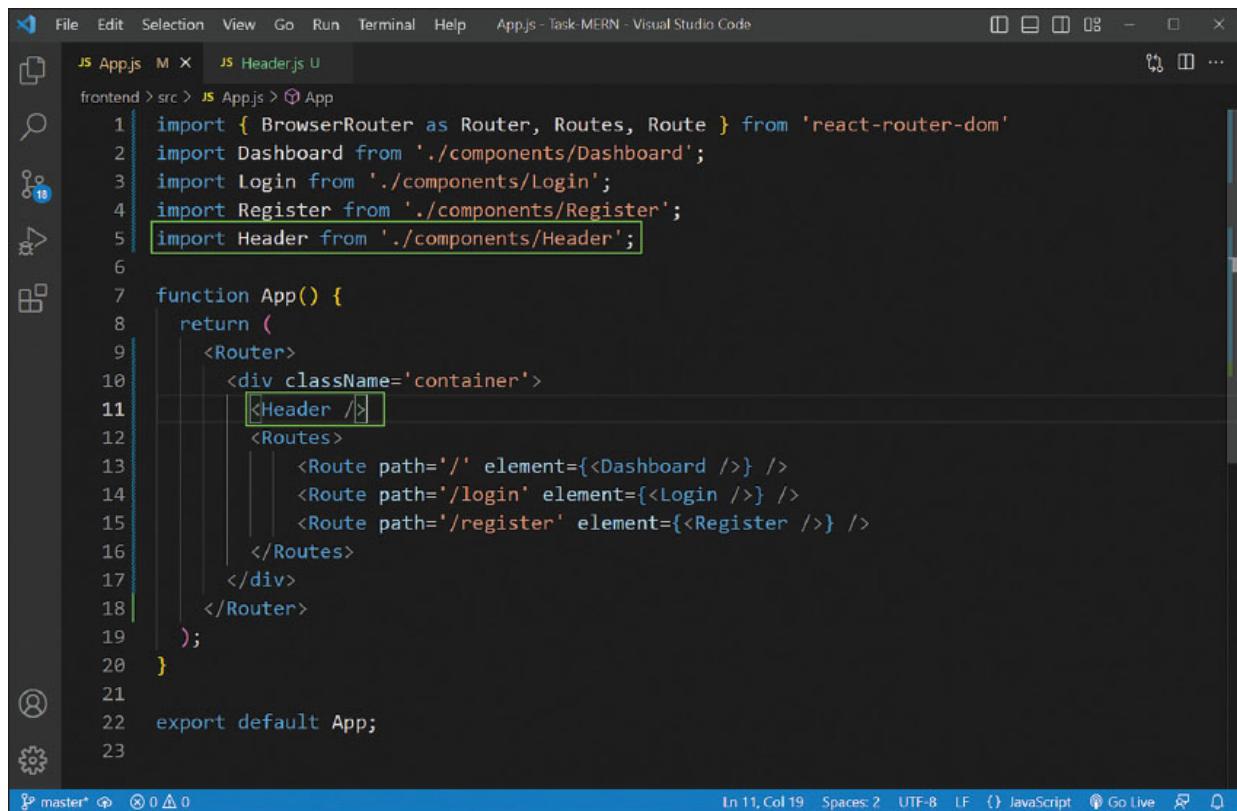


The screenshot shows a Visual Studio Code window with the following details:

- Title Bar:** File Edit Selection View Go Run Terminal Help Header.js - Task-MERN - Visual Studio Code
- File Explorer:** Shows a tree view of the project structure: frontend > src > components > Header.js.
- Code Editor:** The content of the Header.js file is displayed. The code defines a Header component that returns an `<header>` element with a `<div>` class named "logo". Inside this logo div is a `<Link to="/">Task Creator</Link>`. Below this is a `` element containing two `` items. Each item contains a `<Link to="/login"><FaSignInAlt /> Login</Link>` and a `<Link to="/register"><FaUser /> Register</Link>`. The entire code block is highlighted with a green rectangular selection.
- Status Bar:** Shows the file path as master*, line 10, column 15, spaces: 4, encoding: UTF-8, CRLF, and language: JavaScript.

Figure 6.21: Adding routes in header component

We will finally add the Header component inside our `App.js` file. But notice here, we are adding it outside the `<Routes>`. It means that it will be shown on all pages.



The screenshot shows the Visual Studio Code interface with the file `App.js` open. The code defines a `App` component that returns a `Router` component. Inside the `Router`, there is a `Header` component and a `Routes` component. The `Routes` component contains three `Route` components for paths `/`, `/login`, and `/register`, each pointing to `Dashboard`, `Login`, and `Register` components respectively. The `Header` component is highlighted with a green box.

```
1 import { BrowserRouter as Router, Routes, Route } from 'react-router-dom'
2 import Dashboard from './components/Dashboard';
3 import Login from './components/Login';
4 import Register from './components/Register';
5 import Header from './components/Header';

6
7 function App() {
8   return (
9     <Router>
10       <div className='container'>
11         <Header />
12         <Routes>
13           <Route path='/' element={<Dashboard />} />
14           <Route path='/login' element={<Login />} />
15           <Route path='/register' element={<Register />} />
16         </Routes>
17       </div>
18     </Router>
19   );
20 }
21
22 export default App;
```

Figure 6.22: Adding header component in `App.js`

Now, go to `http://localhost:3000/` and we will see a nice-looking header with logo, and two icons for Login and Register.

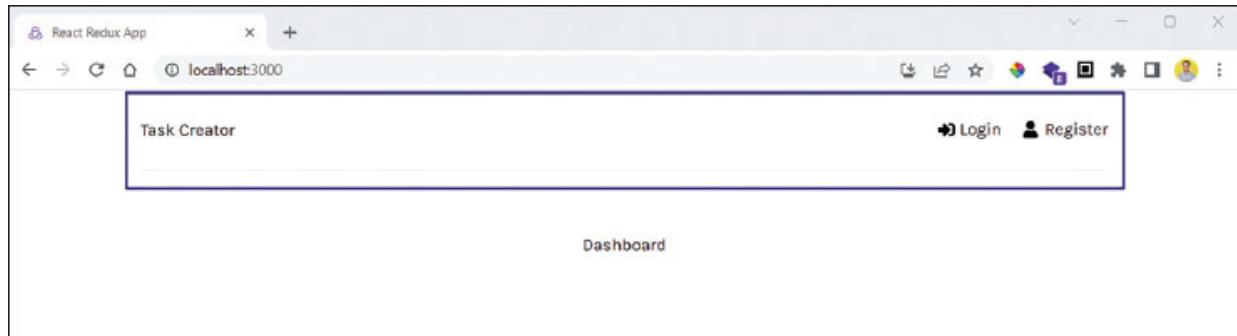


Figure 6.23: Header component in browser

Register Page

Now, we will create our Register page. We can go to this page by clicking the Register logo in the dashboard.

First, replace the basic code with the following code in **Register.js** file. Here, we are first importing `useState` and an icon. Next, we are first creating a state variable of `formData` which will be equal to an object containing `name`, `email`, `password` and `password2`.

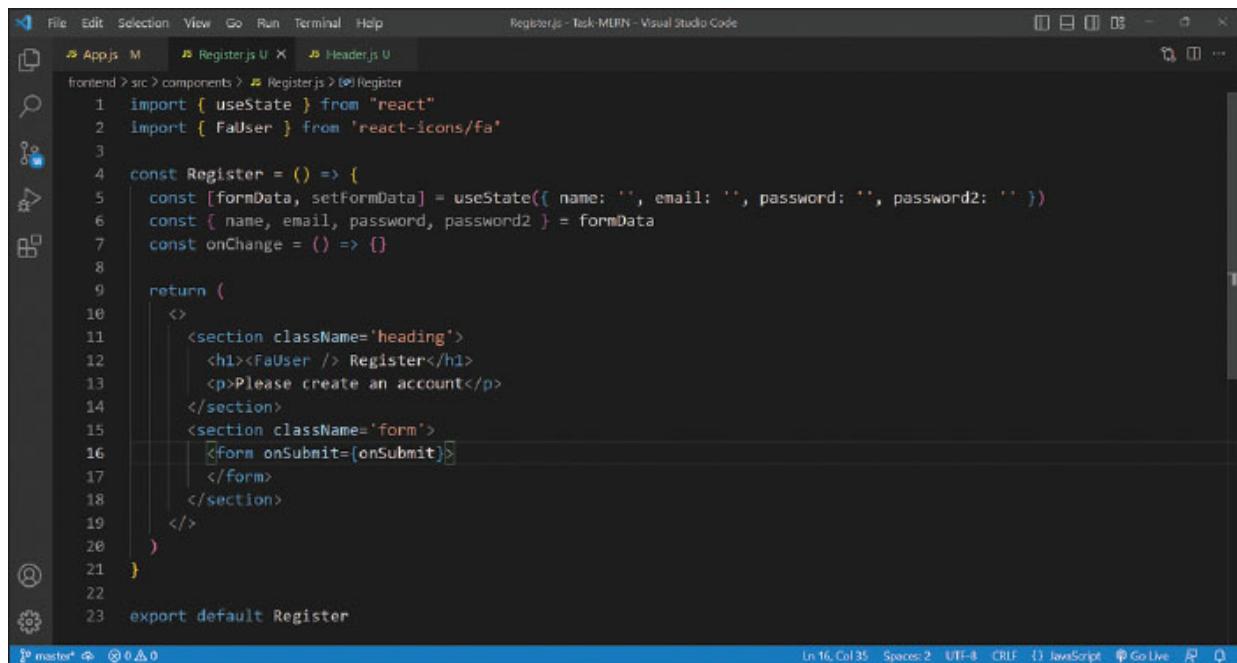
We are also destructuring the `formData`. Inside the return statement, we have a section showing a heading and a paragraph.

Inside the second section, we have a form that we will complete next.

```
import { useState } from "react"
import { FaUser } from 'react-icons/fa'

const Register = () => {
  const [formData, setFormData] = useState({ name: <>, email: <>, password: <>, password2: <> })
  const { name, email, password, password2 } = formData
  const onChange = () => {}
  return (
    <>
      <section className=>heading >>
        <h1><FaUser /> Register</h1>
        <p>Please create an account</p>
      </section>
      <section className=>form >>
        <form onSubmit={onSubmit}>
        </form>
      </section>
    </>
  )
}

export default Register
```



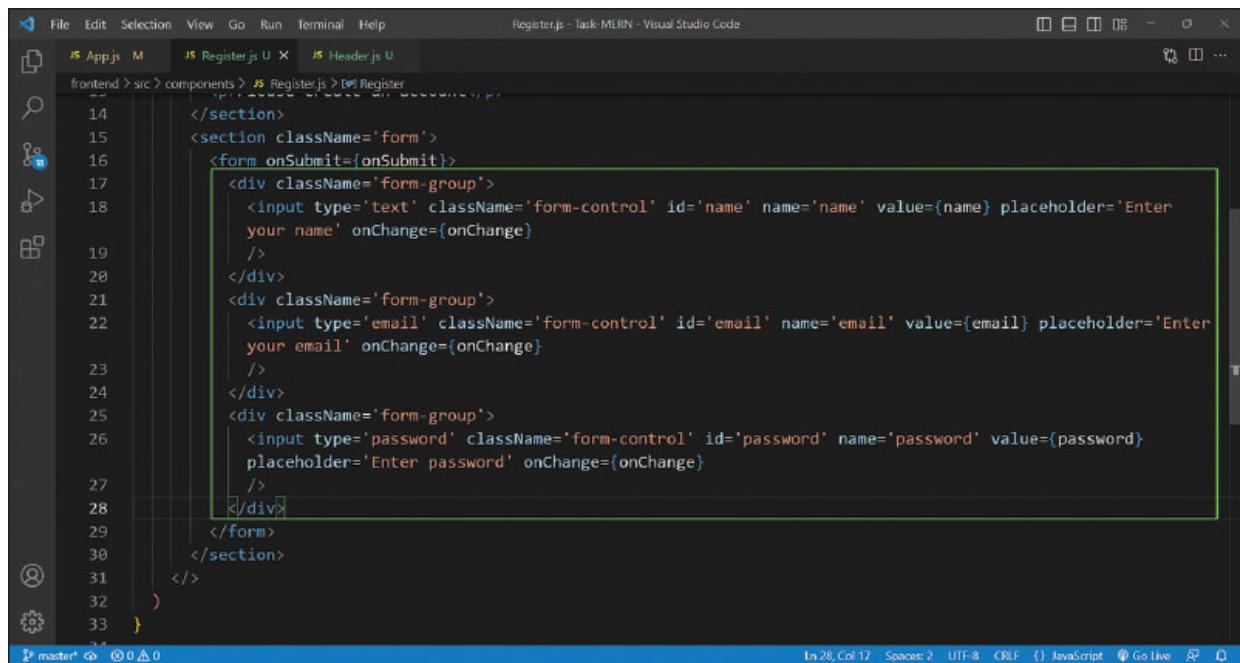
The screenshot shows the Visual Studio Code interface with the 'Register.js' file open. The code defines a React component named 'Register'. It imports 'useState' from 'react' and 'FaUser' from 'react-icons/fa'. The component uses 'useState' to manage state for 'name', 'email', 'password', and 'password2'. It contains a heading section with a title and a paragraph asking to create an account. Below is a form section with a submit button. The code ends with an export statement.

```
File Edit Selection View Go Run Terminal Help
Register.js - Task-MERN - Visual Studio Code
frontend > src > components > Register.js > Register
1 import { useState } from "react"
2 import { FaUser } from 'react-icons/fa'
3
4 const Register = () => {
5   const [formData, setFormData] = useState({ name: '', email: '', password: '', password2: '' })
6   const { name, email, password, password2 } = formData
7   const onChange = () => {}
8
9   return (
10     <>
11       <section className='heading'>
12         <h1><FaUser /> Register</h1>
13         <p>Please create an account</p>
14       </section>
15       <section className='form'>
16         <form onSubmit={onSubmit}>
17           </form>
18       </section>
19     </>
20   )
21 }
22
23 export default Register
Ln 16, Col 35  Spaces: 2  UTF-8  CRLF  { JavaScript  Go Live  R  Q
```

Figure 6.24: Creating register component

Inside the form in **Register.js** file, we will have three input statements for the **name**, **email**, and **password**. These inputs are like what we have in React for input. Also, notice that we have a **name** tag in all inputs.

```
<div className=>form-group >
  <input type=>text > className=>form-control > id=>name >
  name=>name > value={name} placeholder=>Enter your name >
  onChange={onChange}
  />
</div>
<div className=>form-group >
  <input type=>email > className=>form-control > id=>email >
  name=>email > value={email} placeholder=>Enter your email >
  onChange={onChange}
  />
</div>
<div className=>form-group >
  <input type=>password > className=>form-control >
  id=>password > name=>password > value={password}
  placeholder=>Enter password > onChange={onChange}
  />
</div>
```

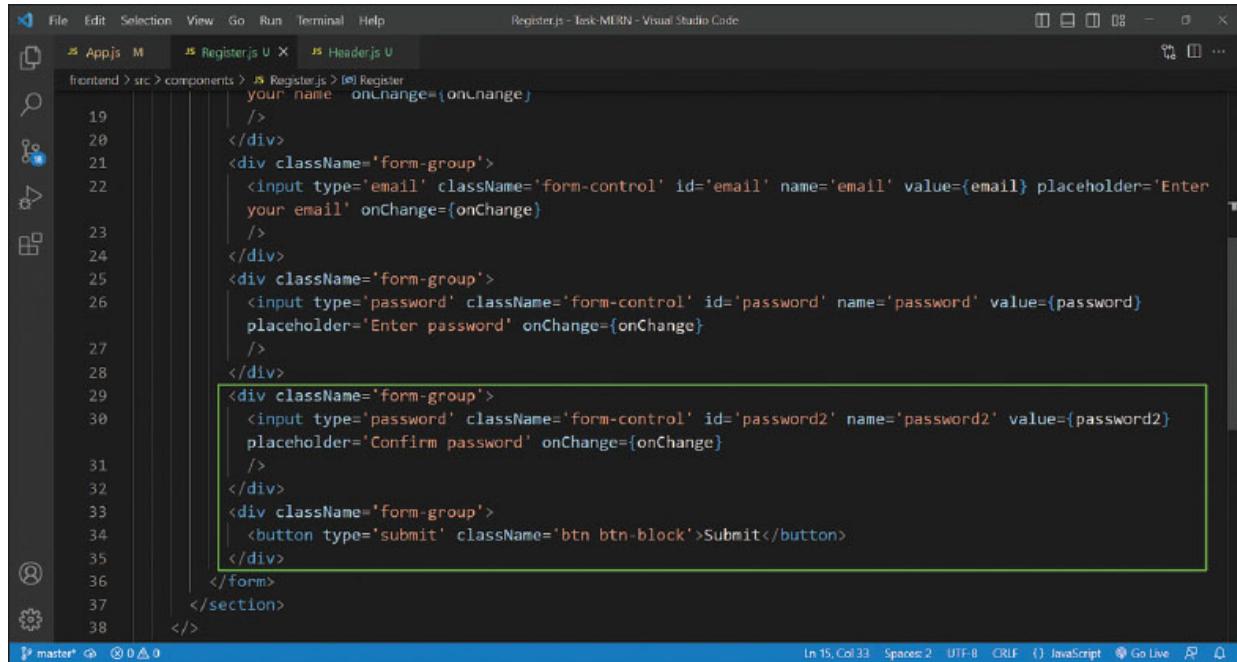


```
File Edit Selection View Go Run Terminal Help
Register.js - Task: MERN - Visual Studio Code
frontend > src > components > Register.js
14     </section>
15     <section className='form'>
16       <form onSubmit={onSubmit}>
17         <div className='form-group'>
18           <input type='text' className='form-control' id='name' name='name' value={name} placeholder='Enter your name' onChange={onChange}>
19         />
20       </div>
21       <div className='form-group'>
22         <input type='email' className='form-control' id='email' name='email' value={email} placeholder='Enter your email' onChange={onChange}>
23       />
24     </div>
25     <div className='form-group'>
26       <input type='password' className='form-control' id='password' name='password' value={password} placeholder='Enter password' onChange={onChange}>
27     />
28   </div>
29   </form>
30 </section>
31 </>
32 )
33 }
```

Figure 6.25: Adding fields in register component

We will also add the input for `password2`, which is our confirm password field. Also, we added our Submit button in **Register.js** file.

```
<div className=>form-group >
  <input type=>password > className=>form-control >
    id=>password1 > name=>password1 > value={password1}
    placeholder=>Confirm password > onChange={onChange}
  />
</div>
<div className=>form-group >
  <button type=>submit > className=>btn btn-block >Submit</button>
</div>
```



```
File Edit Selection View Go Run Terminal Help Register.js - Task-MERN - Visual Studio Code
App.js M Register.js X Header.js V
frontend > src > components > Register.js > Register
  19      > your name' onChange={onChange}
  20      > />
  21      > </div>
  22      > <div className='form-group'>
  23      >   <input type='email' className='form-control' id='email' name='email' value={email} placeholder='Enter
  24      >   your email' onChange={onChange}>
  25      >   />
  26      > </div>
  27      > <div className='form-group'>
  28      >   <input type='password' className='form-control' id='password' name='password' value={password}
  29      >   placeholder='Enter password' onChange={onChange}>
  30      >   />
  31      > </div>
  32      > <div className='form-group'>
  33      >   <input type='password' className='form-control' id='password2' name='password2' value={password2}
  34      >   placeholder='Confirm password' onChange={onChange}>
  35      >   />
  36      > </div>
  37      > </form>
  38      > </section>
  39      > </>
```

Figure 6.26: Adding more fields in register component

Next, we will complete our `onChange` function in the `Register.js` file. Here, we are using `e.target.name` to get all input dynamically. Or else, we would have needed to create different `onChanges` for every input field. The `onSubmit` is now empty, and logic will be added in later chapters.

```
const onChange = e => {
  setFormData(prevState => ({
    ...prevState,
    [e.target.name]: e.target.value
  }) )
}

const onSubmit = e => {
  e.preventDefault()
}
```

```
File Edit Selection View Go Run Terminal Help
App.js M Register.js X Header.js X
frontend > src > components > Register.js > 06Register > 02onChange
1 import { useState } from "react"
2 import { FaUser } from 'react-icons/fa'
3
4 const Register = () => {
5   const [formData, setFormData] = useState({ name: "", email: "", password: "", password2: "" })
6   const { name, email, password, password2 } = formData
7
8   const onChange = e => {
9     setFormData(prevState => ({
10       ...prevState,
11       [e.target.name]: e.target.value
12     }))
13   }
14
15   const onSubmit = e => {
16     e.preventDefault()
17   }
18
19   return (

```

Figure 6.27: Adding functions in register component

On clicking on the register logo, we will be taken to <http://localhost:3000/register>. And the nice-looking **Register** component will be shown.

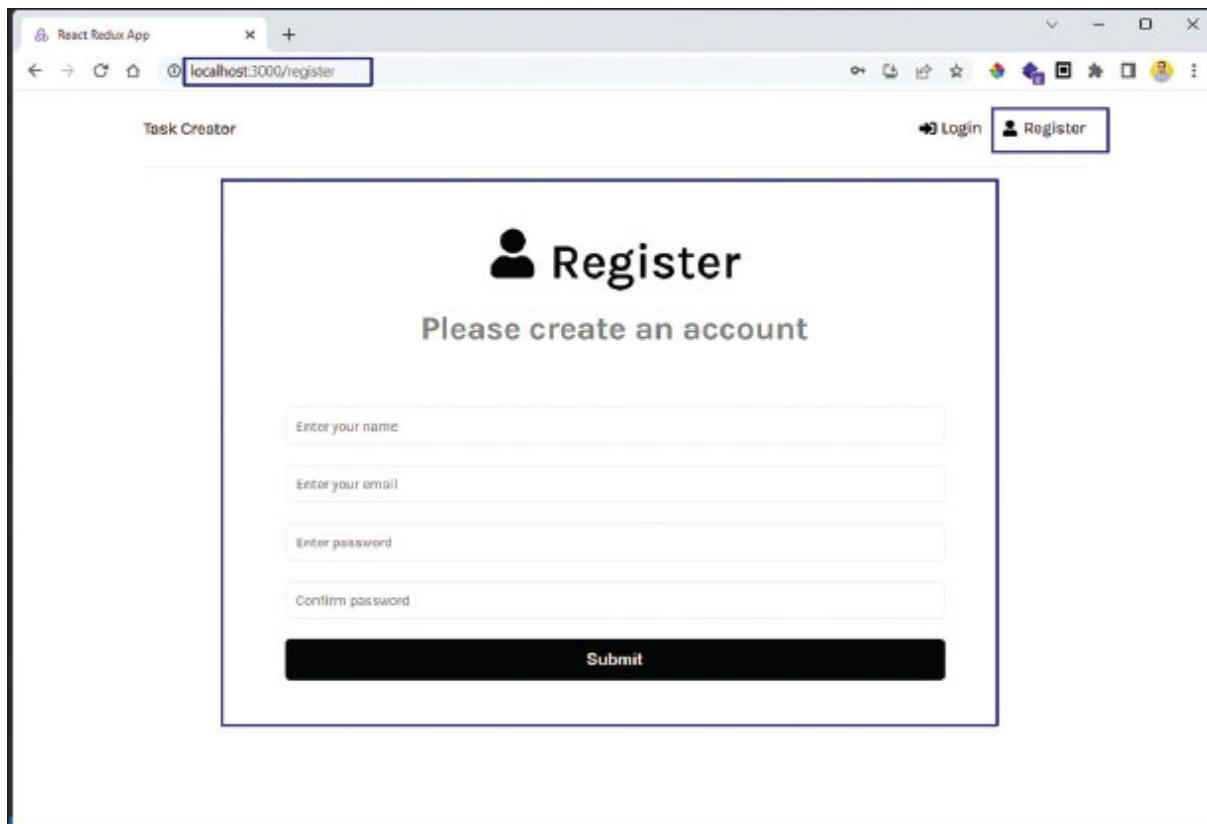


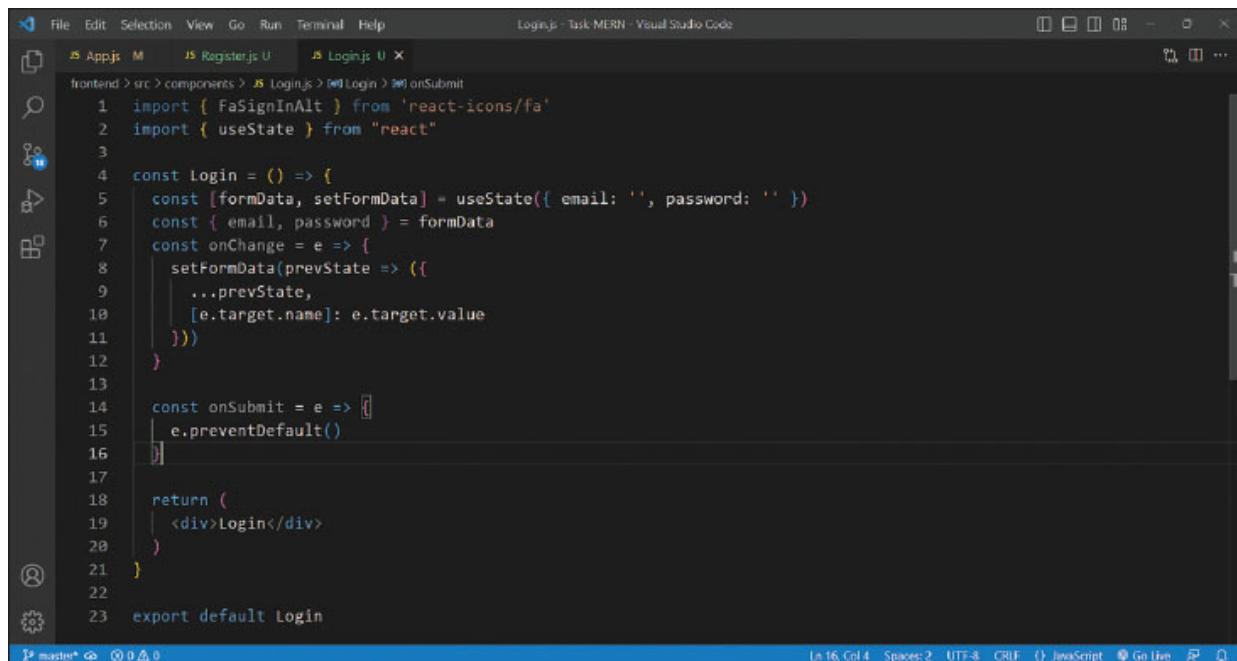
Figure 6.28: Register page in browser

Login Page

Now, we will create the Login page, which is quite similar to the Register page created in the earlier section. First, create a file **Login.js** in the **components** folder and add the following content to it.

Here, we again have the **formData**, but with fewer fields of email and password. The **onChange** and **onSubmit** are also similar to the Register page.

```
import { FaSignInAlt } from 'react-icons/fa'
import { useState } from "react"
const Login = () => {
  const [formData, setFormData] = useState({ email: <>, password: <> })
  const { email, password } = formData
  const onChange = e => {
    setFormData(prevState => ({
      ...prevState,
      [e.target.name]: e.target.value
    }))
  }
  const onSubmit = e => {
    e.preventDefault()
  }
  return (
    <div>Login</div>
  )
}
export default Login
```



The screenshot shows the Visual Studio Code interface with the 'Login.js' file open. The code defines a functional component named 'Login'. It imports 'FaSignInAlt' from 'react-icons/fa' and 'useState' from 'react'. The component state is managed using 'useState' with initial values for email and password. An 'onChange' handler updates the state, and an 'onSubmit' handler prevents the default form submission. The component returns a simple login form.

```
File Edit Selection View Go Run Terminal Help
Login.js - Task MERN - Visual Studio Code
App.js M Register.js U Login.js U X
frontend > src > components > Login.js > 00 Login > 00 onSubmit
1 import { FaSignInAlt } from 'react-icons/fa'
2 import { useState } from "react"
3
4 const Login = () => {
5   const [formData, setFormData] = useState({ email: '', password: '' })
6   const { email, password } = formData
7   const onChange = e => {
8     setFormData(prevState => ({
9       ...prevState,
10      [e.target.name]: e.target.value
11    }))
12  }
13
14  const onSubmit = e => [
15    e.preventDefault()
16  ]
17
18  return (
19    <div>Login</div>
20  )
21}
22
23 export default Login
In 16, Col 4  Spaces: 2  UTF-8  CRLF  (JavaScript)  Go Live  ⚡  ⌂
```

Figure 6.29: Creating login component

Now, inside the return statement, we will have a section with a header and another with a form. The form section will only contain an email, password, and button.

```
<>
<section className=>heading>
  <h1><FaSignInAlt /> Login</h1>
  <p>Login and start creating tasks</p>
</section>
<section className=>form>
  <form onSubmit={onSubmit}>
    <div className=>form-group>
      <input type=>email> className=>form-control> id=>email>
      name=>email> value={email} placeholder=>Enter your
      email> onChange={onChange}
    />
  </div>
  <div className=>form-group>
    <input type=>password> className=>form-control>
    id=>password> name=>password> value={password}
    placeholder=>Enter password> onChange={onChange}
  />
```

```

    </div>
    <div className=>form-group >
      <button type=>submit> className=>btn btn-block>Submit</button>
    </div>
  </form>
</section>
</>

```

```

19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39

```

```

        <>
          <section className='heading'>
            <h1><FaSignInAlt /> Login</h1>
            <p>Login and start creating tasks</p>
          </section>
          <section className='form'>
            <form onSubmit={onSubmit}>
              <div className='form-group'>
                <input type='email' className='form-control' id='email' name='email' value={email} placeholder='Enter your email' onChange={onChange}>
              </div>
              <div className='form-group'>
                <input type='password' className='form-control' id='password' name='password' value={password} placeholder='Enter password' onChange={onChange}>
              </div>
              <div className='form-group'>
                <button type='submit' className='btn btn-block'>Submit</button>
              </div>
            </form>
          </section>
        </>

```

Figure 6.30: Adding fields in Login Component

On clicking on the **Login** logo, we will be taken to <http://localhost:3000/login>. And the nice-looking login component will be shown.

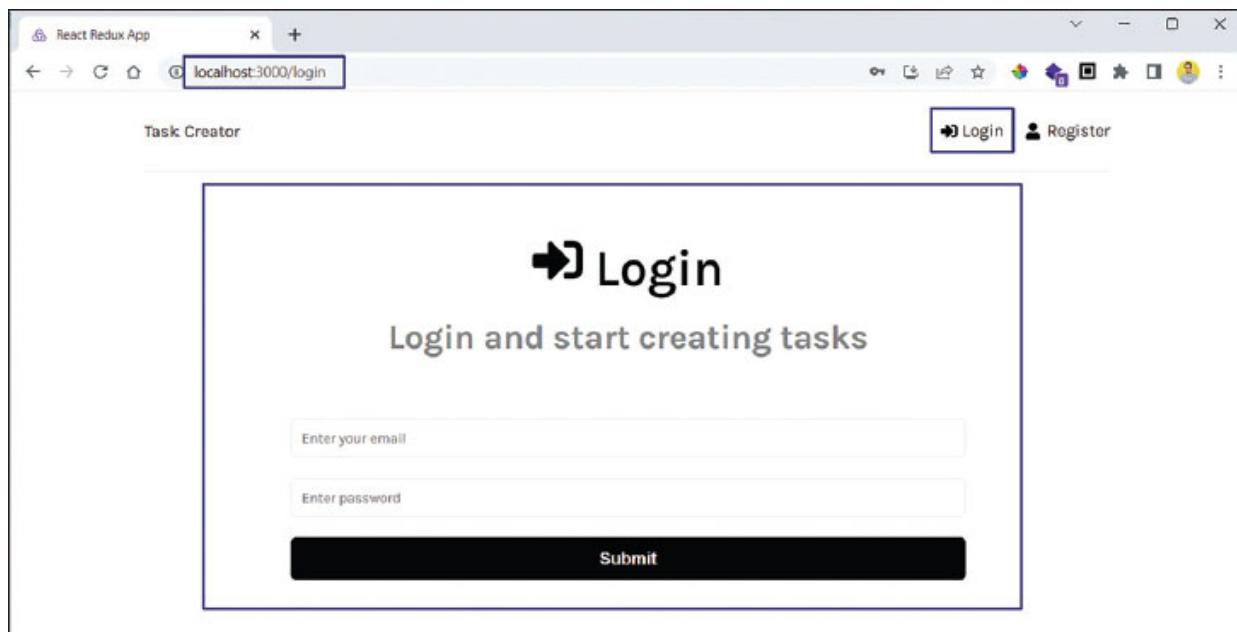


Figure 6.31: Login Component in Browser

Conclusion

In this chapter, we have learned about creating frontends with ReactJS. Here, we had first created a frontend app with the `create-react-app` command. Next, we deleted some boiler plate code to do the basic setup in the app.

After that, we did the React router setup in our project. This library is required for routing in our React app. Lastly, we have created the components of Header, Register, and Login in this chapter.

In the next chapter, we will start with the redux setup using slice. Then we are going to complete the User registration along with the Register form.

Points to remember

- We have created a react app with a redux template using the `create-react-app` command.
- Removing unnecessary files when starting with React app, such as `lovo.svg` and `reportWebVitals.js`
- Setting up the react router in the project and showing different components on different paths.

- Creating components using react icons and different form elements of input and button.

CHAPTER 7

Redux Setup with Slice

Introduction

This chapter covers the implementation of Redux in the project. We will use the latest Toolkit method in Redux to implement a global state in our project. In this chapter, we are also going to set up a reducer for Registration form. Finally, we are also going to test the user registration workflow.

Structure

In this chapter, we are going to discuss the following topics:

- Redux setup with a toolkit
- Auth service and slice
- Registration form hook up
- Testing user registration

Redux setup with a toolkit

To start with Redux with a toolkit, we need to have a slice. Now, traditionally, redux has a separate action creator and reducer. But with the latest toolkit, they have been merged to form the slice. Now, we have the reducer and action creator logic both in slice.

So, create a folder **auth** inside the **features** folder. Inside it, create an **authSlice.js** file and add the following code in it.

Here, we are first importing `createSlice` and `createAsyncThunk` from the redux toolkit. The `createSlice` will be used to create the slice used for reducer and action. And the `createAsyncThunk` will be used for asynchronous actions, which is an API call in our case later on.

After that, we added a variable called `localuser`, which uses local storage to get a user variable. We are going to set this variable later.

Next, we have the `initialState` of our slice, which is an object. Here, we have the `user` key first, which is equal to the `localuser` initially or null if `localuser` is not present. We also have values for `isError`, `isSuccess`, and `isLoading`, which are set as false. These will be used when we do the API call. Lastly, we have a `message` as an empty string.

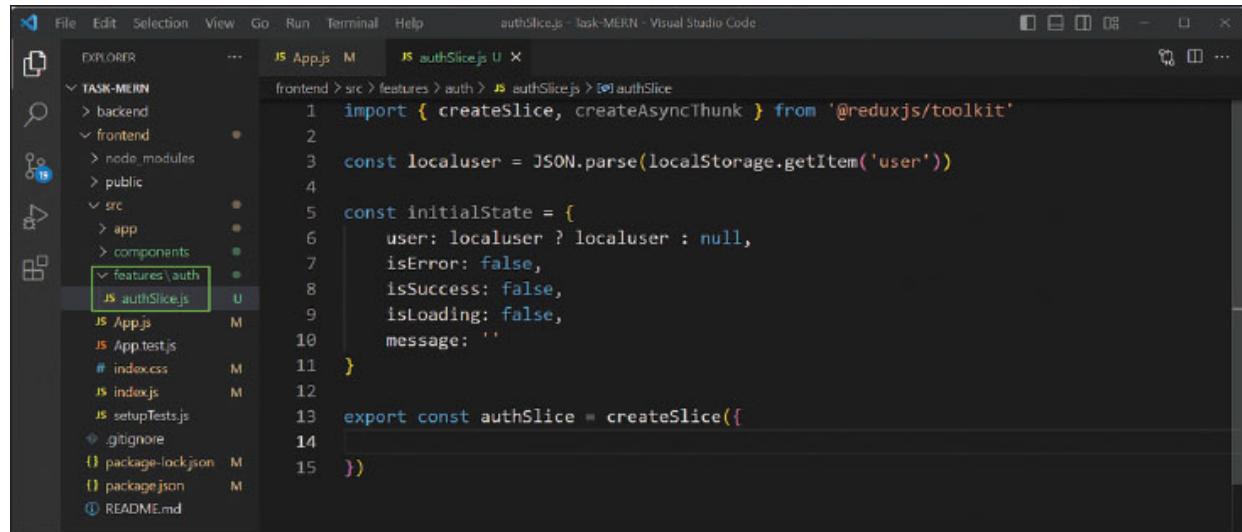
Next, we are exporting the `authSlice`, which is created using the `createSlice` method. We will complete this method next.

```
import { createSlice, createAsyncThunk } from
'@reduxjs/toolkit'

const localuser = JSON.parse(localStorage.getItem('user'))

const initialState = {
  user: localuser ? localuser : null,
  isError: false,
  isSuccess: false,
  isLoading: false,
  message: ''
}

export const authSlice = createSlice({})
```



The screenshot shows the Visual Studio Code interface with the following details:

- File Explorer:** Shows the project structure under "TASK-MERN". The "features/auth" folder contains the "authSlice.js" file, which is currently selected and highlighted with a green border.
- Code Editor:** Displays the code for "authSlice.js". The code defines a slice named "auth" with the following properties:
 - `initialState` is an object with properties: `user` (set to `localuser ? localuser : null`), `isError` (set to `false`), `isSuccess` (set to `false`), `isLoading` (set to `false`), and `message` (set to an empty string).
 - The code uses `createSlice` and `createAsyncThunk` from `@reduxjs/toolkit`.
 - The `authSlice` is exported as a constant.
- Terminal:** Not visible in the screenshot.

Figure 7.1: Creating authSlice.js file

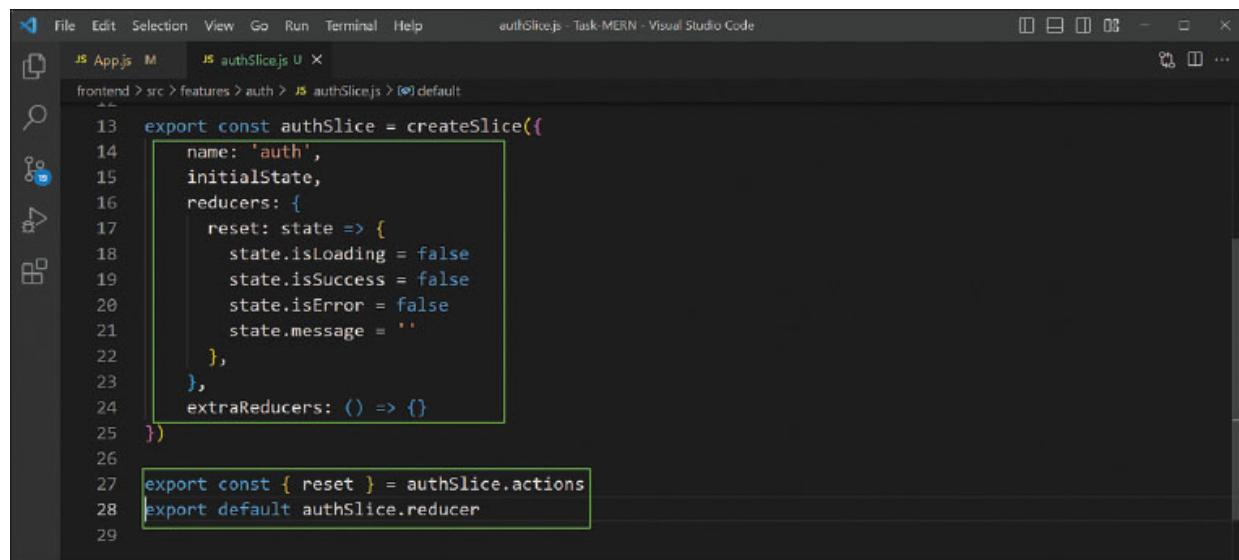
Now, we will write code inside the `createSlice` method in the `authSlice.js` file. Here, we are first giving the name of the slice as `auth`. Then we are

taking the initialState. After that, we have a reducers value, which has a reset. This reset can be used to make the state back to the initial state.

Next, we have an **extraReducers** value, which we are going to complete soon. In the end, we are exporting the reset action and also the reducer.

```
export const authSlice = createSlice({
  name: 'auth',
  initialState,
  reducers: {
    reset: state => {
      state.isLoading = false
      state.isSuccess = false
      state.isError = false
      state.message = ''
    },
  },
  extraReducers: () => {}
})

export const { reset } = authSlice.actions
export default authSlice.reducer
```



```
File Edit Selection View Go Run Terminal Help authSlice.js - Task-MERN - Visual Studio Code
JS App.js M JS authSlice.js U X
frontend > src > features > auth > JS authSlice.js > default
13 export const authSlice = createSlice({
14   name: 'auth',
15   initialState,
16   reducers: {
17     reset: state => {
18       state.isLoading = false
19       state.isSuccess = false
20       state.isError = false
21       state.message = ''
22     },
23   },
24   extraReducers: () => {}
25 })
26
27 export const { reset } = authSlice.actions
28 export default authSlice.reducer
29
```

Figure 7.2: Adding reducers in the authSlice.js file

Now, we will import the reducer in the **store.js** file. Because of the store in a Redux app, we are able to use the global state in different components.

```
import authReducer from '../features/auth/authSlice'
```

```

export const store = configureStore({
  reducer: {
    auth: authReducer
  }
});

```

A screenshot of the Visual Studio Code interface. The title bar says "store.js - Task-MERN - Visual Studio Code". The left sidebar shows a tree view with "App.js", "authSlice.js", and "store.js" selected. The main editor area contains the following code:

```

1 import { configureStore } from '@reduxjs/toolkit';
2 import authReducer from '../features/auth/authSlice'
3
4 export const store = configureStore({
5   reducer: {
6     auth: authReducer
7   }
8 });
9

```

The line "import authReducer from '../features/auth/authSlice'" and the line "auth: authReducer" under the "reducer" key are both highlighted with a yellow rectangular box.

Figure 7.3: Adding authReducer in store.js file

Now, we will be using the famous Chrome/Firefox extension of Redux Devtools in our project. Just go to the link and install it in the Chrome/Firefox browser. Since we have already added it, we are getting the **Remove from chrome** button. Or else we will get **Add to Chrome** button if the extension is not installed.

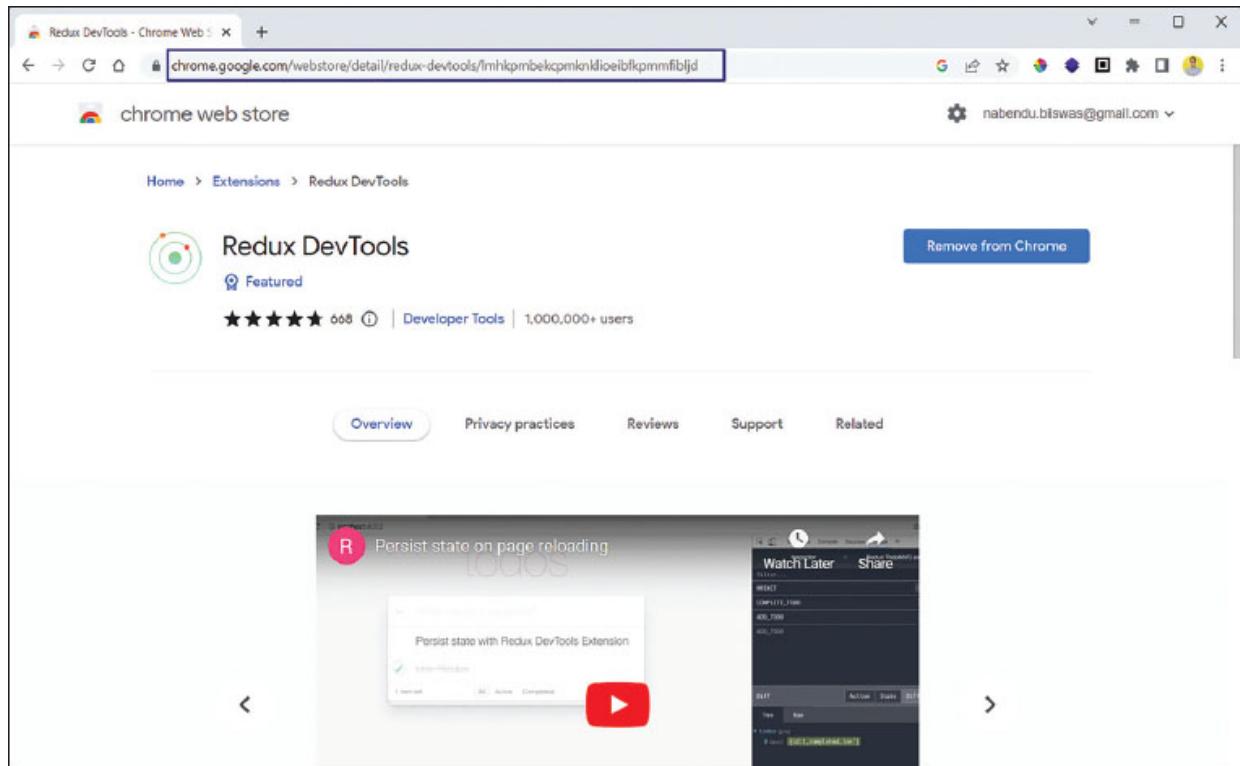


Figure 7.4: Adding Redux Devtools in Browser

In the Redux toolkit, we don't need to do any special configurations for this extension. Earlier in redux projects, we needed to install packages and add code for this extension to work. But the redux toolkit comes in-built with it, and no special configuration is required.

So, open the developer tool, and we will see a **Redux** tab. Here, we will see all of our states for auth. This extension is used in almost all production projects since the Redux states can sometimes be difficult to track.

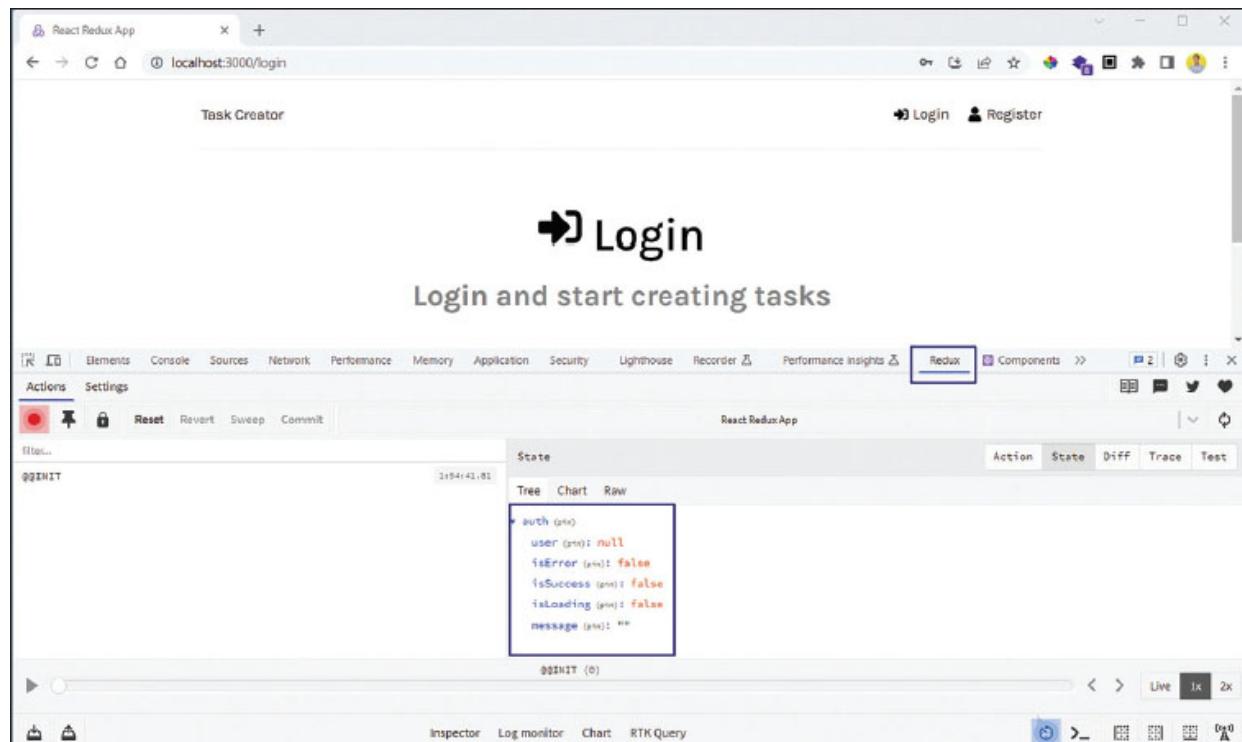


Figure 7.5: Redux Devtools in Browser

Auth service and slice

We will create an auth service in this part and also will complete the auth slice started in the previous part. But first, we will install the package of **axios** and **react-toastify** in our front end.

The package of **axios** will be used to do API calls and **react-toastify** will be used to show toast messages in case of error.

So, we will add both by opening the integrated terminal and using the following **npm** command.

```
npm i axios react-toastify
```



The screenshot shows a terminal window with the following text:

```
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
haben@habendu: MINGW64 ~/Desktop/Task-MERN/frontend (master)
$ npm i axios react-toastify
added 5 packages, and audited 1519 packages in 7s
235 packages are looking for funding
  run 'npm fund' for details
6 high severity vulnerabilities

  To address all issues (including breaking changes), run:
```

Figure 7.6: Adding axios and toastify

Next, we will create the auth service. This service will be used in doing the API call and also saving the result in local storage. So, create a file **authService.js** inside the **auth** folder.

Here, we are first importing `axios` and also creating a variable called `API_URL` which is set to `/api/users/`. Next, we have created a register function which is taking the `userData`. Inside the function, we are doing a POST call to the `API_URL` with the `userData`.

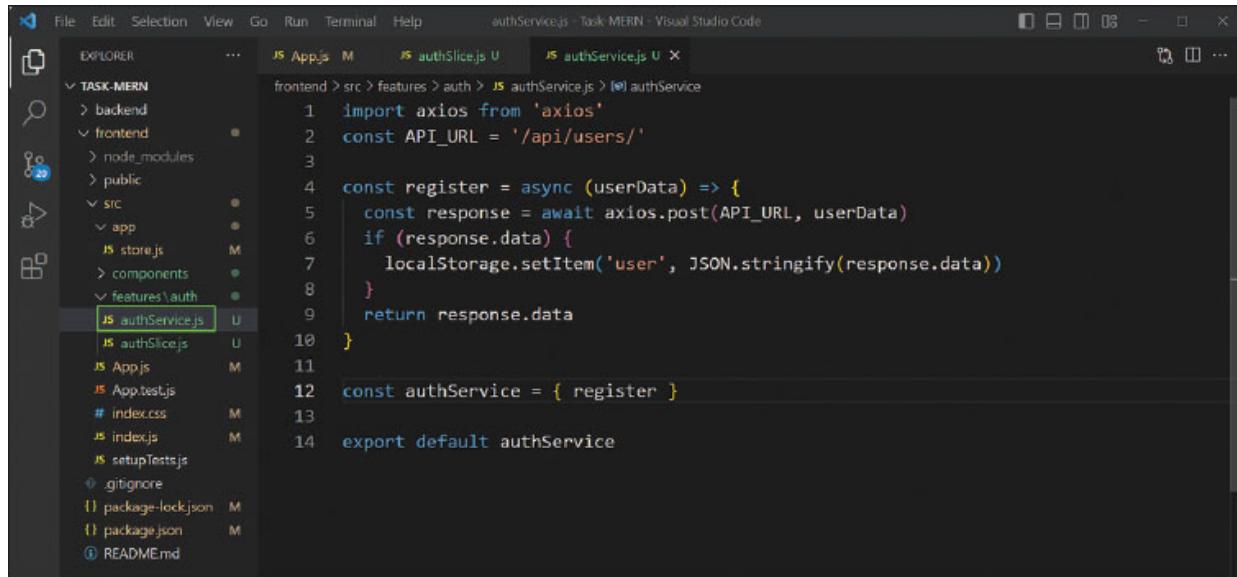
The result of the api call, which we get in `response.data`, is set in the local storage variable `user` using `localStorage.setItem()` function. We are also returning the response from the function.

Lastly, we are exporting the `register` function.

```
import axios from 'axios'
const API_URL = '/api/users/'
const register = async (userData) => {
  const response = await axios.post(API_URL, userData)
  if (response.data) {
    localStorage.setItem('user',
      JSON.stringify(response.data))
  }
  return response.data
}

const authService = { register }

export default authService
```



```
File Edit Selection View Go Run Terminal Help authService.js - Task: MERN - Visual Studio Code
EXPLORER ... JS AuthService.js M JS authSlice.js U JS authService.js U X
TASK-MERN
  > backend
  < frontend
    > node_modules
    > public
      < src
        < app
          JS store.js M
          > components
            < features\auth
              JS authService.js U
              JS authSlice.js U
              JS App.js M
              JS App.test.js M
              # index.css M
              JS index.js M
              JS setupTests.js
            < ignore
            < package-lock.json M
            < package.json M
            README.md
frontend > src > features > auth > JS authService.js > (E) authService
  1 import axios from 'axios'
  2 const API_URL = '/api/users/'
  3
  4 const register = async (userData) => {
  5   const response = await axios.post(API_URL, userData)
  6   if (response.data) {
  7     localStorage.setItem('user', JSON.stringify(response.data))
  8   }
  9   return response.data
 10 }
 11
 12 const authService = { register }
 13
 14 export default authService
```

Figure 7.7: Creating authService.js file

Back in the **authSlice.js** file, we will first import the **authService**. After that, we export a variable **register**. Here, we are using the **createAsyncThunk** function. Again Redux toolkit comes built with a redux thunk, which is a must to do api calls through redux. In the earlier redux versions without a toolkit, we have to manually install the package and do the installation.

Here, the first parameter is the **auth/register**, which means from the auth folder, take the register function. Next, the parameter is an **async arrow function** which takes the user and **thunkAPI** as a parameter.

Inside the function, we have a **try...catch** block. From the **try** block, we are calling the **register** function from the **authService.js** file with the user and returning it. In the catch part, we are simply catching different kinds of errors and returning them.

```
import authService from './authService'
...
...
export const register = createAsyncThunk(
  'auth/register',
  async (user, thunkAPI) => {
    try {
      return await authService.register(user)
    } catch (error) {
```

```

        const message = (error.response && error.response.data
        && error.response.data.message) ||
        error.message ||
        error.toString()
        return thunkAPI.rejectWithValue(message)
    }
}
)

```

```

File Edit Selection View Go Run Terminal Help authSlice.js - Task-MERN - Visual Studio Code
JS App.js M JS authSlice.js U X JS authService.js U
frontend > src > features > auth > JS authSlice.js > [e] register > [+] createAsyncThunk('auth/register') callback > [e] message
1 import { createSlice, createAsyncThunk } from '@reduxjs/toolkit'
2 import authService from './authService'
3
4 const localuser = JSON.parse(localStorage.getItem('user'))
5
6 > const initialState = ...
12 }
13
14 export const register = createAsyncThunk(
15   'auth/register',
16   async (user, thunkAPI) => {
17     try {
18       return await authService.register(user)
19     } catch (error) {
20       const message = (error.response && error.response.data && error.response.data.message) ||
21         error.message ||
22         error.toString()
23       return thunkAPI.rejectWithValue(message)
24     }
25   }
26 )
27
28
29 export const authSlice = createSlice({

```

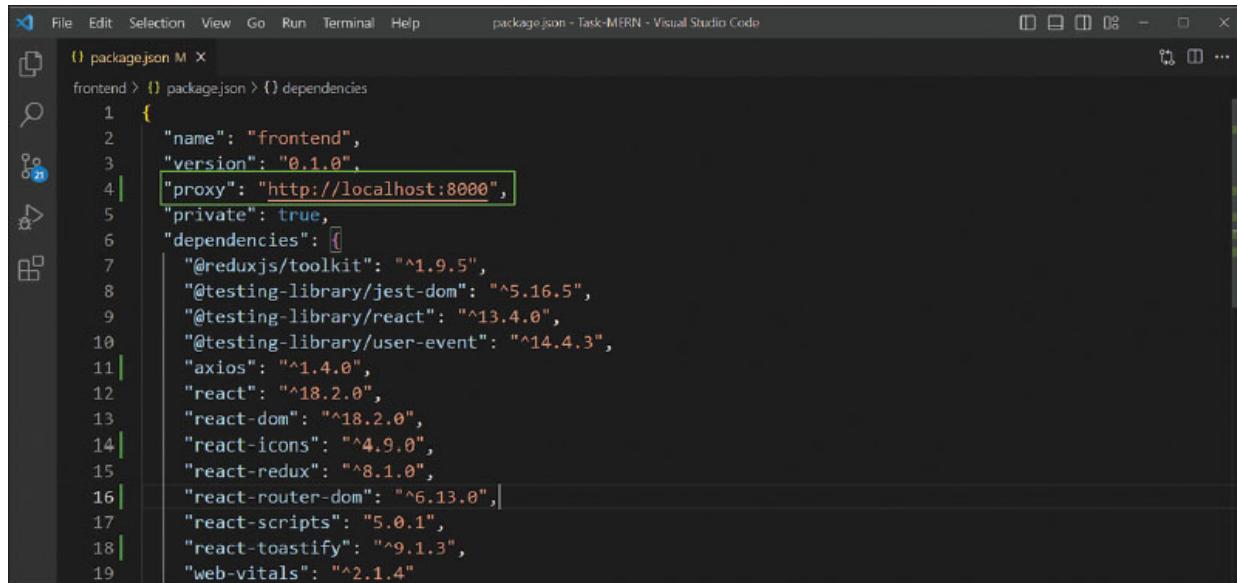
Ln 20, Col 28 Spaces: 4 UTF-B CRLF {} JavaScript ⚡ Go Live ⌂ ⌂

Figure 7.8: Adding thunk in authSlice.js file

The api endpoint from the file **authService.js** should go to the backend endpoint of <http://localhost:8000> and not to the frontend endpoint of <http://localhost:3000>. So, we need to add a proxy variable in the **package.json** file in the **frontend** folder.

```
"proxy": "http://localhost:8000",
```

So, now when we call **axios.post()** inside the **register** function in the **authService.js** file, we will go to <http://localhost:8000/api/users>



```
0 packagejson M X
frontend > {} packagejson > {} dependencies
1 {
2   "name": "frontend",
3   "version": "0.1.0",
4   "proxy": "http://localhost:8000",
5   "private": true,
6   "dependencies": [
7     "@reduxjs/toolkit": "^1.9.5",
8     "@testing-library/jest-dom": "^5.16.5",
9     "@testing-library/react": "^13.4.0",
10    "@testing-library/user-event": "^14.4.3",
11    "axios": "^1.4.0",
12    "react": "^18.2.0",
13    "react-dom": "^18.2.0",
14    "react-icons": "^4.9.0",
15    "react-redux": "^8.1.0",
16    "react-router-dom": "6.13.0",
17    "react-scripts": "5.0.1",
18    "react-toastify": "^9.1.3",
19    "web-vitals": "^2.1.4"
```

Figure 7.9: Adding proxy in the package.json file

Inside our **authSlice.js** file in the **createSlice** function, we will add **extraReducers**. We generally put the reducer action, which changes the state in these **extraReducers**. In the earlier redux versions, we used to do these through the switch statement cases. You can read details for the same in the official redux documentation here.

In our code, we have three cases for pending, fulfilled and rejected cases. Since we are doing an API call to `http://localhost:8000/api/users` through our register function, we have three states in it. When the API call starts, we have a pending state since the API calls generally take 1–2 seconds. We are making the **isLoading** state true and will also show a spinner in this state in the front end.

The next state is the fulfilled case, which will happen if our API call is successful. Here, we are making the **isLoading** as false and **isSuccess** as true and storing the payload which we receive back in the user state.

If, for some reason, the API call is not successful, we have a rejected case. Here, we are making the **isLoading** as false and **isError** as true. We are also storing the error in the message state, which we will receive in the payload—also making the user state variable null.

```
extraReducers: builder => {
  builder
    .addCase(register.pending, (state) => {
```

```

        state.isLoading = true
    })
.addCase(register.fulfilled, (state, action) => {
    state.isLoading = false
    state.isSuccess = true
    state.user = action.payload
})
.addCase(register.rejected, (state, action) => {
    state.isLoading = false
    state.isError = true
    state.message = action.payload
    state.user = null
})
}

```

The screenshot shows the Visual Studio Code interface with the file 'authSlice.js' open. The code defines a reducer for the 'auth' slice. It includes initial state setup and three cases for 'register' actions: pending, fulfilled, and rejected. The 'extraReducers' block is highlighted with a green box.

```

35     state.isSuccess = false
36     state.isError = false
37     state.message = ''
38   },
39 ],
40 extraReducers: builder => {
41   builder
42     .addCase(register.pending, (state) => {
43       state.isLoading = true
44     })
45     .addCase(register.fulfilled, (state, action) => {
46       state.isLoading = false
47       state.isSuccess = true
48       state.user = action.payload
49     })
50     .addCase(register.rejected, (state, action) => {
51       state.isLoading = false
52       state.isError = true
53       state.message = action.payload
54       state.user = null
55     })
56   }
57 }

```

Figure 7.10: Adding extraReducers in the authSlice.js file

Registration form hook up

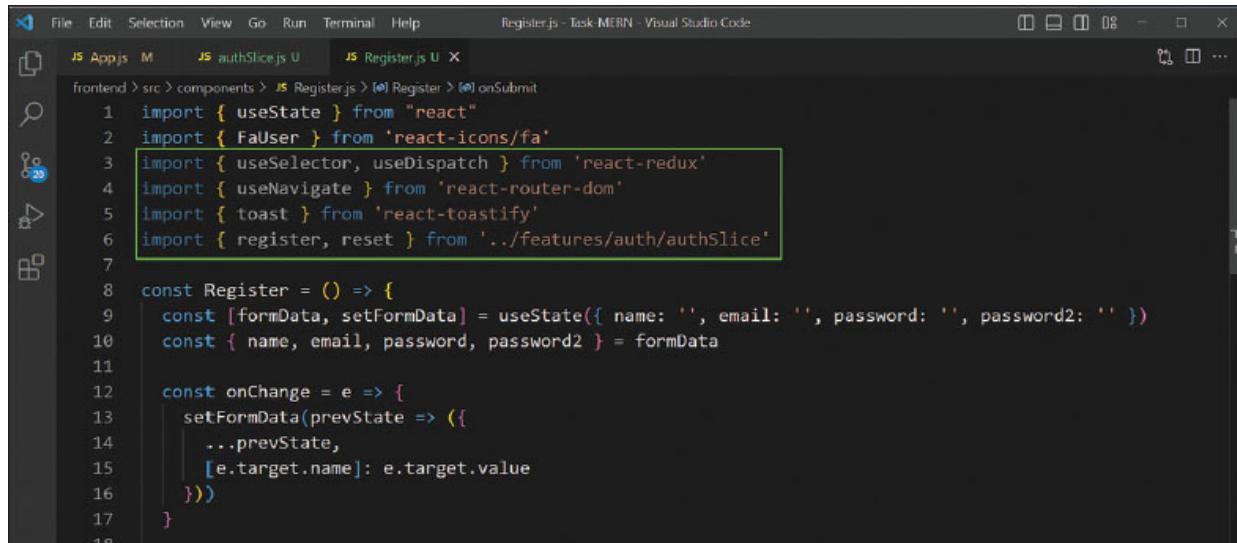
We will now use the slice in our Register component to register a new user. So, head over to the **Register.js** file and add the following imports in it.

Here, we are first importing the custom hooks of `useSelector` and `useDispatch` from `react-redux`. These hooks are used to get the global state of redux and also to dispatch the action creator inside a slice.

After that, we import `useNavigate` from `react-router-dom`. This custom hook is used to navigate easily to different routes. Next, we are importing `toast` from `react-toastify`, which will be used to show the toast message.

Lastly, we are importing the `register` and `reset` from `authSlice`, which will be used to call the register and reset action creators.

```
import { useSelector, useDispatch } from 'react-redux'
import { useNavigate } from 'react-router-dom'
import { toast } from 'react-toastify'
import { register, reset } from '../features/auth/authSlice'
```

A screenshot of Visual Studio Code showing the 'Register.js' file. The code editor has a dark theme. The file contains several import statements. A rectangular selection box highlights the following imports: 'useSelector', 'useDispatch', 'useNavigate', 'toast', and 'register, reset'. The imports are located at the top of the file, below the class definition.

```
import { useState } from "react"
import { FaUser } from 'react-icons/fa'
import { useSelector, useDispatch } from 'react-redux'
import { useNavigate } from 'react-router-dom'
import { toast } from 'react-toastify'
import { register, reset } from '../features/auth/authSlice'

const Register = () => {
  const [formData, setFormData] = useState({ name: '', email: '', password: '', password2: '' })
  const { name, email, password, password2 } = formData

  const onChange = e => {
    setFormData(prevState => ({
      ...prevState,
      [e.target.name]: e.target.value
    }))
}
```

Figure 7.11: Adding imports in the Register.js file

Now, to show the `toast` message using `react-toastify`, we need to do one more configuration. Here, we will first import `ToastContainer` from `react-toastify`. And will also import a corresponding css file.

We now need to add the `ToastContainer` component after the Routing is done, which is after the `<Router>` tag.

```
import { ToastContainer } from 'react-toastify'
import 'react-toastify/dist/ReactToastify.css'
...
<ToastContainer />
```

```
File Edit Selection View Go Run Terminal Help App.js - Task MERN - Visual Studio Code
JS App.js M X JS authSlice.js U JS Register.js U
frontend > src > JS App.js > App
4 import Register from './components/Register';
5 import Header from './components/Header';
6 import { ToastContainer } from 'react-toastify'
7 import 'react-toastify/dist/ReactToastify.css'
8
9 function App() {
10   return [
11     <>
12       <Router>
13         <div className='container'>
14           <Header />
15           <Routes>
16             <Route path="/" element={<Dashboard />} />
17             <Route path="/login" element={<Login />} />
18             <Route path="/register" element={<Register />} />
19           </Routes>
20         </div>
21       </Router>
22       <ToastContainer />
23     </>
24   ];
25 }
26
27 export default App;
Ln 23, Col 1 Spaces: 2 UTF-8 LF (1) JavaScript Go Live R D
```

Figure 7.12: Configuring toastify in App.js file

Back in the **Register.js** file, we will create variables for `navigate` and `dispatch` using the `useNavigate` and `useDispatch` hooks.

Next, we will get the global state of the `user`, `isLoading`, `isError`, `isSuccess`, `message` using the `useSelector` hook. Lastly, inside the `onSubmit()` function, we are first checking if the password and the confirm password are different. And showing a toast message of `Passwords are different` in that case.

Else we are taking the name, email and password entered by the user and putting it in a `userData` variable and, after that dispatching it with the `dispatch` to the `register` function in the `authSlice.js` file.

```
const navigate = useNavigate()
const dispatch = useDispatch()

const { user, isLoading, isError, isSuccess, message } =
useSelector(state => state.auth)

...
...
const onSubmit = e => {
  e.preventDefault()
```

```

        if (password !== password2) {
          toast.error('Passwords are different')
        } else {
          const userData = { name, email, password }
          dispatch(register(userData))
        }
      }
    }
  
```

```

File Edit Selection View Go Run Terminal Help Register.js - Task:MERN - Visual Studio Code
App.js M authSlice.js U Register.js U X
frontend > src > components > Register.js > onSubmitted
8  const Register = () => {
9    const [formData, setFormData] = useState({ name: '', email: '', password: '', password2: '' })
10   const { name, email, password, password2 } = formData
11
12   const navigate = useNavigate()
13   const dispatch = useDispatch()
14
15   const { user, isLoading, isError, isSuccess, message } = useSelector(state => state.auth)
16
17   const onChange = e => {
18     setFormData(prevState => ({ ...state, [e.target.name]: e.target.value }))
19   }
20
21   const onSubmit = e => {
22     e.preventDefault()
23
24     if (password !== password2) {
25       toast.error('Passwords are different')
26     } else {
27       const userData = { name, email, password }
28       dispatch(register(userData))
29     }
30   }
31
32 }
33

```

Figure 7.13: Using hooks in the Register.js file

Now, in the **Register.js** file, we will add an **useEffect()**. This **useEffect** will run when this component loads or when any of the **user**, **isError**, **isSuccess**, **message**, **navigate**, **dispatch** changes.

Inside it, we first check if the state of error is there and show a toast with the error message for that case. Next, if the state is of success or we got the user data, then navigate back to the home route.

If none of the cases is there, we are dispatching the reset to setback everything to initial state values.

```

import { useEffect, useState } from "react"
...
...

```

```

useEffect(() => {
  if (isError) toast.error(message)
  if ( isSuccess || user) navigate('/')
  dispatch(reset())
}, [user, isError, isSuccess, message, navigate, dispatch])

```

```

File Edit Selection View Go Run Terminal Help Register.js - Visual Studio Code
App.js M authSlice.js U Register.js U Spinner.js U
frontend > src > components > Register > Register
1 import { useEffect, useState } from "react"
2 import { FaUser } from 'react-icons/fa'
3 import { useSelector, useDispatch } from 'react-redux'
4 import { useNavigate } from 'react-router-dom'
5 import { toast } from 'react-toastify'
6 import { register, reset } from '../features/auth/authSlice'
7 import Spinner from './Spinner'

8
9 const Register = () => {
10   const [formData, setFormData] = useState({ name: '', email: '', password: '', password2: '' })
11   const { name, email, password, password2 } = formData
12
13   const navigate = useNavigate()
14   const dispatch = useDispatch()
15
16   const { user, isLoading, isError, isSuccess, message } = useSelector(state => state.auth)
17
18   useEffect(() => {
19     if (isError) toast.error(message)
20     if (isSuccess || user) navigate('/')
21     dispatch(reset())
22   }, [user, isError, isSuccess, message, navigate, dispatch])
23
24   const onChange = e => {

```

Figure 7.14: *useEffect* in Register.js file

We will also show a loading spinner on our Register page when the user clicks on the Submit button. For this, we will create a Spinner component. So, create a **Spinner.js** file inside the **components** folder and add the following content to it.

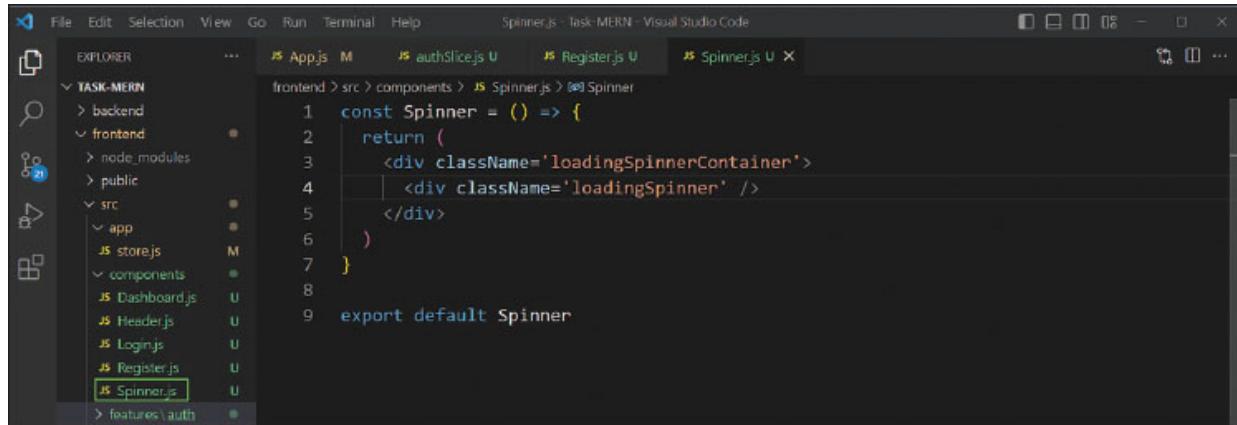
Here, we are just using the already defined CSS in our index.css file, which shows the spinner icon.

```

const Spinner = () => {
  return (
    <div className='loadingSpinnerContainer'>
      <div className='loadingSpinner' />
    </div>
  )
}

export default Spinner

```



The screenshot shows the Visual Studio Code interface with a dark theme. The Explorer sidebar on the left displays a project structure for 'TASK-MERN' with folders like 'backend', 'frontend', 'node_modules', 'public', and 'src'. Inside 'src', there are 'app', 'store.js', and 'components' folders containing files such as 'Dashboard.js', 'Header.js', 'Login.js', 'Register.js', and 'Spinner.js'. The 'Spinner.js' file is currently open in the editor. The code defines a 'Spinner' component as a functional component that returns a container div with a child spinner div.

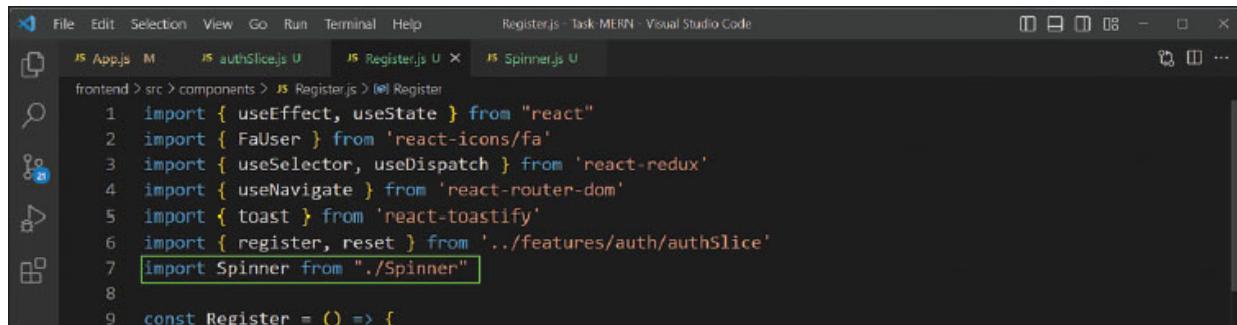
```
const Spinner = () => {
  return (
    <div className='loadingSpinnerContainer'>
      <div className='loadingSpinner' />
    </div>
  )
}

export default Spinner
```

Figure 7.15: Creating Spinner.js file

Now, we will first import the **Spinner** in our **Register.js** file.

```
import Spinner from './Spinner'
```



The screenshot shows the 'Register.js' file open in Visual Studio Code. The code imports several packages and then imports the 'Spinner' component from the local directory. The 'Spinner' import statement is highlighted with a red rectangle.

```
import { useEffect, useState } from "react"
import { FaUser } from 'react-icons/fa'
import { useSelector, useDispatch } from 'react-redux'
import { useNavigate } from 'react-router-dom'
import { toast } from 'react-toastify'
import { register, reset } from '../features/auth/authSlice'
import Spinner from "./Spinner"
```

Figure 7.16: Importing Spinner Component

Now, we will update the return statement in the **Register.js** file. Here, we are first checking if the **isLoading** state is available and showing the **Spinner** component if that is the case. Or else we are showing the whole earlier code.

```
isLoading ? <Spinner /> : (
  <>
    <section className='heading'>
      ...
    </section>
    <section className='form'>
      ...
    </section>
  </>
)
```

```
File Edit Selection View Go Run Terminal Help Register.js - Task: MERN - Visual Studio Code
App.js M authSlice.js U Register.js U Spinner.js U
frontend > src > components > Register.js > [Editor] Register
38     }
39   }
40
41   return (
42     isLoading ? <Spinner /> : []
43   )
44   <>
45     <section className='heading'>...
46     </section>
47     <section className='form'>...
48     </section>
49   </>
50   <div>
51     <Formik
52       initialValues={initialValues}
53       validationSchema={validationSchema}
54       onSubmit={onSubmit}
55     >
56       <FormikForm>
57         <Grid>
58           <GridItem>
59             <Input
60               type='text'
61               name='name'
62               value={name}
63               onChange={handleNameChange}
64             />
65           </GridItem>
66           <GridItem>
67             <Input
68               type='text'
69               name='email'
70               value={email}
71               onChange={handleEmailChange}
72             />
73           </GridItem>
74         </Grid>
75       </FormikForm>
76     </Formik>
77   </div>
78 }
79
80 export default Register
```

Figure 7.17: Using Spinner Component

Testing user registration

Click on the Register button, and you will go to <http://localhost:3000/register>. We have also opened the Redux dev tools, and here we can notice that reset is called and the user state is set to the initial value.

Here, we have entered all the required fields.

The screenshot shows a browser window with the URL localhost:3000/register. The page displays a registration form with fields for Name, Email, Password, and Confirm Password. Below the form is a "Submit" button. To the right of the browser is the Redux Dev Tools extension, which shows the current state of the "auth" slice. The state object is as follows:

```
auth (pre)
  user (null)
  isError (false)
  isSuccess (false)
  isLoading (false)
  message (empty string)
```

Figure 7.18: Initial states in the register

We have intentionally given the confirmed password as wrong. Here, a toast message of `Passwords are different` is shown, which automatically disappears after 5 seconds.

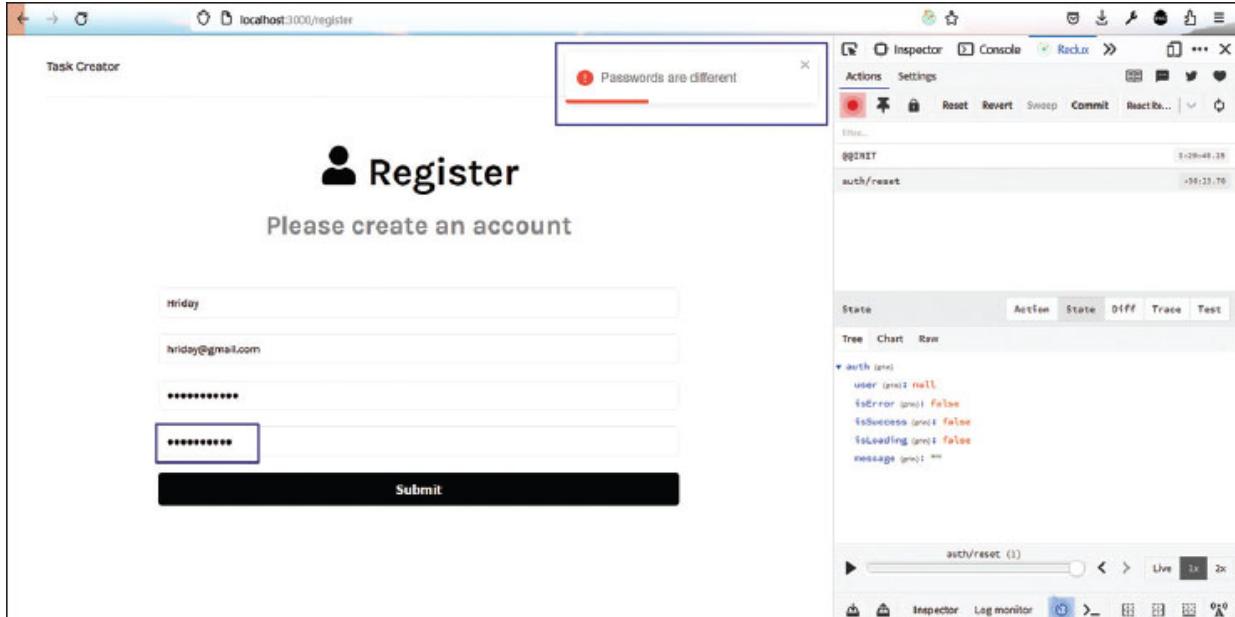


Figure 7.19: Toast message in register

We have, this time, given the same passwords in both fields and hit the `submit` button. Here, we have been taken to the home page of the Dashboard. But also notice that different actions have been done in the Redux devtools.

Here, first, the pending action ran from the `extraReducers` in the `authSlice.js` file. Here, the `isLoading` was set to true, and the rest states were kept as it was earlier.

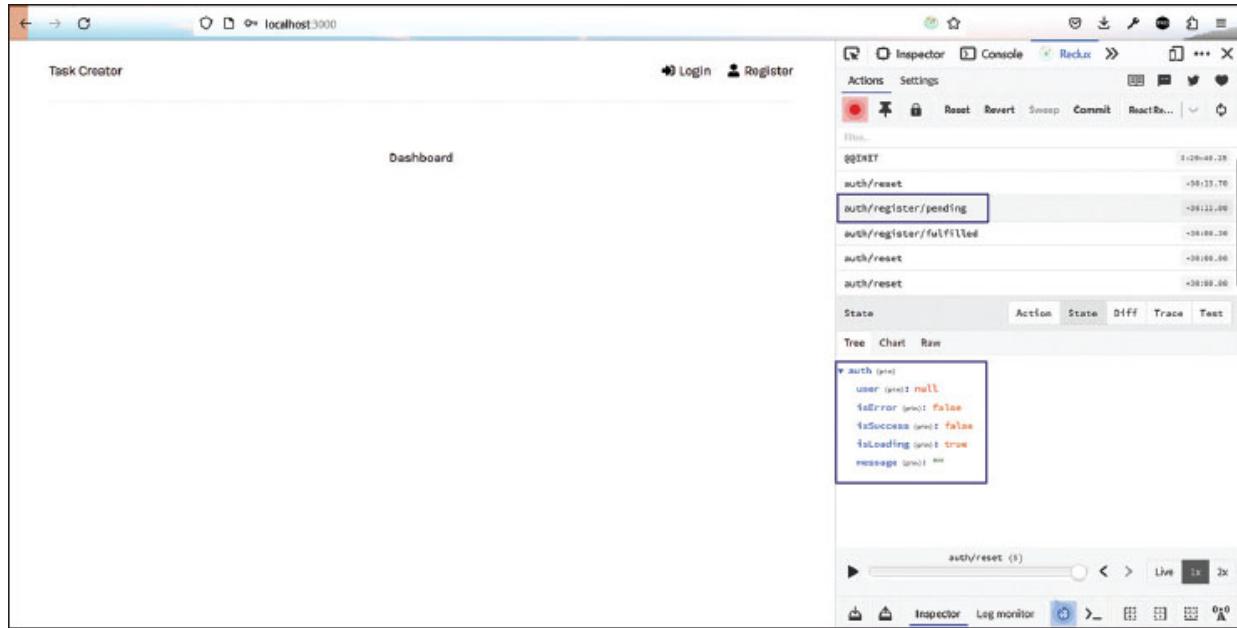


Figure 7.20: Pending state in the register

Since the API call to the backend was successful, the fulfilled action had run. This has made the `isLoading` false and `isSuccess` as true. And the user state was set to the payload received from the backend. This payload consists of `_id`, `name`, `email`, and `token`.

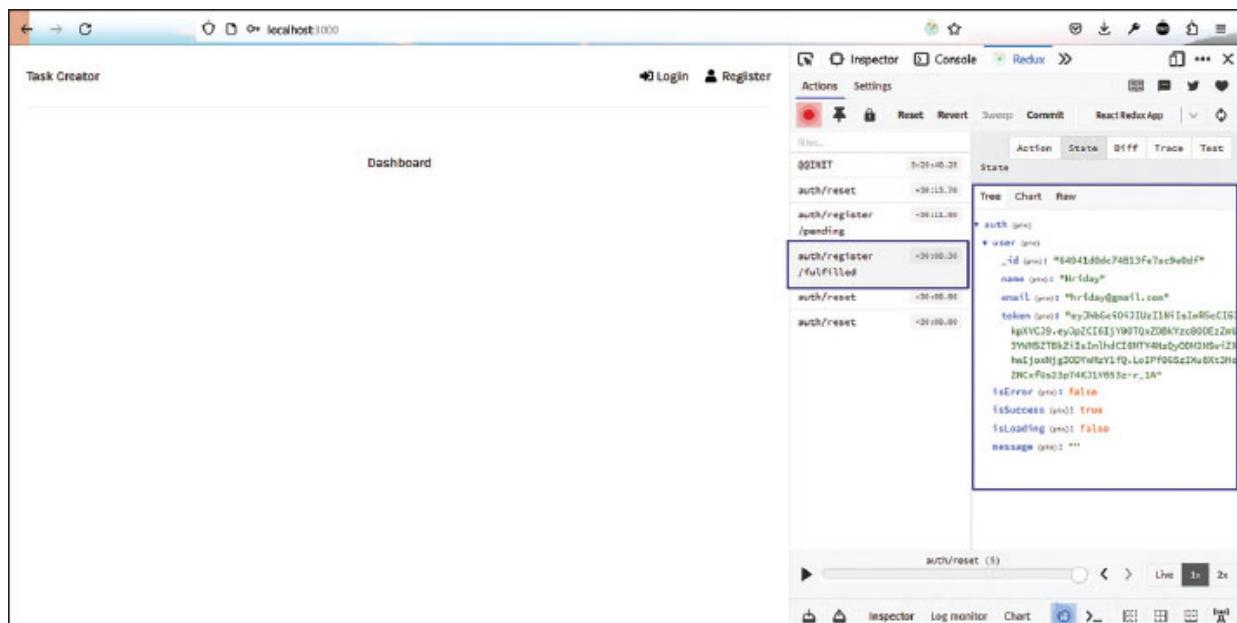


Figure 7.21: Fulfilled state in the register

The reset was run again, and it set everything back to an earlier state, but the user was kept intact.

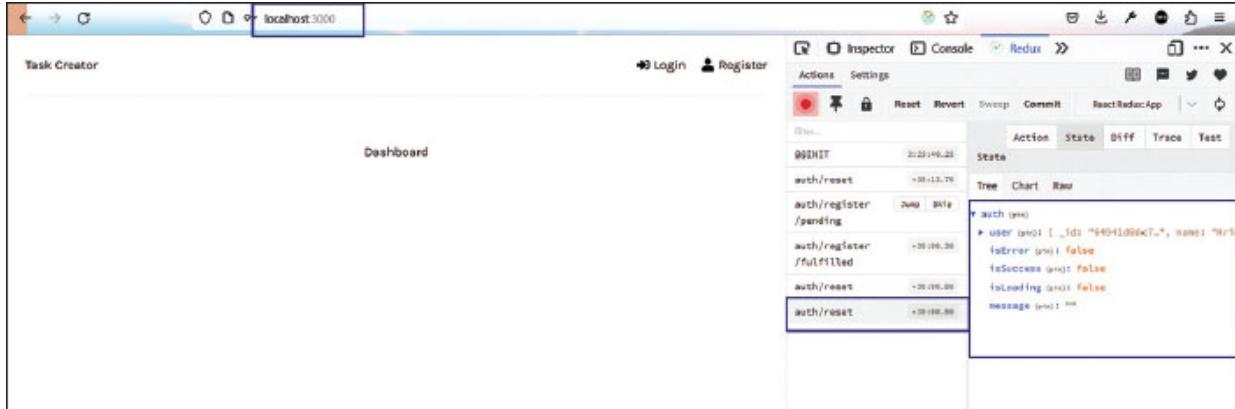


Figure 7.22: Reset state in the register

The user data was also saved in the Local Storage of the browser, containing all the fields of the user object.

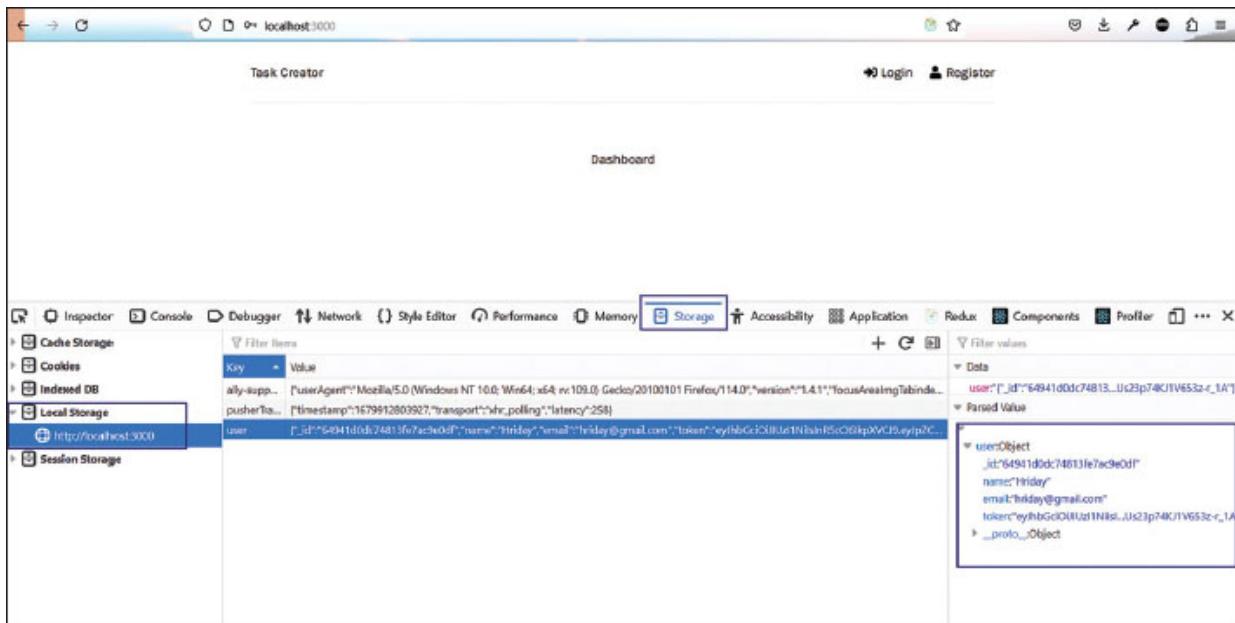


Figure 7.23: Local Storage in Browser

Finally, we checked the value for users in the connected MongoDB database, and a new field was added to it.

The screenshot shows the MongoDB Atlas interface for a project named 'HMRN-Task-App'. On the left, there's a sidebar with sections like 'DEPLOYMENT', 'Database' (selected), 'Data Lake', 'SERVICES', 'Triggers', 'Data API', 'Data Federation', and 'Search'. Under 'Database', it lists 'taskApp' and 'users'. The main area shows a table with columns: '_id', 'name', 'email', 'password', 'createdAt', 'updatedAt', and '__v'. There are two rows of data. The first row is a system-generated document with IDs and timestamps. The second row is a user document with the name 'Hriday', email 'hriday@gmail.com', and a hashed password.

| _id | name | email | password | createdAt | updatedAt | __v |
|---|--------|------------------|--|-------------------------------|-------------------------------|-----|
| <code>ObjectID('4e041d9dc74813fe7ac9e0df')</code> | Hriday | hriday@gmail.com | <code>*\$2a\$10\$1eh56F2Tg/o0CRYz7BaQhQSY920kWf5mVCTeaowHQDFUlkxEBQ0*</code> | 2023-06-19T09:45:25.000+00:00 | 2023-06-19T09:45:25.000+00:00 | 0 |
| <code>ObjectID('4e041d9dc74813fe7ac9e0e1')</code> | Hriday | hriday@gmail.com | <code>*\$2a\$10\$9q4ZPj2s2m621x9e5Te374ex2846AYG2TF7VThv21G.*euSKKkare*</code> | 2023-06-22T10:06:05.256+00:00 | 2023-06-22T10:06:05.256+00:00 | 0 |

Figure 7.24: Record in Database

Conclusion

In this chapter, we have learned about implementing Redux in our project through the toolkit. Here, we first created a slice for auth, which is a combination of reducer and action creator. We had also hooked it up with auth service to help do api calls to the backend endpoint.

Finally, we have completed our Register user functionality from the front end using the slice. And we were able to Register a user by submitting a form from the front end.

In the next chapter, we will implement the login and logout functionalities.

Points to remember

- Implementing the Redux toolkit in a project using slice and services.
- Using a slice in the latest Redux toolkit, we combine the functionalities of reducer and action creator.
- Getting global state through redux in a component. And dispatching action creators from a component.

CHAPTER 8

Login and Logout Functionalities

Introduction

This chapter covers the implementation of Logout and Login functionalities in the project. We will be going to use logic similar to the previous chapter to set both of them. In this chapter, we are also going to set up a reducer for the Login form. Finally, we are also going to test the user login workflow.

Structure

In this chapter, we are going to discuss the following topics:

- Implementing Logout
- Implementing Login
- Login form hook up
- Testing user login

Implementing Logout

In the previous chapter, we have implemented the Register functionality. Now, the logout functionality will be much simpler than it. Here, on click of a new Logout button, we have removed all tokens.

So, first, in the **authSlice.js** file, create a new function called `logout`. Similar to the `register` function, it uses the `createAsyncThunk` function. But it is much simpler than the `register` function of the previous chapter.

Here, the first parameter is the `auth/login`, which means from the `auth` folder, take the `login` function. We are going to create this function next in the `authService.js` file. Next, the parameter is an `async` arrow function calling the `logout()` from the `authService.js` file.

```
export const logout = createAsyncThunk('auth/logout', async () => await authService.logout())
```

```
File Edit Selection View Go Run Terminal Help authSlice.js - Task MERN - Visual Studio Code

JS authSlice.js U X
frontend > src > features > auth > JS authSlice.js > authSlice
12 }
13
14 export const register = createAsyncThunk(
15   'auth/register',
16   async (user, thunkAPI) => {
17     try {
18       return await authService.register(user)
19     } catch (error) {
20       const message = (error.response && error.response.data && error.response.data.message) ||
21         error.message ||
22         error.toString()
23       return thunkAPI.rejectWithValue(message)
24     }
25   }
26 )
27
28 export const logout = createAsyncThunk('auth/logout', async () => await authService.logout())
29
30 export const authSlice = createSlice([[]]
```

Figure 8.1: Creating logout in authSlice.js file

Now, in the authService.js file, we will create our logout function. Again notice that here it's much simpler than the register function created in the earlier chapter.

Here, we are just removing the user from the local storage using the `localStorage.removeItem()` method. After that, we are also exporting the logout function.

```
const logout = () => localStorage.removeItem('user')
```

```
File Edit Selection View Go Run Terminal Help authService.js - Task MERN - Visual Studio Code

JS authService.js U X
frontend > src > features > auth > JS authService.js > authService
1 import axios from 'axios'
2 const API_URL = '/api/users/'
3
4 const register = async (userData) => {
5   const response = await axios.post(API_URL, userData)
6   if (response.data) {
7     localStorage.setItem('user', JSON.stringify(response.data))
8   }
9   return response.data
10 }
11
12 const logout = () => localStorage.removeItem('user')
13
14 const authService = [ register, logout ]
15
16 export default authService
```

Figure 8.2: Creating logout in authService.js file

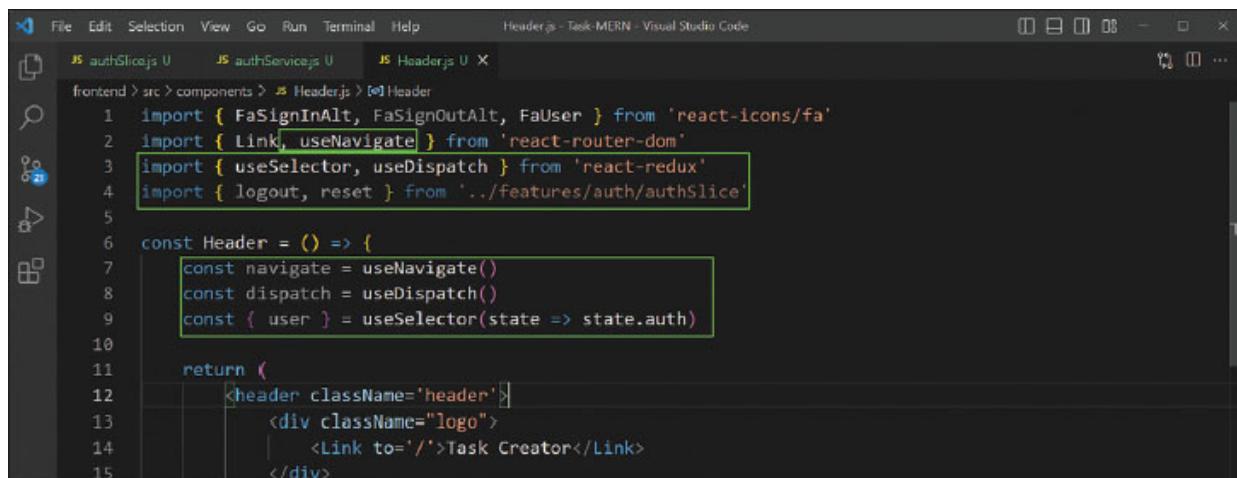
We don't have a Logout button in our project. This Logout button will be created in the Header component. So, head over to the Header.js file and import `useNavigate` from react-router-dom.

We are also importing `useSelector` and `useDispatch` from react-redux. Next, we import logout and reset from the `authSlice` file.

Inside the Header, we have created a `navigate` variable using the `useNavigate` hook. Then we created a `dispatch` variable using the `useDispatch` hook. And we are also accessing the global state of the `user` using the `useSelector` hook.

```
import { Link, useNavigate } from 'react-router-dom'
import { useSelector, useDispatch } from 'react-redux'
import { logout, reset } from '../features/auth/authSlice'

...
...
const navigate = useNavigate()
const dispatch = useDispatch()
const { user } = useSelector(state => state.auth)
```



The screenshot shows the Visual Studio Code interface with the Header.js file open. The file path is indicated as 'frontend > src > components > Header.js'. The code editor displays several imports at the top:

```
1 import { FaSignInAlt, FaSignOutAlt, FaUser } from 'react-icons/fa'
2 import { Link, useNavigate } from 'react-router-dom'
3 import { useSelector, useDispatch } from 'react-redux'
4 import { logout, reset } from '../features/auth/authSlice'
```

Below these imports, the code defines the `Header` component:

```
5 const Header = () => {
6   const navigate = useNavigate()
7   const dispatch = useDispatch()
8   const { user } = useSelector(state => state.auth)
9
10  return (
11    <header className='header'>
12      <div className="logo">
13        <Link to='/'>Task Creator</Link>
14      </div>
```

A green rectangular selection highlights the imports and the beginning of the `Header` component definition.

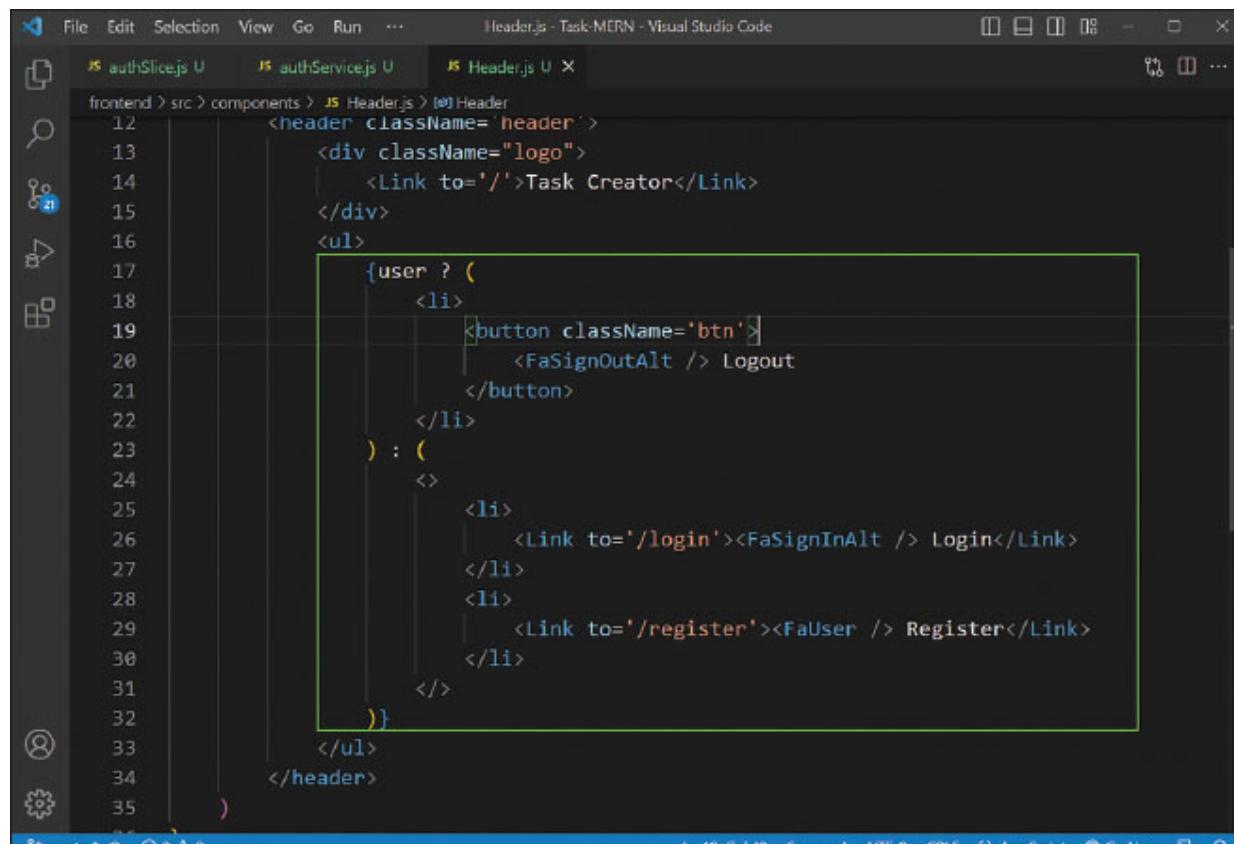
Figure 8.3: Adding imports in the Header.js file

We will update our logic to show buttons in the `Header.js` file. Earlier, we were just showing the Login and Register buttons inside the `` through two ``

But now we have updated the logic and are using a ternary operator. Earlier we were only showing the pair of `Login` and `Register` button. But now if

user is available, we are showing the `Logout` button. Or else the `Login` and `Register` buttons.

```
{user ? (
  <li>
    <button className='btn'>
      <FaSignOutAlt /> Logout
    </button>
  </li>
) : (
  <>
  <li>
    <Link to='/login'><FaSignInAlt /> Login</Link>
  </li>
  <li>
    <Link to='/register'><FaUser /> Register</Link>
  </li>
  </>
)
) }
```



The screenshot shows the `Header.js` file in Visual Studio Code. The code implements a navigation menu that changes based on whether a user is logged in. If a user is logged in, it displays a `Logout` button. Otherwise, it displays `Login` and `Register` links. The code uses a ternary operator to conditionally render the `` elements. The conditional block is highlighted with a green rectangular selection.

```
File Edit Selection View Go Run ... Header.js - Task-MERN - Visual Studio Code
authSlice.js U authService.js U Header.js U X
frontend > src > components > Header.js > Header
12   <header className="header">
13     <div className="logo">
14       <Link to="/">Task Creator</Link>
15     </div>
16     <ul>
17       {user ? (
18         <li>
19           <button className='btn'>
20             <FaSignOutAlt /> Logout
21           </button>
22         </li>
23       ) : (
24         <>
25         <li>
26           <Link to='/login'><FaSignInAlt /> Login</Link>
27         </li>
28         <li>
29           <Link to='/register'><FaUser /> Register</Link>
30         </li>
31       </>
32     )
33     </ul>
34   </header>
35 )
```

Figure 8.4: Adding Logout button in Header.js file

Now, we will add an `onClick` handler to the Logout button in the **Header.js** file. The `onClick` handler is calling a function `logoutFn`.

We have created the `logoutFn` function, which is first dispatching the `logout()` from the **authSlice.js** file. Next, it dispatches the `reset()` from the **authSlice.js** file. Afterwards, we navigate back to the home route using `navigate()`.

```
const logoutFn = () => {
  dispatch(logout())
  dispatch(reset())
  navigate(</>)
}

...
...

{user ? (
  <li>
    <button className=>btn > onClick={logoutFn}>
      <FaSignOutAlt /> Logout
    </button>
  </li>
) : (
  <>
  ...
  </>
) }
```

```
File Edit Selection View Go Run ... Header.js - Task-MERN - Visual Studio Code
authSlice.js U authService.js U Header.js U X
frontend > src > components > Header.js > Header > logoutFn
7 const navigate = useNavigate()
8 const dispatch = useDispatch()
9 const { user } = useSelector(state => state.auth)
10
11 const logoutFn = () => {
12     dispatch(logout())
13     dispatch(reset())
14     navigate('/')
15 }
16
17 return (
18     <header className='header'>
19         <div className="logo">
20             <Link to='/'>Task Creator</Link>
21         </div>
22         <ul>
23             {user ? (
24                 <li>
25                     <button className='btn' onClick={logoutFn}>
26                         <FaSignOutAlt /> Logout
27                     </button>
28                 </li>
29             ) : (
30                 <></>
31             )
32         </ul>
33     </header>
34 )
35
36 export default Header
```

Figure 8.5: Adding Logout function in Header.js file

As in the case of register, we need to add a case in the **extraReducers** in the **authSlice.js** file. In the register, we had three cases because we were doing the API call.

But here, we have only one case of **fulfilled** in which we are making the user state null.

```
.addCase(logout.fulfilled, (state) => {
    state.user = null
})
```

```
state.message = ''  
],  
extraReducers: builder => {  
    builder  
        .addCase(register.pending, (state) => {  
            state.isLoading = true  
        })  
        .addCase(register.fulfilled, (state, action) => {  
            state.isLoading = false  
            state.isSuccess = true  
            state.user = action.payload  
        })  
        .addCase(register.rejected, (state, action) => {  
            state.isLoading = false  
            state.isError = true  
            state.message = action.payload  
            state.user = null  
        })  
        .addCase(logout.fulfilled, (state) => {  
            state.user = null  
        })  
}  
}  
}
```

Figure 8.6: Adding logout case function in authSlice.js file

Now, go to `http://localhost:3000/` from the Chrome/Firefox browser and open the redux devtools. Log in to the app if not already done.

If logged in, we will see the Logout button. And also, in Redux Devtools, we will see the `INIT` state with the user and other states.

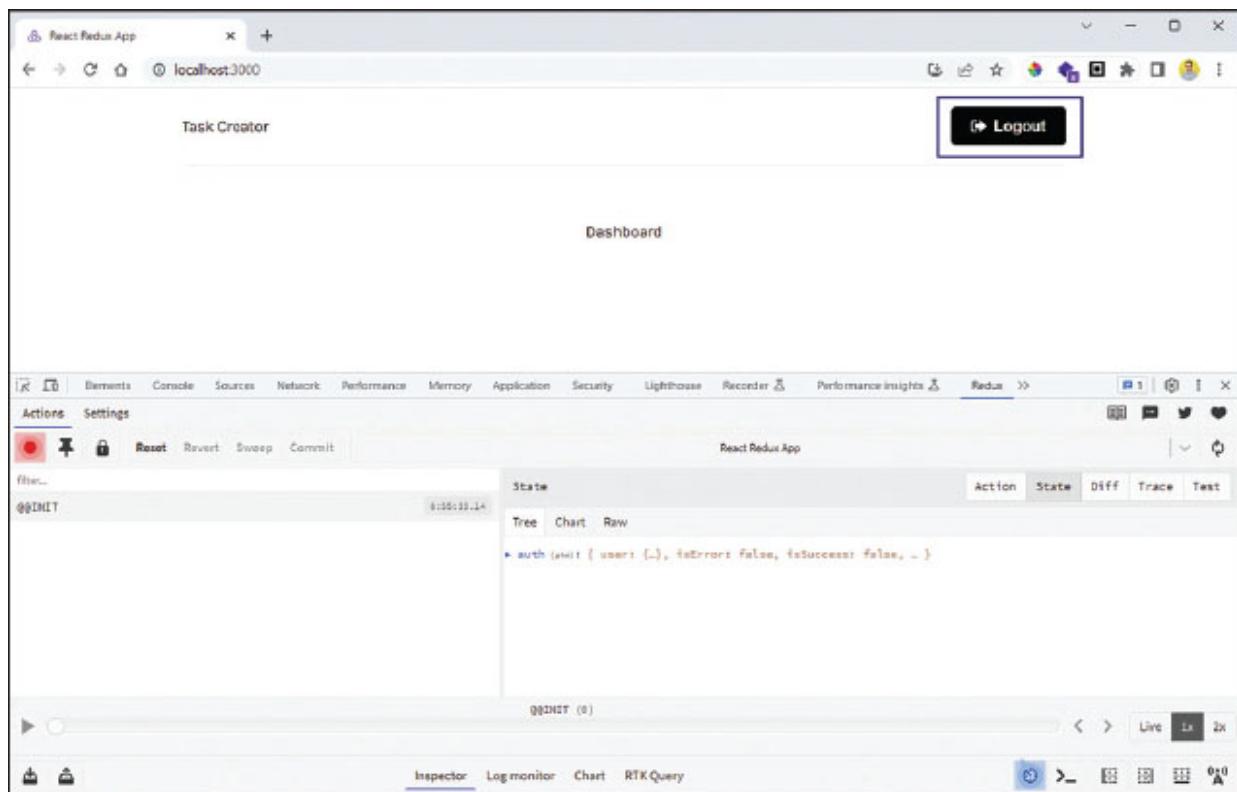


Figure 8.7: Logout button in localhost

Once we click on the Logout button in the preceding screenshot, we see three states have been changed. We have a logout/pending, reset and finally, the logout/fulfilled states.

Since, in the Header.js in `logoutFn()` we are also calling the `reset()` from the `authSlice.js` file, these two additional states are being called.

We can see in the fulfilled state that the user is set to null.

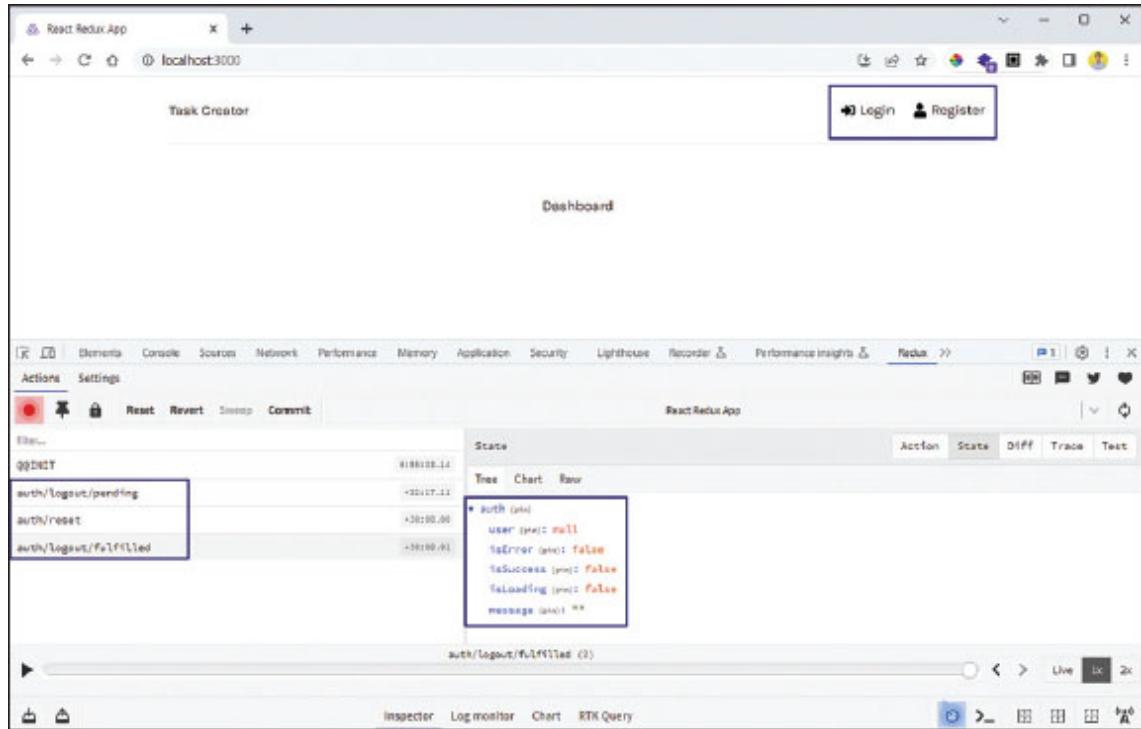


Figure 8.8: On clicking the Logout button in localhost

When they Logout, the user's data is also deleted from the local storage. To check the same, Login again and go to the Application tab in Chrome or Storage tab in Firefox.

Here, click on Local Storage and then `http://localhost:3000/`. Here, we will see the user data being stored in local storage.

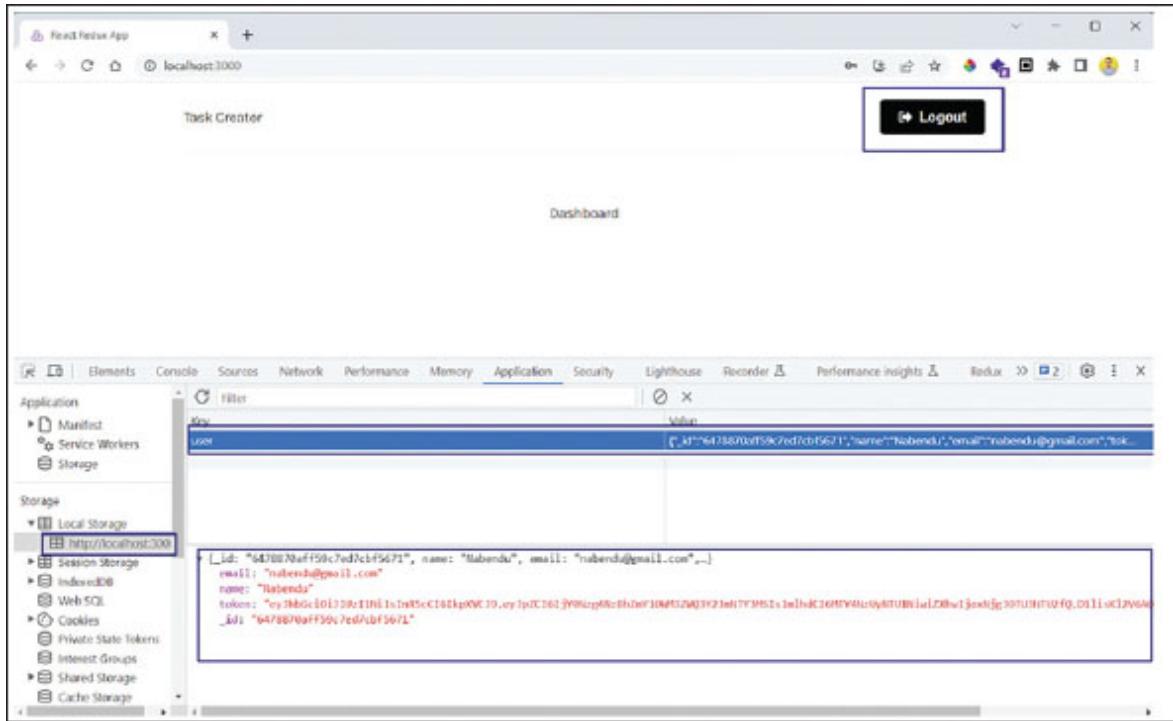


Figure 8.9: Login in localhost showing the user in local storage

Now, click on the Logout button, and we will see that the user data has been deleted from the **LocalStorage**.

This happens because when we click on the **LocalStorage** button, then the function `localStorage.removeItem('user')` in `authService.js` is executed. And this removes the user from local storage.

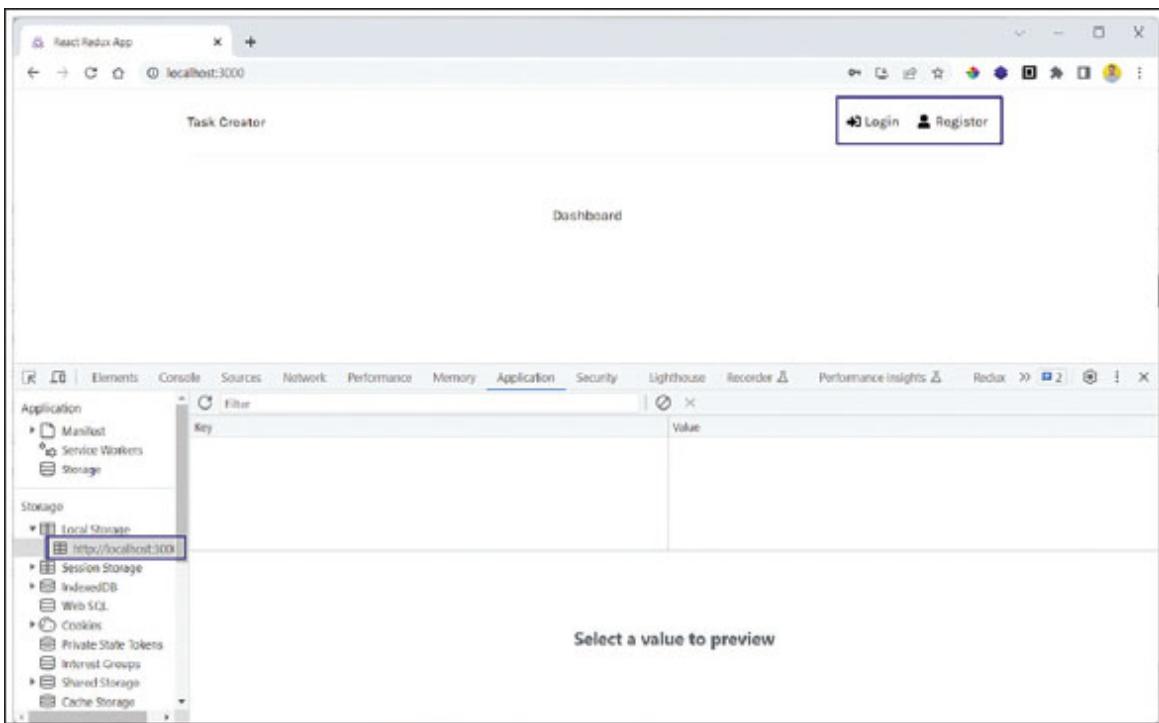


Figure 8.10: Logout in localhost removing user in local storage

Implementing Login

Now, we will implement the Login functionality. This is quite similar to the Register functionality in the previous chapter.

Back in the **authSlice.js** file, we are exporting a variable `login`. Here, we are using the `createAsyncThunk` function.

Here, the first parameter is the `auth/login`, which means from the `auth` folder, take the `login` function. Next, the parameter is an async arrow function which takes the `user` and `thunkAPI` as a parameter.

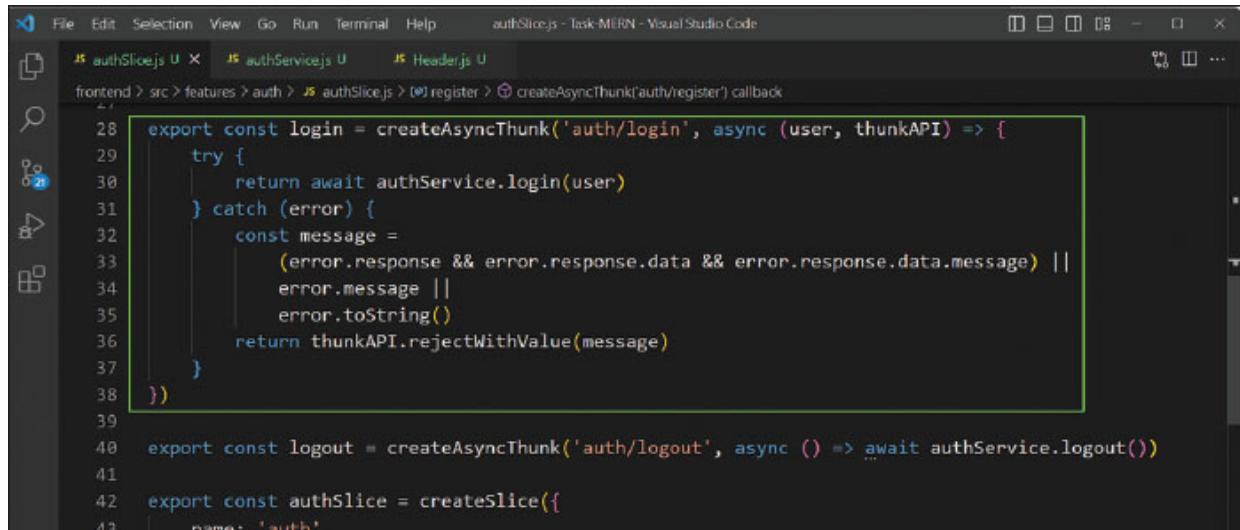
Inside the function, we have a `try...catch` block. From the `try` block, we are calling the `login` function from the `authService.js` file with the `user` and returning it. In the `catch` part, we are simply catching different kinds of errors and returning them.

```
export const login = createAsyncThunk('auth/login', async
  (user, thunkAPI) => {
    try {
      return await authService.login(user)
    } catch (error) {
```

```

    const message =
      (error.response && error.response.data &&
       error.response.data.message) ||
      error.message ||
      error.toString()
    return thunkAPI.rejectWithValue(message)
  }
}

```



The screenshot shows the Visual Studio Code interface with the authSlice.js file open. The code editor has a dark theme. A green rectangular box highlights the implementation of the `login` thunk function. The function uses `createAsyncThunk` to call `authService.login`. It handles errors by extracting a message from the response or the error object itself, and returns it via `thunkAPI.rejectWithValue`.

```

27 import { createAsyncThunk } from '@reduxjs/toolkit'
28 import authService from './authService'
29
30 export const login = createAsyncThunk('auth/login', async (userData, thunkAPI) => {
31   try {
32     return await authService.login(userData)
33   } catch (error) {
34     const message =
35       (error.response && error.response.data && error.response.data.message) ||
36       error.message ||
37       error.toString()
38   }
39 }
40 export const logout = createAsyncThunk('auth/logout', async () => await authService.logout())
41
42 export const authSlice = createSlice({
43   name: 'auth'
}

```

Figure 8.11: Adding thunk in authSlice.js file

Next, we have created a `login` function in the `authService.js` file, which takes the `userData`. Inside the function, we are doing a POST call to the `API_URL` plus `login` with the `userData`.

The result of the api call, which we get in `response.data`, is set in the local storage variable `user` using `localStorage.setItem()` function. We are also returning the response from the function.

Lastly, we are exporting the `login` function.

```

const login = async (userData) => {
  const response = await axios.post(API_URL + 'login',
  userData)
  if (response.data) {
    localStorage.setItem('user',
    JSON.stringify(response.data))
  }
}

```

```

        return response.data
    }
}

```

```

File Edit Selection View Go Run Terminal Help authService.js - Task-MERN - Visual Studio Code
authSlice.js U authService.js U Header.js U
frontend > src > features > auth > authService.js > [0] register
1 import axios from 'axios'
2 const API_URL = '/api/users/'
3
4 const register = async (userData) => {
5     const response = await axios.post(API_URL, userData)
6     if (response.data) {
7         localStorage.setItem('user', JSON.stringify(response.data))
8     }
9     return response.data
10 }
11
12 const login = async (userData) => {
13     const response = await axios.post(API_URL + 'login', userData)
14     if (response.data) {
15         localStorage.setItem('user', JSON.stringify(response.data))
16     }
17     return response.data
18 }
19
20
21 const logout = () => localStorage.removeItem('user')
22
23 const authService = { register, logout, login }
24

```

Figure 8.12: Adding login functionalities in the authService.js file

Next, similar to the register, we will add three cases in the **authSlice.js** file. In our code, we have three cases for pending, fulfilled and rejected cases. Since we are doing an API call to `http://localhost:8000/api/users/login` through our login function, we have three states in it. When the API call starts, we have a pending state since the API calls generally take 1–2 seconds. Again, we are making the `isLoading` state to true and will also show a spinner in this state in the front end.

The next state is the fulfilled case, which will happen if our API call is successful. Here, we are making the `isLoading` as false and `isSuccess` as true and storing the payload which we receive back in the user state.

If, for some reason, the API call is not successful, we have a rejected case. Here, we are making the `isLoading` as false and `isError` as true. We are also storing the error in the `message` state, which we will receive in the payload—also making the user state variable null.

```

.addCase(login.pending, (state) => {
    state.isLoading = true
}

```

```

    })
.addCase(login.fulfilled, (state, action) => {
  state.isLoading = false
  state.isSuccess = true
  state.user = action.payload
})
.addCase(login.rejected, (state, action) => {
  state.isLoading = false
  state.isError = true
  state.message = action.payload
  state.user = null
})

```

```

authSlice.js 1 authSlice.js 2 Header.js 3
frontend > src > features > auth > authSlice.js > authSlice > extraReducers > addCase() callback
63   .addCase(register.rejected, (state, action) => {
64     state.isLoading = false
65     state.isError = true
66     state.message = action.payload
67     state.user = null
68   })
69   .addCase(login.pending, (state) => [
70     state.isLoading = true
71   ])
72   .addCase(login.fulfilled, (state, action) => {
73     state.isLoading = false
74     state.isSuccess = true
75     state.user = action.payload
76   })
77   .addCase(login.rejected, (state, action) => {
78     state.isLoading = false
79     state.isError = true
80     state.message = action.payload
81     state.user = null
82   })
83   .addCase(logout.fulfilled, (state) => {
84     state.user = null
85   })

```

Figure 8.13: Adding cases for login in the authSlice.js file

Login form hook up

We will now use the Slice in our Login component to log in a user. So, head over to the **Login.js** file and add the following imports in it.

Here, we are first importing the **useEffect** hook custom, which will be used to dispatch the reset function soon. Next, we are importing hooks of

`useSelector` and `useDispatch` from `react-redux`. These hooks are used to get the global state of redux and also to dispatch the action creator inside a slice.

After that, we import `useNavigate` from `react-router-dom`. This custom hook is used to navigate easily to different routes. Next, we are importing `toast` from `react-toastify`, which will be used to show the toast message.

Next, we are importing `login` and `reset` from `authSlice`, which will be used to call the login and reset action creators. Lastly, we are importing the Spinner component, which will be used to show the Spinner when the API call starts.

Next, we will create variables for `navigate` and `dispatch` using the `useNavigate` and `useDispatch` hooks.

Next, we will get the global state of the `user`, `isLoading`, `isError`, `isSuccess`, `message` using the `useSelector` hook.

```
import { useState, useEffect } from "react"
import { useSelector, useDispatch } from 'react-redux'
import { useNavigate } from 'react-router-dom'
import { toast } from 'react-toastify'
import { login, reset } from '../features/auth/authSlice'
import Spinner from "./Spinner"

...
const navigate = useNavigate()
const dispatch = useDispatch()
const { user, isLoading, isError, isSuccess, message } =
useSelector(state => state.auth)
```

The screenshot shows the Visual Studio Code interface with the 'Login.js' file open. The code editor displays the following code:

```
1 import { FaSignInAlt } from 'react-icons/fa'
2 import { useState, useEffect } from "react"
3 import { useSelector, useDispatch } from 'react-redux'
4 import { useNavigate } from 'react-router-dom'
5 import { toast } from 'react-toastify'
6 import { login, reset } from '../features/auth/authSlice'
7 import Spinner from "./Spinner"
8
9 const Login = () => {
10   const [formData, setFormData] = useState({ email: '', password: '' })
11   const { email, password } = formData
12   const navigate = useNavigate()
13   const dispatch = useDispatch()
14
15   const { user, isLoading, isError, isSuccess, message } = useSelector(state => state.auth)
16
17   const onChange = e => {
18     setFormData(prevState => ({
19       ...prevState,
20       [e.target.name]: e.target.value
21     }))
22 }
```

Two specific imports are highlighted with green boxes: 'useEffect' at line 2 and 'useSelector' at line 15.

Figure 8.14: Adding imports in the Login.js file

Now, in the **Login.js** file, we will add an `useEffect()`. This `useEffect` will run when this component loads or when any of the `user`, `isError`, `isSuccess`, `message`, `navigate`, `dispatch` changes.

Inside it, we are first checking if the state of error is there and show a toast with the error message for that case. Next, if the state is of success or we got the user data, then navigate back to the home route.

If none of the cases is there, we are dispatching the `reset` to setback everything to initial state values.

A screenshot of Visual Studio Code showing the `Login.js` file. The code is as follows:

```
const { user, isLoading, isError, isSuccess, message } = useSelector(state => state.auth)

useEffect(() => {
  if (isError) toast.error(message)
  if (isSuccess || user) navigate('/')
  dispatch(reset())
}, [user, isError, isSuccess, message, navigate, dispatch])

const onChange = e => {
  setFormData(prevState => ({
    ...prevState,
    [e.target.name]: e.target.value
  }))
}

const onSubmit = e => {
  e.preventDefault()
}
```

Figure 8.15: Adding `useEffect` in `Login.js` file

Now in the `Login.js` file, inside the `onSubmit()` function, we are taking the email and password entered by the user and putting it in a `userData` variable and, after that dispatching it with the dispatch to the login function in the `authSlice.js` file.

```
const onSubmit = e => {
  e.preventDefault()
  const userData = { email, password }
  dispatch(login(userData))
}
```

A screenshot of Visual Studio Code showing the `Login.js` file with the `onSubmit` function expanded. The code is as follows:

```
const onChange = e => {
  setFormData(prevState => ({
    ...prevState,
    [e.target.name]: e.target.value
  }))
}

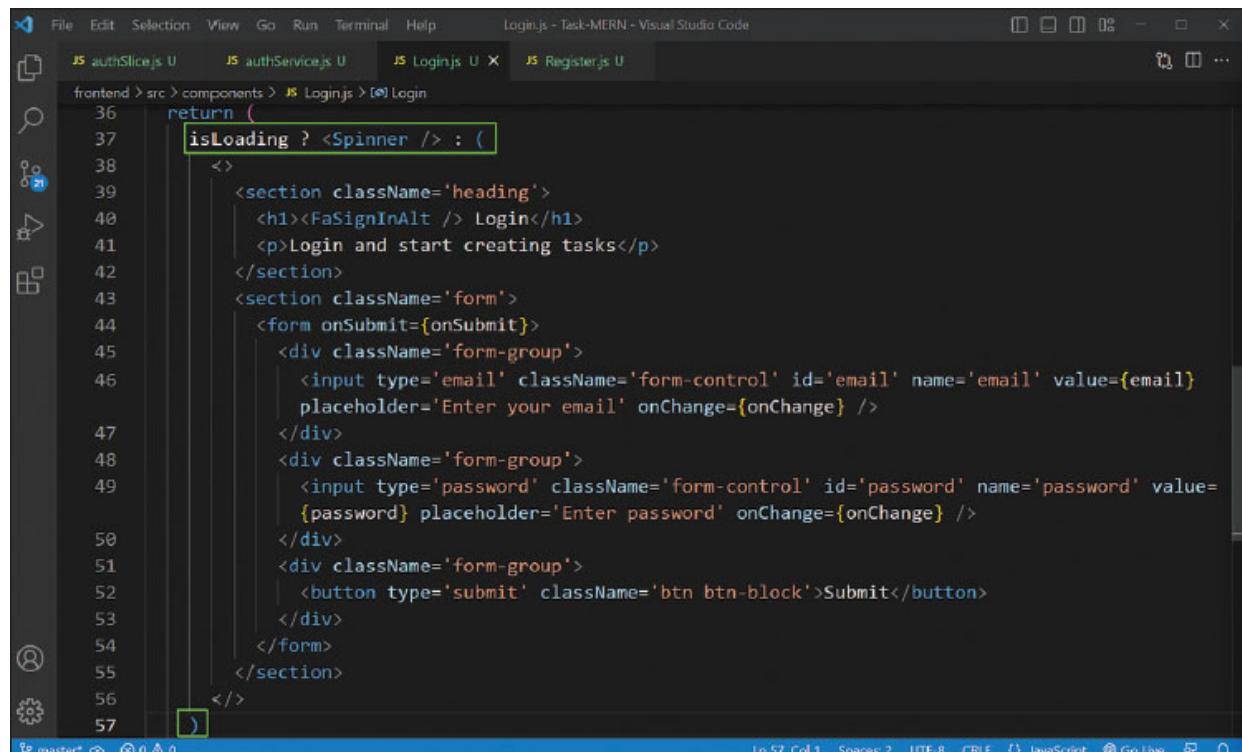
const onSubmit = e => [
  e.preventDefault(),
  const userData = { email, password }
  dispatch(login(userData))
]

return (
  <>
    <section className='heading'>
      <h1>Login</h1>
    </section>
    <form>
      <input type='text' name='email' placeholder='Email' />
      <input type='password' name='password' placeholder='Password' />
      <button type='submit'>Login</button>
    </form>
  </div>
)
```

Figure 8.16: Adding submit logic in the Login.js file

Now, we will update the return statement in the **Login.js** file. Here, we are first checking if the **isLoading** state is available and showing the Spinner component if that is the case. Or else we are showing the whole earlier code.

```
isLoading ? <Spinner /> : (
  <>
  <section className='heading'>
    ...
  </section>
  <section className='form'>
    ...
  </section>
</>
)
```



The screenshot shows the Visual Studio Code interface with the **Login.js** file open. The code editor displays the following snippet:

```
36  return (
37    isLoading ? <Spinner /> : (
38      <>
39        <section className='heading'>
40          <h1><FaSignInAlt /> Login</h1>
41          <p>Login and start creating tasks</p>
42        </section>
43        <section className='form'>
44          <form onSubmit={onSubmit}>
45            <div className='form-group'>
46              <input type='email' className='form-control' id='email' name='email' value={email} placeholder='Enter your email' onChange={onChange} />
47            </div>
48            <div className='form-group'>
49              <input type='password' className='form-control' id='password' name='password' value={password} placeholder='Enter password' onChange={onChange} />
50            </div>
51            <div className='form-group'>
52              <button type='submit' className='btn btn-block'>Submit</button>
53            </div>
54          </form>
55        </section>
56      </>
57    )
  )
```

Figure 8.17: Adding Spinner in Login.js file

Testing user login

Click on the Login button, and you will go to. We have also opened the Redux dev tools, and here we can notice that reset is called and the user state is set to the initial value.

Here, we have entered all the required fields.

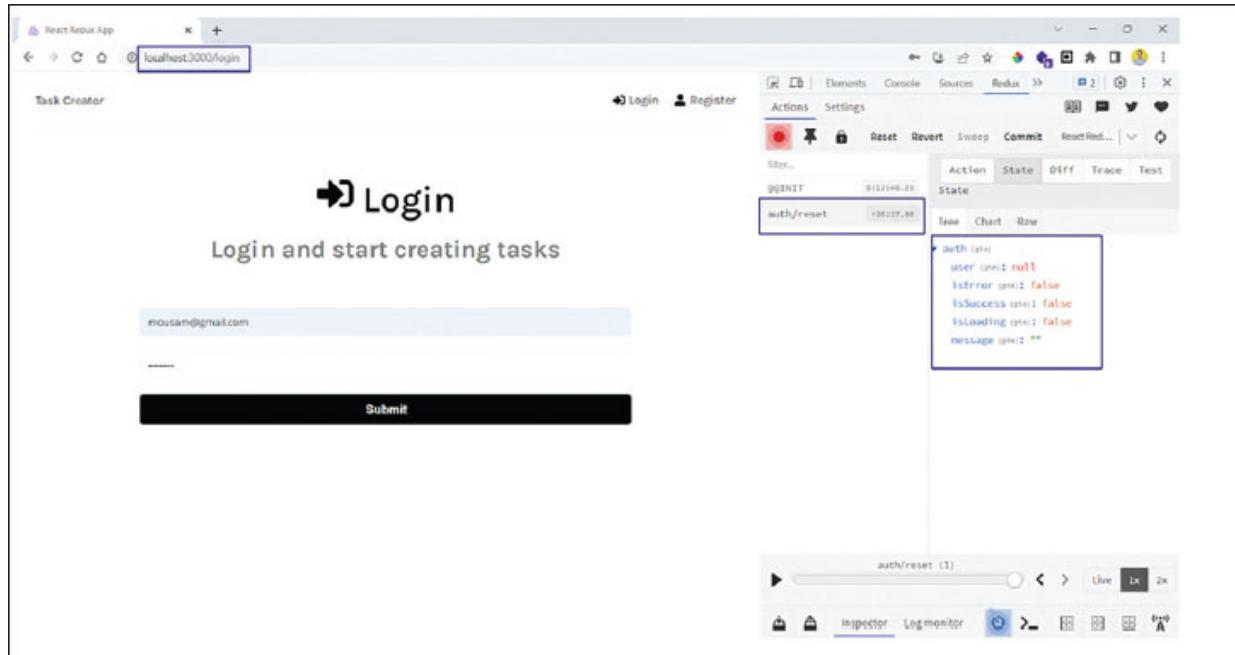


Figure 8.18: Initial states in the login

We have intentionally given the password as wrong. Here, a toast message of **Invalid data** is shown, which automatically disappears after 5 seconds.

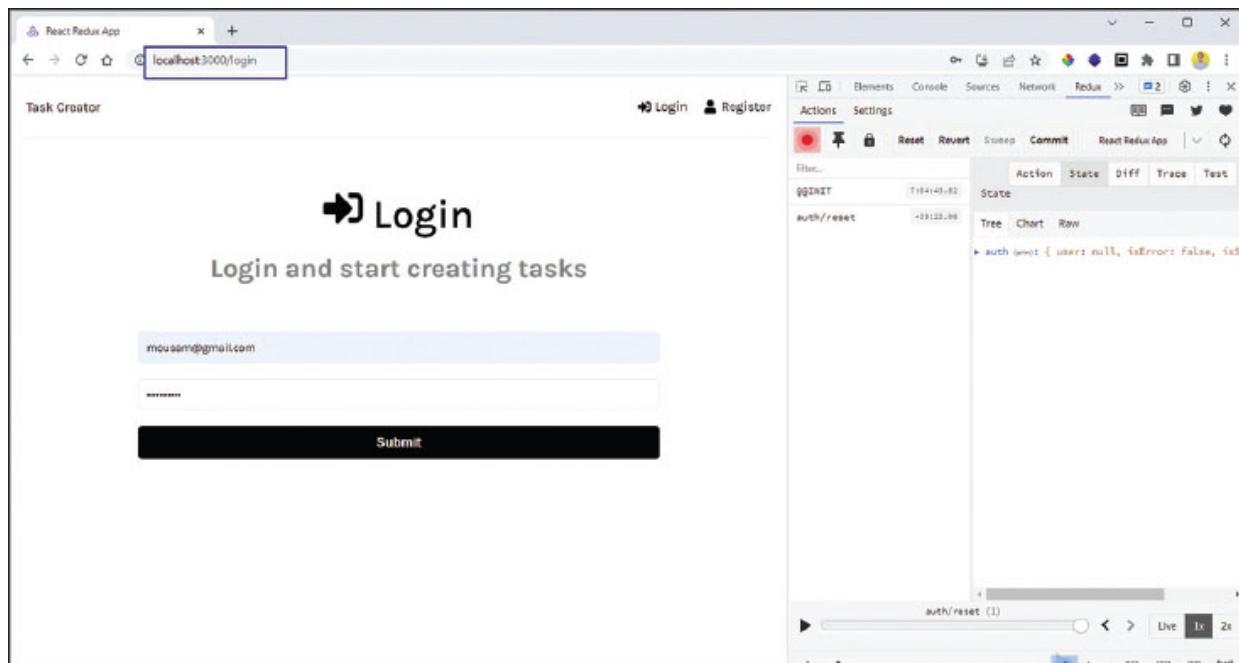


Figure 8.19: Toast message in the login

We have, this time, given the correct password and hit the `Submit` button. Here, we have been taken to the home page of the dashboard. But also notice that different actions have been done in the Redux devtools.

Here, first, the pending action ran from the `extraReducers` in the `authSlice.js` file. Here, the `isLoading` was set to true, and the rest states were kept as it was earlier.

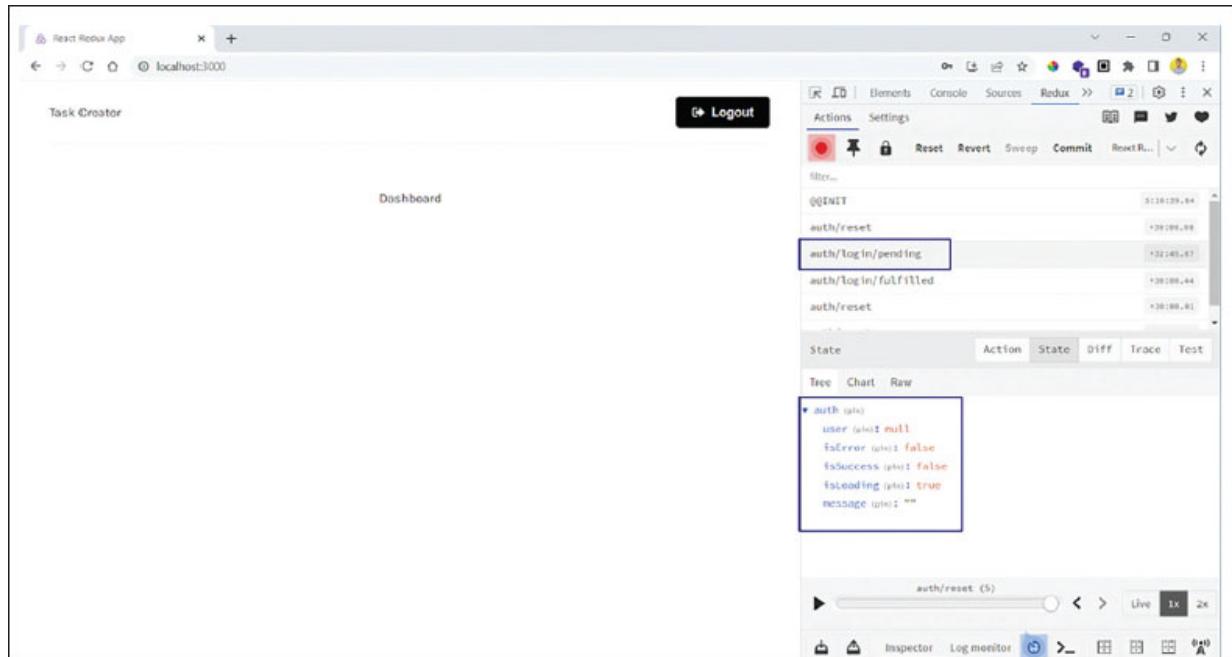


Figure 8.20: Pending state in the login

Since the API call to the backend was successful, the fulfilled action had run. This has made the `isLoading` false and `isSuccess` as true. And the user state was set to the payload received from the backend. This payload consists of `_id`, `name`, `email` and `token`.

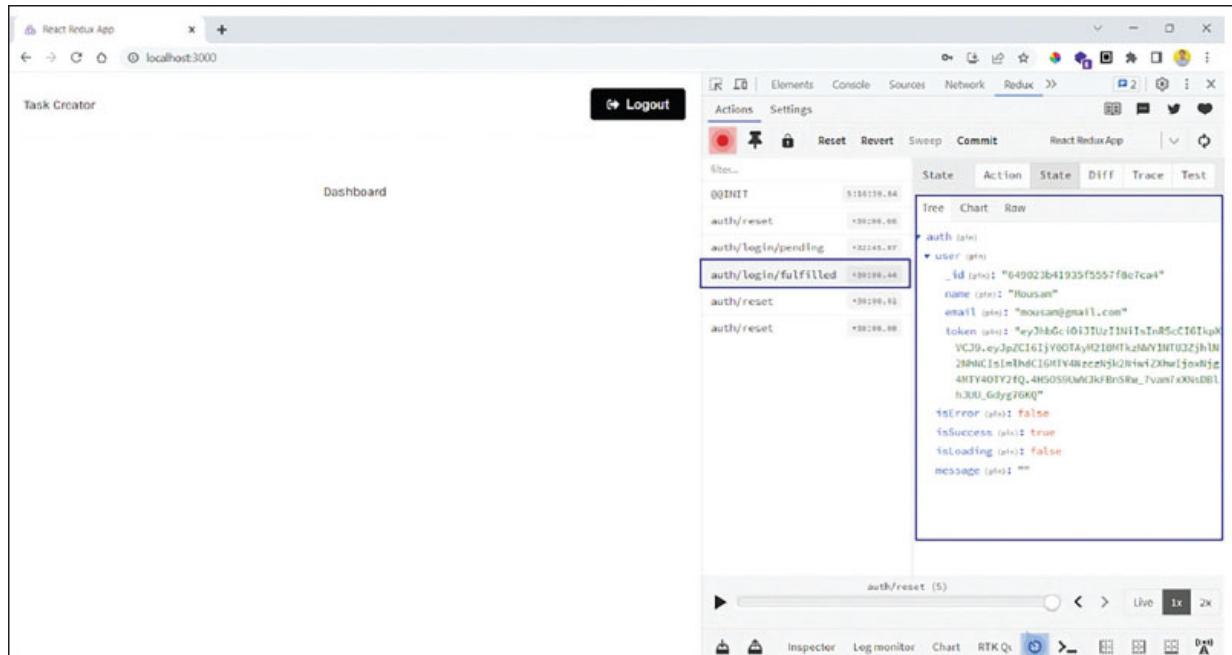


Figure 8.21: Fulfilled state in the login

The reset was run again, and it set everything back to an earlier state, but the user was kept intact.

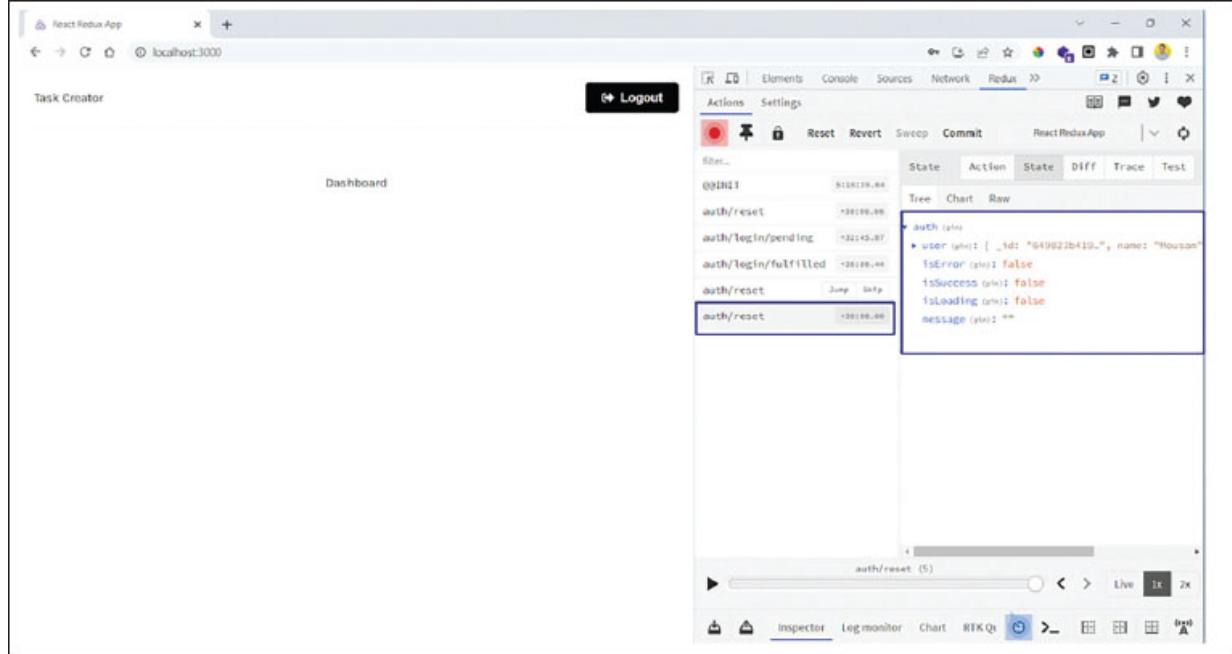


Figure 8.22: Reset state in the login

The user data was also saved in the Local Storage of the browser, containing all the fields of the user object.

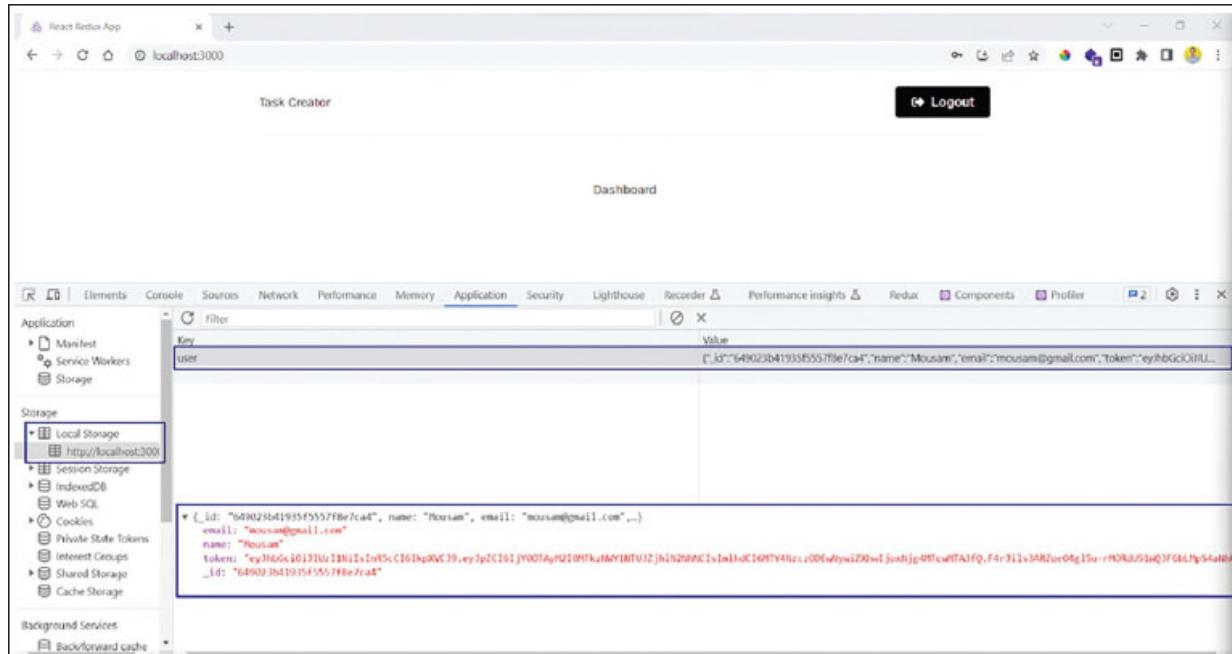


Figure 8.23: Local Storage in Browser

Conclusion

In this chapter, we have learned about implementing Logout in our project through the toolkit. The logout was implemented by simply removing the user from local storage and making its state null. We also created the logic logout button to be shown if the user is logged in.

After that, we created the Login functionalities, which were quite similar to Register in the previous chapter. Finally, we were able to log in as a user by submitting a form from the front end.

In the next chapter, we will implement the restriction of the dashboard and the creation of a Task form.

Points to remember

- How to show a logout button if the user is logged in.
- Using a Slice in the latest Redux toolkit, we combine the functionalities of reducer and action creator.
- How to get global state from Redux in a component and also dispatch action creators from a component.

CHAPTER 9

Dashboard Creation and Task Form

Introduction

This chapter covers the implementation of the Dashboard in the frontend. We will also restrict the dashboard to authorized users. In this chapter, we are also going to create the Task slice in Redux. Finally, we are also going to create the Task Form.

Structure

In this chapter, we are going to discuss the following topics:

- Changing Dashboard logic
- Creating Task Slice
- Creating Task Form

Changing Dashboard Logic

Our Dashboard page was accessible to everyone in the earlier chapter. We are going to change the logic so that only logged-in users can see the dashboard page.

In the **Dashboard.js** file, we are first importing `useEffect` from react, because we will do an async task through it. Next, we are importing `useNavigate` hook from react-router-dom, which will be used to navigate to the login page.

Also, the `useSelector` is imported from react-redux. It will be used to access the global state of the user. Inside the Dashboard component, we are first creating the variables of `navigate` and `user` through the `useNavigate` and `useSelector` hooks, respectively.

After that, from within an `useEffect`, which will run when the user navigates change, we are checking if a user is not available. If that is the case, we are navigating the user to the `/login` route.

```

import { useEffect } from 'react'
import { useNavigate } from 'react-router-dom'
import { useSelector } from 'react-redux'

const Dashboard = () => {
  const navigate = useNavigate()
  const { user } = useSelector(state => state.auth)

  useEffect(() => {
    if (!user) navigate('/login')
  }, [user, navigate])

  return (
    <div>Dashboard</div>
  )
}

export default Dashboard

```

The screenshot shows a dark-themed instance of Visual Studio Code. The title bar reads "Dashboard.js - Task MERN - Visual Studio Code". The main area displays the code for "Dashboard.js". The "EXPLORER" sidebar on the left shows the project structure under "TASK-MERN", including "backend", "frontend", "node_modules", "public", "src" (which contains "app", "components" with "Dashboard.js" selected, "features", "App.js", "App.test.js", "index.css", "index.js", "setupTests.js", ".gitignore", "package-lock.json", "package.json", and "README.md"). The bottom status bar indicates "In 10, Col 16" and other settings like "Spaces: 2", "UTF-8", "CRLF", "JavaScript", and "Go Live".

Figure 9.1: Updating Dashboard.js file

Now, in the browser type <http://localhost:3000/> and hit *enter*.



Figure 9.2: Visiting localhost in browser

We will be redirected to `http://localhost:3000/login` because of the new code in **Dashboard.js** file. We don't have a user state yet.

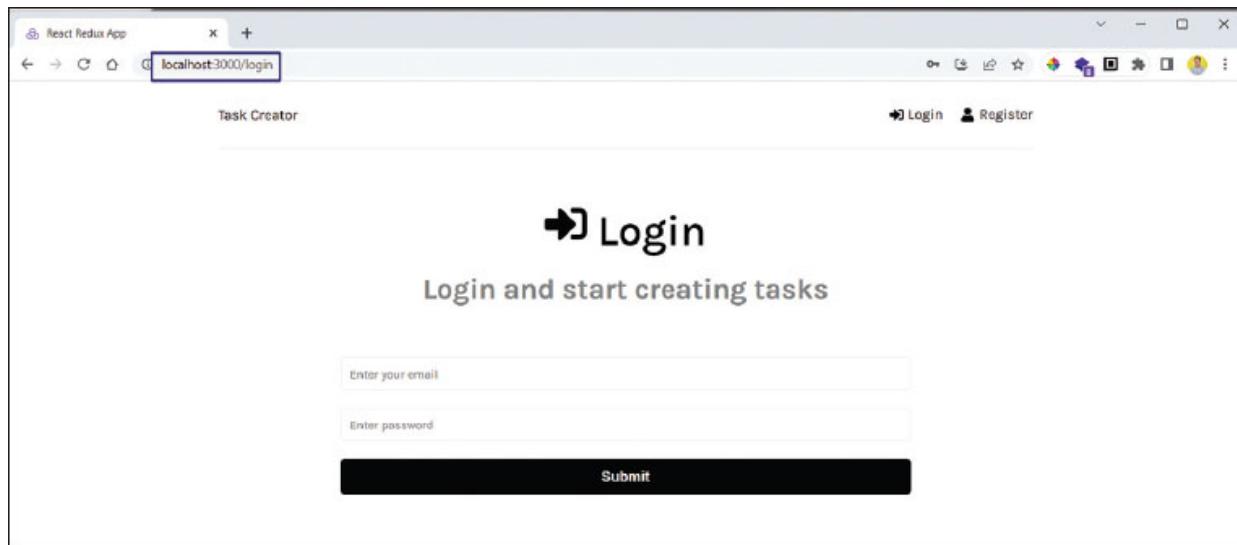


Figure 9.3: Dashboard route changing to login route

Now, in the preceding screen login with a valid email and password. And we will be redirected to the Dashboard page.

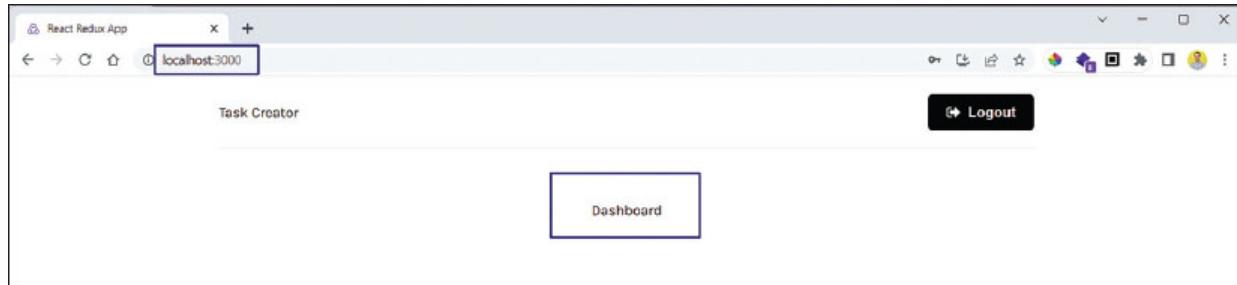


Figure 9.4: Dashboard shown only after logging

Creating Task Slice

Now, we will create the task slice and service which will be used in the dashboard to create tasks. Similar to the auth logic, we will create a folder called **tasks** inside the **features** folder.

Now, create a file **taskSlice.js** and **taskService.js** inside the **tasks** folder. Inside the **taskSlice.js** file, put the following code:

```
import { createSlice, createAsyncThunk } from
'@reduxjs/toolkit'

const initialState = {
  tasks: [],
  isError: false,
  isSuccess: false,
  isLoading: false,
  message: <> </>
}

export const taskSlice = createSlice({
  name: <task>,
  initialState,
  reducers: {
    reset: state => initialState
  }
})

export const { reset } = taskSlice.actions
export default taskSlice.reducer
```

Here, we are first importing **createSlice** and **createAsyncThunk** from redux toolkit. The **createSlice** will be used to create the slice used for reducer and action. And the **createAsyncThunk** will be used for asynchronous actions, which is an API call in our case later on.

Next, we have the **initialState** of our slice which is an object. Here, we have **tasks** key first which is equal to an empty array. We also have values for **isError**, **isSuccess**, and **isLoading** which are set as false. These will be used when we do the API call. Lastly, we have a **message** as an empty string.

Next, we are exporting the **taskSlice**, which is created using the **createSlice** method. Here, we are first giving the name of the slice as a **task**. Then we are taking the **initialState**. After that, we have a reducers value, which has a reset. This reset can be used to restore the state to its initial state.

At the end, we are exporting the reset action and the reducer.

The screenshot shows the Visual Studio Code interface with the following details:

- File Bar:** File, Edit, Selection, View, Go, Run, Terminal, Help.
- Tab Bar:** taskSlice.js - Task-MERN - Visual Studio Code, taskSlice.js U X, taskService.js U.
- Explorer:** Shows the project structure under "TASK-MERN". The "features" folder is expanded, showing "auth" and "tasks" subfolders. "taskService.js" and "taskSlice.js" are listed under "tasks".
- Editor:** Displays the content of "taskSlice.js". The code defines a slice for tasks using Redux Toolkit's createSlice and createAsyncThunk.
- Bottom Status Bar:** In 20, Col 25, Spaces: 4, UTF-8, CR/LF, JavaScript, Go Live, etc.

```
import { createSlice, createAsyncThunk } from '@reduxjs/toolkit'
const initialState = {
  tasks: [],
  isError: false,
  isSuccess: false,
  isLoading: false,
  message: ''
}
export const taskSlice = createSlice({
  name: 'task',
  initialState,
  reducers: {
    reset: state => initialState
  }
})
export const { reset } = taskSlice.actions
export default taskSlice.reducer
```

Figure 9.5: Basic taskSlice.js file

Now, we will import the task reducer in the **store.js** file. Because of the store in a Redux app, we are able to use global state in different components. So, now we will be able to access the tasks state in various components.

The screenshot shows the Visual Studio Code interface with the following details:

- File Bar:** File, Edit, Selection, View, Go, Run, Terminal, Help.
- Tab Bar:** store.js - Task-MERN - Visual Studio Code, taskSlice.js U X, store.js M X, taskService.js U.
- Explorer:** Shows the project structure under "TASK-MERN". The "app" folder is expanded, showing "store.js".
- Editor:** Displays the content of "store.js". It imports configureStore and defines a store object with a reducer property containing authReducer and taskReducer.
- Bottom Status Bar:** In 20, Col 25, Spaces: 4, UTF-8, CR/LF, JavaScript, Go Live, etc.

```
import { configureStore } from '@reduxjs/toolkit';
import authReducer from '../features/auth/authSlice';
import taskReducer from '../features/tasks/taskSlice';

export const store = configureStore({
  reducer: {
    auth: authReducer,
    tasks: taskReducer
  }
});
```

Figure 9.6: Adding tasks state in store.js file

Now, back in <http://localhost:3000/> after logging in we will see the initial state of tasks in the Redux devtools tab of the developer console.

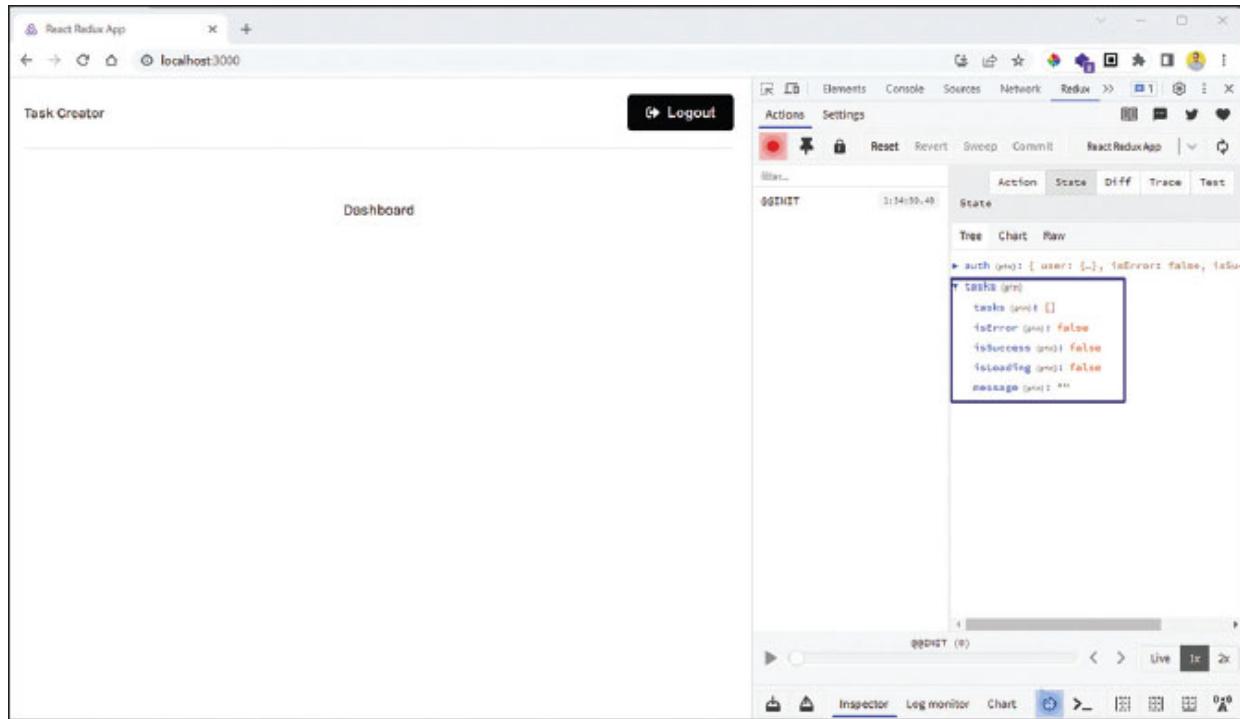
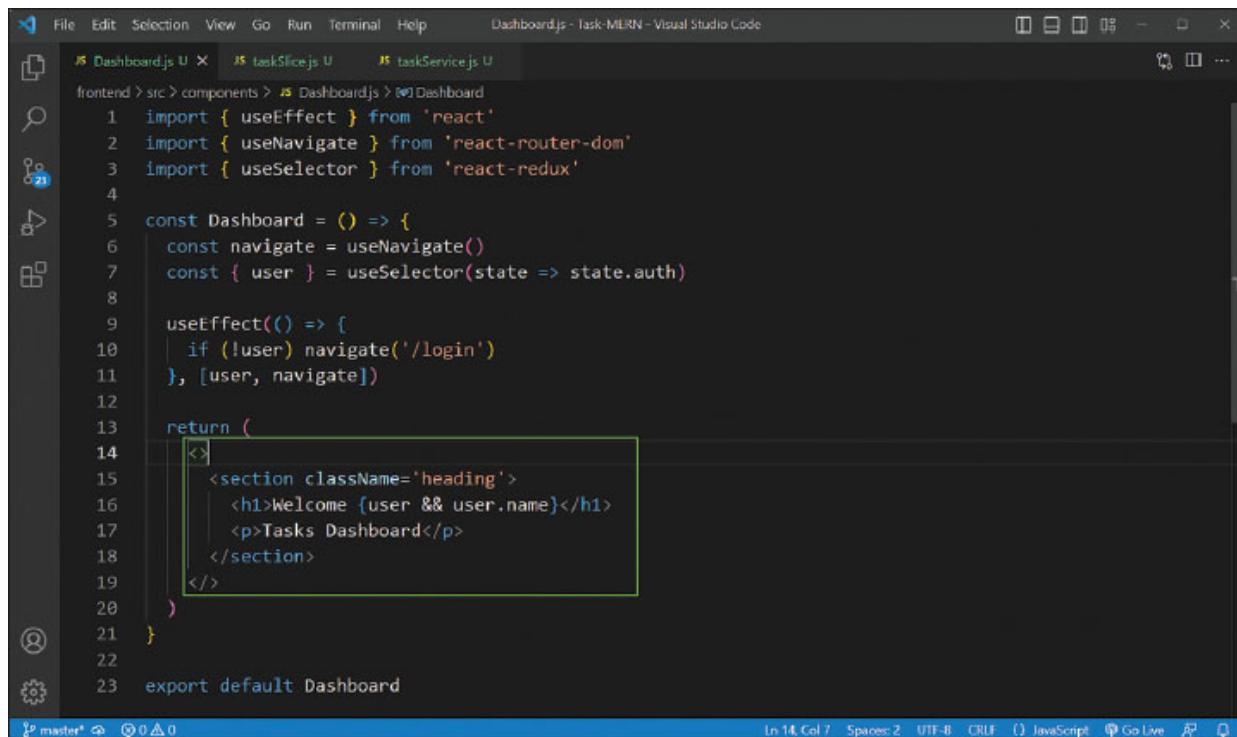


Figure 9.7: Initial tasks state in Redux devtools

Back in the **Dashboard.js** file, we will show a Welcome message now. Here, we are showing the user name also from the user global state. Since we should be successfully logged in when reaching this component, we will get this user name.

```
<>
<section className=>heading >>
  <h1>Welcome {user && user.name}</h1>
  <p>Tasks Dashboard</p>
</section>
</>
```



```
File Edit Selection View Go Run Terminal Help Dashboard.js - Task-MERN - Visual Studio Code
Dashboard.js U taskSlice.js U taskService.js U
frontend > src > components > Dashboard.js > Dashboard
1 import { useEffect } from 'react'
2 import { useNavigate } from 'react-router-dom'
3 import { useSelector } from 'react-redux'
4
5 const Dashboard = () => {
6   const navigate = useNavigate()
7   const { user } = useSelector(state => state.auth)
8
9   useEffect(() => {
10     if (!user) navigate('/login')
11   }, [user, navigate])
12
13   return (
14     <>
15       <section className='heading'>
16         <h1>Welcome {user && user.name}</h1>
17         <p>Tasks Dashboard</p>
18       </section>
19     </>
20   )
21 }
22
23 export default Dashboard
In 14, Col 7  Spaces: 2  UTF-8  CR/LF  JavaScript  Go Live  ⚡  ⌂
```

Figure 9.8: Adding Username in Dashboard.js file

Back in `http://localhost:3000/` after logging, we will see the user name also, with a text of Tasks Dashboard.

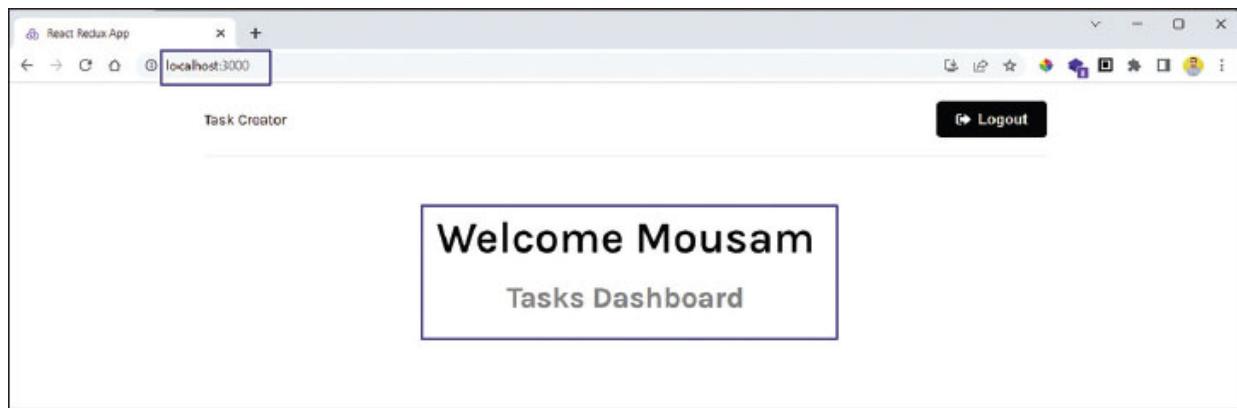


Figure 9.9: Showing Username in localhost

Creating Task Form

Now, we will create a Task Form, which will be used to take the user input in the Dashboard for tasks. So, first create a file `TaskForm.js` inside the `components` folder.

Here, we are first importing the `useState` from react and the `useDispatch` hook from react-redux. Next, we have a basic `TaskForm` functional component, showing the text `TaskForm` inside a div.

```
import { useState } from 'react'
import { useDispatch } from 'react-redux'

const TaskForm = () => {
  return (
    <div>TaskForm</div>
  )
}

export default TaskForm
```

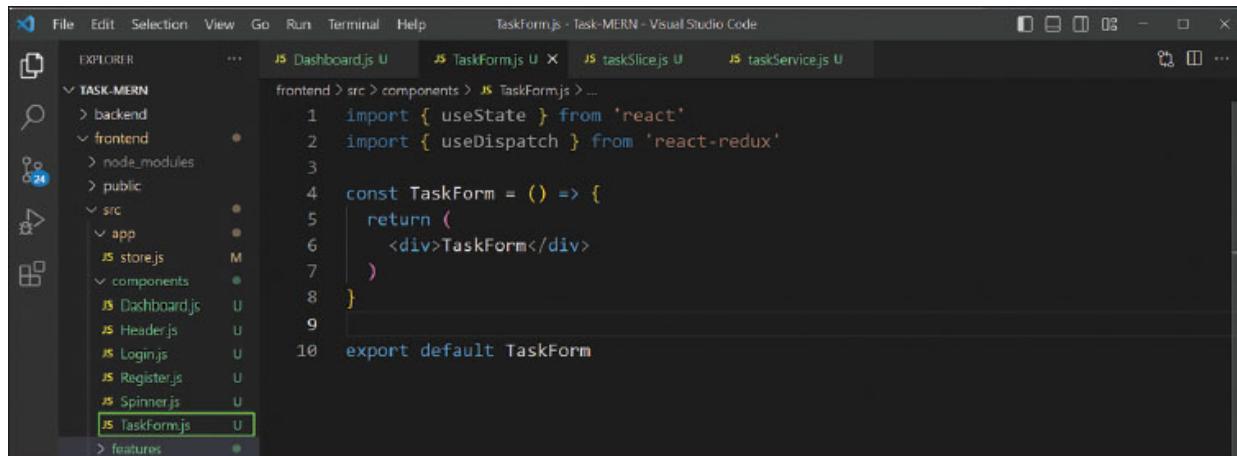


Figure 9.10: Creating TaskForm.js file

Now, we will import this `TaskForm` component in our `Dashboard.js` file. Here, we are first using an import statement for the `TaskForm` component. After that, we are adding it after the section.

```
import TaskForm from './TaskForm'

...
<></>
<section className=>heading >
  <h1>Welcome {user && user.name}</h1>
  <p>Tasks Dashboard</p>
</section>
<TaskForm />
</>
```

The screenshot shows the Visual Studio Code interface with the 'Dashboard.js' file open. The code editor displays the following snippet:

```
1 import { useEffect } from 'react'
2 import { useNavigate } from 'react-router-dom'
3 import { useSelector } from 'react-redux'
4 import TaskForm from './TaskForm'

5
6 const Dashboard = () => {
7   const navigate = useNavigate()
8   const { user } = useSelector(state => state.auth)

9
10 useEffect(() => {
11   if (!user) navigate('/login')
12 }, [user, navigate])

13
14 return (
15   <>
16   <section className='heading'>
17     <h1>Welcome {user && user.name}</h1>
18     <p>Tasks Dashboard</p>
19   </section>
20   <TaskForm />
21   </>
22 )
23 }
24
```

The line `<TaskForm />` is highlighted with a green rectangular selection. The status bar at the bottom indicates the file is 20 lines long, 19 columns wide, and uses 2 spaces per tab, with UTF-8 encoding and JavaScript selected.

Figure 9.11: Adding TaskForm component in Dashboard.js file

Back in <http://localhost:3000/> we will see the **TaskForm** div being shown.

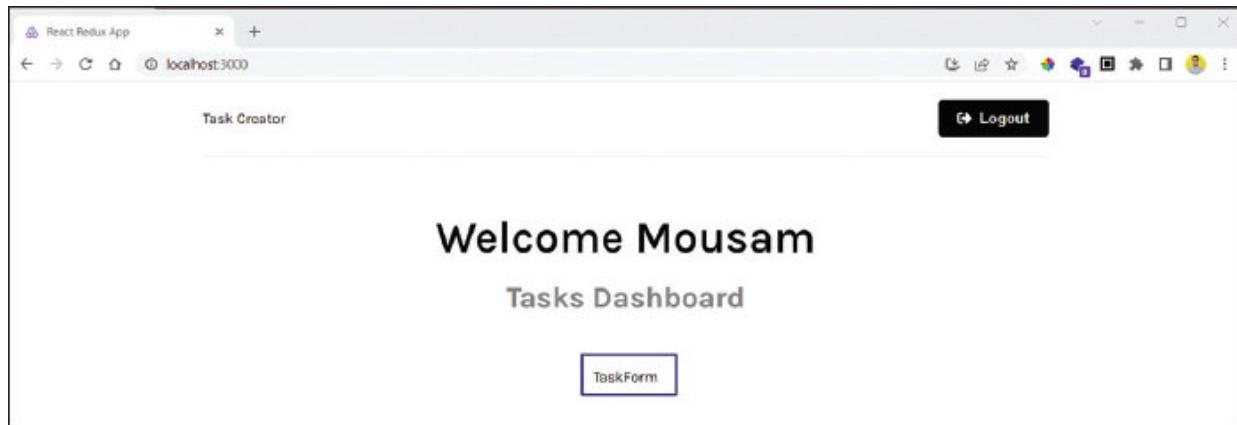


Figure 9.12: Showing TaskForm component in localhost

Next, we will complete the **TaskForm** component by adding the following code in **TaskForm.js** file:

```
const TaskForm = () => {
  const [text, setText] = useState(<></>)

  const onSubmit = (e) => {
```

```

    e.preventDefault()
    setText('')
  }
  return (
    <section className=>form>>
      <form onSubmit={onSubmit}>
        <div className=>form-group>
          <label htmlFor=>text>>Task</label>
          <input type=>text> id=>text> value={text} onChange={e => setText(e.target.value)}
          />
        </div>
        <div className=>form-group>
          <button className=>btn btn-block> type=>submit>>Add Task</button>
        </div>
      </form>
    </section>
  )
}

```

Here, inside the `TaskForm` function, we are first having a state of text using the `useState` hook. Next, we have a submit function which is using `e.preventDefault()`, to prevent the page from refreshing when we hit the Add Task button. We are also setting the text state back to an empty screen here.

Inside the return, we have a section with a class of form. These styles are already there in the `index.css` file. Next, we have a form with an onSubmit handler which is calling the `onSubmit` function created earlier.

Next, we have a div with a class of **form-group**. Inside it, we have a label and an input box. This input box is changing the state of the text when the user types in it.

In the next div, we have a button with the class name for styles. Since this button is inside a form, it is of type submit. When we click this **Add Task** button, it will trigger the `onSubmit` handler of the form.

A screenshot of Visual Studio Code showing the `TaskForm.js` file. The code defines a functional component `TaskForm` that creates a form with a text input and a submit button. The code uses `useState` to manage the text value and `useEffect` to handle the submission.

```
4  const TaskForm = () => {
5    const [text, setText] = useState('')
6    const onSubmit = (e) => {
7      e.preventDefault()
8      setText('')
9    }
10
11   return (
12     <section className='form'>
13       <form onSubmit={onSubmit}>
14         <div className='form-group'>
15           <label htmlFor='text'>Task</label>
16           <input type='text' id='text' value={text} onChange={e => setText(e.target.value)}>
17         />
18         </div>
19         <div className='form-group'>
20           <button className='btn btn-block' type='submit'>Add Task</button>
21         </div>
22       </form>
23     </section>
24   )
25 }
26
```

Figure 9.13: Adding login TaskForm.js file

Going back to `http://localhost:3000/` will show us a nice form in the Dashboard, with input box and a button.

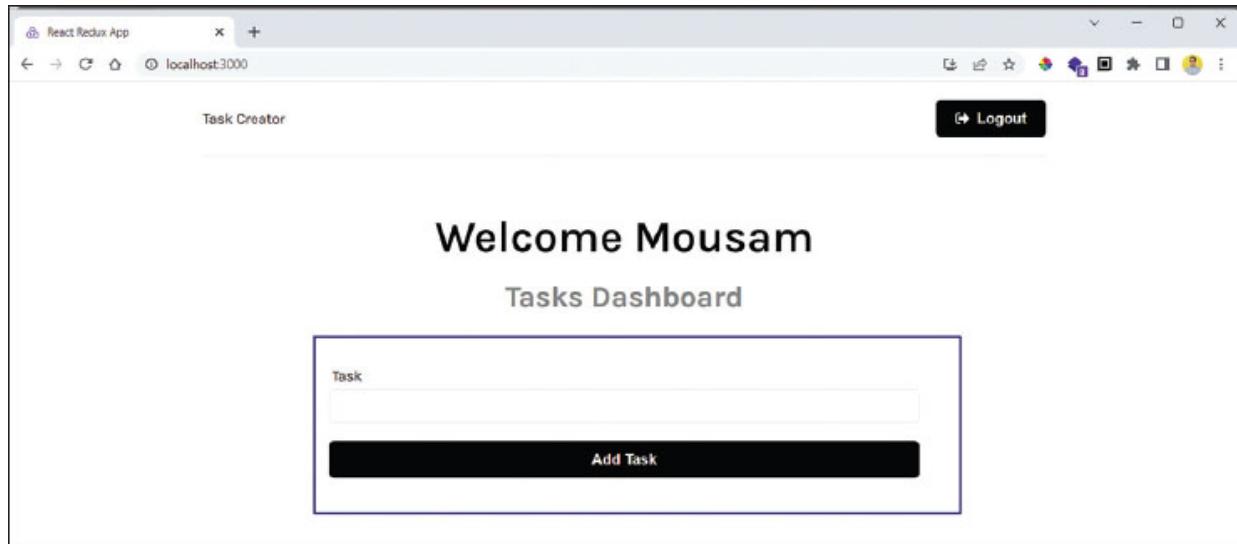


Figure 9.14: Updated TaskForm component in localhost

Lastly, in the `TaskForm.js` file, we will first import the `createTask` method from `taskSlice.js` file. We have not yet created this method, and will be created in the next chapter.

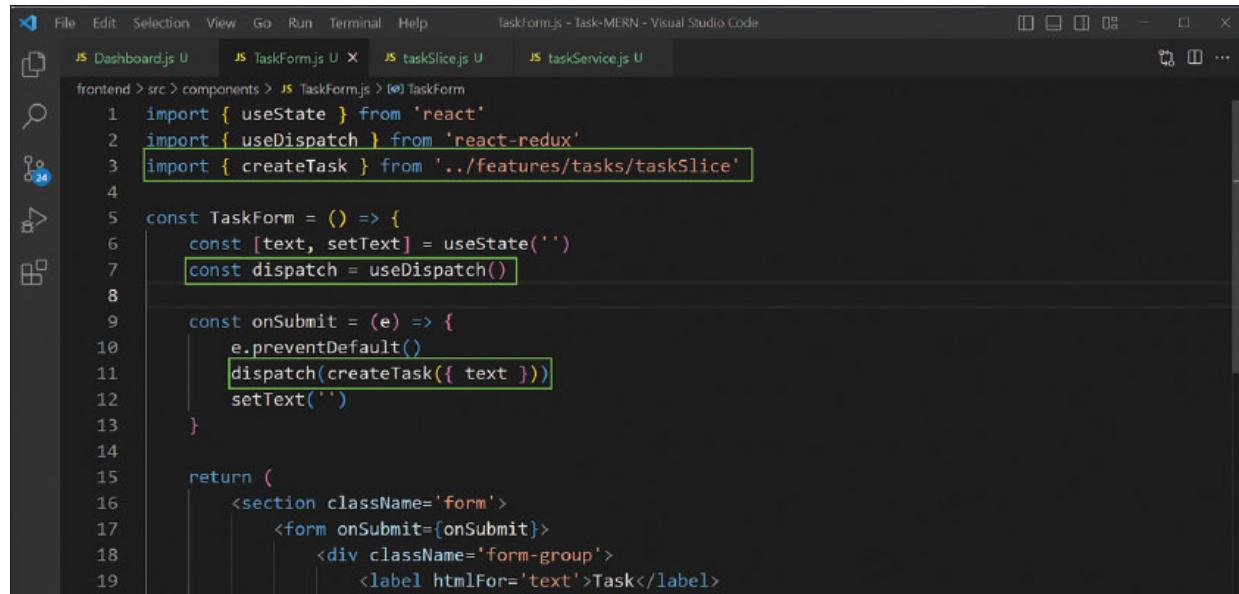
After that, inside the `TaskForm` function, we are first creating a dispatch variable by using the `useDispatch()` hook. Next, we are using the dispatch variable inside the `onSubmit` function. Here, we are using the dispatch variable to call the `createTask` method with the text state.

```
import { useState } from 'react'
import { useDispatch } from 'react-redux'
import { createTask } from '../features/tasks/taskSlice'

const TaskForm = () => {
  const [text, setText] = useState('')
  const dispatch = useDispatch()

  const onSubmit = (e) => {
    e.preventDefault()
    dispatch(createTask({ text }))
    setText('')
  }

  return (
    ...
  )
}
```



```
1 import { useState } from 'react'
2 import { useDispatch } from 'react-redux'
3 import { createTask } from '../features/tasks/taskSlice'

4
5 const TaskForm = () => {
6   const [text, setText] = useState('')
7   const dispatch = useDispatch()

8
9   const onSubmit = (e) => {
10     e.preventDefault()
11     dispatch(createTask({ text }))
12     setText('')
13   }

14
15   return (
16     <section className='form'>
17       <form onSubmit={onSubmit}>
18         <div className='form-group'>
19           <label htmlFor='text'>Task</label>
```

Figure 9.15: Adding dispatch login in TaskForm.js file

Conclusion

In this chapter, we learned about changing the Dashboard logic in our project. Here, we have restricted the dashboard to the logged in user. After that, we created the task slice, which will be used to create tasks. We also created a Task Form. In this form, we can take the user input to create a task.

In the next chapter, we will complete the task functionalities. And also fetch the tasks from the server and display them in Dashboard. We will also add the delete tasks logic.

Points to Remember

- Implementing logic for only logged-in users to see the dashboard.
- Using a slice to create the global task state.
- Creating a form in React for the input of tasks.

Multiple Choice Questions

1. What does the `useNavigate` hook do?
 - a. Navigate to home route
 - b. Navigate to any provided route
 - c. Navigate to login route
 - d. There is nothing like `useNavigate` hook
2. What does the `useSelector` hook do?
 - a. Access the local state
 - b. Access the component state
 - c. There is nothing like `useSelector` hook
 - d. Access the global state
3. In the redux toolkit the slice is a combination of
 - a. store and reducer
 - b. store and action
 - c. action and reducer

- d. Reducer only
4. How to set a local state in a Functional React component?
- a. Using `useEffect` hook
 - b. Using `useState` hook
 - c. Using `this.state`
 - d. State is not in functional components
5. What does the `useDispatch` hook do?
- a. Used to `dispatch` action to Slice
 - b. Used to `dispatch` state to Slice
 - c. Used to get global state from Slice
 - d. There is nothing like `useDispatch` hook

Answers

- 1. b
- 2. d
- 3. c
- 4. b
- 5. a

CHAPTER 10

Using Thunk and Completing App

Introduction

This chapter covers the implementation of Thunk in our Task workflow. We will also fetch the tasks from the server. This chapter also completes our app, in which we will add logic to display the tasks and also delete them.

Structure

In this chapter, we are going to cover the following topics:

- Creating task with Async Thunk
- Fetching tasks from the server
- Displaying tasks
- Deleting tasks

Creating task with Async Thunk

Back in the **taskSlice.js** file, which we created in our previous chapter, we will first import the **taskService**. Next, we are exporting a variable **createTask**. Here, again we are using the **createAsyncThunk** function. We don't need to import Thunk because the redux toolkit comes in-built with Thunk.

In the **createAsyncThunk** function, the first parameter is the **tasks/create**, which means from the **tasks** folder, take the **create** function. Next, the parameter is an async arrow function which takes the **taskData** and **thunkAPI** as a parameter.

Inside the function, we have a **try...catch** block. From the **try** block, we are first getting the token using the **getState()** method. Next, we call the **createTask** function from the **taskService.js** file with the **taskData** and **token** and then return it.

In the `catch` part, we are simply catching different kinds of errors and returning them. Note that the catch block will only execute if there is an error in the try block.

```
import taskService from './taskService'  
...  
export const createTask = createAsyncThunk(  
  <tasks/create>,  
  async (taskData, thunkAPI) => {  
    try {  
      const token = thunkAPI.getState().auth.user.token  
      return await taskService.createTask(taskData, token)  
    } catch (error) {  
      const message =  
        (error.response && error.response.data &&  
        error.response.data.message)  
        || error.message  
        || error.toString()  
      return thunkAPI.rejectWithValue(message)  
    }  
  }  
)
```

```
JS Dashboard.js U JS TaskForm.js U JS taskSlice.js U JS taskService.js U
frontend > src > features > tasks > taskSlice.js > [1] createTask > [2] createAsyncThunk('tasks/create') callback
  1 import { createSlice, createAsyncThunk } from '@reduxjs/toolkit'
  2 import taskService from './taskService'
  3
  4 > const initialState = ...
 10 }
 11
 12 export const createTask = createAsyncThunk(
 13   'tasks/create',
 14   async (taskData, thunkAPI) => {
 15     try {
 16       const token = thunkAPI.getState().auth.user.token
 17       return await taskService.createTask(taskData, token)
 18     } catch (error) {
 19       const message =
 20         (error.response && error.response.data && error.response.data.message) ||
 21         error.message ||
 22         error.toString()
 23       return thunkAPI.rejectWithValue(message)
 24     }
 25   }
 26 )
 27
 28 export const taskSlice = createSlice({
 29   name: 'task',
 30 }
```

Figure 10.1: Creating `createTask` in `taskSlice.js` file

Next, we will create the task service. This service will be used to save the task data in the database. But since only the logged-in user should be able to do this, we will use a token also. So, create a file **taskService.js** inside the **tasks** folder.

Here, we are first importing **axios** and also creating a variable called **API_URL** which is set to `/api/tasks/`. Next, we have created a **createTask** function which takes the **taskData** and the **token**. Note that this only is the function which we are calling from our `taskSlice.js` file.

Inside the function, we have a **config** object first, where we are creating a **headers** key. The value of it is an object, which has a key of Authorization and a value of “Bearer token”. Note that it is mandatory to add the keyword Bearer to the token while doing a POST call with the token.

Next, we are doing a **POST** call to the **API_URL** with the **taskData** and **config**. The result of the api call which we get in `response.data` and returning back the response from the function. Lastly, we are exporting the **createTask** function.

```
import axios from 'axios'
const API_URL = '/api/tasks/'
```

```

const createTask = async (taskData, token) => {
  const config = {
    headers: {
      Authorization: `Bearer ${token}`,
    }
  }
  const response = await axios.post(API_URL, taskData, config)
  return response.data
}

const taskService = { createTask, getTasks, deleteTask }
export default taskService

```

```

File Edit Selection View Go Run Terminal Help taskService.js - Task MERN - Visual Studio Code
JS Dashboard.js U JS TaskForm.js U JS taskSlice.js U JS taskService.js U X
Frontend > src > features > tasks > JS taskService.js [0] default
1 import axios from 'axios'
2
3 const API_URL = '/api/tasks/'
4
5 const createTask = async (taskData, token) => {
6   const config = {
7     headers: {
8       Authorization: `Bearer ${token}`,
9     }
10  }
11  const response = await axios.post(API_URL, taskData, config)
12  return response.data
13}
14
15 const taskService = { createTask }
16
17 export default taskService
18

```

Figure 10.2: Creating createTask in taskService.js file

Inside our **taskSlice.js** file in the **taskSlice** function, we will add **extraReducers**. We will put the reducer action, which changes the state in these **extraReducers**.

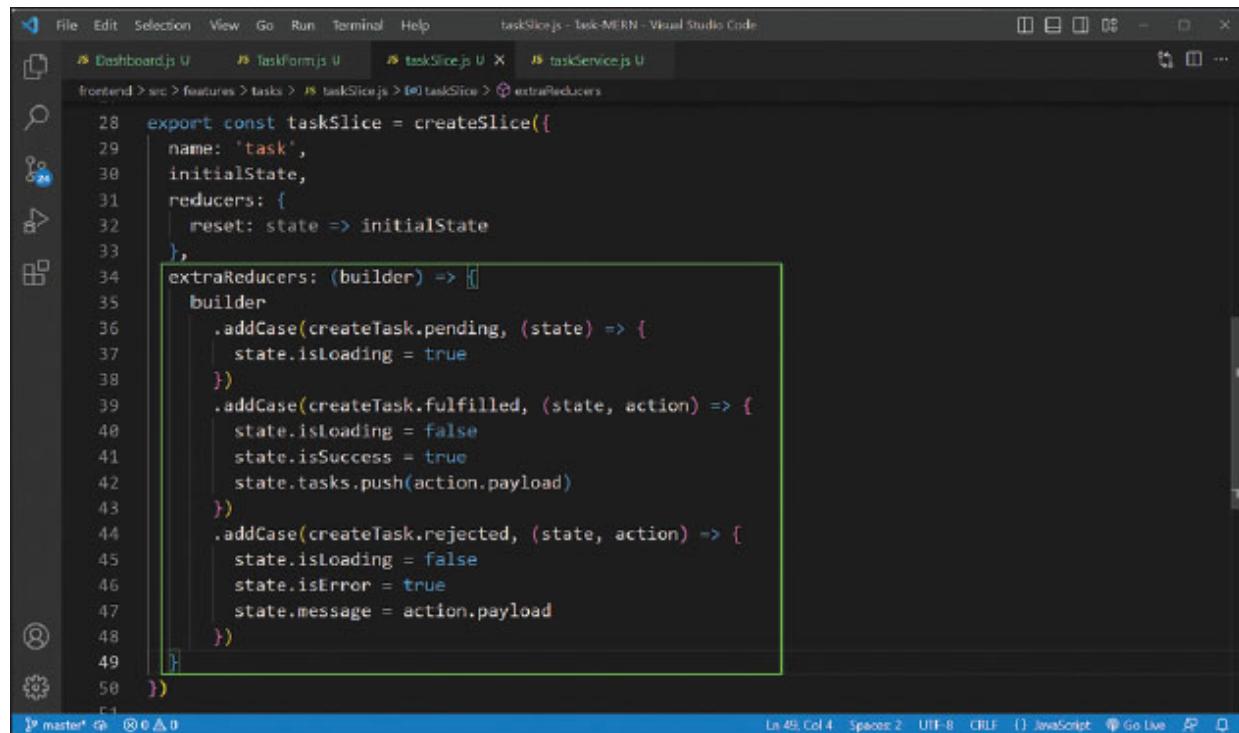
In our code, we have three cases for pending, fulfilled and rejected cases. Since we are doing an API call to through our `createTask` function, we have three states in it. When the API call starts, we have a pending state since the API calls generally take 1–2 seconds. In the pending state, `isLoading` will be made to true, and we will also show a spinner in this state in the front end.

The next state is the fulfilled case, which will happen if our API call is successful. Here, we are making the `isLoading` as false and `isSuccess` as true

and storing the payload which we receive back in the `tasks` state.

If, for some reason, the API call is not successful, we have a rejected case. Here, we are making the `isLoading` as false, `isError` as true. We are also storing the error in the `message` state, which we will receive in the payload.

```
extraReducers: (builder) => {
  builder
    .addCase(createTask.pending, (state) => {
      state.isLoading = true
    })
    .addCase(createTask.fulfilled, (state, action) => {
      state.isLoading = false
      state.isSuccess = true
      state.tasks.push(action.payload)
    })
    .addCase(createTask.rejected, (state, action) => {
      state.isLoading = false
      state.isError = true
      state.message = action.payload
    })
}
}
```



The screenshot shows the `taskSlice.js` file in Visual Studio Code. The code defines a `taskSlice` slice with a `name` of 'task' and an `initialState`. It includes a `reducers` object with a `reset` function and an `extraReducers` function. The `extraReducers` function uses a builder pattern to handle three cases: pending, fulfilled, and rejected. The pending case sets `isLoading` to true. The fulfilled case sets `isLoading` to false, sets `isSuccess` to true, and pushes the `payload` into the `tasks` array. The rejected case sets `isLoading` to false, sets `isError` to true, and sets the `message` to the `payload`. A green box highlights the entire `extraReducers` block.

```
28 export const taskSlice = createSlice({
29   name: 'task',
30   initialState,
31   reducers: {
32     reset: state => initialState
33   },
34   extraReducers: (builder) => [
35     builder
36       .addCase(createTask.pending, (state) => {
37         state.isLoading = true
38       })
39       .addCase(createTask.fulfilled, (state, action) => {
40         state.isLoading = false
41         state.isSuccess = true
42         state.tasks.push(action.payload)
43       })
44       .addCase(createTask.rejected, (state, action) => {
45         state.isLoading = false
46         state.isError = true
47         state.message = action.payload
48       })
49   ]
50 }
```

Figure 10.3: Creating extraReducers in taskSlice.js file

Now in Chrome/Firefox browser, go to <http://localhost:3000/> and log in if not done. Also, open the Redux devtools to see the redux states. We will see the initial login states of auth and tasks in the redux devtools.

Here, add anything in the **Task** input box and click the **Add Task** button.

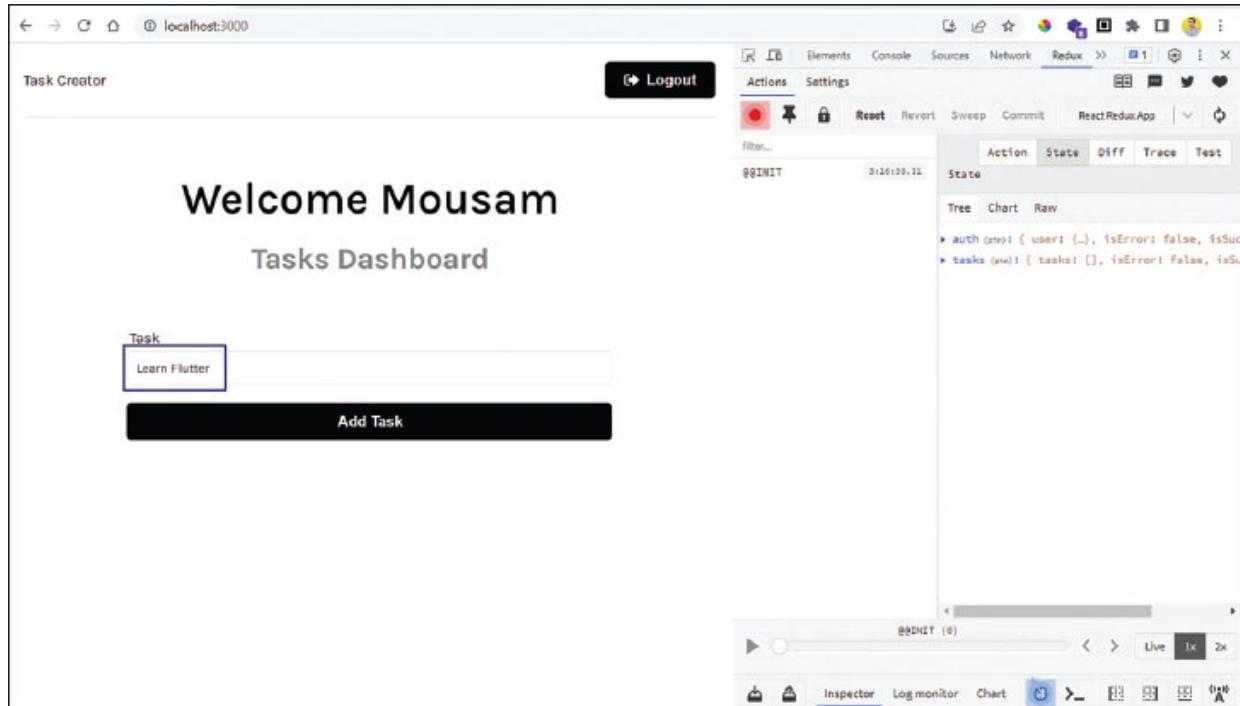


Figure 10.4: Adding text in Frontend

Here, first, the pending action ran from the extraReducers in the **taskSlice.js** file. Here, the **isLoading** was set to true, and the rest states were kept as it was earlier.

Next, the API call to the backend was successful, so the fulfilled action had run. This has made the **isLoading** as false, **isSuccess** as true and **isError** as false. And the tasks state was set to the payload received from the backend. This payload consists of **text**, **user**, **_id**, **createdAt**, and **updatedAt**.

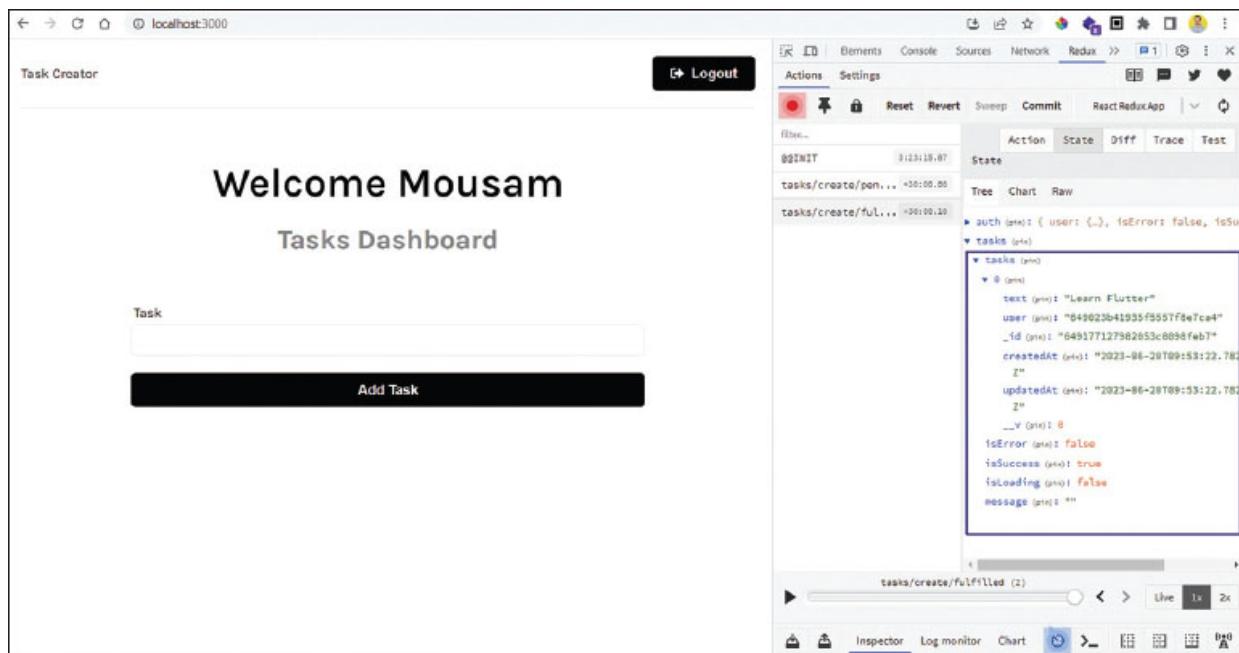


Figure 10.5: Task been added in Redux

Finally, we checked the value for tasks in the connected MongoDB database, and a new field was added to it.

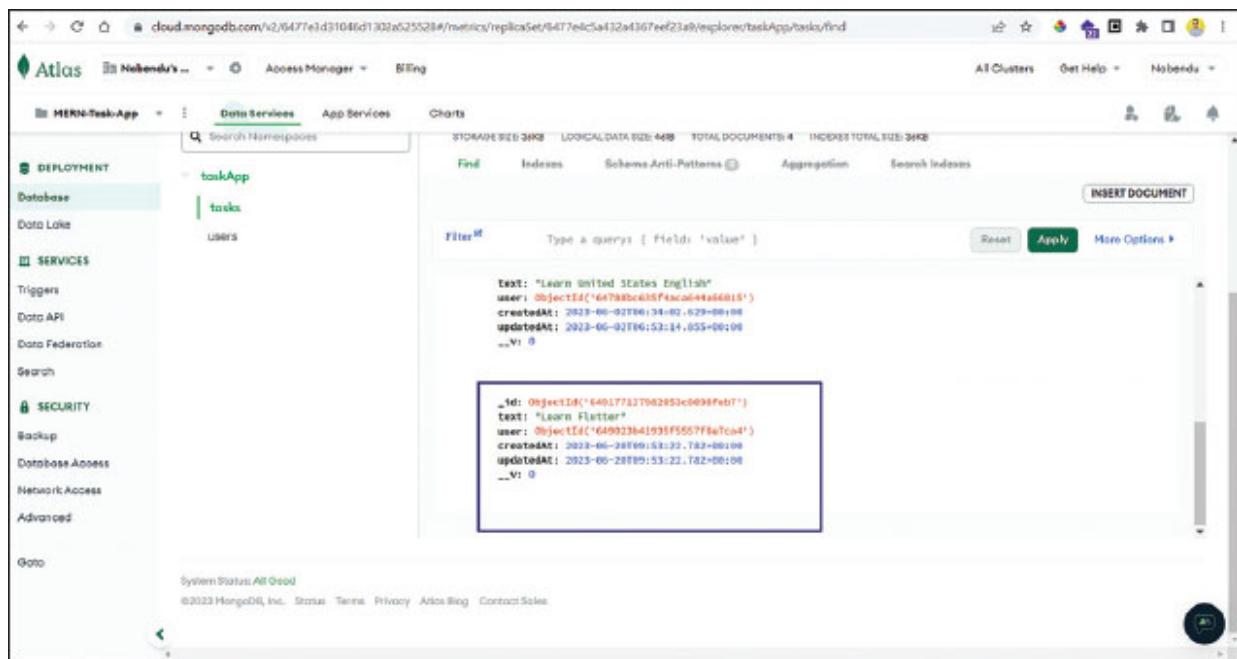


Figure 10.6: Task been added to the database

Fetching tasks from server

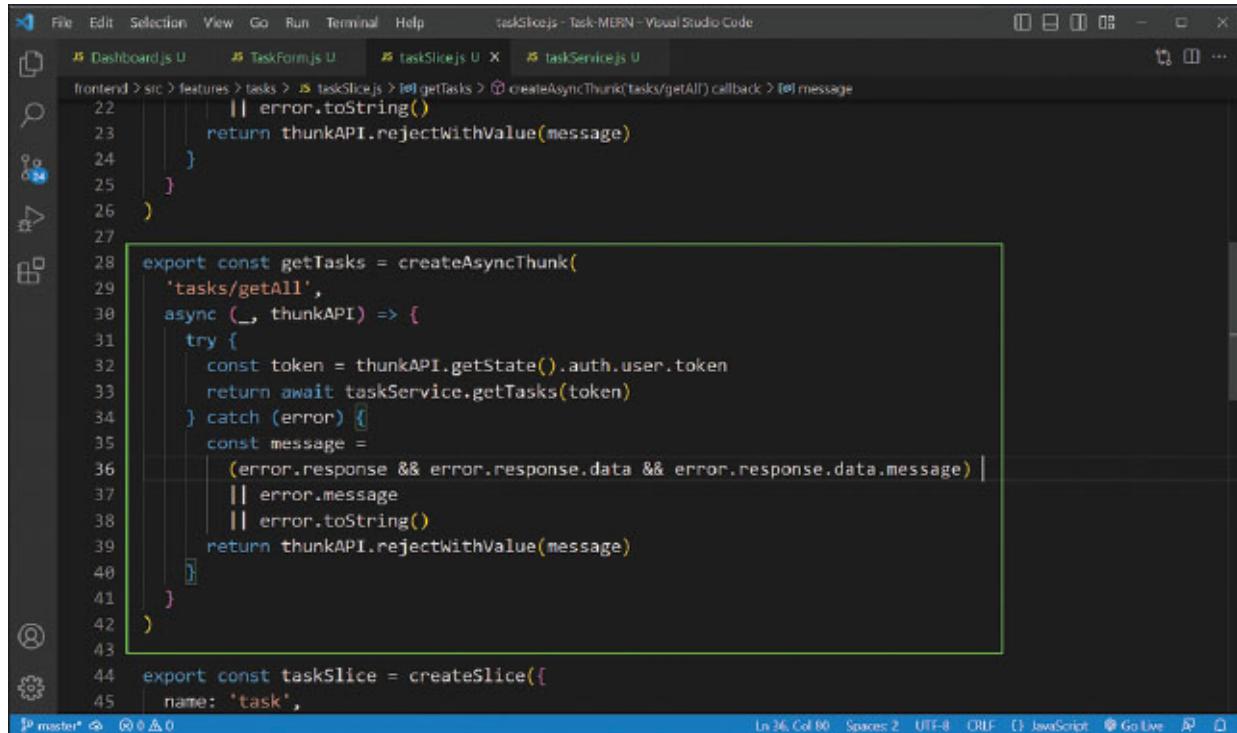
Now, we will fetch all tasks from the server. For this, in the **taskSlice.js** file, we will create a `getTasks` variable. Here, we are again using the `createAsyncThunk` function.

In the `createAsyncThunk` function, the first parameter is the **tasks/getAll**, which means from the **tasks** folder, take the `getAll` function. Next, the parameter is an async arrow function which takes `_` and `thunkAPI` as a parameter. This is a common JavaScript way to say that no parameter is required.

Inside the function, we have a `try...catch` block. From the `try` block, we are first getting the token using the `getState()` method. Next, we call the `getTasks` function from the **taskService.js** file with the token and then return it.

In the `catch` part, we are simply catching different kinds of errors and returning them.

```
export const getTasks = createAsyncThunk(
  'tasks/getAll',
  async (_, thunkAPI) => {
    try {
      const token = thunkAPI.getState().auth.user.token
      return await taskService.getTasks(token)
    } catch (error) {
      const message =
        (error.response && error.response.data &&
        error.response.data.message)
        || error.message
        || error.toString()
      return thunkAPI.rejectWithValue(message)
    }
  }
)
```



```
22     || error.toString()
23     return thunkAPI.rejectWithValue(message)
24   }
25 }
26 )
27
28 export const getTasks = createAsyncThunk(
29   'tasks/getAll',
30   async (_, thunkAPI) => {
31     try {
32       const token = thunkAPI.getState().auth.user.token
33       return await taskService.getTasks(token)
34     } catch (error) {
35       const message =
36         (error.response && error.response.data && error.response.data.message) ||
37         error.message ||
38         error.toString()
39       return thunkAPI.rejectWithValue(message)
40     }
41   }
42 )
43
44 export const taskSlice = createSlice({
45   name: 'task',
```

Figure 10.7: getTasks function in taskSlice.js file

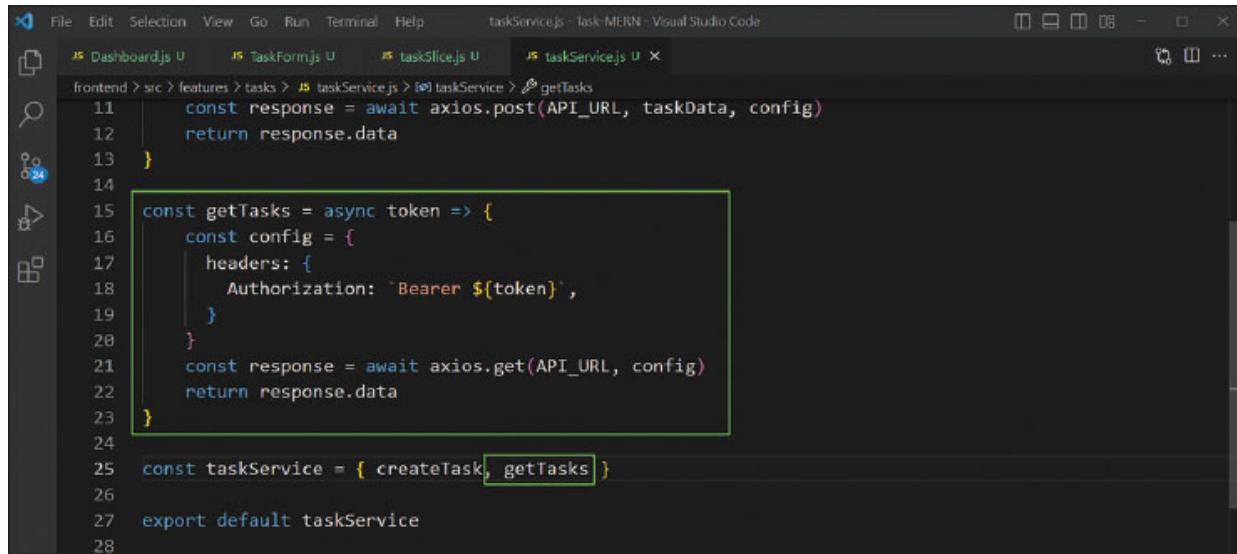
Back in the **taskService.js** file, we have created a **getTasks** function which takes the **token** as a parameter. This is the function which we are calling from our **taskSlice.js** file.

Inside the function, we have a **config** object first, similar to the one created in the **createTask** function earlier in the chapter.

Next, we are doing a **GET** call to the **API_URL** with the **config**. The result of the api call which we get in **response.data** and returning back the response from the function. Lastly, we are exporting the **getTasks** function.

```
const getTasks = async token => {
  const config = {
    headers: {
      Authorization: `Bearer ${token}`,
    }
  }
  const response = await axios.get(API_URL, config)
  return response.data
}

const taskService = { createTask, getTasks }
```



```
File Edit Selection View Go Run Terminal Help taskService.js - Task-MERN - Visual Studio Code
Dashboard.js U TaskForm.js U taskSlice.js U taskService.js U
frontend > src > features > tasks > taskService.js > getTasks
11  const response = await axios.post(API_URL, taskData, config)
12  return response.data
13 }
14
15 const getTasks = async token => {
16  const config = {
17    headers: {
18      Authorization: `Bearer ${token}`,
19    }
20  }
21  const response = await axios.get(API_URL, config)
22  return response.data
23 }
24
25 const taskService = { createTask, getTasks }
26
27 export default taskService
28
```

Figure 10.8: `getTasks` function in `taskService.js` file

Inside our `taskSlice.js` file in the `taskSlice` function, we will add the new cases in the `extraReducers`.

In our code, we have three cases for pending, fulfilled and rejected cases. Since we are doing an API GET call through our `getTasks` function, we have three states in it. When the API call starts, we have a pending state. In the pending state, `isLoading` will be made to true.

The next state is the fulfilled case, which will happen if our API call is successful. Here, we are making the `isLoading` as false and `isSuccess` as true and storing the payload which we receive back in the `tasks` state.

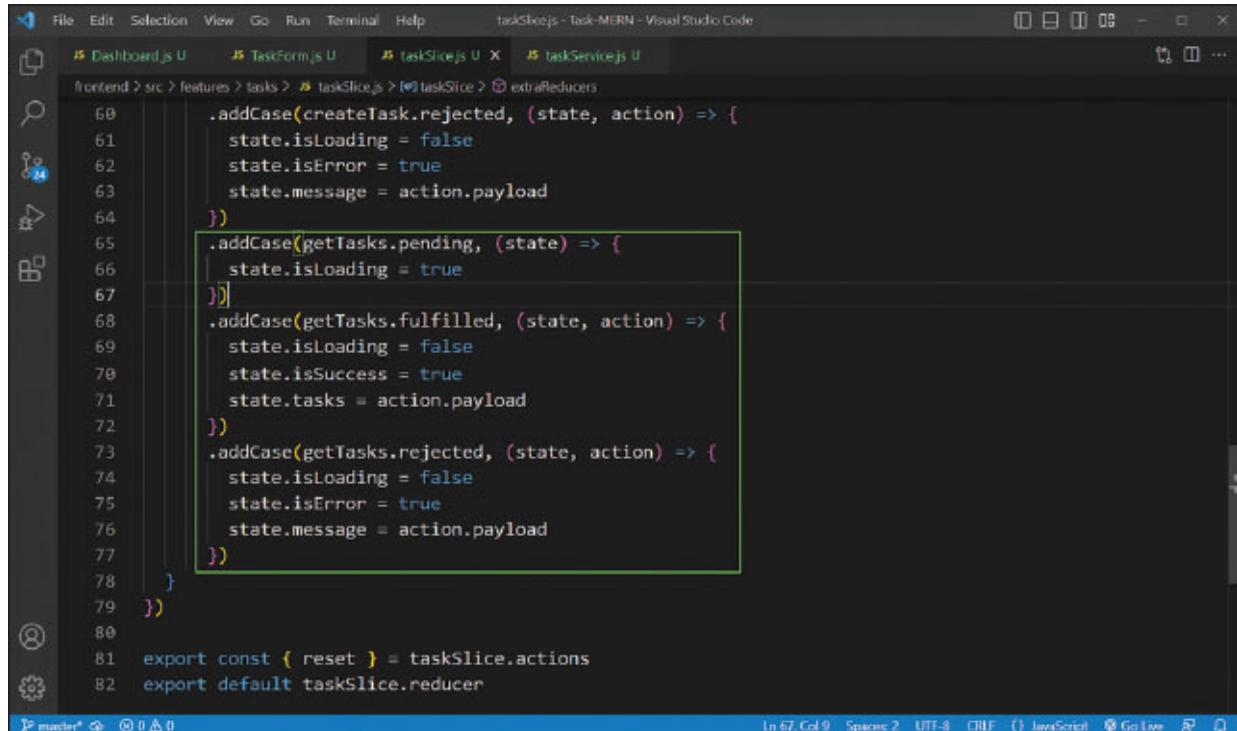
If, for some reason, the API call is not successful, we have a rejected case. Here, we are making the `isLoading` as false, `isError` as true. We are also storing the error in the message state, which we will receive in the payload.

```
.addCase(getTasks.pending, (state) => {
  state.isLoading = true
})
.addCase(getTasks.fulfilled, (state, action) => {
  state.isLoading = false
  state.isSuccess = true
  state.tasks = action.payload
})
.addCase(getTasks.rejected, (state, action) => {
  state.isLoading = false
  state.isError = true
  state.message = action.payload.error.message
})
```

```

    state.isError = true
    state.message = action.payload
  }
}

```



```

File Edit Selection View Go Run Terminal Help taskSlice.js - Task-MERN - Visual Studio Code
Dashboard.js U TaskForm.js U taskSlice.js X taskService.js U
Frontend > src > features > tasks > taskSlice.js > taskSlice > extraReducers
60   .addCase(createTask.rejected, (state, action) => {
61     state.isLoading = false
62     state.isError = true
63     state.message = action.payload
64   })
65   .addCase(getTasks.pending, (state) => {
66     state.isLoading = true
67   })
68   .addCase(getTasks.fulfilled, (state, action) => {
69     state.isLoading = false
70     state.isSuccess = true
71     state.tasks = action.payload
72   })
73   .addCase(getTasks.rejected, (state, action) => {
74     state.isLoading = false
75     state.isError = true
76     state.message = action.payload
77   })
78 }
79 )
80
81 export const { reset } = taskSlice.actions
82 export default taskSlice.reducer

```

The screenshot shows the `taskSlice.js` file in Visual Studio Code. The code defines a reducer function with several cases. The cases for `getTasks.pending`, `getTasks.fulfilled`, and `getTasks.rejected` are highlighted with a green rectangular selection. The `getTasks.pending` case sets `state.isLoading` to `true`. The `getTasks.fulfilled` case sets `state.isLoading` to `false`, sets `state.isSuccess` to `true`, and sets `state.tasks` to `action.payload`. The `getTasks.rejected` case sets `state.isLoading` to `false`, sets `state.isError` to `true`, and sets `state.message` to `action.payload`.

Figure 10.9: extraReducer cases in taskSlice.js file

Now, in the **Dashboard.js** file, we will show a button instead of the earlier text. In the next part, we will add logic to show all tasks from a new component when we click this button.

A screenshot of Visual Studio Code showing the code editor with the file `Dashboard.js` open. The code is a React component named `Dashboard`. A specific line of code, which contains a `button` element, is highlighted with a yellow box. The code snippet is as follows:

```
1 import { useEffect } from 'react'
2 import { useNavigate } from 'react-router-dom'
3 import { useSelector } from 'react-redux'
4 import TaskForm from './TaskForm'
5
6 const Dashboard = () => {
7   const navigate = useNavigate()
8   const { user } = useSelector(state => state.auth)
9
10  useEffect(() => {
11    if (!user) navigate('/login')
12  }, [user, navigate])
13
14  return (
15    <>
16      <section className='heading'>
17        <h1>Welcome {user && user.name}</h1>
18        <div style={{ display: 'flex', justifyContent: 'center' }}>
19          <button className='btn' onClick={() => navigate('/alltasks')}>Check Tasks</button>
20        </div>
21      </section>
22      <TaskForm />
23    </>
24  )
}
```

Figure 10.10: Adding button in `Dashboard.js` file

Back in the browser at `http://localhost:3000/`, we will see the button for all tasks.

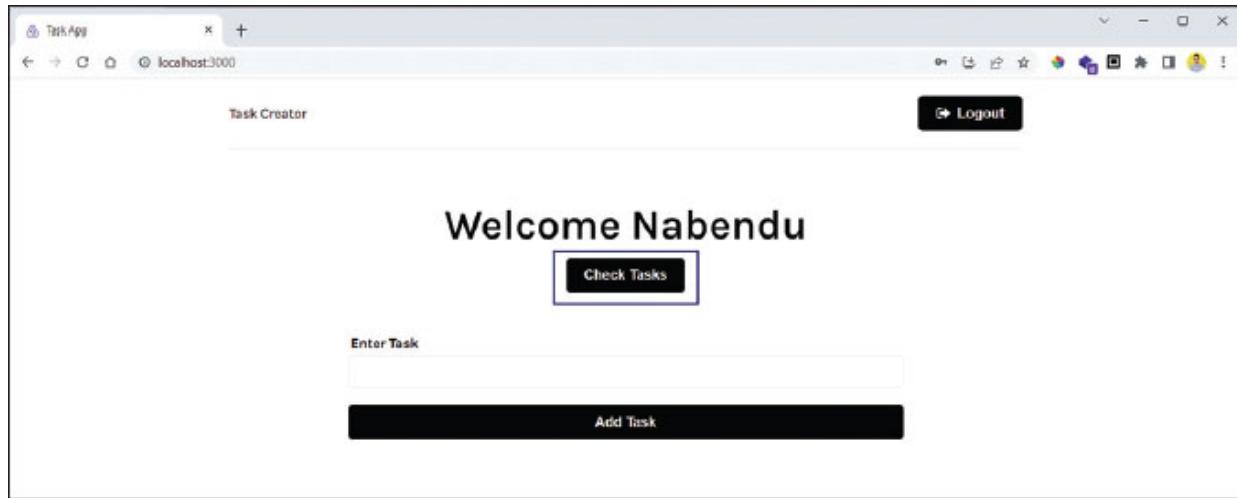


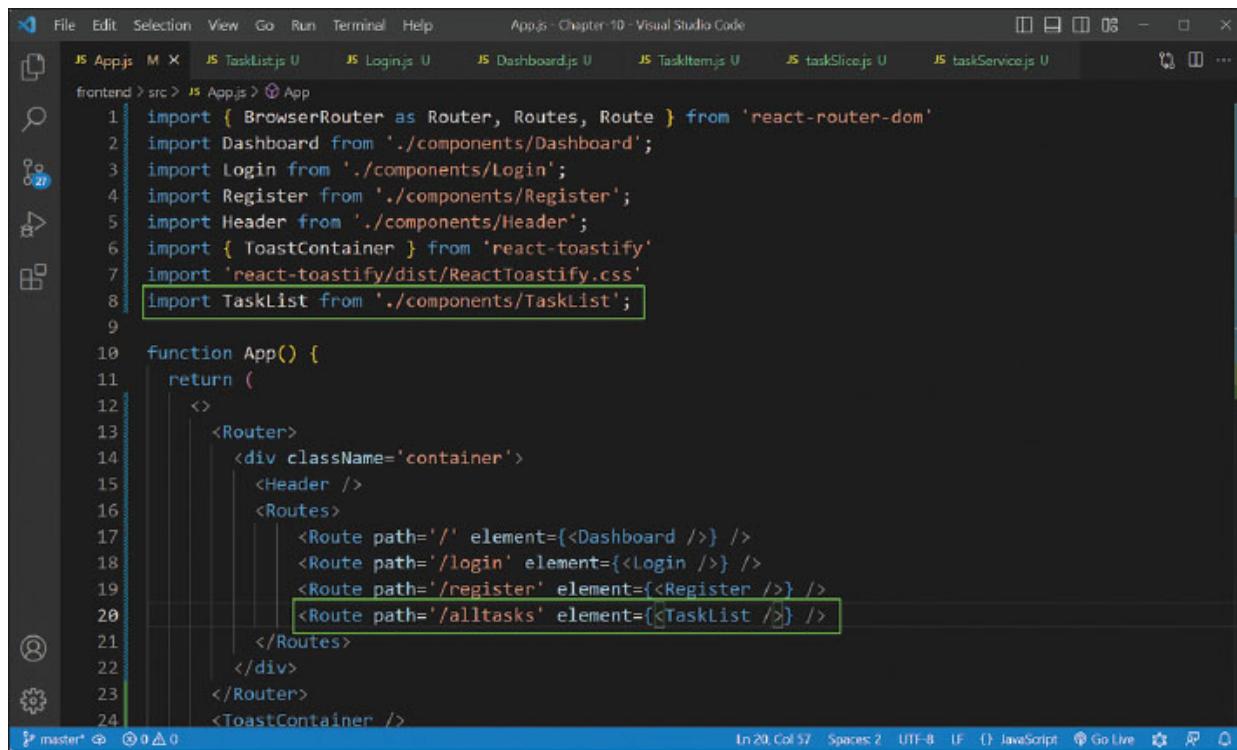
Figure 10.11: Button in localhost

Displaying the tasks

Now, we will display the tasks for which we have created the logic in the previous part. Here, in the **App.js** file, we will add a new route to show all tasks.

For this, we are adding a **<Route>** with the path as **/alltasks** and which will call the **TaskList** component. We are also importing this **TaskList** component, which we are going to create next.

```
import TaskList from './components/TaskList';  
...  
...  
<Route path='/alltasks' element={<TaskList />} />
```



The screenshot shows the **App.js** file in Visual Studio Code. The code editor displays the following content:

```
1 import { BrowserRouter as Router, Routes, Route } from 'react-router-dom'  
2 import Dashboard from './components/Dashboard';  
3 import Login from './components/Login';  
4 import Register from './components/Register';  
5 import Header from './components/Header';  
6 import { ToastContainer } from 'react-toastify'  
7 import 'react-toastify/dist/ReactToastify.css'  
8 import TaskList from './components/TaskList';  
9  
10 function App() {  
11   return (  
12     <>  
13       <Router>  
14         <div className='container'>  
15           <Header />  
16           <Routes>  
17             <Route path='/' element={<Dashboard />} />  
18             <Route path='/login' element={<Login />} />  
19             <Route path='/register' element={<Register />} />  
20             <Route path='/alltasks' element={<TaskList />} />  
21           </Routes>  
22         </div>  
23       </Router>  
24       <ToastContainer />
```

The line `8 import TaskList from './components/TaskList';` and the `<Route path='/alltasks' element={<TaskList />} />` line are highlighted with a yellow box, indicating they are the focus of the current step.

Figure 10.12: Adding new route in **App.js** file

Next, create a new file **TaskList.js** in the **components** folder. Here, we are first importing the **useEffect** hook from react, which will be used to do the async task of calling different action creators through dispatch. Next, we import **useSelector** and **useDispatch** hooks from **react-redux**. As earlier, they will be used to access the global state and dispatch the action creator.

Next, we are importing the recently created **getTasks** function from the task slice and also importing the reset function. We are also importing a **TaskItem**

component, which we have not created yet and the Spinner component from showing a Spinner. Lastly, we are importing the `useNavigate` hook, which will be used in our `useEffect`.

Now, inside the `TaskList` function, we are first creating a variable of dispatch and navigating using the `useDispatch` and `useNavigate` hooks, respectively. After that, using the `useSelector` hook, we get the global state of tasks. Also, notice that we are destructuring it to get the `tasks`, `isLoading`, `isError`, and `message`.

Next, inside the `useEffect` hook, we are first checking for errors and console logging it. If there are no errors, then we are calling the `getTasks` method through the `dispatch` function. We also have an unmounting state dispatching the reset method. The `useEffect` method also has a second parameter as an array of `navigate`, `isError`, `message` and `dispatch`. This means the `useEffect` will be fired whenever these will change. Lastly, the return statement is only showing a div, which we will update next.

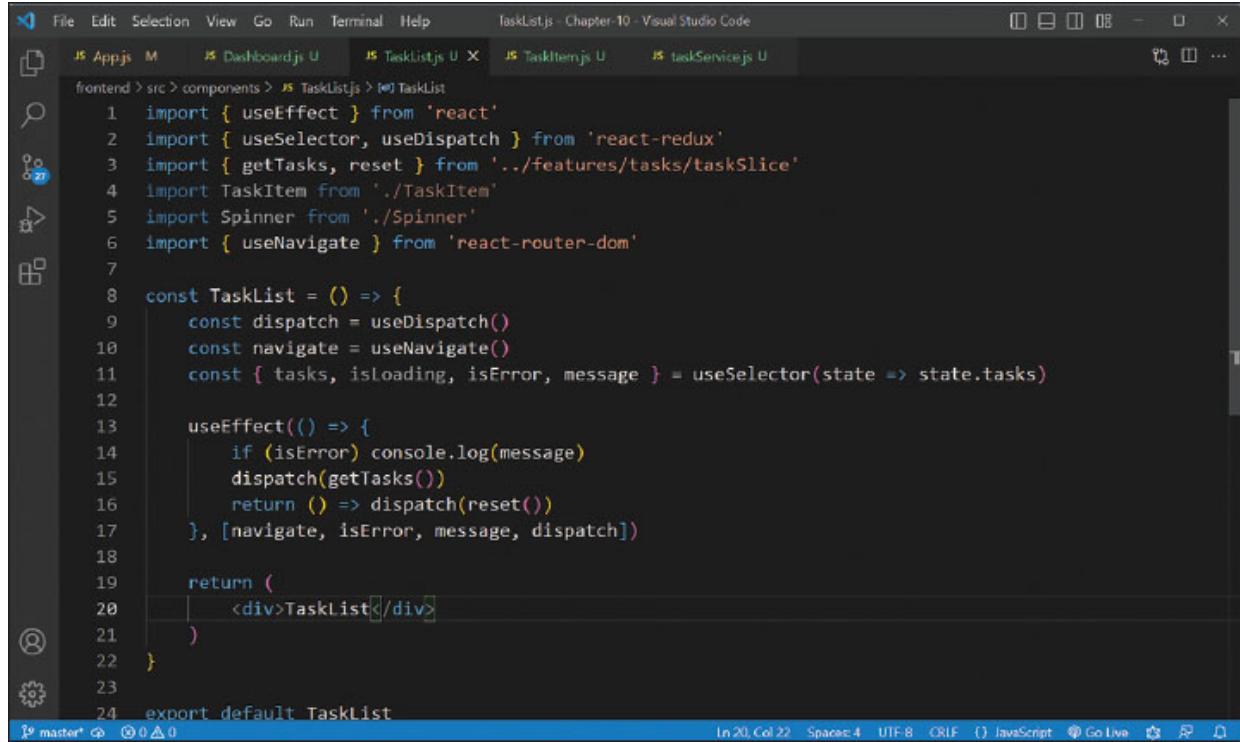
```
import { useEffect } from 'react'
import { useSelector, useDispatch } from 'react-redux'
import { getTasks, reset } from '../features/tasks/taskSlice'
import TaskItem from './TaskItem'
import Spinner from './Spinner'
import { useNavigate } from 'react-router-dom'

const TaskList = () => {
  const dispatch = useDispatch()
  const navigate = useNavigate()
  const { tasks, isLoading, isError, message } =
    useSelector(state => state.tasks)

  useEffect(() => {
    if (isError) console.log(message)
    dispatch(getTasks())
    return () => dispatch(reset())
  }, [navigate, isError, message, dispatch])

  return (
    <div>TaskList</div>
  )
}
```

```
export default TaskList
```



The screenshot shows the Visual Studio Code interface with the TaskList.js file open. The file contains code for a React component named TaskList. It imports various hooks and actions from 'react', 'react-redux', and 'taskSlice'. The component uses the useEffect hook to dispatch actions and log messages. It also uses the useSelector hook to get tasks and the useNavigate hook to handle navigation. The return statement contains a conditional rendering logic using the ternary operator. The code is well-formatted with proper indentation and syntax highlighting.

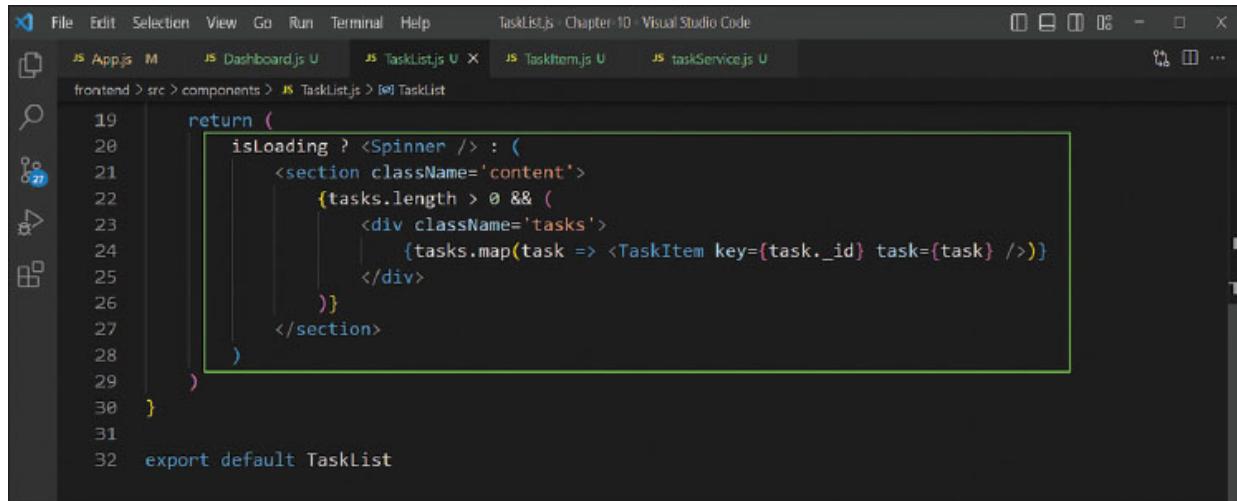
```
File Edit Selection View Go Run Terminal Help TaskList.js - Chapter-10 - Visual Studio Code
JS App.js M JS Dashboard.js U JS TaskList.js X JS TaskItem.js U JS taskService.js U
frontend > src > components > JS TaskList.js > [0] TaskList
1 import { useEffect } from 'react'
2 import { useSelector, useDispatch } from 'react-redux'
3 import { getTasks, reset } from '../features/tasks/taskSlice'
4 import TaskItem from './TaskItem'
5 import Spinner from './Spinner'
6 import { useNavigate } from 'react-router-dom'
7
8 const TaskList = () => {
9   const dispatch = useDispatch()
10  const navigate = useNavigate()
11  const { tasks, isLoading, isError, message } = useSelector(state => state.tasks)
12
13  useEffect(() => {
14    if (isError) console.log(message)
15    dispatch(getTasks())
16    return () => dispatch(reset())
17  }, [navigate, isError, message, dispatch])
18
19  return (
20    <div>TaskList</div>
21  )
22}
23
24 export default TaskList
In 20, Col 22  Spaces: 4  UTF-8  CR/LF  () JavaScript  Go Live  ⚡  ⚡  ⚡
```

Figure 10.13: The TaskList.js file

Next, we will update the return statement inside the **TaskList.js** file. Here, we are using the ternary operator and checking if the `isLoading` is true, then showing the `Spinner` component. Or else the other part is executed. Here, we are first checking if the `tasks` array length is greater than zero.

If it is the case, then we are looping through the `tasks` variable and sending each task to the `TaskItem` component.

```
isLoading ? <Spinner /> : (
  <section className='content'>
    {tasks.length > 0 && (
      <div className='tasks'>
        {tasks.map(task => <TaskItem key={task._id} task={task}>
          />)
      </div>
    ) }
  </section>
)
```



```
File Edit Selection View Go Run Terminal Help TaskList.js · Chapter 10 · Visual Studio Code
JS App.js M JS Dashboard.js U JS TaskList.js U JS TaskItem.js U JS taskService.js U
frontend > src > components > JS TaskList.js > (0) TaskList
19 return (
20   isLoading ? <Spinner /> : (
21     <section className='content'>
22       {tasks.length > 0 && (
23         <div className='tasks'>
24           {tasks.map(task => <TaskItem key={task._id} task={task} />)}
25         </div>
26       )}
27     </section>
28   )
29 )
30 }
31
32 export default TaskList
```

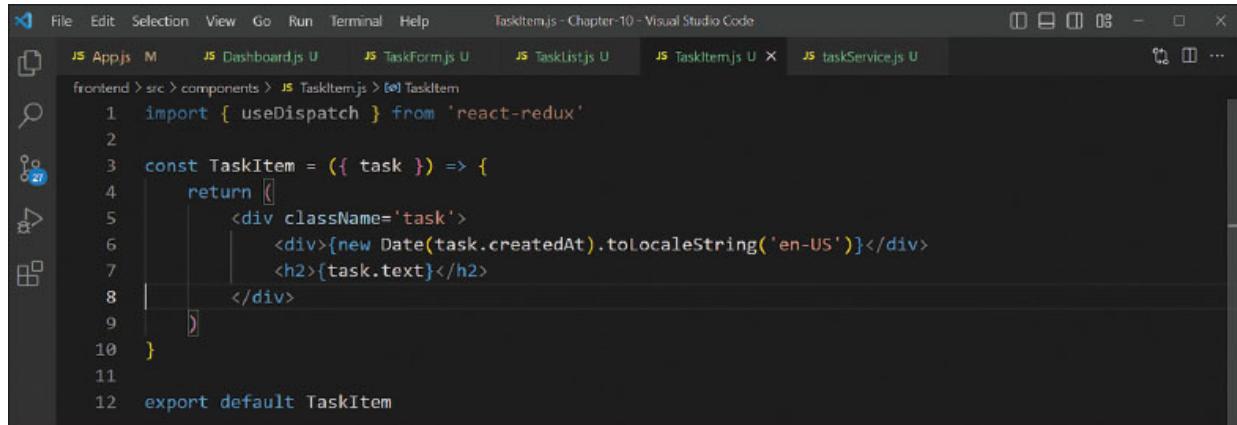
Figure 10.14: Adding return logic in TaskList.js file

Next, create the **TaskItem.js** file in the **components** folder. Here, we are first importing the `useDispatch` hook from `react-redux`, which we are going to use later while creating delete functionalities.

Inside the `TaskItem` function, we are first destructuring the props of the task. Next, we show the `createdAt` and `text` inside a div and h2, respectively. Also, notice that the `createdAt` is changed to the proper format using the new `Date()` and `toLocaleString('en-US')`.

```
import { useDispatch } from 'react-redux'

const TaskItem = ({ task }) => {
  return (
    <div className='task'>
      <div>{new Date(task.createdAt).toLocaleString('en-US')}
```

A screenshot of the Visual Studio Code interface. The title bar says "TaskItem.js - Chapter-10 - Visual Studio Code". The left sidebar shows a tree view with "frontend > src > components > TaskItem.js". The main editor tab is "TaskItem.js" which contains the following code:

```
1 import { useDispatch } from 'react-redux'
2
3 const TaskItem = ({ task }) => {
4     return [
5         <div className='task'>
6             <div>{new Date(task.createdAt).toLocaleString('en-US')}
```

Figure 10.15: Creating TaskItem.js file

We will also update the **TaskForm.js** file to navigate to the/**alltasks** route and hence show the **TaskList** component. Here, we are first importing the `useNavigate` hook from `react-router-dom`.

After that, we use it to create a variable called `navigate` inside the `TaskForm` function. After that, in the `onSubmit()` method, which is called after the user clicks on the **Add Tasks** button, we add `navigate()` at the end to go to **/alltasks**.

Also, we are changing a bit of the text style of Enter Text using inline styling.

```
import { useNavigate } from 'react-router-dom'

const TaskForm = () => {
    const navigate = useNavigate()

    const onSubmit = (e) => {
        e.preventDefault()
        dispatch(createTask({ text }))
        setText('')
        navigate('/alltasks')
    }

    return (
        <section className='form'>
            <form onSubmit={onSubmit}>
                <div className='form-group'>
                    <label htmlFor='text' style={{ fontWeight:
                        'bolder' }}>Enter Task</label>
                </div>
            </form>
        </section>
    )
}
```

```

        </form>
    </section>
)
}

```

The screenshot shows a Visual Studio Code window with the following code in the TaskForm.js file:

```

1 import { useState } from 'react'
2 import { useDispatch } from 'react-redux'
3 import { createTask } from '../features/tasks/taskSlice'
4 import { useNavigate } from 'react-router-dom'

5
6 const TaskForm = () => {
7     const [text, setText] = useState('')
8     const dispatch = useDispatch()
9     const navigate = useNavigate()

10
11     const onSubmit = (e) => {
12         e.preventDefault()
13         dispatch(createTask({ text }))
14         setText('')
15         navigate('/alltasks')
16     }

17     return (
18         <section className='form'>
19             <form onSubmit={onSubmit}>
20                 <div className='form-group'>
21                     <label htmlFor='text' style={{ fontWeight: 'bold' }}>Enter Task</label>
22                     <input type='text' id='text' value={text} onChange={e => setText(e.target.value)}>
23                 </div>
24             </form>
25         </section>
26     )
27 }

```

The code is being edited to update the navigation logic. The `navigate` function call at line 15 has been updated to `navigate('/alltasks')` instead of `navigate('/tasks')`. The code is also being formatted with Prettier.

Figure 10.16: Updating navigation in TaskForm.js file

Now, in the Chrome/Firefox browser, directly open <http://localhost:3000/alltasks> or click on the **Check Tasks** button to go there. Also, open the Redux devtools in the browser. Here, we will first see the pending case for getAll tasks.

In this state, since the API call has been going on, we will see the isLoading as true. The tasks will be an empty array, and the isError and isSuccess will be false. Also, the message will be an empty string.

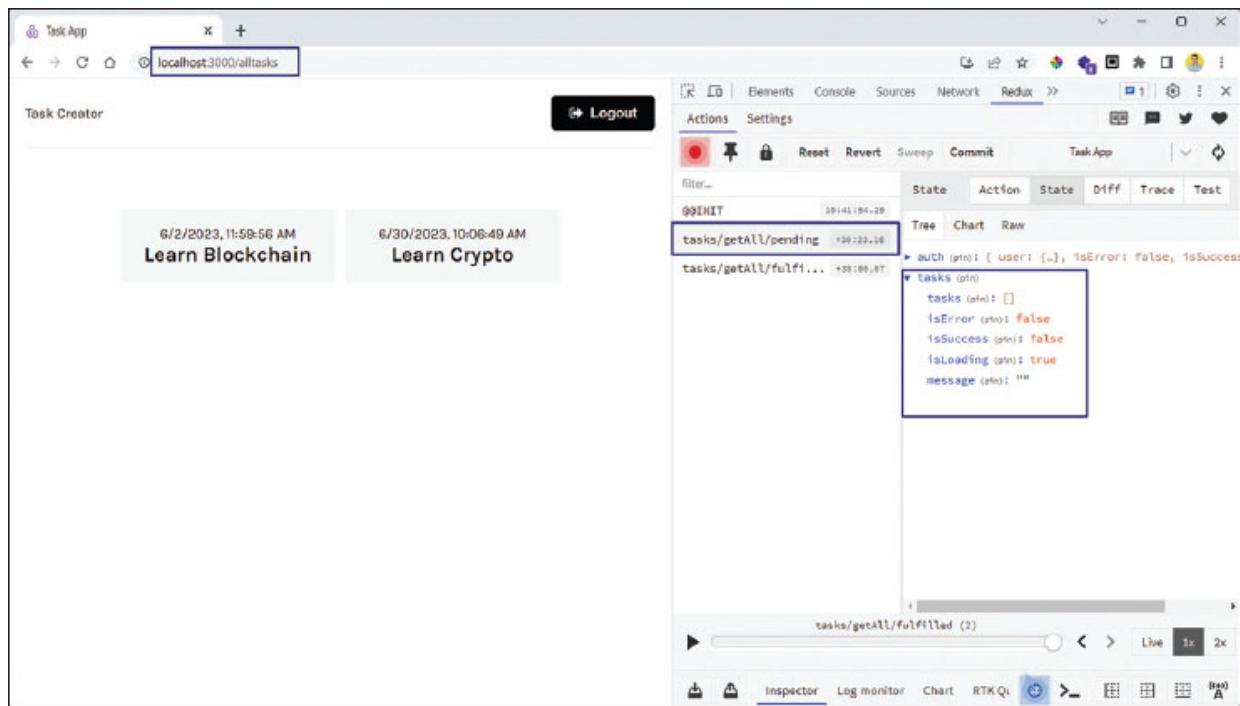


Figure 10.17: Pending state for all tasks

Once the API call is successful, we will see the tasks array is filled with data from the backend. It contains the text and the `createdAt` field, which we are showing in the browser.

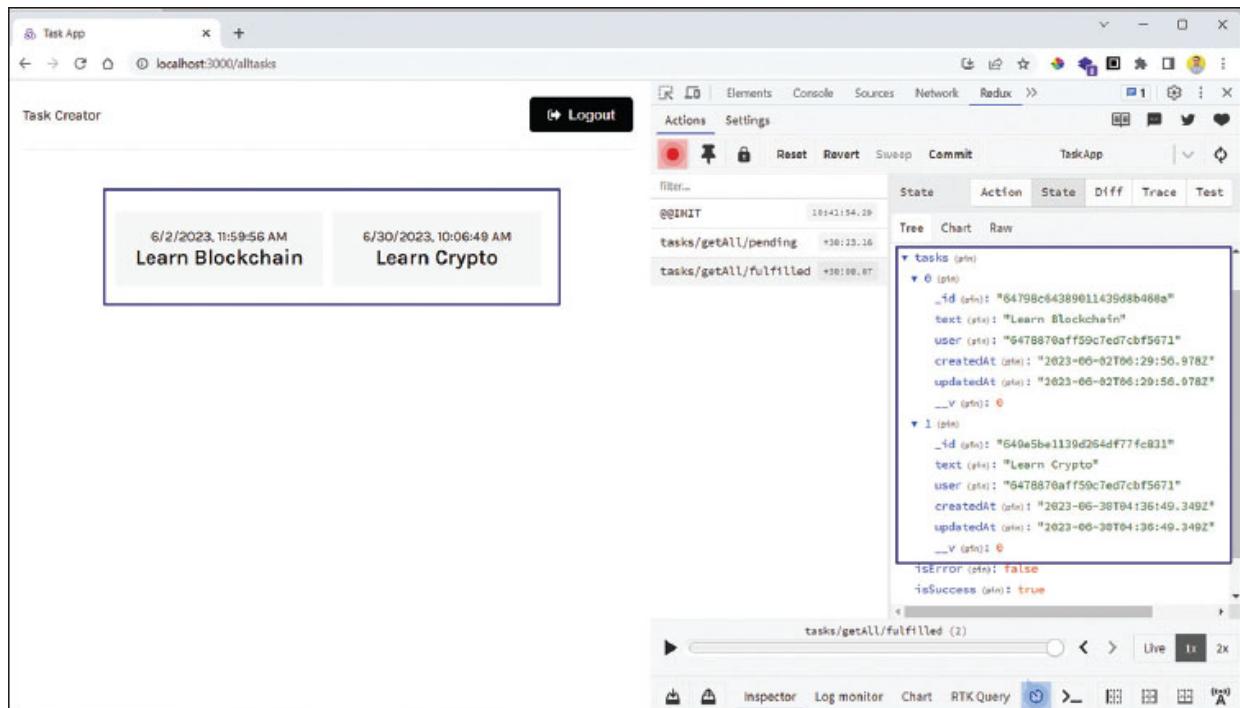


Figure 10.18: Fulfilled state for all tasks

Now, back in `http://localhost:3000/`, enter a task and click on the **Add Task** button. Notice that when we came here, the reset case was running, and it made all states its initial value.

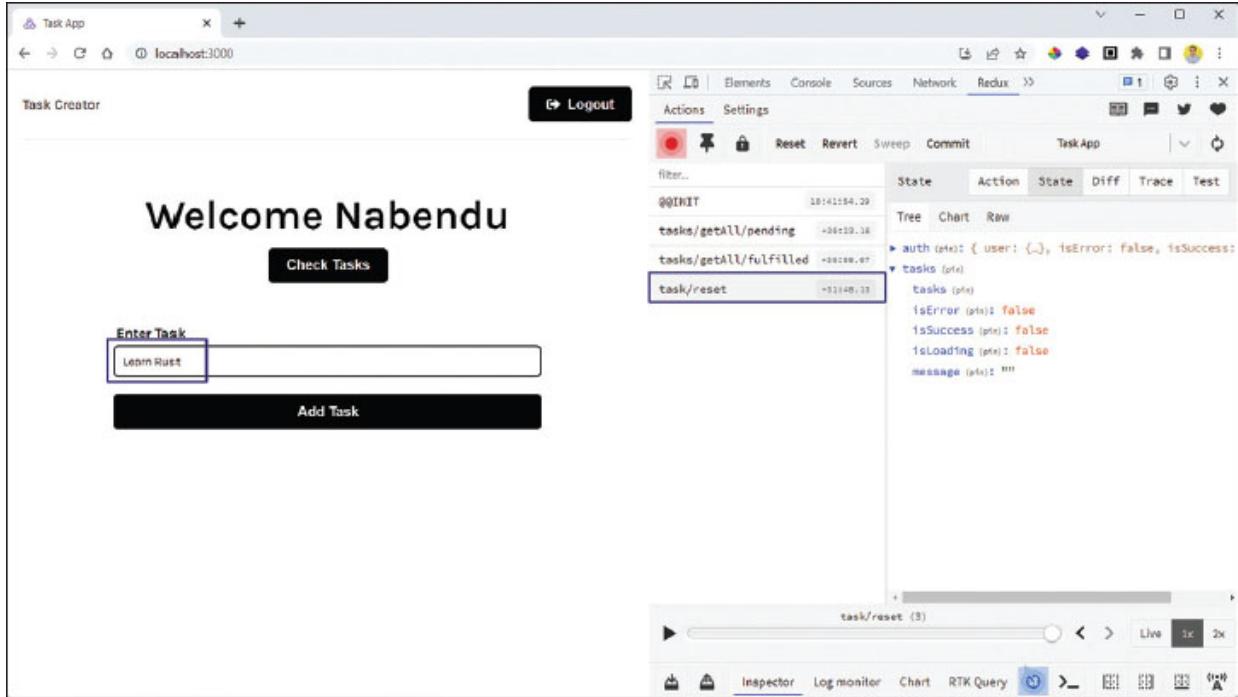


Figure 10.19: Reset before adding tasks

On clicking on the **Add Task**, we are taken to `http://localhost:3000/alltasks` and the new task is added. Also, notice the new task is added in the tasks state in Redux devtools.

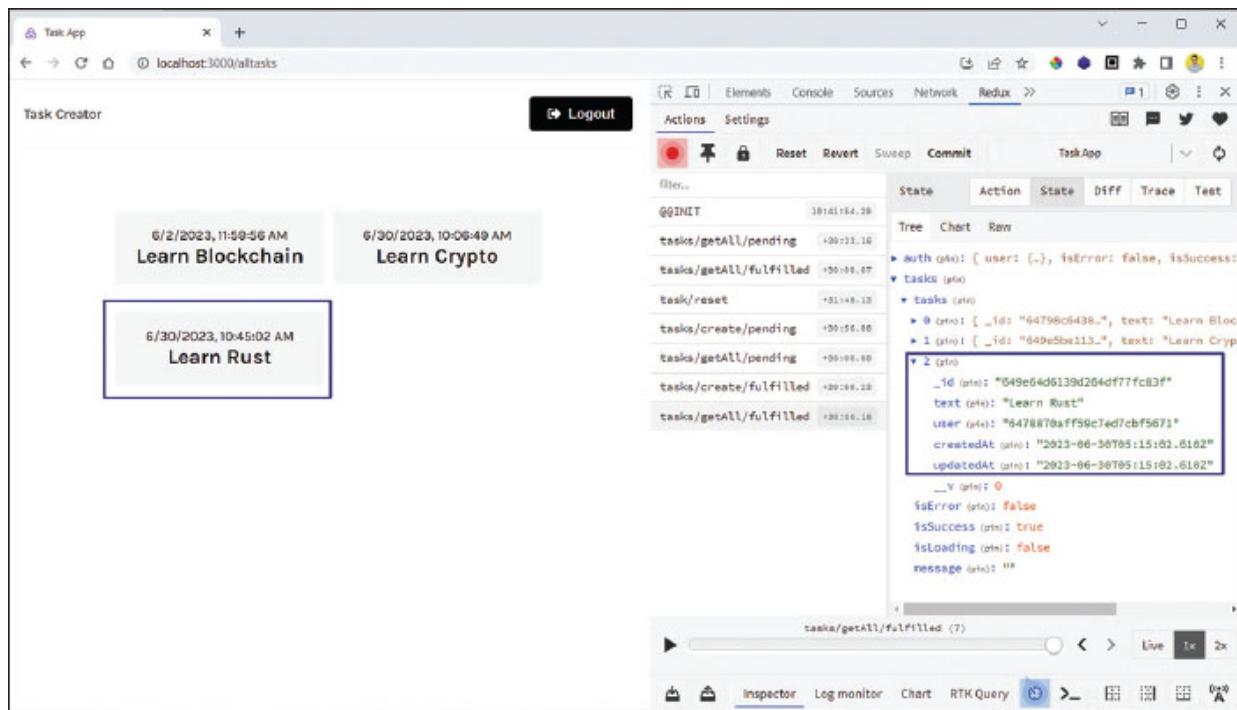


Figure 10.20: Added new task

Now, let's also see the tasks for another user. Here, we have logged in with another user's login and then clicked on the **Check Tasks** button.

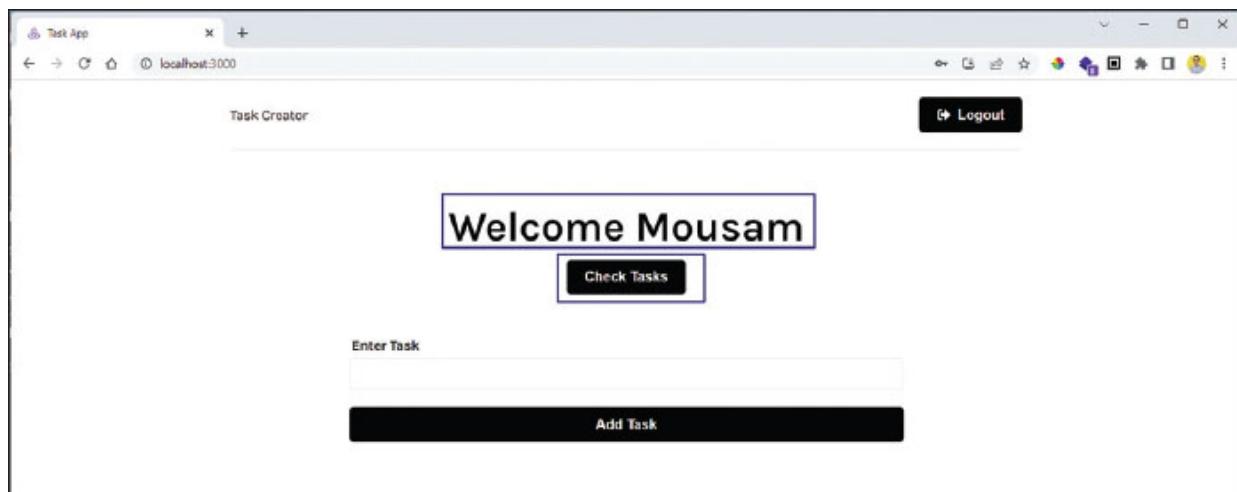


Figure 10.21: Checking tasks for different user

Here, notice that different tasks are shown for the user in the <http://localhost:3000/alltasks> link.

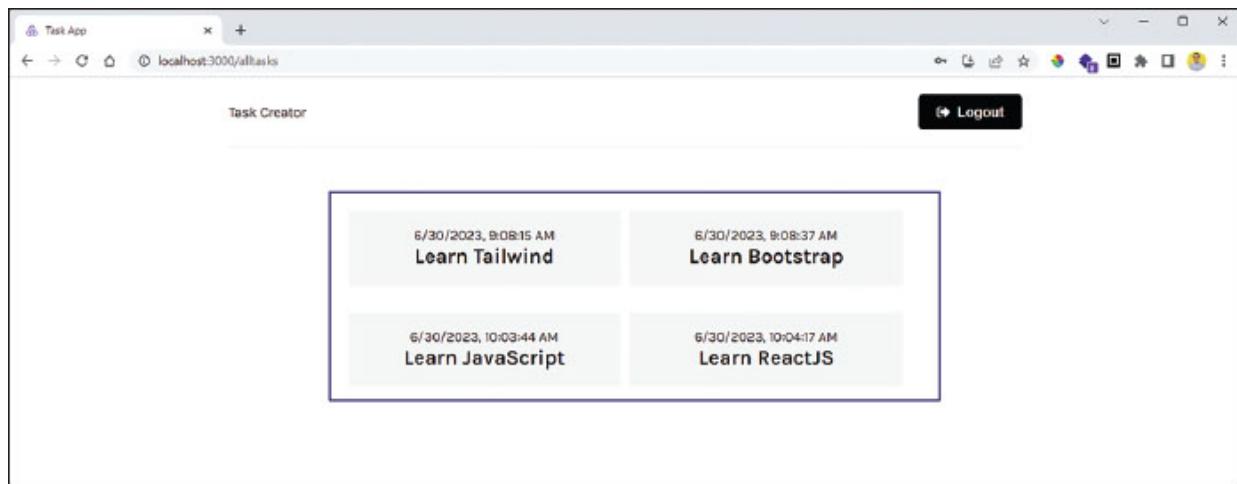


Figure 10.22: Tasks for different user

Deleting tasks

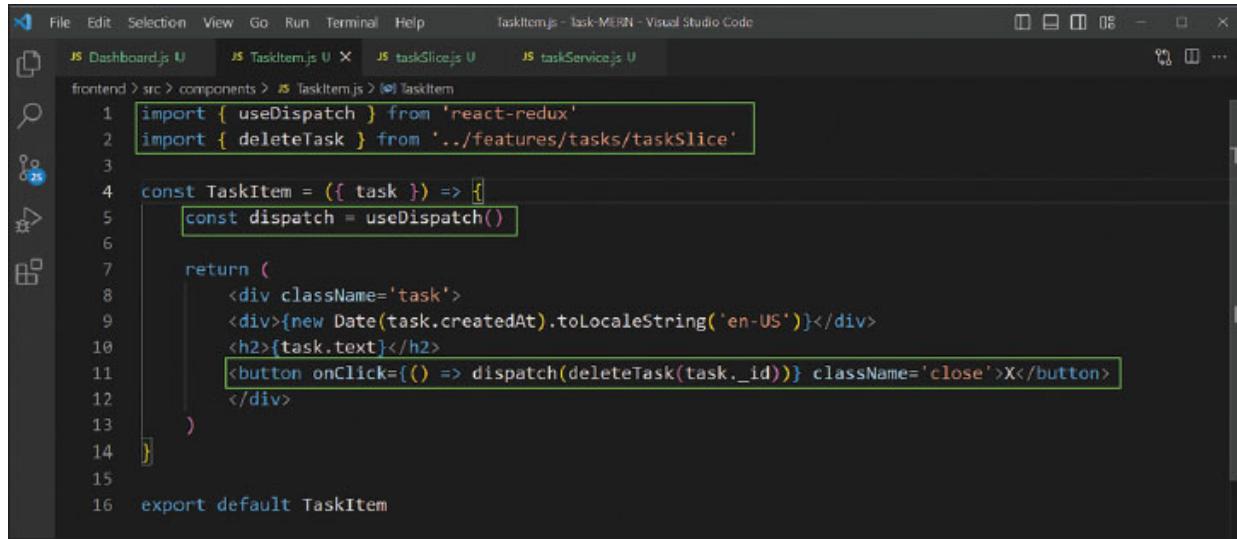
Now, we will add the last functionality in our project, which is to delete a task. So in the **TaskItem.js** file, we will first import the `useDispatch` hook from `react-redux`. Next, we are also importing the `deleteTask` from `taskSlice`, which we will create next.

Inside the **TaskItem**, we are creating a dispatch variable which will use the `useDispatch`. Next, we have added a button which will dispatch the `deleteTask()` with the task id.

```
import { useDispatch } from 'react-redux'
import { deleteTask } from '../features/tasks/taskSlice'

const TaskItem = ({ task }) => {
  const dispatch = useDispatch()

  return (
    <div className='task'>
      ...
      <button onClick={() => dispatch(deleteTask(task._id))}>
        className='close'>X</button>
    </div>
  )
}
```



```
1 import { useDispatch } from 'react-redux'
2 import { deleteTask } from '../features/tasks/taskSlice'
3
4 const TaskItem = ({ task }) => [
5   const dispatch = useDispatch()
6
7   return (
8     <div className='task'>
9       <div>{new Date(task.createdAt).toLocaleString('en-US')}</div>
10      <h2>{task.text}</h2>
11      <button onClick={() => dispatch(deleteTask(task._id))} className='close'>X</button>
12    </div>
13  )
14}
15
16 export default TaskItem
```

Figure 10.23: Adding button to delete task

Now, in the **taskSlice.js** file, we will create a **deleteTask** variable. Here, we are again using the **createAsyncThunk** function.

In the **createAsyncThunk** function, the first parameter is the **tasks/delete**, which means from the **tasks** folder, take the **delete** function. Next, the parameter is an async arrow function which takes **id** and **thunkAPI** as a parameter.

Inside the function, we have a **try...catch** block. From the **try** block, we are first getting the token using the **getState()** method. Next, we call the **deleteTask** function from the **taskService.js** file with the **id** and the **token** and then return it.

In the **catch** part, we are simply catching different kinds of errors and returning them.

```
export const deleteTask = createAsyncThunk(
  'tasks/delete',
  async (id, thunkAPI) => {
    try {
      const token = thunkAPI.getState().auth.user.token
      return await taskService.deleteTask(id, token)
    } catch (error) {
      const message =
        (error.response && error.response.data &&
        error.response.data.message)
```

```

    || error.message
    || error.toString()
  return thunkAPI.rejectWithValue(message)
}
}
)

```

```

File Edit Selection View Go Run Terminal Help taskSlice.js - Task-MERN - Visual Studio Code
JS Dashboard.js U JS Taskitem.js U JS taskSlice.js U X JS taskService.js U
frontend > src > features > tasks > taskSlice.js > deleteTask > createAsyncThunk('tasks/delete') callback
39   return thunkAPI.rejectWithValue(message)
40 }
41 }
42 )
43
44 export const deleteTask = createAsyncThunk(
45   'tasks/delete',
46   async (id, thunkAPI) => {
47     try {
48       const token = thunkAPI.getState().auth.user.token
49       return await taskService.deleteTask(id, token)
50     } catch (error) {
51       const message =
52         (error.response && error.response.data) && error.response.data.message
53         || error.message
54         || error.toString()
55       return thunkAPI.rejectWithValue(message)
56     }
57   }
58 )
59
60 export const taskSlice = createSlice({
61   name: 'task',
62   initialState,

```

In 50 Col 22 Spaces: 2 UTF-8 CRLF {} JavaScript Go Live

Figure 10.24: deleteTask function in taskSlice.js file

Back in the **taskService.js** file, we have created a **deleteTask** function which takes the **id** and **token** as a parameter. This is the function which we are calling from our **taskSlice.js** file.

Inside the function, we have a **config** object first, similar to the one created in the **getTasks** function earlier in the chapter.

Next, we are doing a DELETE call to the **API_URL** plus **id** with the **config**. The result of the api call which we get in **response.data** and returning back the response from the function. Lastly, we are exporting the **deleteTask** function.

```

const deleteTask = async (id, token) => {
  const config = {
    headers: {

```

```

        Authorization: `Bearer ${token}`,
    }
}
const response = await axios.delete(API_URL + id, config)
return response.data
}

const taskService = { createTask, getTasks, deleteTask }

```

The screenshot shows a Visual Studio Code interface with the title bar "taskService.js - Task-MERN - Visual Studio Code". The left sidebar shows files: Dashboard.js, TaskItem.js, taskSlice.js, and taskService.js. The main editor area displays the code for taskService.js. A green rectangular selection highlights the following code block:

```

25 const deleteTask = async (id, token) => {
26   const config = [
27     headers: {
28       Authorization: `Bearer ${token}`
29     }
30   ]
31   const response = await axios.delete(API_URL + id, config)
32   return response.data
33 }
34
35 const taskService = { createTask, getTasks, deleteTask }
36
37 export default taskService
38

```

Figure 10.25: deleteTask function in taskService.js file

Now, in our **taskSlice.js** file in the **taskSlice** function, we will add the new cases in the **extraReducers**.

In our code, we have three cases for pending, fulfilled and rejected cases. Since we are doing an API DELETE call through our **deleteTask** function, we have three states in it. When the API call starts, we have a pending state. In the pending state, **isLoading** will be made to true.

The next state is the fulfilled case, which will happen if our API call is successful. Here, we are making the **isLoading** as false and **isSuccess** as true and then filtering the tasks state to remove the passed task and update the tasks state.

If, for some reason, the API call is not successful, we have a rejected case. Here, we are making the **isLoading** as false, **isError** as true. We are also storing the error in the **message** state, which we will receive in the payload.

```

.addCase(deleteTask.pending, (state) => {
  state.isLoading = true
})

```

```

    .addCase(deleteTask.fulfilled, (state, action) => {
      state.isLoading = false
      state.isSuccess = true
      state.tasks = state.tasks.filter(task => task._id !==
        action.payload.id)
    })
    .addCase(deleteTask.rejected, (state, action) => {
      state.isLoading = false
      state.isError = true
      state.message = action.payload
    })
  )

```

```

File Edit Selection View Go Run Terminal Help taskSlice.js - Task-MERN - Visual Studio Code
JS Dashboard.js U JS TaskItem.js U JS taskSlice.js X JS taskService.js U
frontend > src > features > tasks > JS taskSlice.js > [W] taskSlice > extraReducers > addCase[deleteTask.rejected] callback
  90     state.isLoading = false
  91     state.isError = true
  92     state.message = action.payload
  93   })
  94   .addCase(deleteTask.pending, (state) => {
  95     state.isLoading = true
  96   })
  97   .addCase(deleteTask.fulfilled, (state, action) => {
  98     state.isLoading = false
  99     state.isSuccess = true
100     state.tasks = state.tasks.filter(task => task._id !== action.payload.id)
101   })
  102   .addCase(deleteTask.rejected, (state, action) => {
  103     state.isLoading = false
  104     state.isError = true
  105     state.message = action.payload
  106   })
107 }
108 }
109
110 export const { reset } = taskSlice.actions
111 export default taskSlice.reducer

```

Figure 10.26: extraReducers for delete in taskSlice.js file

Now, go back to <http://localhost:3000/alltasks>, and we will see the X button. We can see that there are four tasks here and also notice the task in the Redux devtools.

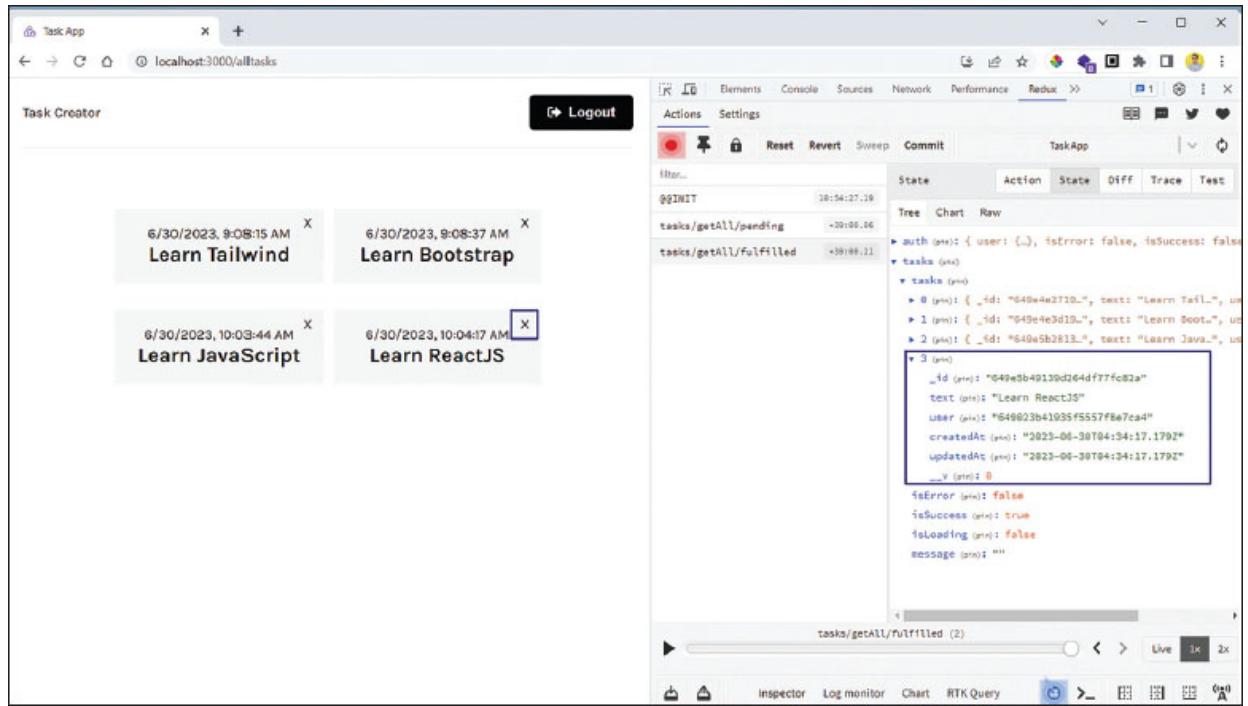


Figure 10.27: All tasks for a user in localhost

Once we click on the X button in `http://localhost:3000/alltasks`, we will first see the pending case for delete tasks.

In this state, since the API call has been going on, we will see the `isLoading` as true. The `isError` will be false, and the `isSuccess` will be true. Also, the message will be an empty string. The tasks array will still contain four elements.

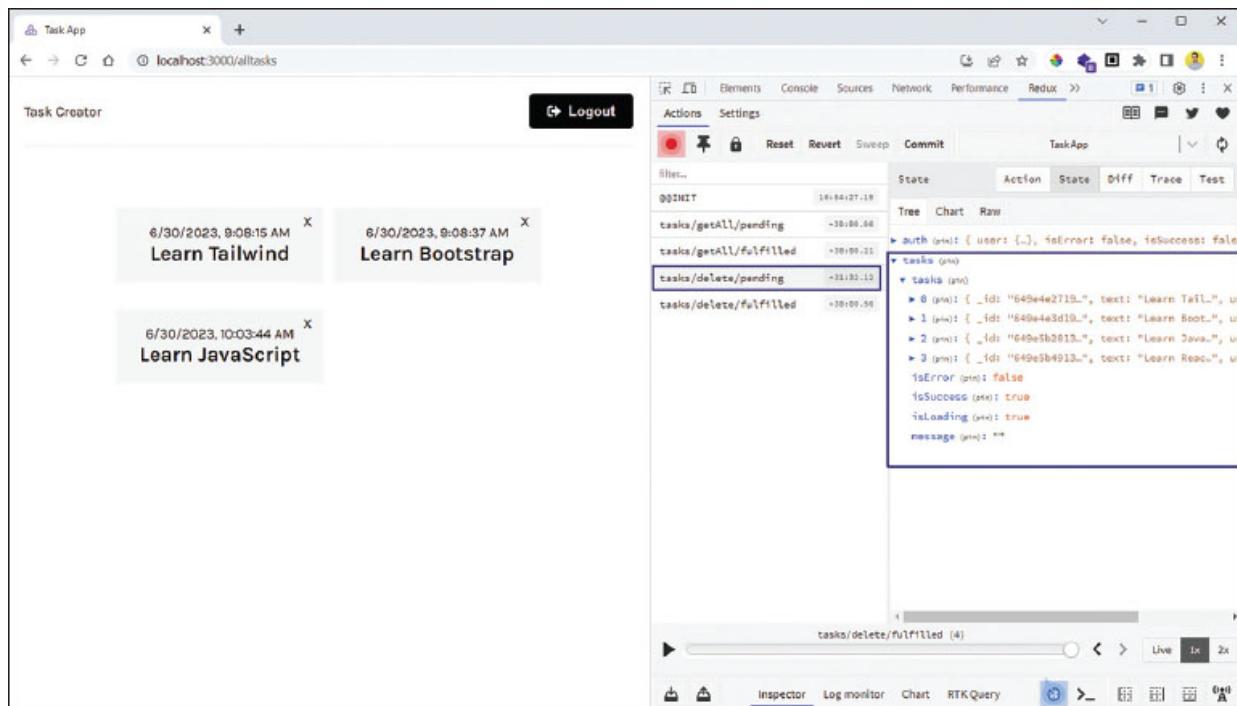


Figure 10.28: Pending state for delete in localhost

Once the API call is successful, we will see the fulfilled case for delete tasks. Also, the tasks state will now contain three elements.

In the browser also, we will see the `Learn ReactJS` element being deleted.

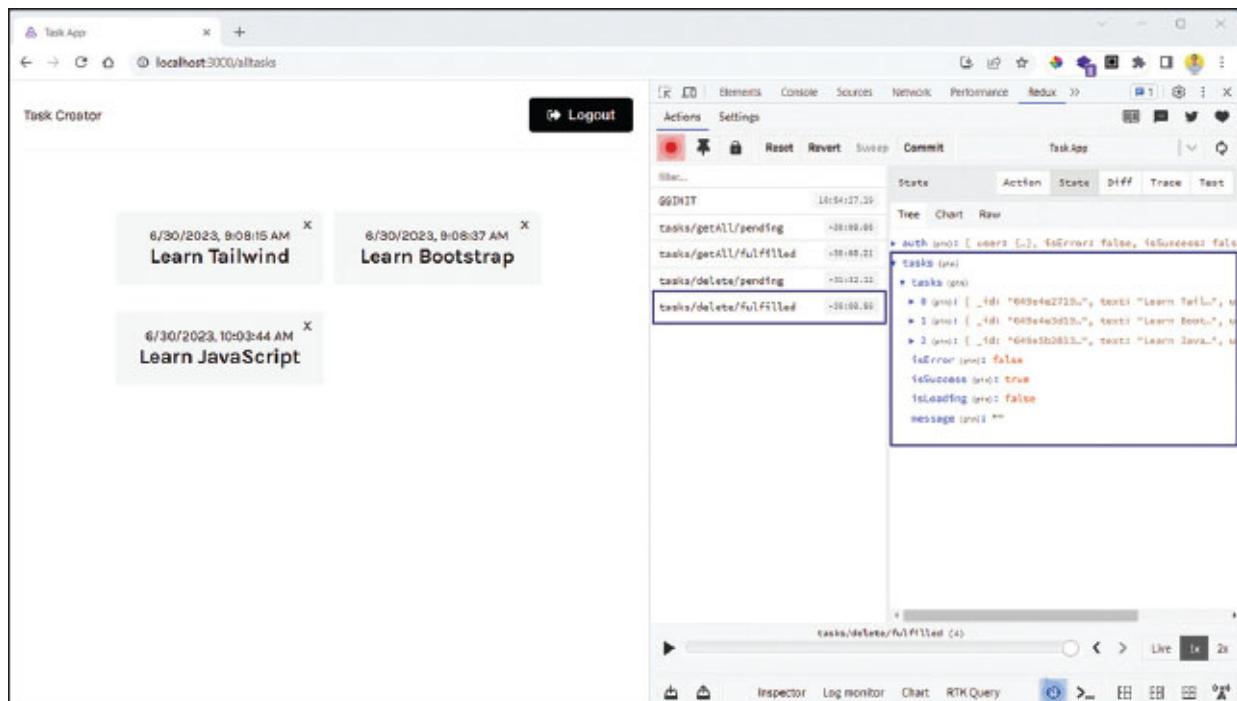


Figure 10.29: Fulfilled state for delete in localhost

Conclusion

In this chapter, we have learned about implementing Thunk in our Task workflow. Here, we have also fetched all tasks from the database. After that, we displayed all tasks in the front end.

Next, we have also learned to delete the task from the front end and database.

In the next chapter, we will test the front end made in React using Jest and React Testing Library.

Points to remember

- Implementing tasks with async Thunk
- Displaying all tasks on the front end
- Deleting a task from the front end and database

CHAPTER 11

Frontend Testing

Introduction

This chapter covers the testing of our frontend using Jest and React Testing Library. These two libraries are in-built in React and help us do unit testing in our frontend code.

It's generally the developer's responsibility to do unit testing of code. Unit testing helps catch errors early, and in a lot of companies, the unit testing code coverage should be 80%. Unit testing involves some type of coding, which is again a developer domain. The testers generally do end-to-end testing using manual or automated testing, which is different than the unit testing done by developers.

Structure

In this chapter, we are going to discuss the following topics:

- Setup testing in Frontend
- Task Slice and Service test with Jest
- Testing with React Testing Library
- Configuring and Checking Coverage

Setup testing in Frontend

We don't need to do much setup for testing, as the react app created using create-react-app comes in-built with the testing library of Jest and also React Testing Library(RTL). We can check the same in **package.json** on our frontend.

```
"@testing-library/jest-dom": "^5.16.5",
"@testing-library/react": "^13.4.0",
"@testing-library/user-event": "^14.4.3"
```

```
1  {
2    "name": "frontend",
3    "version": "0.1.0",
4    "proxy": "http://localhost:8000",
5    "private": true,
6    "dependencies": {
7      "@reduxjs/toolkit": "^1.9.5",
8      "@testing-library/jest-dom": "^5.16.5",
9      "@testing-library/react": "^13.4.0",
10     "@testing-library/user-event": "^14.4.3",
11     "axios": "^1.4.0",
12     "react": "^18.2.0",
13     "react-dom": "^18.2.0",
14     "react-icons": "^4.9.0",
15     "react-redux": "^8.1.0",
16     "react-router-dom": "^6.13.0",
17     "react-scripts": "5.0.1",
18     "react-toastify": "^9.1.3",
19     "web-vitals": "^2.1.4"
20   },
21   "scripts": {
22     "start": "react-scripts start",
23     "build": "react-scripts build",
24   }
25 },
```

Figure 11.1: Checking React testing libraries

Now, from the terminal go to the frontend folder and run the npm test. It will fail since we have made a lot of changes in the **App.js** file.

```
C:\WINDOWS\system32\cmd.exe + \n\nnaben@Nabendu MINGW64 ~/Desktop/Task-MERN\n$ cd frontend/\n\nnaben@Nabendu MINGW64 ~/Desktop/Task-MERN/frontend (master)\n$ npm test\n\n> frontend@0.1.0 test\n> react-scripts test\nFAIL src/App.test.js\n  • Test suite failed to run\n\n  Jest encountered an unexpected token\n\n
```

Figure 11.2: Running tests

Now, we will remove the **App.test.js** file as it will cause errors in our tests.

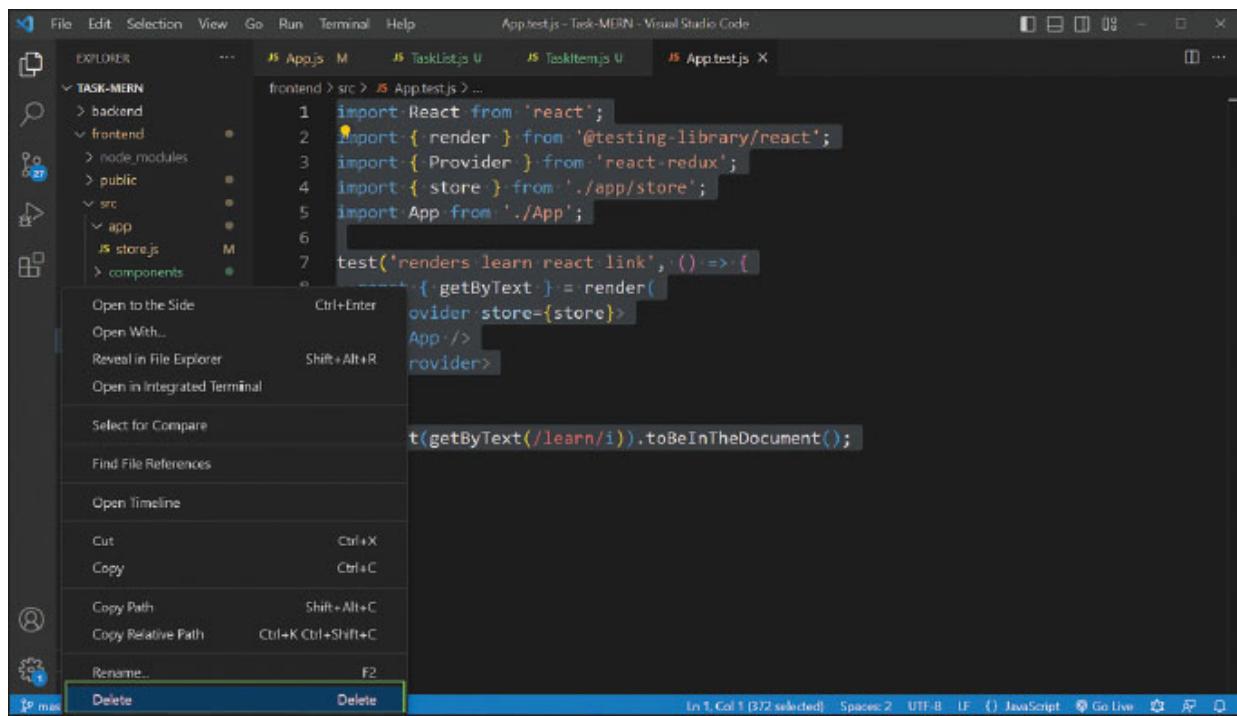


Figure 11.3: Deleting App.test.js file

We will write our first Jest test for the **Spinner.js** file. For this, we have also created a **Spinner.test.js** file. In Jest testing, we need to identify any element with something unique, but we don't have any in **Spinner.js** file. So, we have added the attribute of **data-testid** in both divs.

```
<div className='loadingSpinnerContainer' data-testid="spin-
container">
  <div className='loadingSpinner' data-testid="inner-
  container" />
</div>
```

```

const Spinner = () => {
  return (
    <div className='loadingSpinnerContainer' data-testid="spin-container">
      <div className='loadingSpinner' data-testid="inner-container" />
    </div>
  )
}

export default Spinner

```

Figure 11.4: Adding data-testid in Spinner.js file

Finally, we will write our first test in the **Spinner.test.js** file. Here, we will first import the render and screen from the testing library. We will also import the Spinner component.

In jest testing, we have a ‘describe’ block wrapping all of our tests. Here, the first parameter is a string and the second is an arrow function. Next, we have a single test. Here, also the first parameter is a string which is “render correctly” in our case. The second parameter is an arrow function in which we will write the test statements.

Here, we are first rendering the Spinner component with the render method. Next, we created a variable called **containerDiv**, and with **screen.getByTestId()** got the first div with the name **spin-container**. Here, we are testing it with the **expect()** function and **toBeInTheDocument()**.

We are repeating the same for the **inner-container**.

```

import { render, screen } from "@testing-library/react";
import Spinner from "./Spinner";

describe("Spinner", () => {
  test("render correctly", () => {

```

```

        render(<Spinner />);

    const containerDiv = screen.getByTestId("spin-container");
    expect(containerDiv).toBeInTheDocument();

    const innerDiv = screen.getByTestId("inner-container");
    expect(innerDiv).toBeInTheDocument();
  }
}

```

The screenshot shows the Visual Studio Code interface with the file 'Spinner.test.js' open. The code is a Jest test for the 'Spinner' component, checking if it renders correctly and if its container and inner divs are in the document. The code is identical to the one provided in the text block.

Figure 11.5: Writing test in Spinner.test.js file

Now, on running the tests with **npm test**, the test in **Spinner.test.js** will pass.

The screenshot shows a terminal window with three tabs: 'Windows PowerShell', 'C:\WINDOWS\system32\cmd.exe', and 'C:\WINDOWS\system32\cmd..'. The active tab shows the output of the 'npm test' command. The output indicates a 'PASS' result for the 'src/components/Spinner.test.js' file. It details a single test named 'Spinner' that passed ('✓ render correctly (31 ms)'). Summary statistics show 'Test Suites: 1 passed, 1 total' and 'Tests: 1 passed, 1 total'. It also shows 'Snapshots: 0 total' and 'Time: 1.975 s'. A message at the bottom says 'Ran all test suites related to changed files.' Below the terminal, there is a 'Watch Usage' section with several keyboard shortcuts: 'Press a to run all tests.', 'Press f to run only failed tests.', 'Press q to quit watch mode.', 'Press p to filter by a filename regex pattern.', 'Press t to filter by a test name regex pattern.', and 'Press Enter to trigger a test run.'

Figure 11.6: Running successful test from Spinner.test.js

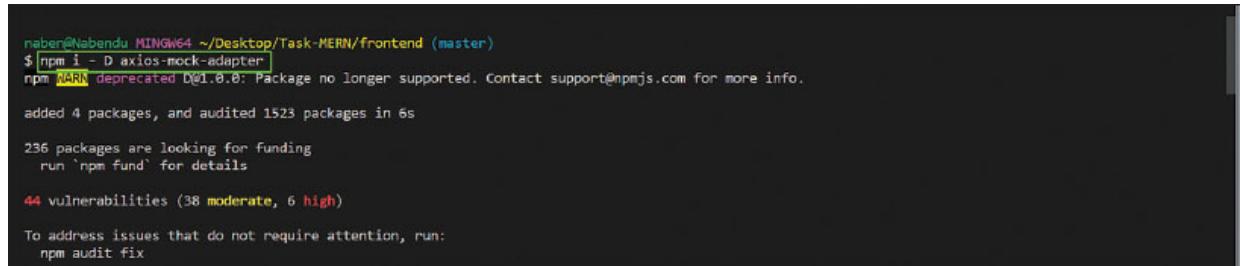
Task Slice and Service Test with Jest

We will now test the **taskSlice.js** and **taskService.js** files. The tests for these components are a bit complicated because we need to test them using mock

data.

For this, we will install the library of `axios-mock-adapter` with the following command. This library helps us to mock axios calls. Note that we are installing the same dev dependency as we don't need it in production.

```
npm i -D axios-mock-adapter
```



```
naben@Nabendu MINGW64 ~/Desktop/Task-MERN/frontend (master)
$ npm i -D axios-mock-adapter
npm WARN deprecated @1.0.0: Package no longer supported. Contact support@npmjs.com for more info.

added 4 packages, and audited 1523 packages in 6s

236 packages are looking for funding
  run `npm fund` for details

44 vulnerabilities (38 moderate, 6 high)

To address issues that do not require attention, run:
  npm audit fix
```

Figure 11.7: Installing `axios-mock-adapter` package

Next, we will install `redux-mock-store` in our frontend app. This library will mock the redux store in our app. We will install it with the following command:

```
npm i redux-mock-store
```



```
naben@Nabendu MINGW64 ~/Desktop/Task-MERN/frontend (master)
$ npm i redux-mock-store
added 2 packages, and audited 1525 packages in 3s

236 packages are looking for funding
  run `npm fund` for details

44 vulnerabilities (38 moderate, 6 high)

To address issues that do not require attention, run:
  npm audit fix

To address all issues (including breaking changes), run:
  npm audit fix --force
```

Figure 11.8: Installing `redux-mock-store` package

We also need to add a new `.babelrc` in the root directory of the frontend, and add the content for presets in it. Besides this, we need to install `babel-jest` and `@babel/preset-env` as dev dependency.

```
npm install --save-dev babel-jest @babel/preset-env
{
  "presets": [
    "@babel/preset-env"
  ]
}
```

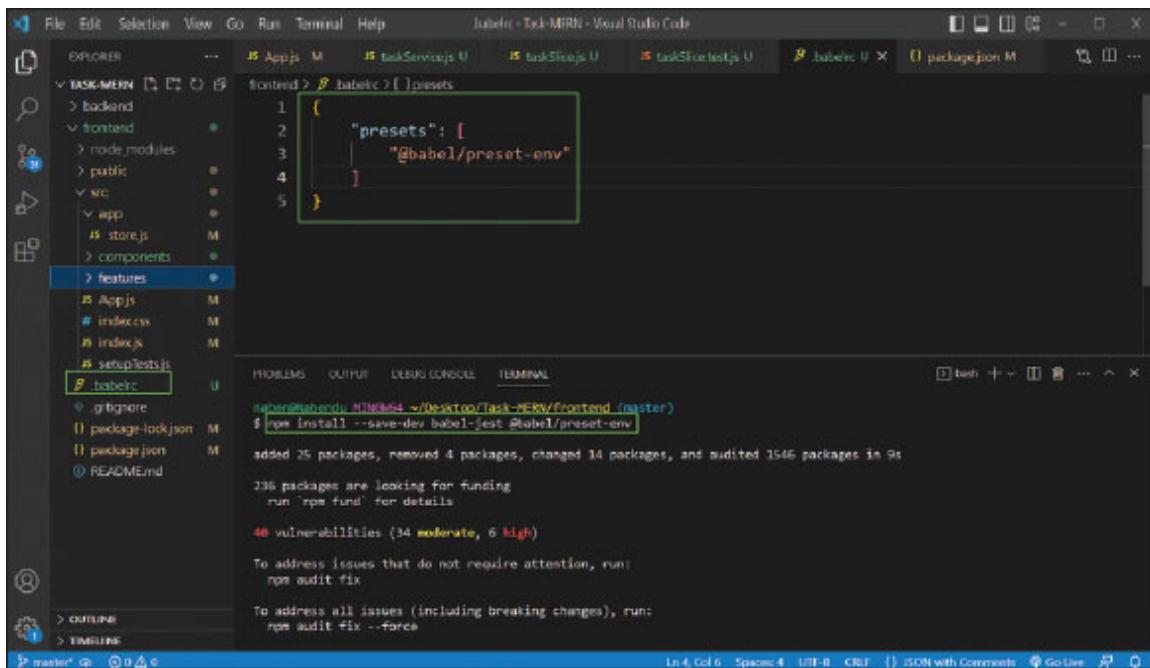


Figure 11.9: Changing babel configurations

We also need to do a setup in the **package.json** file. Here, we are using **babel-jest** to transform the js or jsx files. And we are also ignoring the **node_modules** and **axios**.

```

"jest": {
  "transform": {
    "^.+\\\\.jsx?$": "babel-jest"
  },
  "transformIgnorePatterns": [
    "node_modules/(?!axios)/"
  ]
}

```

The screenshot shows the Visual Studio Code interface with the package.json file open. A specific section of the code, which defines a Babel transform for JSX files, is highlighted with a green rectangular selection. The code snippet is as follows:

```
    "jest": {
      "transform": {
        "^.+\\.(js|jsx)$": "babel-jest"
      },
      "transformIgnorePatterns": [
        "node_modules/(?!axios)/"
      ]
    }
```

Figure 11.10: Adding babel config in package.json file

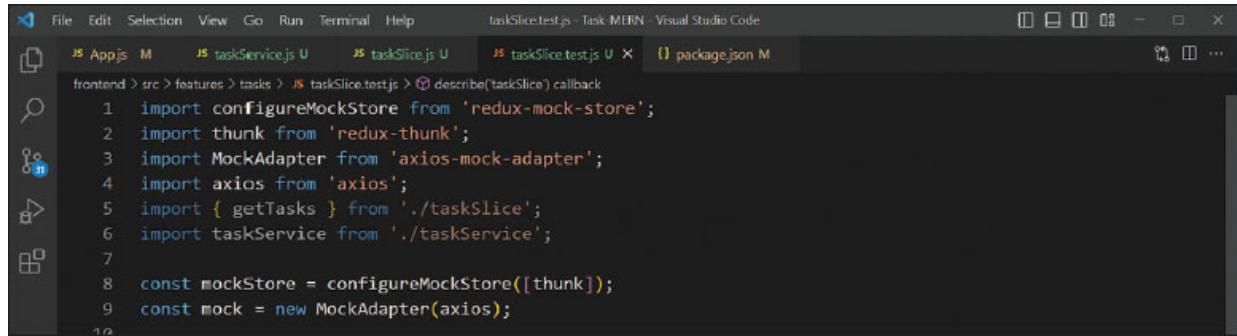
Now, we will create a **taskSlice.test.js** file inside the **tasks** folder. Here, we will first import **configureMockStore** from redux-mock-store, which will help us to mock redux. Next, we will import thunk middleware from **redux-thunk**.

We will import the **MockAdapter** from **axios-mock-adapter** which will help us mock **axios**. Next, we will also import axios which is used to do API calls in React. We will also import **getTasks** and **taskService**.

Lastly, we will create a variable of **mockStore** and use the **configureMockStore** and pass thunk in it. And we will also create a variable of **mock** and use the **MockAdapter** and pass axios in it.

```
import configureMockStore from 'redux-mock-store';
import thunk from 'redux-thunk';
import MockAdapter from 'axios-mock-adapter';
import axios from 'axios';
import { getTasks } from './taskSlice';
import taskService from './taskService';

const mockStore = configureMockStore([thunk]);
const mock = new MockAdapter(axios);
```



```
File Edit Selection View Go Run Terminal Help taskSlice.test.js - Task MERN - Visual Studio Code
JS App.js M JS taskService.js U JS taskSlice.js U JS taskSlice.test.js U X package.json M
frontend > src > features > tasks > JS taskSlice.test.js > describe(taskSlice) callback
1 import configureMockStore from 'redux-mock-store';
2 import thunk from 'redux-thunk';
3 import MockAdapter from 'axios-mock-adapter';
4 import axios from 'axios';
5 import { getTasks } from './taskSlice';
6 import taskService from './taskService';
7
8 const mockStore = configureMockStore([thunk]);
9 const mock = new MockAdapter(axios);
10
```

Figure 11.11: Writing imports in taskSlice.test.js file

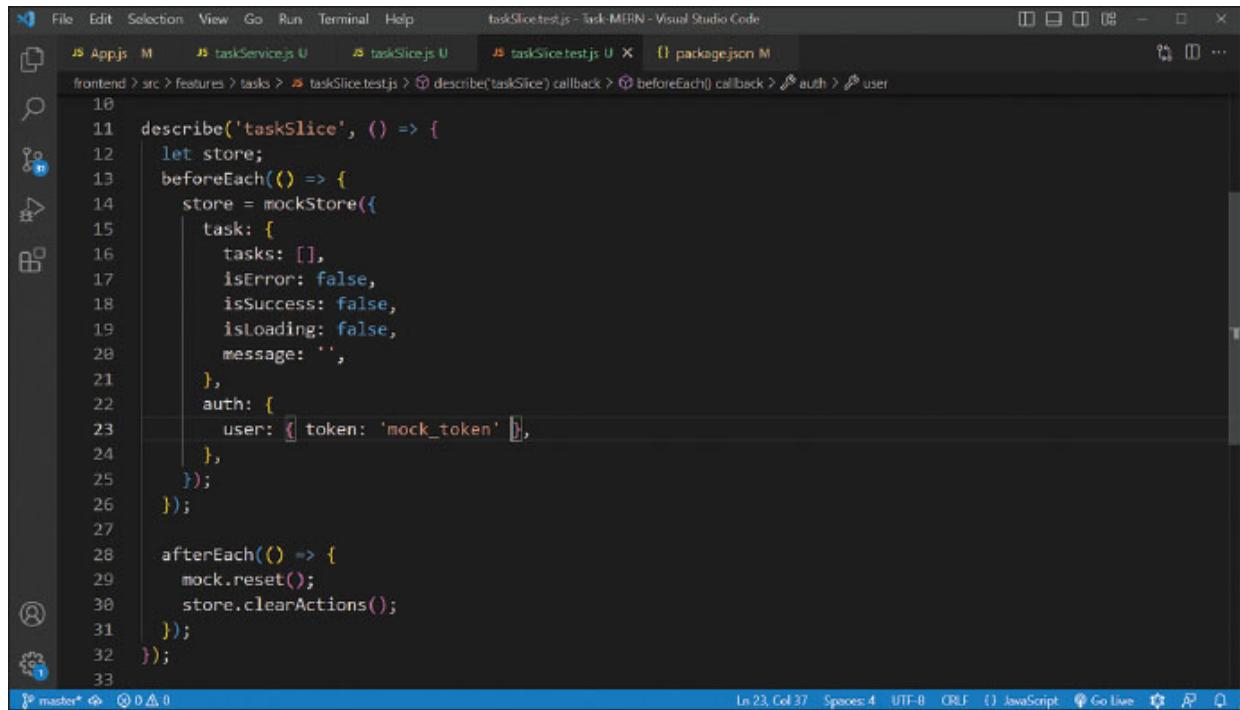
Next, in the **taskSlice.test.js** file, inside a `describe` block, we will first create a variable store. We will have `beforeEach()` and `afterEach()` functions. These functions run before and after every test.

In the `beforeEach`, we are using `mockStore` to mock our initial task state as per the `taskSlice.js` file. Also, we need to use a mock user token, as it is used in the `taskSlice.js` file.

In the `afterEach`, we are resetting the mock and the store.

```
describe('taskSlice', () => {
  let store;
  beforeEach(() => {
    store = mockStore({
      task: {
        tasks: [],
        isError: false,
        isSuccess: false,
        isLoading: false,
        message: '',
      },
      auth: {
        user: { token: 'mock_token' },
      },
    });
  });
  afterEach(() => {
    mock.reset();
    store.clearActions();
  });
}
```

```
});
```



```
File Edit Selection View Go Run Terminal Help taskSlice.test.js - Task-MERN - Visual Studio Code
JS App.js M JS taskService.js U JS taskSlice.js U JS taskSlice.test.js U X package.json M
frontend > src > features > tasks > taskSlice.test.js > describe(taskSlice) callback > beforeEach() callback > auth > user
10
11  describe('taskSlice', () => {
12    let store;
13    beforeEach(() => {
14      store = mockStore({
15        task: {
16          tasks: [],
17          isError: false,
18          isSuccess: false,
19          isLoading: false,
20          message: '',
21        },
22        auth: {
23          user: { token: 'mock_token' },
24        },
25      });
26    });
27
28    afterEach(() => {
29      mock.reset();
30      store.clearActions();
31    });
32  });
33
```

Figure 11.12: Writing describe in taskSlice.test.js file

Now, we will write our test in the **taskSlice.test.js** file. Here, we have a test function, where we first use the **mock_token**. Next, we have taken a dummy task which is an array of objects. Here, we have given some dummy fields.

Next, we created a constant variable called **getTaskSpy**. Here, using the **jest.spyOn()** which takes the first parameter as **taskService** and the second as **getTasks**. This should be resolved to the tasks.

Next, we are dispatching the **getTasks()** from **taskSlice.js** file. Finally, we are expecting the **getTaskssSpy** to be called using the token.

```
test(<calls the taskService to fetch tasks>, async () => {
  const token = 'mock_token';
  const tasks = [
    {
      _id: '649e4e271947362dc297436a',
      text: 'Learn Tailwind',
      user: '649023b41935f5557f8e7ca4',
      createdAt: '2023-06-30T03:38:15.287Z',
      updatedAt: '2023-06-30T03:38:15.287Z',
```

```

    __v: 0
}

];

const getTasksSpy = jest.spyOn(taskService,
  'getTasks').mockResolvedValue(tasks);
await store.dispatch(getTasks());
expect(getTasksSpy).toHaveBeenCalledWith(token);
});

```

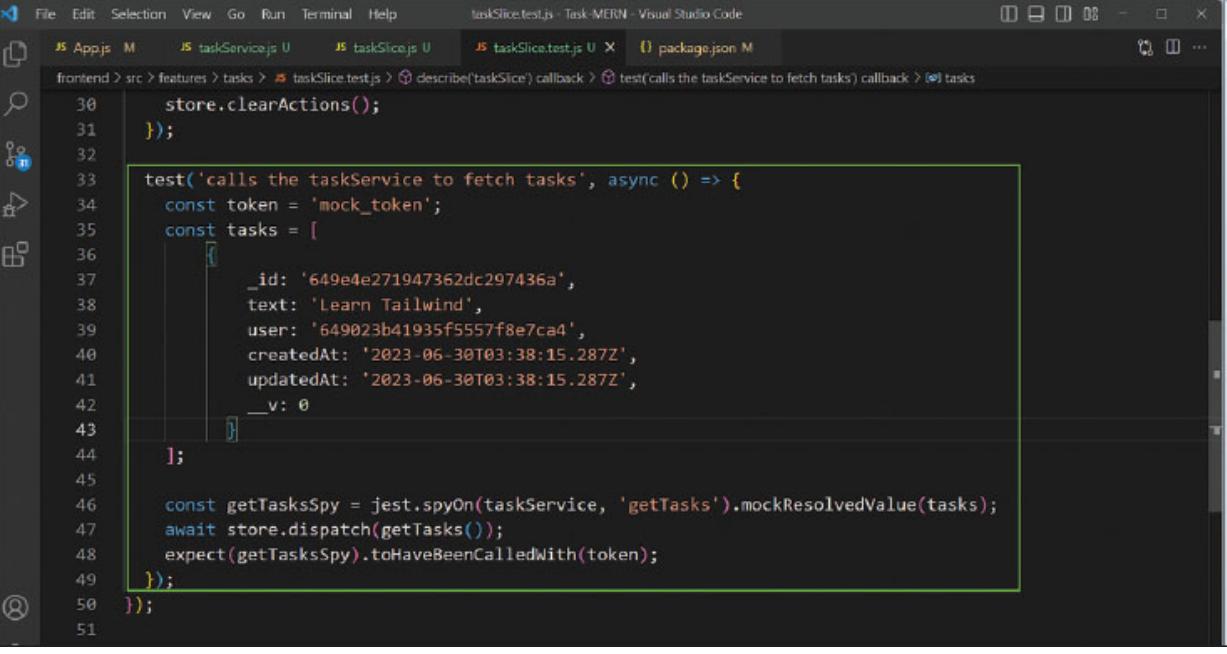


Figure 11.13: Writing tests in taskSlice.test.js file

Now, on running the test with npm test our **taskSlice.test.js** file will pass.

```

naben@Nabendu MINGW64 ~/Desktop/Task-MERN/frontend/src/features/tasks (master)
$ npm test

> frontend@0.1.0 test
> react-scripts test
PASS  src/features/tasks/taskSlice.test.js
PASS  src/components/Spinner.test.js

Test Suites: 2 passed, 2 total
Tests:       2 passed, 2 total
Snapshots:  0 total
Time:        2.569 s
Ran all test suites related to changed files.

Watch Usage
> Press a to run all tests.
> Press f to run only failed tests.
> Press q to quit watch mode.
> Press p to filter by a filename regex pattern.
> Press t to filter by a test name regex pattern.
> Press Enter to trigger a test run.
|

```

Figure 11.14: Running tests for taskSlice.test.js file

Now, we will write the test for the task service component. So, create a **taskService.test.js** file inside the **tasks** folder. Here, we are first importing axios for API calls. Then we are importing MockAdapter for mocking axios. Lastly, we are importing the **taskService** component. We also created a mock variable using **MockAdapter** and passed the axios.

```
import axios from 'axios';
import MockAdapter from 'axios-mock-adapter';
import taskService from './taskService';

const mock = new MockAdapter(axios);
```

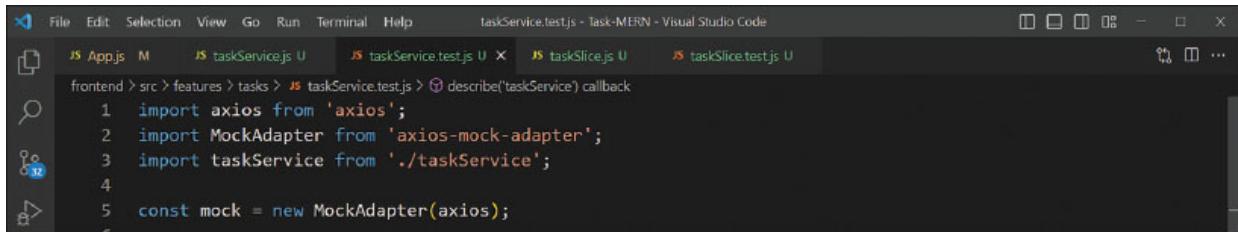


Figure 11.15: Writing imports for taskService.test.js file

Now, we will create a describe block in the **taskService.test.js** file. Here, we have first the **afterEach()** which will reset the mock after every test. Next, inside the test, we first have a token constant of token. Then we have a tasks array with an object containing a task.

Now, we are using the **mock.onGet()** to hit the API endpoint of /api/tasks using the token. Here, we expect the reply to have 200 and the tasks array. Next, we are calling the **taskService** file **getTasks** function using the token. The response is expected to be the tasks array.

```
describe('taskService', () => {
  afterEach(() => {
    mock.reset();
  });

  test('fetches tasks successfully', async () => {
    const token = 'mock_token';
    const tasks = [
      {
        _id: '649e4e271947362dc297436a',
        text: 'Learn Tailwind',
      }
    ];
    mock.onGet('/api/tasks', { token }, { status: 200, body: tasks });
    const response = await taskService.getTasks(token);
    expect(response).toEqual(tasks);
  });
});
```

```

        user: '649023b41935f5557f8e7ca4',
        createdAt: '2023-06-30T03:38:15.287Z',
        updatedAt: '2023-06-30T03:38:15.287Z',
        __v: 0
    }
];

mock.onGet('/api/tasks/', { headers: { Authorization:
`Bearer ${token}` } }).reply(200, tasks);
const response = await taskService.getTasks(token);
expect(response).toEqual(tasks);
});
}
);

```

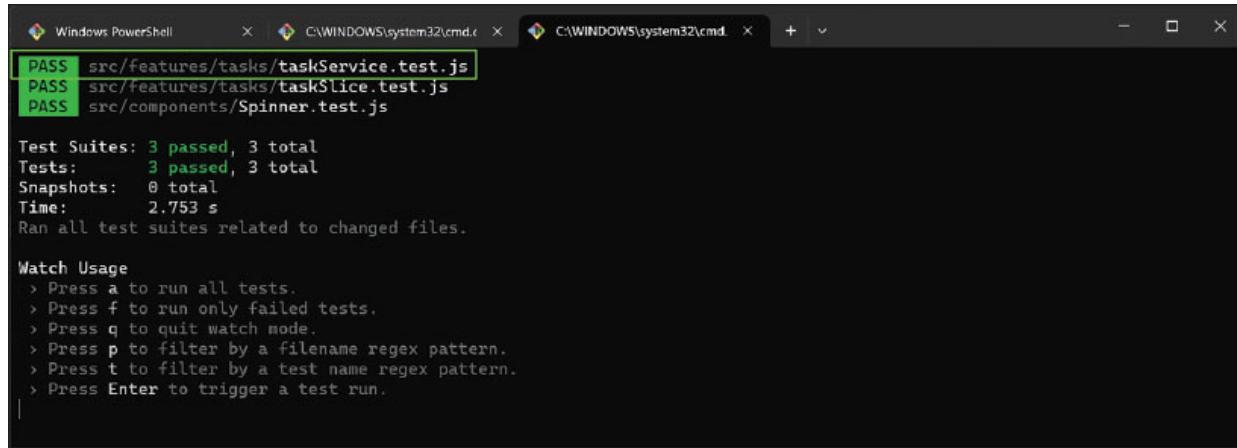
```

File Edit Selection View Go Run Terminal Help taskService.test.js - Task MERN - Visual Studio Code
taskService.test.js U taskService.test.js X taskService.js U taskSlice.test.js U
frontend > src > features > tasks > taskService.test.js > describe('taskService') callback
7  describe('taskService', () => [
8    afterEach(() => {
9      mock.reset();
10   });
11
12   test('fetches tasks successfully', async () => {
13     const token = 'mock_token';
14     const tasks = [
15       {
16         _id: '649e4e271947362dc297436a',
17         text: 'Learn Tailwind',
18         user: '649023b41935f5557f8e7ca4',
19         createdAt: '2023-06-30T03:38:15.287Z',
20         updatedAt: '2023-06-30T03:38:15.287Z',
21         __v: 0
22       }
23     ];
24
25     mock.onGet('/api/tasks/', { headers: { Authorization: `Bearer ${token}` } }).reply(200, tasks);
26     const response = await taskService.getTasks(token);
27     expect(response).toEqual(tasks);
28   });
29 });

```

Figure 11.16: Writing test for taskService.test.js file

- On running the `npm` test again, the test in `taskService.test.js` file passes.



The screenshot shows a Windows PowerShell window with three tabs open. The active tab displays the output of a Jest test run. It shows 3 passed tests across three suites: taskService.test.js, taskSlice.test.js, and Spinner.test.js. The total time taken is 2.753 seconds. A 'Watch Usage' section provides key bindings for running tests.

```
PASS  src/features/tasks/taskService.test.js
PASS  src/features/tasks/taskSlice.test.js
PASS  src/components/Spinner.test.js

Test Suites: 3 passed, 3 total
Tests:       3 passed, 3 total
Snapshots:   0 total
Time:        2.753 s
Ran all test suites related to changed files.

Watch Usage
> Press a to run all tests.
> Press f to run only failed tests.
> Press q to quit watch mode.
> Press p to filter by a filename regex pattern.
> Press t to filter by a test name regex pattern.
> Press Enter to trigger a test run.
```

Figure 11.17: Running test for taskService.test.js file

Testing with React Testing Library

In this section, we will test the Task Item and Store components. So, first, create a file **TaskItem.test.js** in the **components** folder and add the following code in it. Here, we will first import the render and Provider. Next, we are importing the `configureMockStore` from `redux-mock-store`, which will help us to mock redux.

We are also importing the component of **TaskItem** for testing. Now, inside a describe block, we have first created a task, with dummy data.

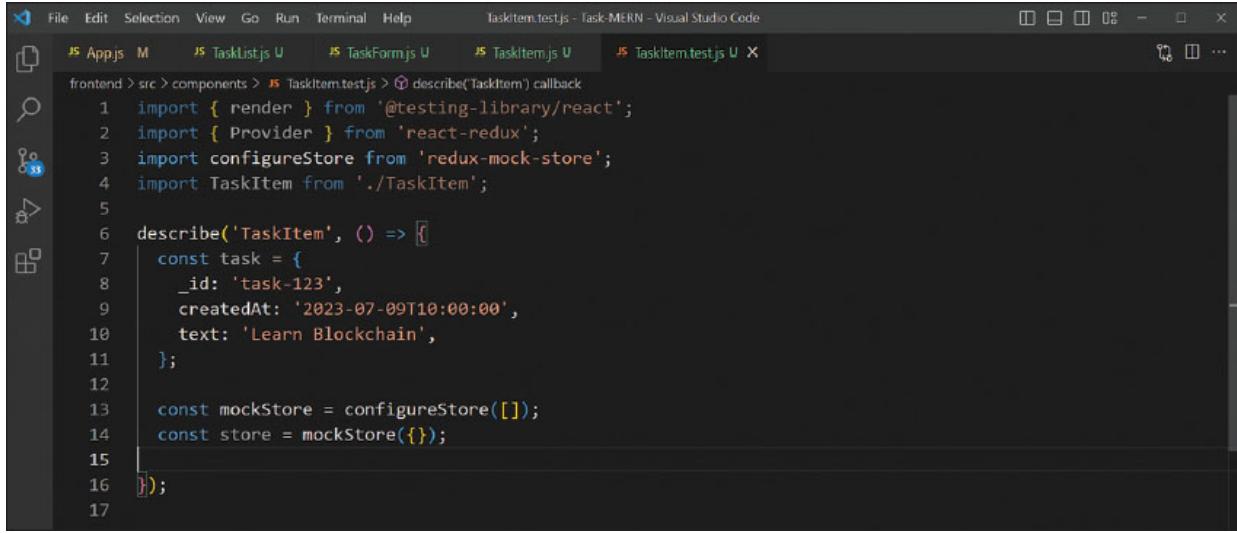
Lastly, we will create a variable of `mockStore` and use the `configureMockStore` and pass an empty array in it. And we will also create a variable of the store and call the `mockStore`.

```
import { render } from '@testing-library/react';
import { Provider } from 'react-redux';
import configureStore from 'redux-mock-store';
import TaskItem from './TaskItem';

describe('TaskItem', () => {
  const task = {
    _id: 'task-123',
    createdAt: '2023-07-09T10:00:00',
    text: 'Learn Blockchain',
  };

  const mockStore = configureStore([]);
  const store = mockStore({});
```

```
});
```



```
File Edit Selection View Go Run Terminal Help TaskItem.test.js - Task-MERN - Visual Studio Code
App.js M TaskList.js U TaskForm.js U TaskItem.js U TaskItemtest.js X
frontend > src > components > TaskItem.test.js > describe('TaskItem') callback
1 import { render } from '@testing-library/react';
2 import { Provider } from 'react-redux';
3 import configureStore from 'redux-mock-store';
4 import TaskItem from './TaskItem';
5
6 describe('TaskItem', () => [
7   const task = {
8     _id: 'task-123',
9     createdAt: '2023-07-09T10:00:00',
10    text: 'Learn Blockchain',
11  };
12
13  const mockStore = configureStore([]);
14  const store = mockStore({});
15]
16);
17
```

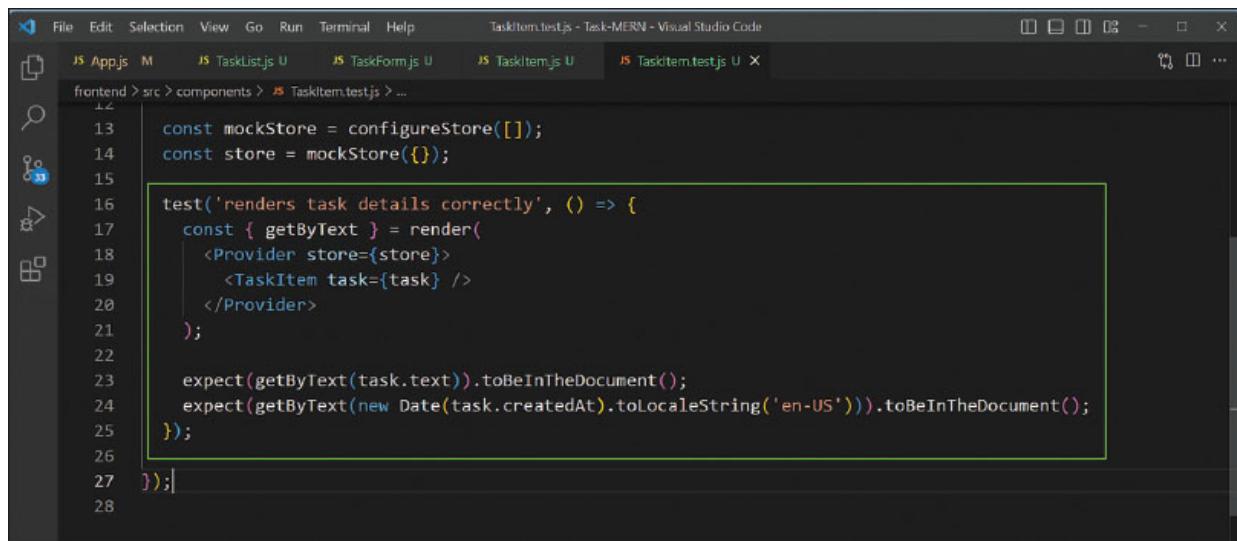
Figure 11.18: Writing imports & describe for TaskItem.test.js file

Next, we will add tests in the **TaskItem.test.js** file, inside the `describe` block. Here, we are rendering the `TaskItem` component, in which we are passing our dummy task. We are also wrapping it with the redux Provider. The redux provider is taking our mock store.

We are extracting the `getByText` from the `render` function, through which we are doing our tests. Now, we have two expected tests in which we are checking if the text and `createdAt` is in the document.

```
test(<renders task details correctly>, () => {
  const { getByText } = render(
    <Provider store={store}>
      <TaskItem task={task} />
    </Provider>
  );

  expect(getByText(task.text)).toBeInTheDocument();
  expect(getByText(new
    Date(task.createdAt).toLocaleString('en-
    US'))).toBeInTheDocument();
});
```



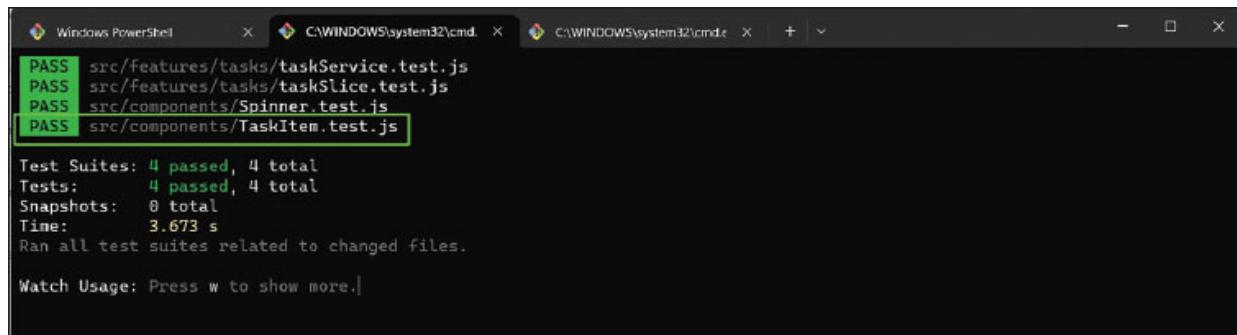
```
const mockStore = configureStore([]);
const store = mockStore({});

test('renders task details correctly', () => {
  const { getByText } = render(
    <Provider store={store}>
      <TaskItem task={task} />
    </Provider>
  );

  expect(getByText(task.text)).toBeInTheDocument();
  expect(getByText(new Date(task.createdAt).toLocaleString('en-US'))).toBeInTheDocument();
});
```

Figure 11.19: Writing test for TaskItem.test.js file

On running the `npm` test again, the test in **TaskItem.test.js** file passes.



```
PASS  src/features/tasks/taskService.test.js
PASS  src/features/tasks/taskSlice.test.js
PASS  src/components/Spinner.test.js
PASS  src/components/TaskItem.test.js

Test Suites: 4 passed, 4 total
Tests:       4 passed, 4 total
Snapshots:  0 total
Time:        3.673 s
Ran all test suites related to changed files.

Watch Usage: Press w to show more.
```

Figure 11.20: Running test for TaskItem.test.js file

Now, we will write the tests for our **store.js** file. So, create a **store.test.js** file and add the following content in it. Here, we are first importing the `configureStore` from redux toolkit. Next, we are also importing the `authReducer` and `taskReducer` from the respective slice files.

Now, inside a describe block we are writing out a test to create the store with correct reducers. Here, again we have a `store` variable created with `configureStore`. Inside it we are passing the reducer with auth and tasks. Notice that it is similar to what we are doing in the **store.js** file.

Next, we get the state of the reducers with the `getState()` and storing it in a `storeReducers` variable. Finally, we are checking whether this `storeReducers` have the properties of auth and tasks.

```
import { configureStore } from '@reduxjs/toolkit';
```

```

import authReducer from '../features/auth/authSlice';
import taskReducer from '../features/tasks/taskSlice';

describe('store', () => {
  test(`creates the store with the correct reducers`, () => {
    const store = configureStore({
      reducer: {
        auth: authReducer,
        tasks: taskReducer
      }
    });

    const storeReducers = store.getState();
    expect(storeReducers).toHaveProperty('auth');
    expect(storeReducers).toHaveProperty('tasks');
  });
});

```

The screenshot shows a Visual Studio Code interface with the following details:

- File Explorer (Left):** Shows the project structure under "TASK-MERN". The "components" folder is currently selected.
- Editor (Right):** Displays the content of the file "store.test.js". The code is a Jest test for the store, checking if it has the correct reducers ("auth" and "tasks").
- Status Bar (Bottom):** Shows "Line 20 Col 1 Spaces: 4 UTF-8 CR LF JavaScript Go Live".

Figure 11.21: Writing test for `store.test.js` file

On running the npm test again, the test in **store.test.js** file passes.

```

Windows PowerShell      C:\WINDOWS\system32\cmd.exe      C:\WINDOWS\system32\cmd.exe
PASS  src/features/tasks/taskService.test.js
PASS  src/features/tasks/taskSlice.test.js
PASS  src/app/store.test.js
PASS  src/components/Spinner.test.js
PASS  src/components/TaskItem.test.js

Test Suites: 5 passed, 5 total
Tests:       5 passed, 5 total
Snapshots:   0 total
Time:        3.594 s
Ran all test suites related to changed files.

Watch Usage
> Press a to run all tests.
> Press f to run only failed tests.
> Press q to quit watch mode.
> Press p to filter by a filename regex pattern.
> Press t to filter by a test name regex pattern.
> Press Enter to trigger a test run.

```

Figure 11.22: Running test for `store.test.js` file

Now, we will write the tests for our `index.js` file. So, create an `index.test.js` file and add the following content in it. Here, we are first importing the required things, which include `render`, `Provider`, `store`, and the `App` component.

Next, we have written a simple test in which we are extracting a container variable from the `render` function. Inside the render, we are passing the `App` component, wrapped with the `Provider` component, where we are passing the store. This is similar to what we are doing in the `index.js` file.

Now, we have a variable called `rootComponent` in which we are storing the `firstChild`. This is actually the `App` component. Next, we are testing and expecting this `rootComponent` to be in the document.

Also, when we run this test with the `npm run test`, it will pass.

```

import React from 'react';
import { render } from '@testing-library/react';
import { Provider } from 'react-redux';
import { store } from './app/store';
import App from './App';

test('renders the root component correctly', () => {
  const { container } = render(
    <Provider store={store}>
      <App />
    </Provider>
  );
}

```

```

    const rootComponent = container.firstChild;
    expect(rootComponent).toBeInTheDocument();
} );

```

```

File Edit Selection View Go Run Terminal Help indextest.js - Task MERN - Visual Studio Code
EXPLORER ... ist.js U JS TaskForm.js U JS TaskItem.js U JS store.js M JS store.test.js U JS index.js M JS index.test.js U X
TASK-MERN
> backend
> frontend
  > node_modules
  > public
  > src
    > app
    > components
    > features
      JS App.js M
      # index.css M
      JS index.js M
      JS index.test.js U
      JS setupTests.js
      .babelrc U
      .gitignore
      package-lock.json M
      package.json M
      README.md

```

```

frontend > src > JS index.test.js > test('renders the root component correctly') callback
1 import React from 'react';
2 import { render } from '@testing-library/react';
3 import { Provider } from 'react-redux';
4 import { store } from './app/store';
5 import App from './App';

6
7 test('renders the root component correctly', () => {
8   const { container } = render(
9     <Provider store={store}>
10    <App />
11  </Provider>
12);
13
14 const rootComponent = container.firstChild;
15
16 expect(rootComponent).toBeInTheDocument();
17 });
18

```

Figure 11.23: Writing test for index.test.js file

Configuring and Checking Coverage

In this section, we will learn to configure our frontend app to include coverage. After that, we will check the coverage for our app. In a lot of production scenarios, it is expected to provide 80% coverage.

First, in the **package.json** file, we will add the following line in scripts. Here, the test will be known as coverage and it will run the npm test with options of coverage and **watchAll**.

```
"coverage": "npm test -- --coverage --watchAll"
```

The screenshot shows the Visual Studio Code interface with a dark theme. The left sidebar has icons for file, folder, search, and other project-related functions. The main editor area displays the `package.json` file. A specific line of code, `"coverage": "npm test -- --coverage --watchAll"`, is highlighted with a yellow box. The status bar at the bottom shows the file path as `fronted/package.json`, the line number as `In 39 Col 36`, and the character position as `Space: 2 LF: 1`. The status bar also includes icons for JSON, GitHub, and other settings.

```
17   "react-dom": "^18.2.0",
18   "react-icons": "^4.9.0",
19   "react-redux": "^8.1.0",
20   "react-router-dom": "^6.14.1",
21   "react-scripts": "5.0.1",
22   "react-toastify": "^9.1.3",
23   "redux-mock-store": "^1.5.4",
24   "web-vitals": "^2.1.4"
25 },
26 // Debug
27 "scripts": {
28   "start": "react-scripts start",
29   "build": "react-scripts build",
30   "test": "react-scripts test",
31   "eject": "react-scripts eject",
32   "coverage": "npm test -- --coverage --watchAll"
33 },
34 "eslintConfig": {
35   "extends": [
36     "react-app",
37     "react-app/jest"
38   ],
39   "overrides": [
40     {
41       "files": [
42         "src/**/*.js"
43       ],
44       "testPathPattern": "src/test/unit"
45     }
46   ]
47 }
```

Figure 11.24: Adding coverage command in package.json file

After that, open a terminal and run the command `npm run coverage`. It will first test all the test files. We will notice that all of them passed.

The screenshot shows a terminal window with three tabs: "Windows PowerShell", "C:\WINDOWS\system32\cmd", and "C:\WINDOWS\system32\cmd". The current tab is the Windows PowerShell one. The command `npm run coverage` is entered and executed. The output shows the test results for various files in the `src` directory, with all tests passing (indicated by green bars).

```
naben@Nabendu MINGW64 ~/Desktop/Task-MERN/frontend (master)
$ npm run coverage

> frontend@0.1.0 coverage
> npm test -- --coverage --watchAll

> frontend@0.1.0 test
> react-scripts test --coverage --watchAll
PASS  src/components/Spinner.test.js
PASS  src/features/tasks/taskSlice.test.js
PASS  src/components/TaskItem.test.js
PASS  src/features/tasks/taskService.test.js
PASS  src/app/store.test.js
PASS  src/index.test.js
```

Figure 11.25: Running coverage command

Once the tests are done, we will get coverage for all files. The coverage checks how many lines of code are covered in all files. We see a lot of red because in this app, we didn't do extensive testing and covered all the files.

| File | % Stmt | % Branch | % Funcs | % Lines | Uncovered Line #s |
|--------------------|--------|----------|---------|---------|-----------------------------|
| All files | 37.79 | 14.75 | 26.56 | 39.06 | |
| src | 25 | 100 | 100 | 25 | |
| App.js | 100 | 100 | 100 | 100 | |
| index.js | 0 | 100 | 100 | 0 | 8-11 |
| src/app | 100 | 100 | 100 | 100 | |
| store.js | 100 | 100 | 100 | 100 | |
| src/components | 45.16 | 26.66 | 36.66 | 48.1 | |
| Dashboard.js | 88.88 | 50 | 75 | 85.71 | 19 |
| Header.js | 70 | 50 | 66.66 | 66.66 | 12-14 |
| Login.js | 66.66 | 62.5 | 50 | 76.47 | 24,31-33 |
| Register.js | 4.34 | 0 | 0 | 5.26 | 10-41 |
| Spinner.js | 100 | 100 | 100 | 100 | |
| TaskForm.js | 54.54 | 100 | 33.33 | 54.54 | 12-15,23 |
| TaskItem.js | 75 | 100 | 50 | 75 | 11 |
| TaskList.js | 7.69 | 0 | 0 | 10 | 9-24 |
| src/features/auth | 32.69 | 6.25 | 13.33 | 34 | |
| authService.js | 35.71 | 0 | 0 | 38.46 | 5-9,13-17 |
| authSlice.js | 31.57 | 8.33 | 16.66 | 32.43 | 17-23,29-36,56-84 |
| src/features/tasks | 38.5 | 0 | 16.66 | 31.03 | |
| taskService.js | 57.14 | 100 | 33.33 | 57.14 | 6-12,26-32 |
| taskSlice.js | 22.22 | 0 | 13.33 | 22.72 | 15-23,36-39,47-55,64,69-105 |

```

Test Suites: 6 passed, 6 total
Tests:       6 passed, 6 total
Snapshots:   0 total
Time:        7.169 s
Ran all test suites.

```

Figure 11.26: Checking coverage of files

We can also see the coverage in a nice html file. A **coverage** folder will be created in our frontend app. So, open it and then the **lcov-report** folder inside it. Here, we will find an **index.html** file, which contains all of our reports of coverage.

The screenshot shows the Visual Studio Code interface with the following details:

- File Explorer:** Shows the project structure under "TASK-MERN". The "index.html" file is selected and highlighted.
- Editor:** Displays the content of the "index.html" file, which is an HTML template for a code coverage report.
- Bottom Status Bar:** Shows "In 1, Col 1" and other status indicators.

```

1 <!doctype html>
2 <html lang="en">
3   <head>
4     <title>Code coverage report for All files</title>
5     <meta charset="utf-8" />
6     <link rel="stylesheet" href="prettyify.css" />
7     <link rel="stylesheet" href="base.css" />
8     <link rel="shortcut icon" type="image/x-icon" href="favicon.png" />
9     <meta name="viewport" content="width=device-width, initial-scale=1" />
10    <style type="text/css">
11      .coverage-summary .sorter {
12        background-image: url(sort-arrow-sprite.png);
13      }
14    </style>
15  </head>
16  <body>
17    <div class="wrapper">
18      <div class="pad1">
19        <h1>All files</h1>
20        <div class="clearfix">
21
22
23
24

```

Figure 11.27: HTML file for coverage

Now, on opening the **index.html** file in the browser we will see the coverage of the major files in a nice graphical format.

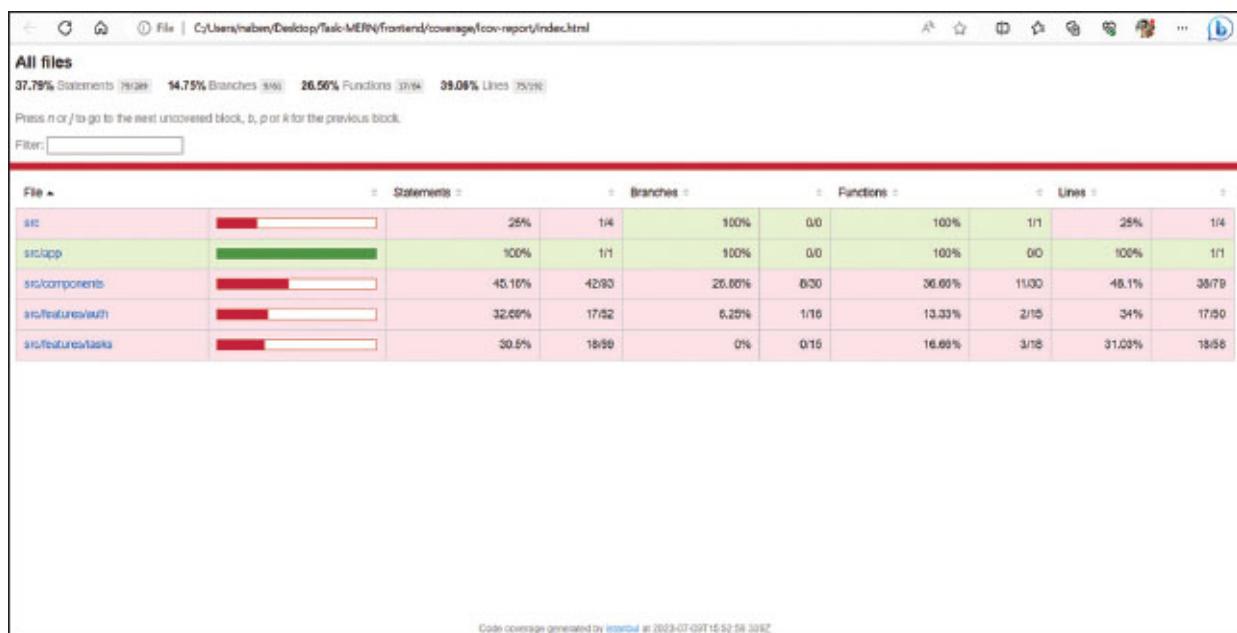


Figure 11.28: Coverage in a browser

Conclusion

In this chapter, we have learned to test our frontend code written in React. We have used the in-built libraries of Jest and React testing library to unit test our various components.

In the next chapter, we will test the backend built in NodeJS using Jest and Supertest.

Points to remember

- To write tests we need to target an element. Sometimes we don't have a unique field, and we can use data-testid for the same.
- We don't want to call the real API endpoint in testing. So, we add mocking capabilities in testing.
- We can also mock data, services, and functions, and through it, write complex tests to cover all scenarios.
- Once we are done with testing, we need to check the coverage for all test cases.

CHAPTER 12

Backend Testing

Introduction

This chapter covers the testing of our backend using Jest. This library is not in built into NodeJS, but we have to install it manually, as with most things related to NodeJS.

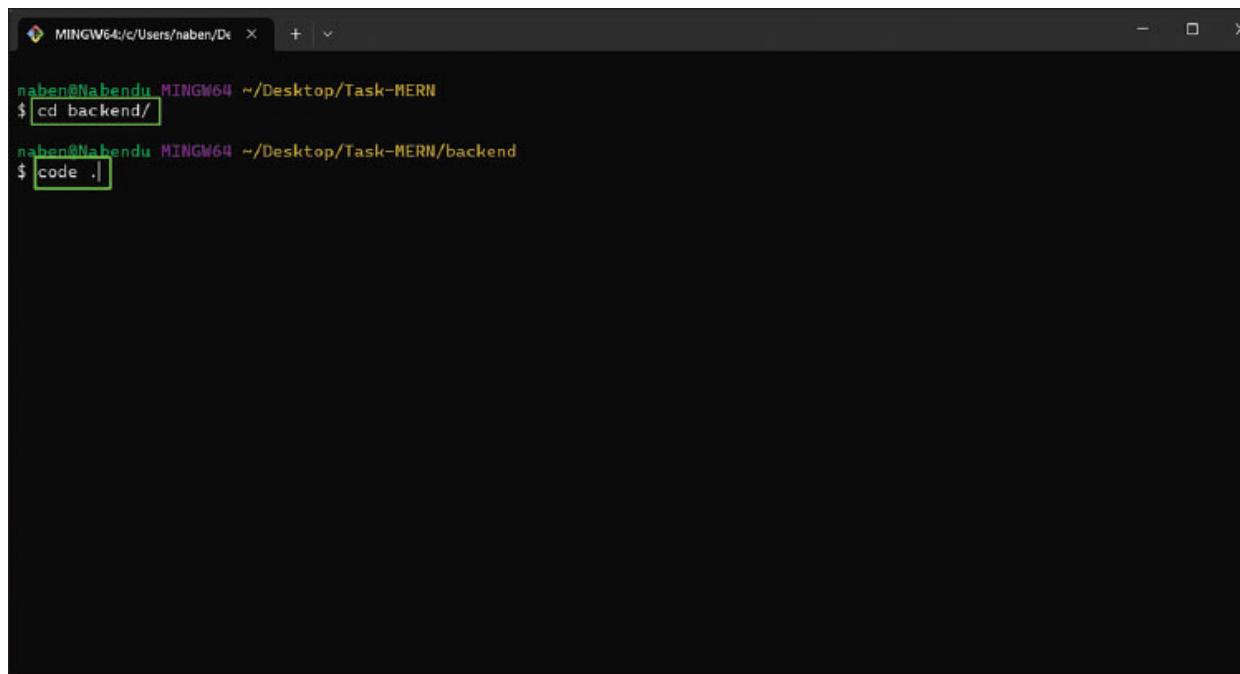
Structure

In this chapter, we will cover the following topics:

- Setting up testing in the backend
- Testing Register User controller
- Testing `getTasks` and `setTask` controllers
- Testing Update Task controller

Setting up testing in the backend

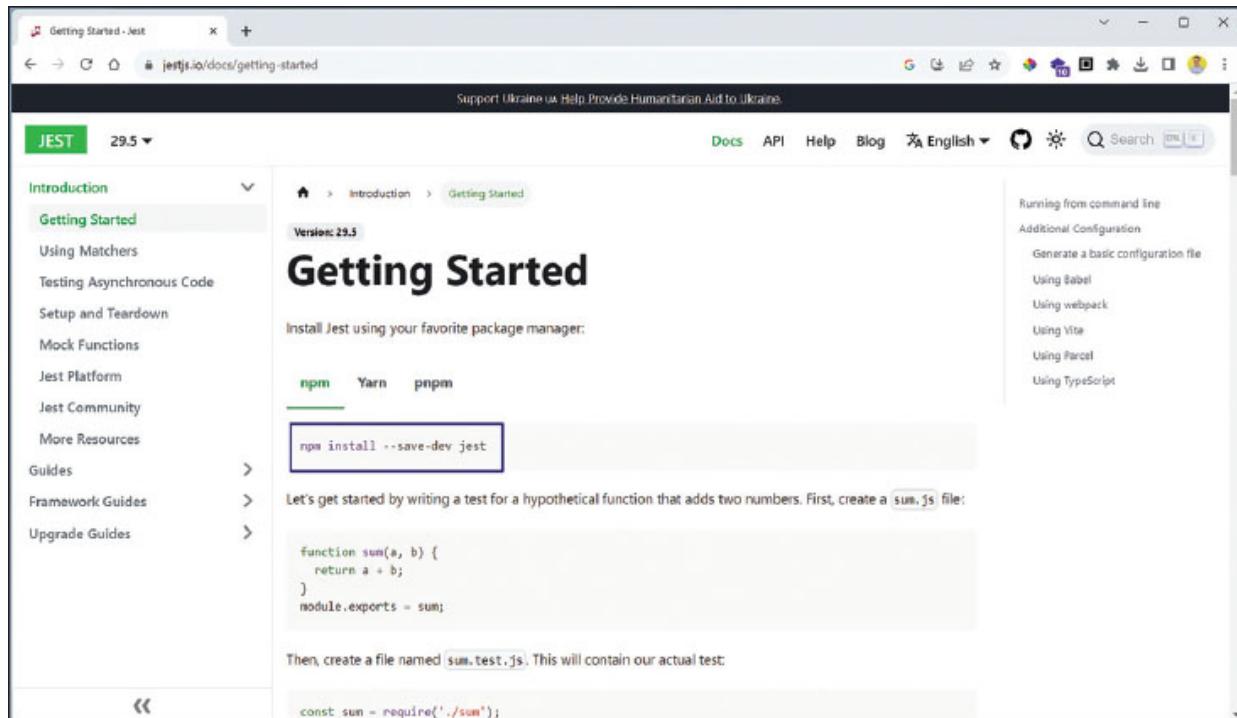
We need to do all the setup for testing, as the NodeJS app doesn't come with any testing installed. So, first change to the backend directory and then open it with VS Code with the `code`. command.



```
naben@Nabendu MINGW64 ~/Desktop/Task-MERN
$ cd backend/
naben@Nabendu MINGW64 ~/Desktop/Task-MERN/backend
$ code .
```

Figure 12.1: Switching to the Backend

Head over to <https://jestjs.io/docs/getting-started> site and copy the command to install Jest in your code.



The screenshot shows a web browser window with the URL jestjs.io/docs/getting-started. The page title is "Getting Started - Jest". On the left, there's a sidebar with a "JEST 29.5" header and a navigation menu including "Introduction", "Getting Started" (which is currently selected), "Using Matchers", "Testing Asynchronous Code", "Setup and Teardown", "Mock Functions", "Jest Platform", "Jest Community", "More Resources", "Guides", "Framework Guides", and "Upgrade Guides". The main content area has a heading "Getting Started" and sub-sections for "Install Jest using your favorite package manager:" (with options for npm, Yarn, and pnpm) and "Let's get started by writing a test for a hypothetical function that adds two numbers. First, create a `sum.js` file:". It shows a snippet of code:

```
function sum(a, b) {
  return a + b;
}
module.exports = sum;
```

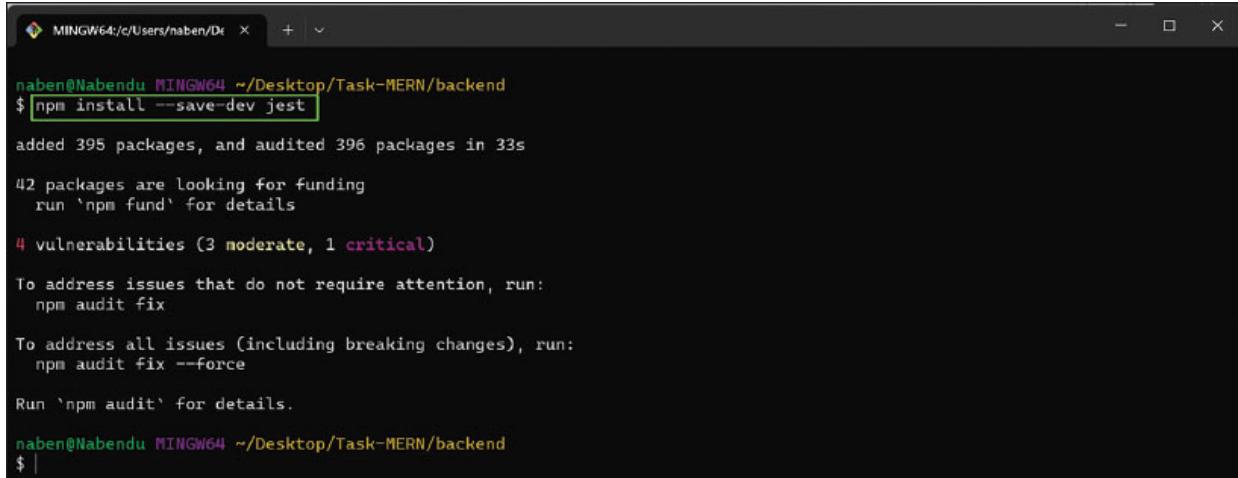
Below that, it says "Then, create a file named `sum.test.js`. This will contain our actual test:" followed by another snippet:

```
const sum = require('./sum');
```

Figure 12.2: Jest Docs

In the backend folder from the terminal, we will give the following command. Notice that we are installing jest as dev dependent since we don't require it in production.

```
npm install --save-dev jest
```



```
MINGW64:/c/Users/naben/Desktop/Task-MERN/backend
$ npm install --save-dev jest
added 395 packages, and audited 396 packages in 33s
42 packages are looking for funding
  run 'npm fund' for details

4 vulnerabilities (3 moderate, 1 critical)

To address issues that do not require attention, run:
  npm audit fix

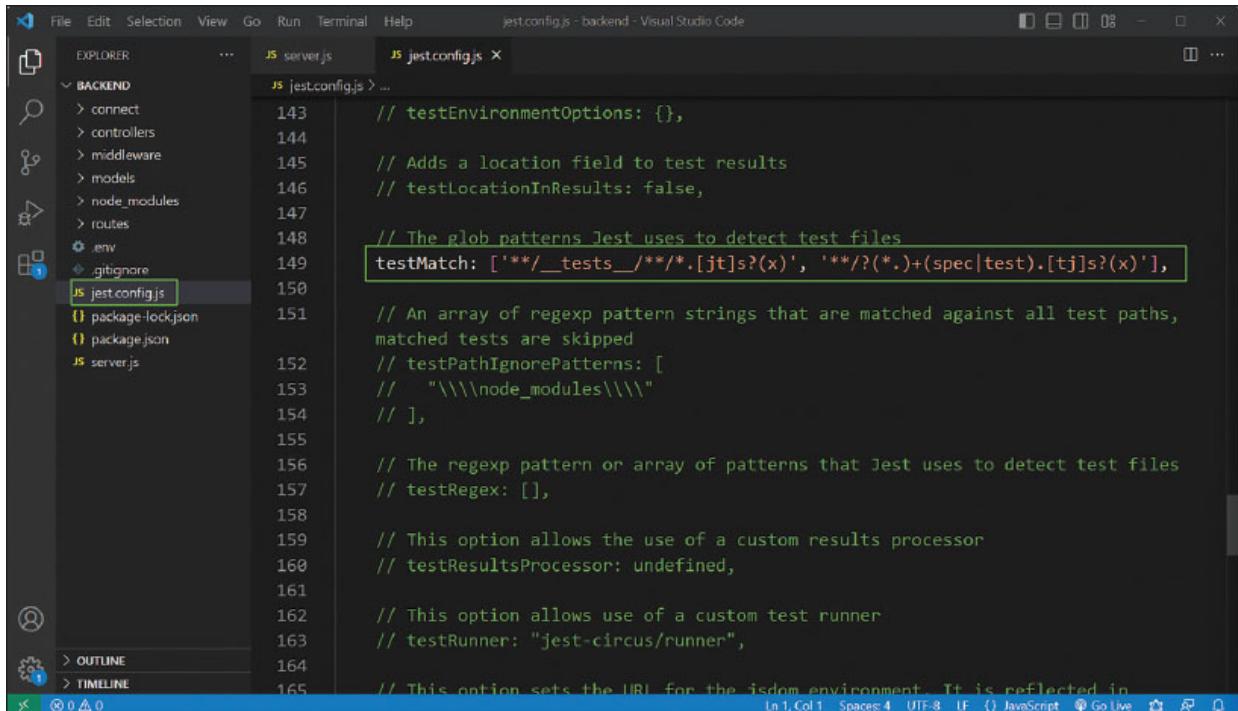
To address all issues (including breaking changes), run:
  npm audit fix --force

Run 'npm audit' for details.

naben@Nabendu MINGW64 ~/Desktop/Task-MERN/backend
$ |
```

Figure 12.3: Installing Jest

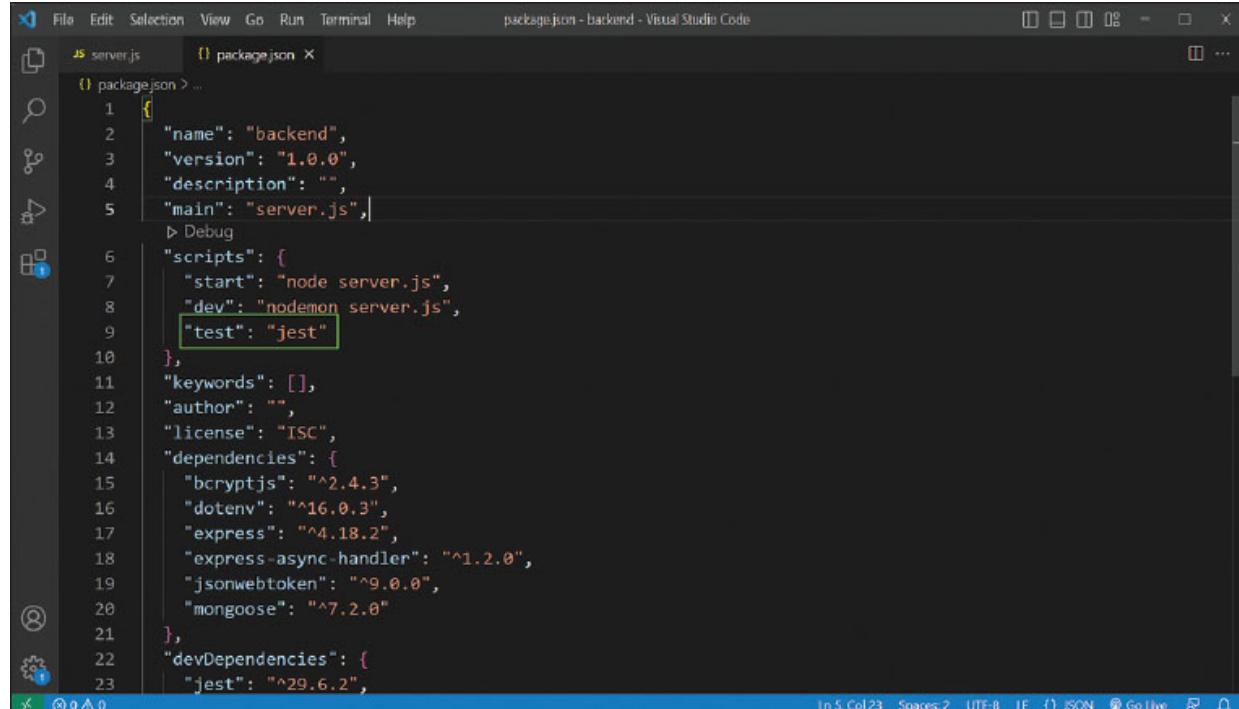
Copy the `jest.config.js`, from the code at the end of this chapter. Here, make sure that the `testMatch` file is not commented on.



```
File Edit Selection View Go Run Terminal Help
jest.config.js - backend - Visual Studio Code
EXPLORER  ... JS server.js  JS jest.config.js ...
BACKEND
  > connect
  > controllers
  > middleware
  > models
  > node_modules
  > routes
    ⚙ .env
    ⚙ .gitignore
  ⚙ jest.config.js
  ⚙ package-lock.json
  ⚙ package.json
  ⚙ server.js
143 // testEnvironmentOptions: {},
144 // Adds a location field to test results
145 // testLocationInResults: false,
146
147 // The glob patterns Jest uses to detect test files
148 testMatch: ['**/_tests_/**/*.[jt]s?(x)', '**/?(*.)+(spec|test).[tj]s?(x)'],
149
150 // An array of regexp pattern strings that are matched against all test paths,
151 // matched tests are skipped
152 // testPathIgnorePatterns: [
153 //   "\\\\[node_modules\\\\"
154 // ],
155
156 // The regexp pattern or array of patterns that Jest uses to detect test files
157 // testRegex: [],
158
159 // This option allows the use of a custom results processor
160 // testResultsProcessor: undefined,
161
162 // This option allows use of a custom test runner
163 // testRunner: "jest-circus/runner",
164
165 // This option sets the URL for the isdom environment. It is reflected in
  Int, Col 1  Spaces: 4  UTF-8  ⓘ JavaScript  ⓘ Go live  ⌂  ⌂  ⌂
```

Figure 12.4: Configuring Jest

Finally, we will update the **package.json** file to have a script called test, which will call **jest**.



The screenshot shows the Visual Studio Code interface with two tabs open: "server.js" and "package.json". The "package.json" tab is active and displays the following JSON code:

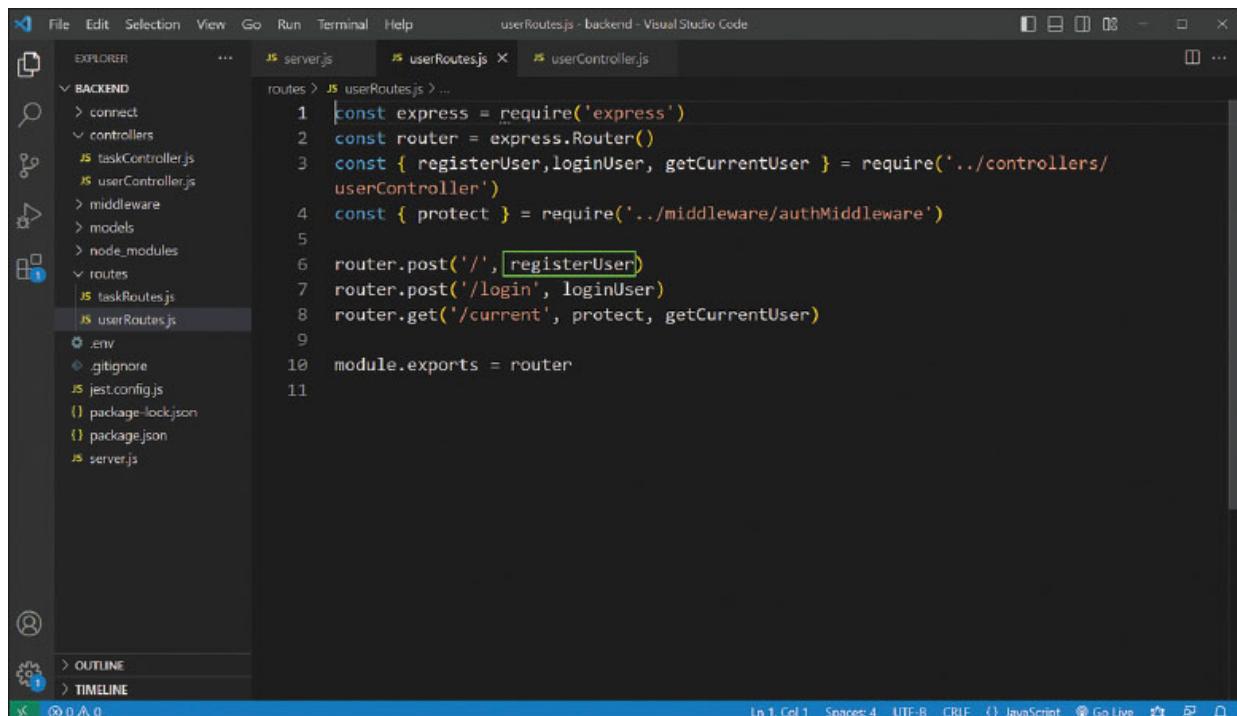
```
1 {  
2   "name": "backend",  
3   "version": "1.0.0",  
4   "description": "",  
5   "main": "server.js",  
6   "scripts": {  
7     "start": "node server.js",  
8     "dev": "nodemon server.js",  
9     "test": "jest"  
10    },  
11   "keywords": [],  
12   "author": "",  
13   "license": "ISC",  
14   "dependencies": {  
15     "bcryptjs": "^2.4.3",  
16     "dotenv": "^16.0.3",  
17     "express": "^4.18.2",  
18     "express-async-handler": "^1.2.0",  
19     "jsonwebtoken": "^9.0.0",  
20     "mongoose": "^7.2.0"  
21   },  
22   "devDependencies": {  
23     "jest": "^29.6.2",  
24   }  
25 }
```

The "test" script entry is highlighted with a yellow box. The status bar at the bottom of the code editor shows "In 5 Col 28 Spaces: 2 LITE-B IE 71 JSON @ GitHub".

Figure 12.5: Adding Jest

Testing registerUser controller

We will test the **registerUser** controller now. It is called when we hit the / route with a post call. In the **userRoutes.js** file we call the **registerUser** function through a **router.post()**.



```
const express = require('express')
const router = express.Router()
const { registerUser, loginUser, getCurrentUser } = require('../controllers/userController')
const { protect } = require('../middleware/authMiddleware')

router.post('/', registerUser)
router.post('/login', loginUser)
router.get('/current', protect, getCurrentUser)

module.exports = router
```

Figure 12.6: Calling Controller

The `registerUser` function in the `userController.js` file is as follows, which we created in earlier chapters. Here, we get the `name`, `email`, and `password` from the body. After validating all fields, we also check if the email exists with `findOne()`. If it exists, we are throwing an error.

We also encrypt the password with `bcrypt` before saving it in the database with `bcrypt`. Finally, we send a status of `201` and `_id`, `name`, and `email` back.

```
const registerUser = asyncHandler(async (req, res) => {
  const { name, email, password } = req.body
  if (!name || !email || !password) {
    res.status(400)
    throw new Error('All fields are mandatory')
  }
  const userExists = await User.findOne({ email })
  if (userExists) {
    res.status(400)
    throw new Error('User Exists')
  }

  const salt = await bcrypt.genSalt(10)
  const hashedPassword = await bcrypt.hash(password, salt)
```

```
const user = await User.create({ name, email, password:  
hashedPassword })  
if (user) {  
  res.status(201).json({ _id: user.id, name: user.name,  
  email: user.email, token: generateJWTtoken(user._id) })  
} else {  
  res.status(400)  
  throw new Error('Invalid user data')  
}  
})
```

The screenshot shows the Visual Studio Code interface with the following details:

- File Explorer:** Shows files: server.js, userRoutes.js, and UserController.js (the active tab).
- Code Editor:** Displays the content of the UserController.js file. The code handles user registration, validating input and hashing passwords.
- Bottom Status Bar:** Shows file statistics: In 22, Col 1, Spaces: 4, UTF-8, CR/LF, JavaScript, Go Live, and icons for Find, Replace, and Save.

```
const registerUser = asyncHandler(async (req, res) => {
    const { name, email, password } = req.body
    if (!name || !email || !password) {
        res.status(400)
        throw new Error('All fields are mandatory')
    }

    const userExists = await User.findOne({ email })
    if (userExists) {
        res.status(400)
        throw new Error('User Exists')
    }

    const salt = await bcrypt.genSalt(10)
    const hashedPassword = await bcrypt.hash(password, salt)
    const user = await User.create({ name, email, password: hashedPassword })
    if (user) {
        res.status(201).json({ _id: user.id, name: user.name, email: user.email, token: generateJWTtoken(user._id) })
    } else {
        res.status(400)
        throw new Error('Invalid user data')
    }
})
```

Figure 12.7: Register User Controller

We will write the test for this file. So, create a `_tests_` folder in the root directory and a `userController.test.js` file inside it. Here, we first import the `registerUser` from the `userController.js` file.

In `jest.mock()`, we pass the path to `userModel` as the first parameter and the arrow function as the second parameter. Inside the arrow function, we have created a variable of `mockUser` which is an object containing `_id`, `name`, and `email`.

Then, we return the mocked function of `findOne` and `create` from it. Next, we again use the `jest.mock()` and mock the `sign` function from the `userController.js` file.

Finally, we use `bcrypt` to mock the `gensalt` and `hash` functions used in the `userController.js` file.

```
const { registerUser } =
  require('../controllers/userController');

// Mock User model functions
jest.mock('../models/userModel', () => {
  // Mock User model
  const mockUser = {
    _id: 'user-id',
    name: 'John Doe',
    email: 'johndoe@example.com',
  };

  return {
    findOne: jest.fn().mockResolvedValue(null),
    create: jest.fn().mockResolvedValue(mockUser),
  };
});

// Mock JWT and bcrypt
jest.mock('jsonwebtoken', () => ({
  sign: jest.fn().mockReturnValue('mock-token'),
}));

const bcrypt = require('bcryptjs');
bcrypt.genSalt = jest.fn().mockResolvedValue('mock-salt');
bcrypt.hash = jest.fn().mockResolvedValue('mock-hashed-
password');
```

The screenshot shows the Visual Studio Code interface with the following details:

- File Explorer (Left):** Shows the project structure under the 'BACKEND' folder, including files like server.js, userRoutes.js, userModel.js, taskModel.js, and userController.test.js.
- Code Editor (Center):** Displays the content of userController.test.js. The code uses Jest to mock User model functions, JWT and bcrypt modules, and the registerUser function from the controller.
- Bottom Status Bar:** Shows information such as 'In 21 Col 1', 'Status 4', 'UTF-8', 'CR/LF', '15 JavaScript', and a 'Go To Line' input field.

Figure 12.8: Register User Test setup

After the initial configuration, we will write the first test. Here, inside the test function from jest, we have two parameters. The first parameter is a string, which will be displayed when we run the test.

The second parameter is an arrow function, which will contain our whole test logic. Here, we have created a variable of req first, which is an object. This object contains a key of the body, which contains a value as an object. This object contains the name, email and password data.

In the next res object, we contain two values of status and json which are mock of status and json function from register function.

We call the `registerUser` function with the `req` and `res` using await. Then we expect the status to be 201 in this success scenario.

```
// Test
test('should register a new user', async () => {
  const req = {
    body: {
      name: 'John Doe',
      email: 'johndoe@example.com',
      password: 'password',
    },
  }
  const res = {
    status: jest.fn(),
    json: jest.fn(),
  }
  await registerUser(req, res)
  expect(res.status).toHaveBeenCalledWith(201)
  expect(res.json).toHaveBeenCalledWith({
    message: 'User registered successfully',
  })
})
```

```

};

const res = {
  status: jest.fn().mockReturnThis(),
  json: jest.fn(),
};

await registerUser(req, res);
expect(res.status).toHaveBeenCalledWith(201);
});

```

```

File Edit Selection View Go Run Terminal Help userController.test.js - backend - Visual Studio Code
server.js userRoutes.js userController.js userController.test.js
tests > userController.test.js ...
22 bcrypt.genSalt = jest.fn().mockResolvedValue('mock-salt');
23 bcrypt.hash = jest.fn().mockResolvedValue('mock-hashed-password');
24
25 // Test
26 test('should register a new user', async () => {
27   const req = {
28     body: {
29       name: 'John Doe',
30       email: 'johndoe@example.com',
31       password: 'password',
32     },
33   };
34
35   const res = {
36     status: jest.fn().mockReturnThis(),
37     json: jest.fn(),
38   };
39
40   await registerUser(req, res);
41   expect(res.status).toHaveBeenCalledWith(201);
42 });
43

```

Figure 12.9: Register User First Test

Now, in the terminal from the backend folder, run the command `npm run test` and we will see the test has been passed. Also, notice that the name of the test which we have given “should register a new user” is being displayed.

```

naben@Nabendu MINGW64 ~/Desktop/Task-MERN/backend
$ npm run test

> backend@1.0.0 test
> jest

PASS  __tests__/_userController.test.js
  ✓ should register a new user (4 ms)

Test Suites: 1 passed, 1 total
Tests:       1 passed, 1 total
Snapshots:   0 total
Time:        0.433 s, estimated 2 s
Ran all test suites.

naben@Nabendu MINGW64 ~/Desktop/Task-MERN/backend
$ |

```

Figure 12.10: Register User Test run

We write the test case for an error in a missing field. Again, we have used the test method from jest but given it a different name. The `req` and the `res` are almost similar to our earlier test, but in the `req`, we are missing the email field.

After that, we call the `registerUser` through an expect, but it will throw an error because of the missing field. So, we chain it with `rejects` and `toThrow` from jest where we pass the “**All fields are mandatory**” message. Note that this message is the same as the message in the `register` function inside the `userController.js` file.

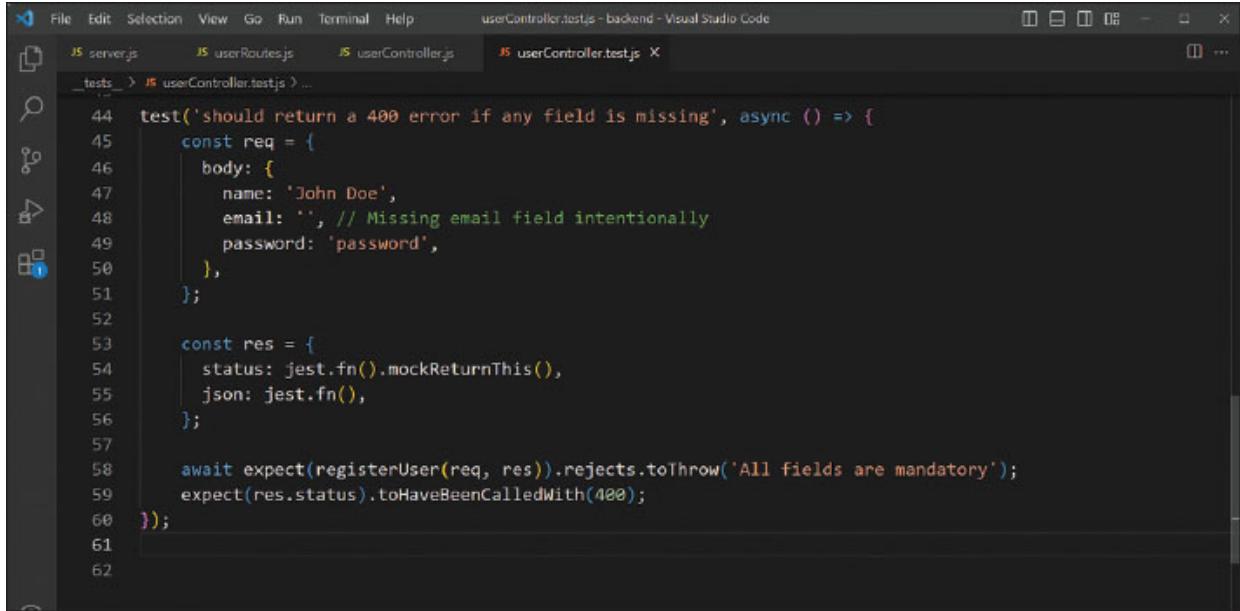
Lastly, we also check whether the status of 400 will be received because of the failed scenario.

```

test('should return a 400 error if any field is missing',
  async () => {
    const req = {
      body: {
        name: 'John Doe',
        email: '', // Missing email field intentionally
        password: 'password',
      },
    };
    const res = {
      status: jest.fn().mockReturnThis(),
      json: jest.fn(),
    };
    await expect(registerUser(req, res)).rejects.toThrow('All
fields are mandatory');
    expect(res.status).toHaveBeenCalledWith(400);
  }
);

```

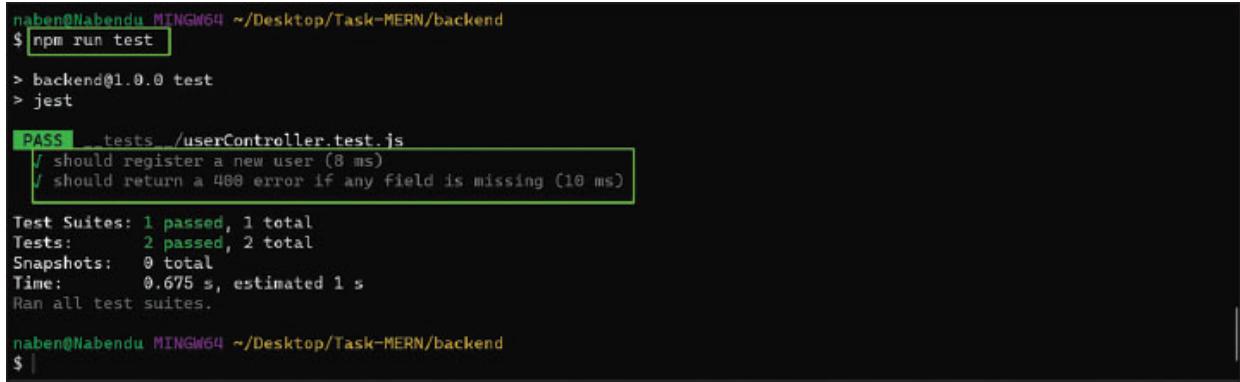
```
} );
```



```
File Edit Selection View Go Run Terminal Help UserController.test.js - backend - Visual Studio Code
server.js userRoutes.js UserController.js UserController.test.js ...
tests_ > UserController.test.js > ...
44  test('should return a 400 error if any field is missing', async () => {
45    const req = {
46      body: {
47        name: 'John Doe',
48        email: '', // Missing email field intentionally
49        password: 'password',
50      },
51    };
52
53    const res = {
54      status: jest.fn().mockReturnThis(),
55      json: jest.fn(),
56    };
57
58    await expect(registerUser(req, res)).rejects.toThrow('All fields are mandatory');
59    expect(res.status).toHaveBeenCalledWith(400);
60  });
61
62
```

Figure 12.11: Register User Second Test

Again, from the terminal run the command `npm run test` and we will see the new test has been passed.



```
naben@Nabendu MINGW64 ~/Desktop/Task-MERN/backend
$ npm run test
> backend@1.0.0 test
> jest
PASS  __tests__/_userController.test.js
  ✓ should register a new user (8 ms)
  ✓ should return a 400 error if any field is missing (10 ms)

Test Suites: 1 passed, 1 total
Tests:       2 passed, 2 total
Snapshots:   0 total
Time:        0.675 s, estimated 1 s
Ran all test suites.

naben@Nabendu MINGW64 ~/Desktop/Task-MERN/backend
$ |
```

Figure 12.12: Register User Test run

Testing `getTasks` and `setTask` controller

We will now test the `getTasks` and `setTask` functions from the `taskController.js` file, which we created in earlier chapters.

These are simple functions which are used to get the task and add a new task in the database. In the `getTasks` we find the task with the `find()` method in which we pass the user id.

In the `setTask`, we first check if the text is present and throw an error if it is not present. After that, we use the `create()` method to send the text and user id to the database and save it. Finally, we send back a status of 200 along with the task to the browser.

```
const getTasks = asyncHandler(async (req, res) => {
  const tasks = await Task.find({ user: req.user.id })
  res.status(200).json(tasks);
})

const setTask = asyncHandler(async (req, res) => {
  if(!req.body.text){
    res.status(400)
    throw new Error('Please enter a task')
  }

  const task = await Task.create({ text: req.body.text, user:
  req.user.id })
  res.status(200).json(task);
})
```

The screenshot shows the Visual Studio Code interface with the following details:

- File Explorer:** Shows the project structure with files like server.js, taskRoutes.js, taskController.js, taskController.test.js, userController.js, and userController.test.js.
- Code Editor:** Displays the `taskController.js` file content. A green rectangular selection highlights the entire `setTask` function.
- Status Bar:** Shows the current line (Ln 69), column (Col 1), character count (62 selected), and file encoding (UTF-8).

```
1  const asyncHandler = require('express-async-handler')
2  const Task = require('../models/taskModel')
3  const User = require('../models/userModel')

4
5  const getTasks = asyncHandler(async (req, res) => {
6    const tasks = await Task.find({ user: req.user.id })
7    res.status(200).json(tasks);
8  })

9
10 const setTask = asyncHandler(async (req, res) => {
11   if(!req.body.text){
12     res.status(400)
13     throw new Error('Please enter a task')
14   }

15   const task = await Task.create({ text: req.body.text, user: req.user.id })
16   res.status(200).json(task);
17 }

18
19 const updateTask = asyncHandler(async (req, res) => {
20   const task = await Task.findById(req.params.id)
21
22   if (!task) {
23     res.status(400)
```

Figure 12.13: Get Task and Set Task Controllers

Now, we will create a file **taskController.test.js** in the **__tests__** folder. Here, we first import the **getTasks** and **setTask** from the **taskController.js** file. After that, we import task from the models and also mock the task model with **jest.mock()**.

We write our first test which is to get a task. Here, our **req** variable is an object with a user key which contains a value of the object. This object has an id as a key and a user-id as a value.

Then, we mock the tasks, which is an array of objects. Now, each object contains a **_id**, text and user. Next, we mock the **find()** method in the **getTasks()** method inside the **taskController.js** file.

Our **res** object contains the status and json as key and the respective **jest.fn()** for mocking them. Next, we call the **getTasks()** with **req** and **res**.

Finally, we write the expect statements where we check the **res.status** to be **200** and also the **res.json** to contain the tasks.

```
const { getTasks, setTask, updateTask } =
require('../controllers/taskController');
const Task = require('../models/taskModel');
jest.mock('../models/taskModel');

test('should get tasks for a user', async () => {
  const req = { user: { id: <user-id> } };
  // Mocking tasks for the user
  const tasks = [
    { _id: 'task-id-1', text: 'Task 1', user: 'user-id' },
    { _id: 'task-id-2', text: 'Task 2', user: 'user-id' },
  ];
  // Mocking the find method to return tasks for the user
  Task.find.mockResolvedValue(tasks);

  const res = {
    status: jest.fn().mockReturnThis(),
    json: jest.fn(),
  };

  await getTasks(req, res);
  // Ensure that the response contains the expected tasks
  expect(res.status).toHaveBeenCalledWith(200);
```

```

    expect(res.json).toHaveBeenCalledWith(tasks);
  });

```

```

File Edit Selection View Go Run Terminal Help taskController.test.js - backend - Visual Studio Code
EXPLORER server.js taskRoutes.js taskController.js taskController.test.js userController.js userController.test.js ...
BACKEND tests taskController.test.js userController.test.js ...
connect controllers taskController.js userController.js ...
middleware models taskModel.js userModel.js ...
routes .env gitignore jestconfig.js package-lock.json package.json server.js ...
...
taskController.test.js
1 const { getTasks, setTask } = require('../controllers/taskController');
2 const Task = require('../models/taskModel');
3 jest.mock('../models/taskModel');
4
5 test('should get tasks for a user', async () => {
6   const req = { user: { id: 'user-id' } };
7   // Mocking tasks for the user
8   const tasks = [
9     { _id: 'task-id-1', text: 'Task 1', user: 'user-id' },
10    { _id: 'task-id-2', text: 'Task 2', user: 'user-id' },
11  ];
12  // Mocking the find method to return tasks for the user
13  Task.find.mockResolvedValue(tasks);
14
15  const res = {
16    status: jest.fn().mockReturnThis(),
17    json: jest.fn(),
18  };
19  await getTasks(req, res);
20  // Ensure that the response contains the expected tasks
21  expect(res.status).toHaveBeenCalledWith(200);
22  expect(res.json).toHaveBeenCalledWith(tasks);
23});
24

```

Figure 12.14: Get Task Test

The next test is for setting a task and it is almost similar to the previous test for getting a task. Here again, first we have a **req** object.

Then, we mock the task object. Note that it is different from our earlier test in which we have a task array. Next, we mock the **create()** method in the **setTask()** method inside the **taskController.js** file.

Our **res** object contains the **status** and **json** as key and is similar to the earlier test. Next, we call the **setTask** with the **req** and **res**.

We have written the expect statements where we check the **res.status** to be 200. Also, the **res.json** to contain the task.

```

test('should set a new task for a user', async () => {
  const req = { user: { id: <user-id> }, body: { text: <New Task> } };

  // Mocking the created task
  const task = { _id: <new-task-id>, text: <New Task>, user: <user-id> };

```

```
// Mocking the create method to return the new task
Task.create.mockResolvedValue(task);

const res = {
  status: jest.fn().mockReturnThis(),
  json: jest.fn(),
};

await setTask(req, res);

// Ensure that the response contains the new task
expect(res.status).toHaveBeenCalledWith(200);
expect(res.json).toHaveBeenCalledWith(task);
});
```

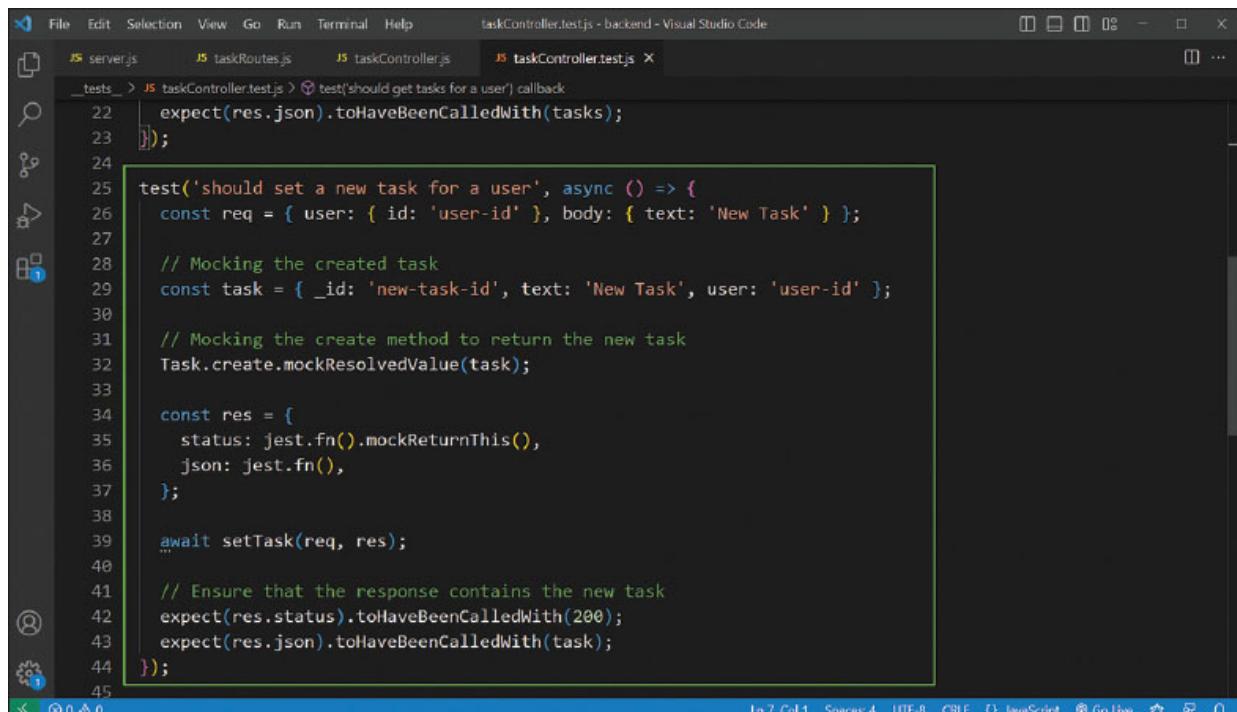


Figure 12.15: Set Task Test

We write the test for the error, when we have a missing task text. Here again, we have a `req` object but we have been given an empty body.

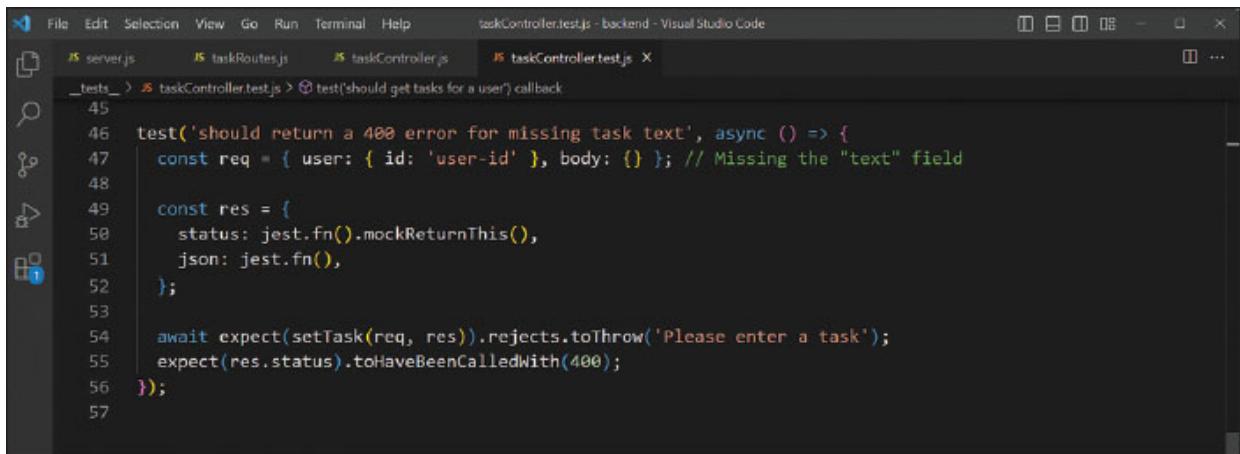
Next, the res object has status and json keys which have mock values with `jest.fn()`. After that, we call the `setTask` through an expect, but it will throw an error because of the missing field. So, we chain it with `rejects` and `toThrow` from jest where we pass the “`Please enter a task`” message.

Note that this message is the same as the message in the `setTask` function inside the `taskController.js` file. Lastly, we also check whether the status of 400 will be received because of the failed scenario.

```
test('should return a 400 error for missing task text', async () => {
  const req = { user: { id: 'user-id' }, body: {} }; // Missing the "text" field

  const res = {
    status: jest.fn().mockReturnThis(),
    json: jest.fn(),
  };

  await expect(setTask(req, res)).rejects.toThrow('Please enter a task');
  expect(res.status).toHaveBeenCalledWith(400);
});
```



```
File Edit Selection View Go Run Terminal Help taskController.test.js - backend - Visual Studio Code
server.js taskRoutes.js taskController.js taskController.test.js
	tests_ > taskController.test.js > test('should get tasks for a user') callback
45
46 test('should return a 400 error for missing task text', async () => {
47   const req = { user: { id: 'user-id' }, body: {} }; // Missing the "text" field
48
49   const res = {
50     status: jest.fn().mockReturnThis(),
51     json: jest.fn(),
52   };
53
54   await expect(setTask(req, res)).rejects.toThrow('Please enter a task');
55   expect(res.status).toHaveBeenCalledWith(400);
56 });
57
```

Figure 12.16: Set Task Error Test

We will run the `npm run test` from the terminal and our new tests in the `taskController.test.js` file passes.

```

naben@Nabendu MINGW64 ~/Desktop/Task-MERN/backend
$ npm run test

> backend@1.0.0 test
> jest

PASS __tests__/_userController.test.js
PASS __tests__/_taskController.test.js

Test Suites: 2 passed, 2 total
Tests:      5 passed, 5 total
Snapshots:  0 total
Time:       1.605 s, estimated 5 s
Ran all test suites.

naben@Nabendu MINGW64 ~/Desktop/Task-MERN/backend
$
```

Figure 12.17: Running Tests

Testing update Task controller

We will now test the update task controller from the **taskController.js** file. Here, we first find the task with the **findById** method by passing the id. Next, we check if the task is present. If it is not present, we throw an error of “**Task not found**”.

We also find the user with **findById** and pass the user id. Again, if the user is not found we throw the error “**No such user found**”.

Next, the test is for checking if the task’s user id and user’s id are the same. If they are not the same, we throw the error “**User is not authorized to update**”.

Finally, we update the task with the method of **findByIdAndUpdate** by passing the task id and **threq.body**. We also send back a status of 200, along with the updated task to the sender.

```

const updateTask = asyncHandler(async (req, res) => {
  const task = await Task.findById(req.params.id)

  if (!task) {
    res.status(400)
    throw new Error('Task not found')
  }

  const user = await User.findById(req.user.id)

  if (!user) {
    res.status(401)
```

```

        throw new Error('No such user found')
    }

    if (task.user.toString() !== user.id) {
        res.status(401)
        throw new Error('User is not authorized to update')
    }
    const updatedTask = await
    Task.findByIdAndUpdate(req.params.id, req.body, { new: true })
    res.status(200).json(updatedTask)
}

```

```

File Edit Selection View Go Run Terminal Help taskController.js - Visual Studio Code
server.js taskRoutes.js taskController.js taskController.test.js
controller > taskController.js > updateTask > [async] callback > user
20  const updateTask = asyncHandler(async (req, res) => {
21      const task = await Task.findById(req.params.id)
22
23      if (!task) {
24          res.status(404)
25          throw new Error('Task not found')
26      }
27
28      const user = await User.findById(req.user.id)
29
30      if (!user) {
31          res.status(401)
32          throw new Error('No such user found')
33      }
34
35      if (task.user.toString() !== user.id) {
36          res.status(401)
37          throw new Error('User is not authorized to update')
38      }
39
40      const updatedTask = await Task.findByIdAndUpdate(req.params.id, req.body, { new: true })
41      res.status(200).json(updatedTask)
42  })

```

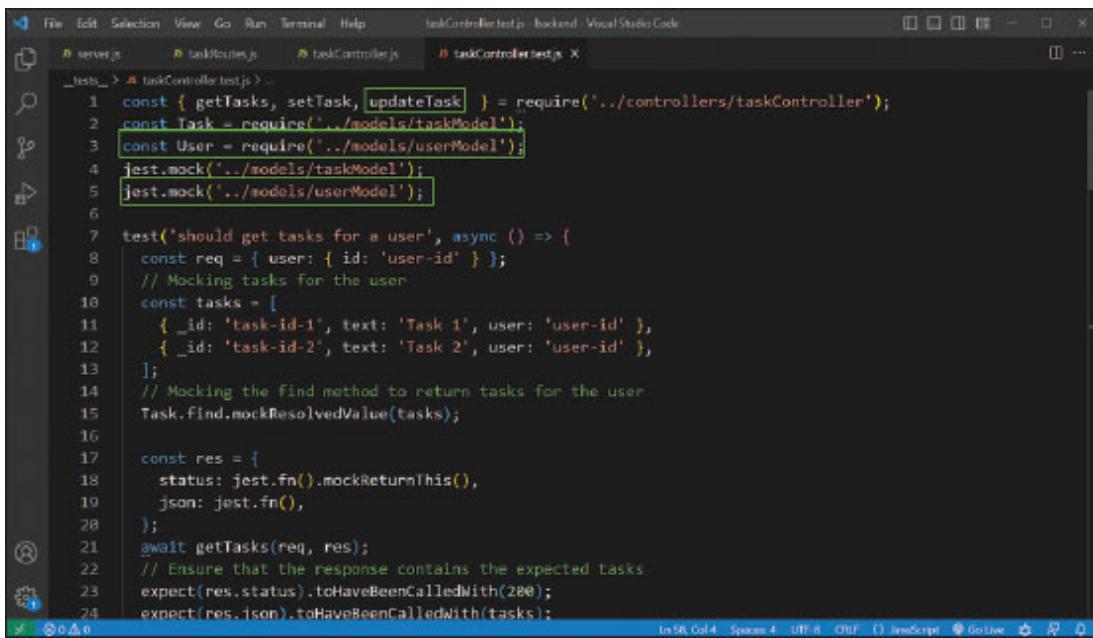
Figure 12.18: Update Task Controller

Back in the **taskController.test.js** file, we have to update our imports first. We first import the **updateTask** from the controllers. Next, we also import the user model and also mock the user model with **jest.mock()**.

```

const { getTasks, setTask, updateTask } =
require('../controllers/taskController');
const Task = require('../models/taskModel');
const User = require('../models/userModel');
jest.mock('../models/taskModel');
jest.mock('../models/userModel');

```



The screenshot shows a Visual Studio Code interface with the following details:

- File Explorer:** Shows files like server.js, taskRoutes.js, taskController.js, and taskController.test.js.
- Code Editor:** Displays the content of taskController.test.js. The code imports required modules and sets up a test for getting tasks for a user. It uses Jest's mocking capabilities to simulate database interactions.
- Status Bar:** Shows information such as 'In 58 Col 4', 'Spaces 4', 'UTF-8', 'CRLF', '(1) JavaScript', 'Go To Line', and file icons.

```
taskController.test.js - backend - Visual Studio Code
File Edit Selection View Go Run Terminal Help
server.js taskRoutes.js taskController.js taskController.test.js X
tests_ > taskController.test.js ...
1 const { getTasks, setTask, updateTask } = require('../controllers/taskController');
2 const Task = require('../models/taskModel');
3 const User = require('../models/userModel');
4 jest.mock('../models/taskModel');
5 jest.mock('../models/userModel');
6
7 test('should get tasks for a user', async () => {
8   const req = { user: { id: 'user-id' } };
9   // Mocking tasks for the user
10  const tasks = [
11    { _id: 'task-id-1', text: 'Task 1', user: 'user-id' },
12    { _id: 'task-id-2', text: 'Task 2', user: 'user-id' },
13  ];
14  // Mocking the find method to return tasks for the user
15  Task.find.mockResolvedValue(tasks);
16
17  const res = {
18    status: jest.fn().mockReturnThis(),
19    json: jest.fn(),
20  };
21  await getTasks(req, res);
22  // Ensure that the response contains the expected tasks
23  expect(res.status).toHaveBeenCalledWith(200);
24  expect(res.json).toHaveBeenCalledWith(tasks);
```

Figure 12.19: Importing user models

Now, we will write our first test for the update task in the **taskController.test.js** file. Here, we check if we are getting the 401 error if the user is not found. First, we have created a variable of **taskId** and **userId**.

We created a **req** object with params, user and body as keys. Each one of them contains an object as the value. The params object has a key-value pair of **id** and **taskId**. Then the user object has a key-value pair of id and **userId** and the body object has a key-value pair of text and ‘Updated Task’.

We create a variable of **taskToUpdate** which is an object. It contains the keys of **_id**, **text** and **user** with respective values.

We mock the task **findById** to return the mocked task of **taskToUpdate**. Similarly, we also mock the user **findById** and return a null which tells the user is not found.

Our **res** object contains **status** and **json** with respective mock functions. After that, we call the **updateTask** through an expect, but it will throw an error because of the missing user. So, we chain it with **rejects** and **toThrow** from jest where we are passing the “No such user found” message.

Note that this message is the same as the message in the **updateTask** function inside the **taskController.js** file. Lastly, we also check whether the status of 401 will be received because of the failed scenario.

```
test('should return a 401 error if user is not found', async () => {
  const taskId = 'task-id-1';
  const userId = 'non-existent-user-id';
  const req = { params: { id: taskId }, user: { id: userId }, body: { text: 'Updated Task' } };
  // Mocking the task to be updated
  const taskToUpdate = { _id: taskId, text: 'Original Task', user: 'user-id' };
  // Mocking the findById method to return the task to be updated
  Task.findById.mockResolvedValue(taskToUpdate);
  // Mocking the findById method to return null, indicating user not found
  User.findById.mockResolvedValue(null);
  const res = {
    status: jest.fn().mockReturnThis(),
    json: jest.fn(),
  };
  await expect(updateTask(req, res)).rejects.toThrow('No such user found');
  expect(res.status).toHaveBeenCalledWith(401);
});
```

```
File Edit Selection View Go Run Terminal Help taskControllerTest.js - backend - Visual Studio Code
JS server.js JS taskRoutes.js JS taskController.js JS taskControllerTest.js ...
tests... > JS taskControllerTest.js > ...
59
60 test('should return a 401 error if user is not found', async () => {
61   const taskId = 'task-id-1';
62   const userId = 'non-existent-user-id';
63   const req = { params: { id: taskId }, user: { id: userId }, body: { text: 'Updated Task' } };
64
65   // Mocking the task to be updated
66   const taskToUpdate = { _id: taskId, text: 'Original Task', user: 'user-id' };
67
68   // Mocking the findById method to return the task to be updated
69   Task.findById.mockResolvedValue(taskToUpdate);
70
71   // Mocking the findById method to return null, indicating user not found
72   User.findById.mockResolvedValue(null);
73
74   const res = [
75     status: jest.fn().mockReturnThis(),
76     json: jest.fn(),
77   ];
78
79   await expect(updateTask(req, res)).rejects.toThrow('No such user found');
80   expect(res.status).toHaveBeenCalledWith(401);
81
82 });

```

Figure 12.20: User not found error test

The next test we have for the user is not authorized to update the task. Here again, we have a `taskId` and `userId` variable. After that, we have a `req` object exactly similar to our previous test.

Our `taskToUpdate` also has a similar structure as the previous test. But notice here that the user value is different from the owner's. After that, we are mocking the task `findById` which will return the task to be updated.

We mock the user `findById`, which will return our authorized user with the id of `user-id-2`. Again, our `res` object contains `status` and `json` with respective mock functions.

We call the `updateTask` through an expect, but it will throw an error because of the unauthorized user. So, we chain it with `rejects` and `toThrow` from `jest` where we pass the “`User is not authorized to update`” message.

Lastly, we also check whether the status of `401` will be received because of the failed scenario.

```
test(<should return a 401 error if user is not authorized to
update the task>, async () => {
  const taskId = 'task-id-1';
```

```
const userId = 'user-id-2'; // Different user ID from the
task owner
const req = { params: { id: taskId }, user: { id: userId },
body: { text: 'Updated Task' } };
// Mocking the task to be updated, owned by a different
user
const taskToUpdate = { _id: taskId, text: 'Original Task',
user: 'user-id-1' };
// Mocking the findById method to return the task to be
updated
Task.findById.mockResolvedValue(taskToUpdate);
// Mocking the findById method to return the user
User.findById.mockResolvedValue({ _id: userId });
const res = {
  status: jest.fn().mockReturnThis(),
  json: jest.fn(),
};
await expect(updateTask(req, res)).rejects.toThrow('User is
not authorized to update');
expect(res.status).toHaveBeenCalledWith(401);
});
```

The screenshot shows a Visual Studio Code interface with the following details:

- File Bar:** File, Edit, Selection, View, Go, Run, Terminal, Help.
- Active File:** taskController.test.js - backend - Visual Studio Code
- Code Editor:** The code is a Jest test for the taskController.js file. It uses the Mocha framework and Chai assertions. The test checks if an unauthorized user receives a 401 error when attempting to update a task.

```
test('should return a 401 error if user is not authorized to update the task', async () => {
  const taskId = 'task-id-1';
  const userId = 'user-id-2'; // Different user ID from the task owner
  const req = { params: { id: taskId }, user: { id: userId }, body: { text: 'Updated Task' } };

  // Mocking the task to be updated, owned by a different user
  const taskToUpdate = { _id: taskId, text: 'Original Task', user: 'user-id-1' };

  // Mocking the findById method to return the task to be updated
  Task.findById.mockResolvedValue(taskToUpdate);

  // Mocking the findById method to return the user
  User.findById.mockResolvedValue({ _id: userId });

  const res = {
    status: jest.fn().mockReturnThis(),
    json: jest.fn(),
  };

  await expect(updateTask(req, res)).rejects.toThrow('User is not authorized to update');
  expect(res.status).toHaveBeenCalledWith(401);
});
```

Figure 12.21: User not authorized error test

We will again run the `npm run test` from the terminal and all the new tests will also pass.



A screenshot of a terminal window titled 'naben@Nabendu MINGW64 ~/Desktop/Task-MERN/backend'. It shows the command '\$ npm run test' being run. The output indicates 2 passed tests: 'userController.test.js' and 'taskController.test.js'. The summary shows 2 test suites, 7 tests passed, and 0 snapshots taken. The total time was 1.785 seconds. The command '\$ |' is shown at the bottom.

```
naben@Nabendu MINGW64 ~/Desktop/Task-MERN/backend
$ npm run test

> backend@1.0.0 test
> jest

PASS  __tests__/_userController.test.js
PASS  __tests__/_taskController.test.js

Test Suites: 2 passed, 2 total
Tests:    7 passed, 7 total
Snapshots: 0 total
Time:    1.785 s, estimated 2 s
Ran all test suites.

naben@Nabendu MINGW64 ~/Desktop/Task-MERN/backend
$ |
```

Figure 12.22: Running Tests

Conclusion

In this chapter, we have learned to test our backend code written in NodeJS. We have used the popular libraries of jest to unit test our various components. In the final chapter, we will deploy both our frontend and backend code separately.

Points to remember

- Configuring jest from the start for a NodeJS application
- Adding mocking capabilities for testing
- Writing complex tests using mock data and services
- Writing tests for common backend scenarios of get task, set task and update task

CHAPTER 13

Deployment

Introduction

This chapter covers the deployment of both our frontend and backend code. We will use it with freely available services. This includes deploying the front end with Netlify and the back end with Back4app.

Structure

In this chapter, we will discuss the following topics:

- Frontend code repo creation
- Backend code repo creation
- Backend deployment in Back4app
- Backend integration with frontend
- Frontend deployment in Netlify
- Fixing CORS errors and final deployments

Frontend code repo creation

We will first create a repository for our frontend code in GitHub. For this, you need to have a GitHub account and also Git installed on your Windows machine. By default, Mac and Linux machines have Git installed.

First login to your GitHub account at <https://github.com/>.

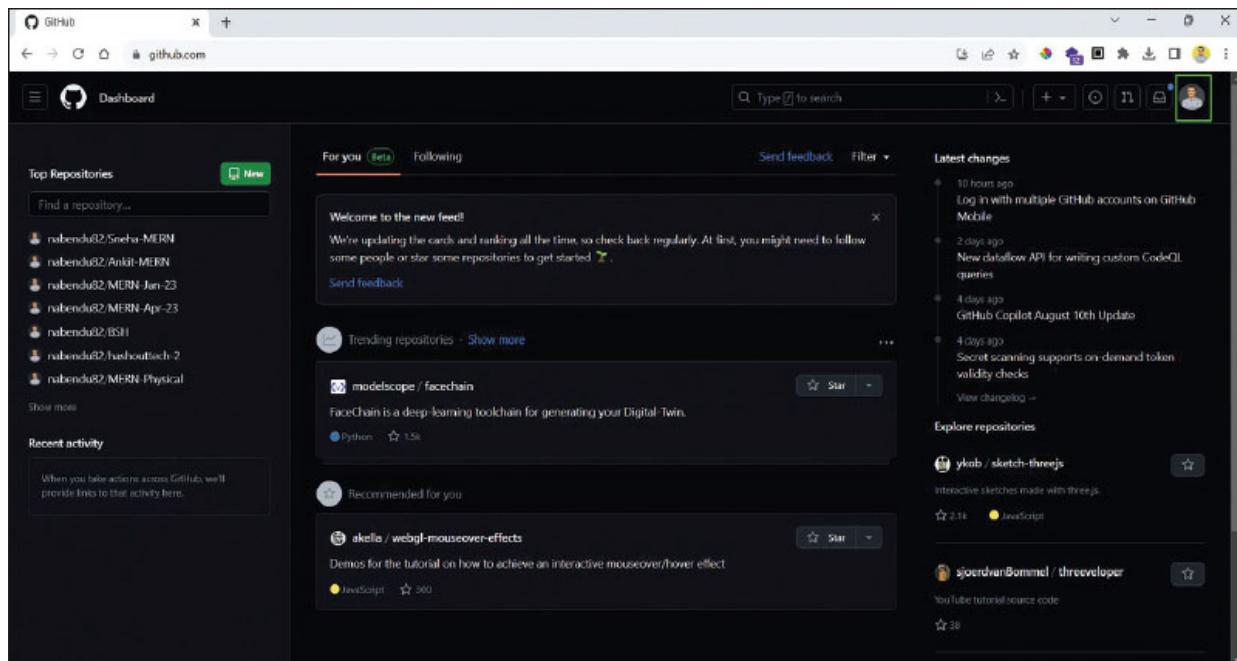


Figure 13.1: GitHub

Now, click on the Plus sign (+) in the top right corner. And then in the dropdown, click on **New repository**.

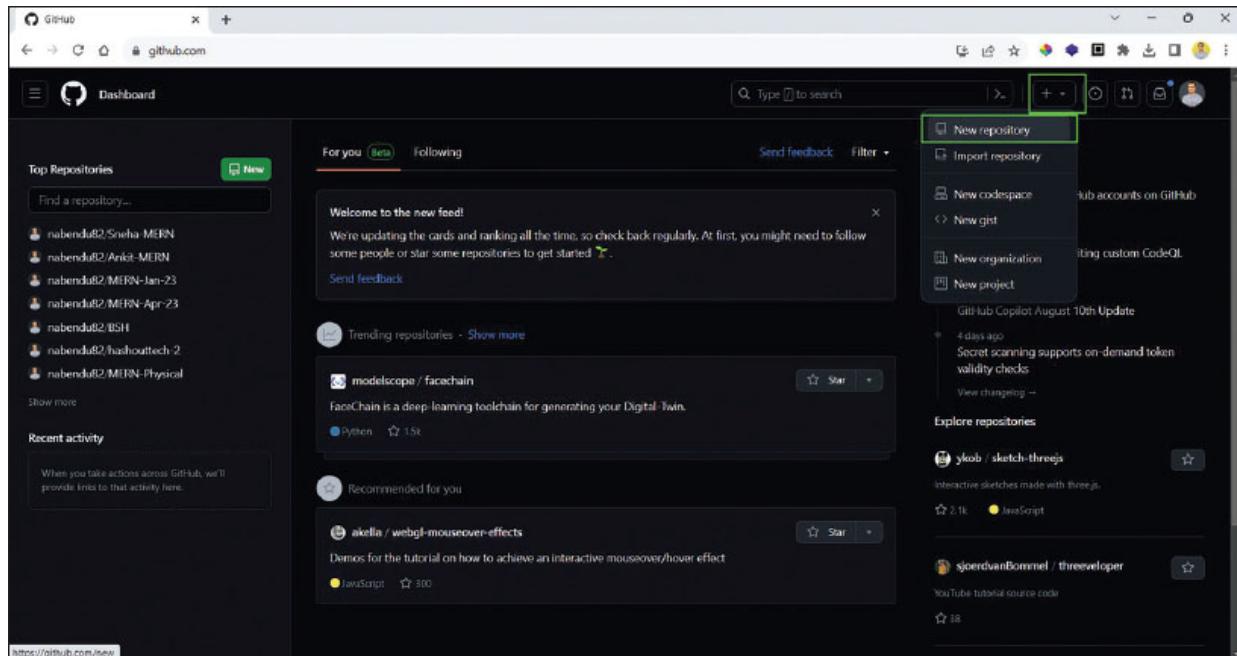


Figure 13.2: New repository

In the next screen give the repo a name like **task-mern-frontend**. Also, give a nice description. Make sure the repo is public and then click on the **Create**

repository button.

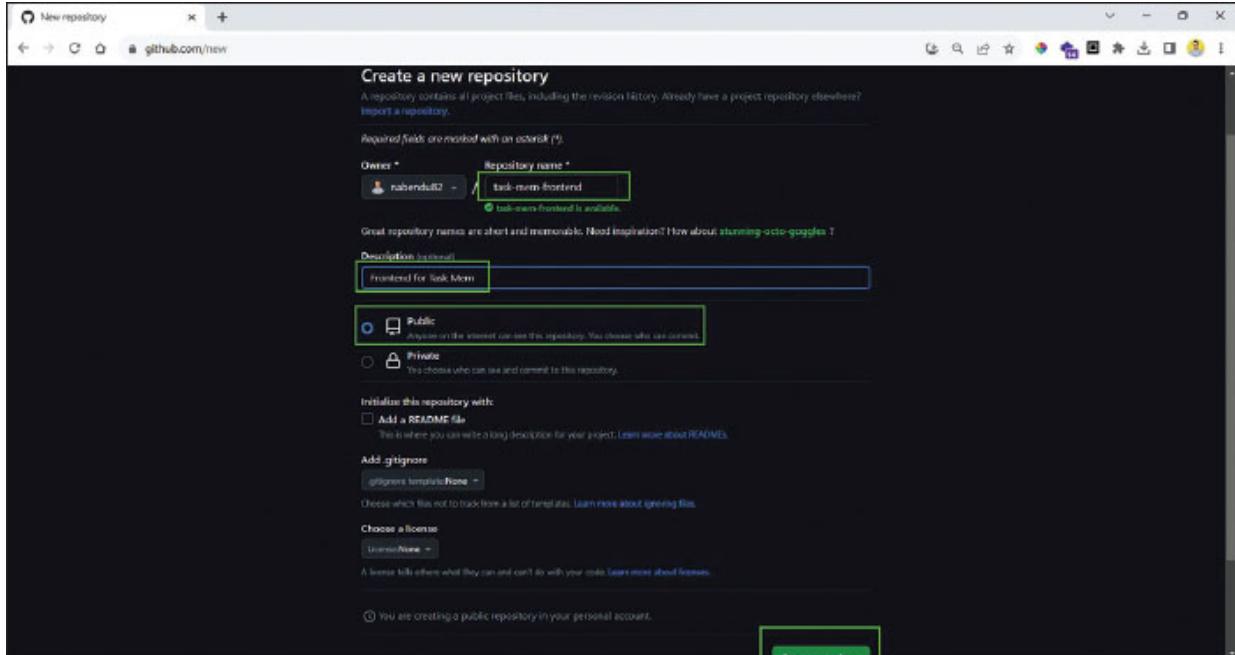


Figure 13.3: Creating a New repository

In the next screen, we will get all the commands to create a repo. Then, push the code to GitHub.

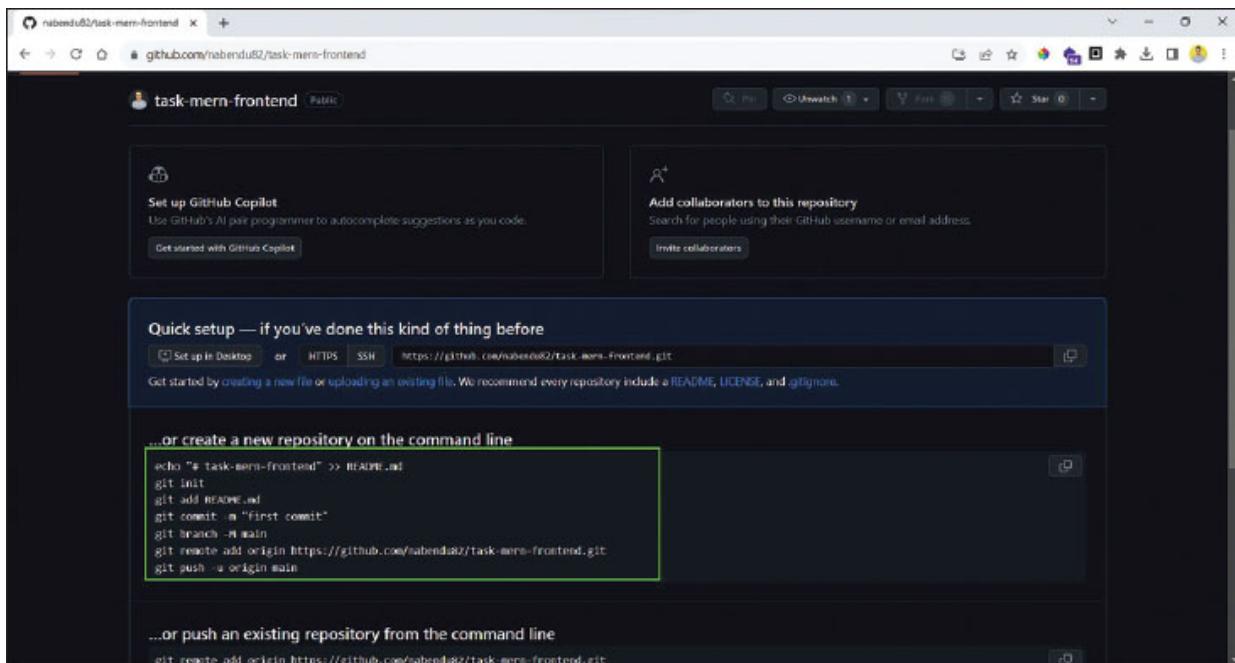
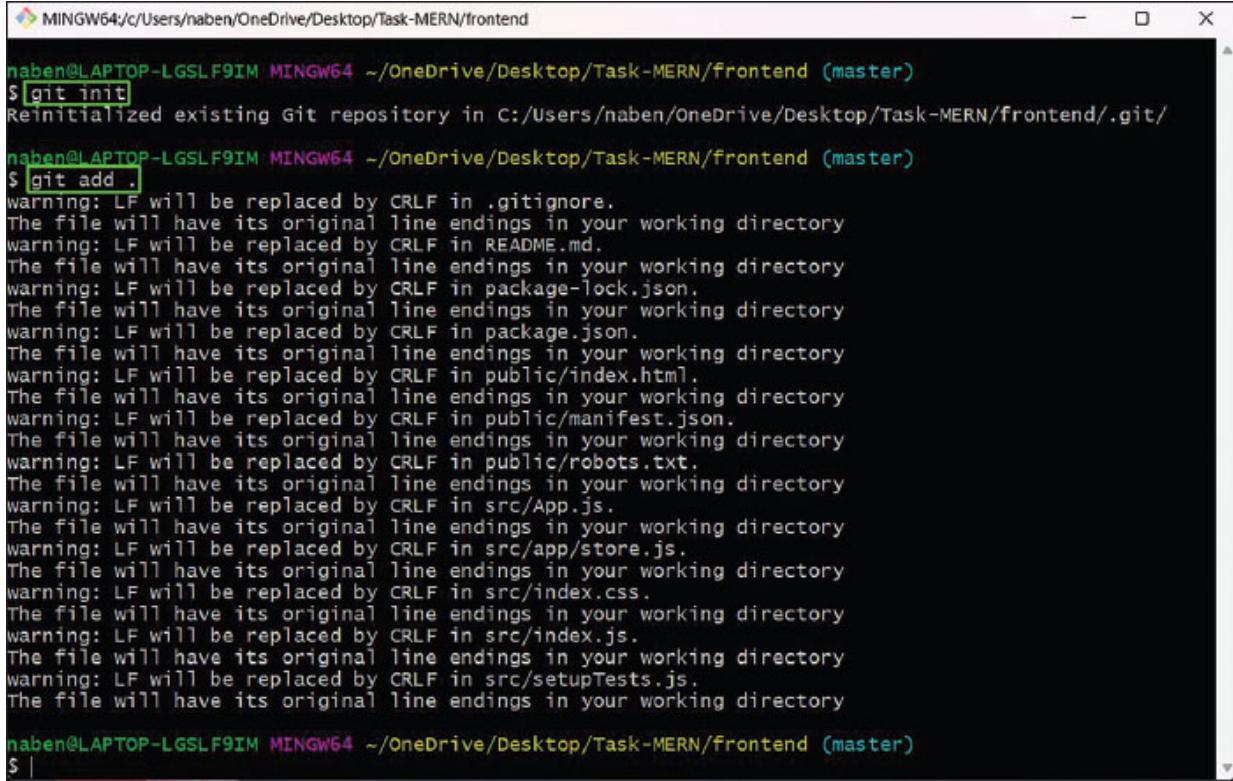


Figure 13.4: Commands for the New repository

Now, from the terminal (Windows, Mac or Linux), first go to the folder where our frontend code is located. After that, enter the following commands. Here, the first command is creating a new git repository.

The second command is adding all the files to the staging area. Note that both the commands can be found in the preceding screenshot, although a bit modified.

```
git init  
git add.
```



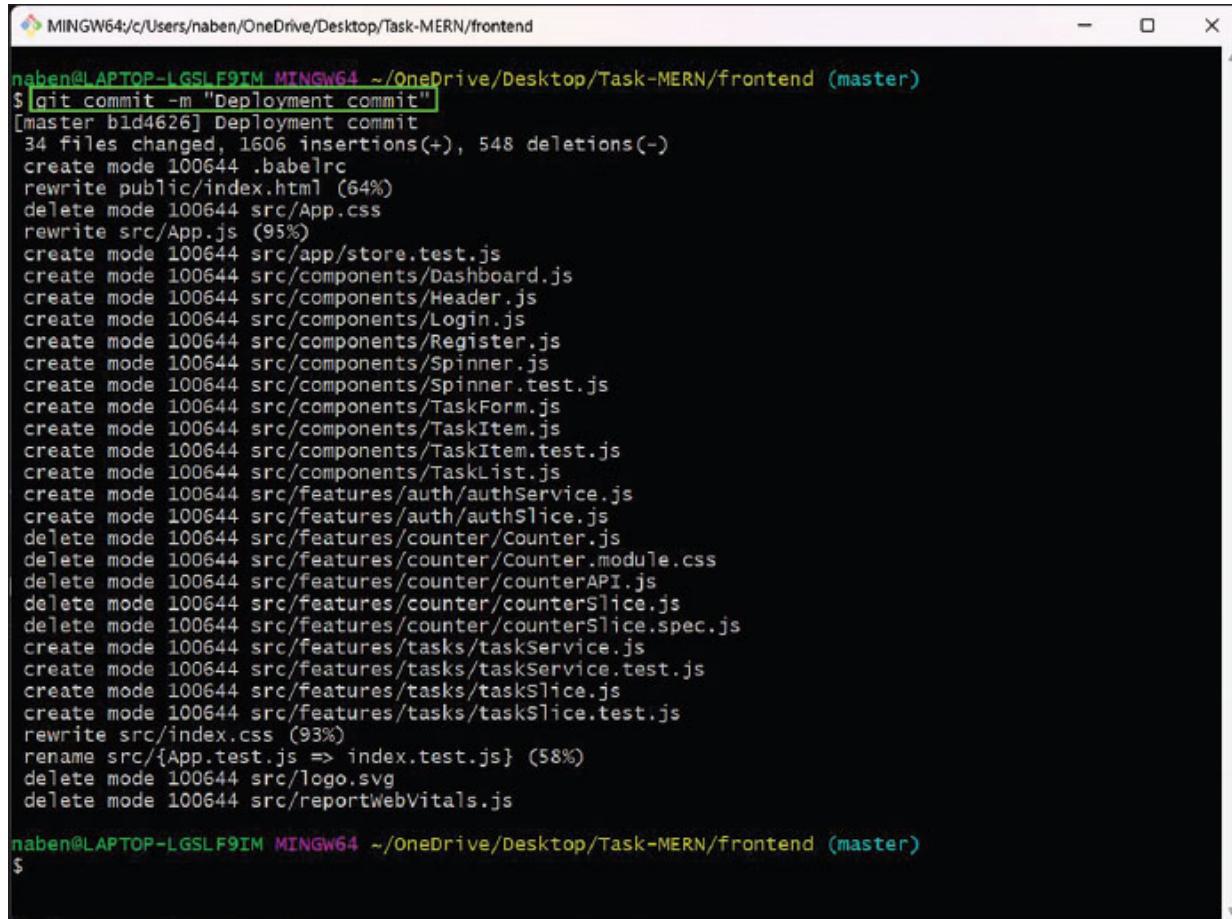
A screenshot of a terminal window titled "MINGW64/c/Users/naben/OneDrive/Desktop/Task-MERN/frontend". The window shows the following command-line session:

```
naben@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/frontend (master)  
$ git init  
Reinitialized existing Git repository in C:/Users/naben/OneDrive/Desktop/Task-MERN/frontend/.git/  
  
naben@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/frontend (master)  
$ git add .  
warning: LF will be replaced by CRLF in .gitignore.  
The file will have its original line endings in your working directory  
warning: LF will be replaced by CRLF in README.md.  
The file will have its original line endings in your working directory  
warning: LF will be replaced by CRLF in package-lock.json.  
The file will have its original line endings in your working directory  
warning: LF will be replaced by CRLF in package.json.  
The file will have its original line endings in your working directory  
warning: LF will be replaced by CRLF in public/index.html.  
The file will have its original line endings in your working directory  
warning: LF will be replaced by CRLF in public/manifest.json.  
The file will have its original line endings in your working directory  
warning: LF will be replaced by CRLF in public/robots.txt.  
The file will have its original line endings in your working directory  
warning: LF will be replaced by CRLF in src/App.js.  
The file will have its original line endings in your working directory  
warning: LF will be replaced by CRLF in src/app/store.js.  
The file will have its original line endings in your working directory  
warning: LF will be replaced by CRLF in src/index.css.  
The file will have its original line endings in your working directory  
warning: LF will be replaced by CRLF in src/index.js.  
The file will have its original line endings in your working directory  
warning: LF will be replaced by CRLF in src/setupTests.js.  
The file will have its original line endings in your working directory  
  
naben@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/frontend (master)  
$ |
```

Figure 13.5: git init and add

Next, we will run the command to **commit** the code in the staging area to the commit area. Notice, here we can give any message and we have given a **Deployment commit**.

```
git commit -m "Deployment commit"
```



The screenshot shows a terminal window with the following content:

```
naben@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/frontend (master)
$ git commit -m "Deployment commit"
[master b1d4626] Deployment commit
 34 files changed, 1606 insertions(+), 548 deletions(-)
 create mode 100644 .babelrc
 rewrite public/index.html (64%)
 delete mode 100644 src/App.css
 rewrite src/App.js (95%)
 create mode 100644 src/app/store.test.js
 create mode 100644 src/components/Dashboard.js
 create mode 100644 src/components/Header.js
 create mode 100644 src/components/Login.js
 create mode 100644 src/components/Register.js
 create mode 100644 src/components/Spinner.js
 create mode 100644 src/components/Spinner.test.js
 create mode 100644 src/components/TaskForm.js
 create mode 100644 src/components/TaskItem.js
 create mode 100644 src/components/TaskItem.test.js
 create mode 100644 src/components/TaskList.js
 create mode 100644 src/features/auth/authService.js
 create mode 100644 src/features/auth/authSlice.js
 delete mode 100644 src/features/counter/Counter.js
 delete mode 100644 src/features/counter/Counter.module.css
 delete mode 100644 src/features/counter/counterAPI.js
 delete mode 100644 src/features/counter/counterSlice.js
 delete mode 100644 src/features/counter/counterSlice.spec.js
 create mode 100644 src/features/tasks/taskService.js
 create mode 100644 src/features/tasks/taskService.test.js
 create mode 100644 src/features/tasks/taskSlice.js
 create mode 100644 src/features/tasks/taskSlice.test.js
 rewrite src/index.css (93%)
 rename src/{App.test.js => index.test.js} (58%)
 delete mode 100644 src/logo.svg
 delete mode 100644 src/reportWebVitals.js

naben@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/frontend (master)
$
```

Figure 13.6: git commit

Next, we will first give the command to create a branch called main. The next command will add the unique remote path given to us by GitHub. The last push command will push our code from the local system to GitHub.

Note that all of these commands are exactly the same as what we have got from our GitHub command list earlier.

```
git branch -m main
git remote add origin https://github.com/nabendu82/task-mern-
frontend.git
git push -u origin main
```

```

MINGW64:/c/Users/naben/OneDrive/Desktop/Task-MERN/frontend
$ git branch -M main
naben@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/frontend (main)
$ git remote add origin https://github.com/nabendu82/task-mern-frontend.git
naben@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/frontend (main)
$ git push -u origin main
Enumerating objects: 66, done.
Counting objects: 100% (66/66), done.
Delta compression using up to 12 threads
Compressing objects: 100% (64/64), done.
Writing objects: 100% (66/66), 193.31 KiB | 6.44 MiB/s, done.
Total 66 (delta 8), reused 0 (delta 0), pack-reused 0
remote: Resolving deltas: 100% (8/8), done.
To https://github.com/nabendu82/task-mern-frontend.git
 * [new branch]      main -> main
Branch 'main' set up to track remote branch 'main' from 'origin'.
naben@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/frontend (main)
$ |

```

Figure 13.7: git push

Back in GitHub, we will find all of our code being uploaded in our repo.

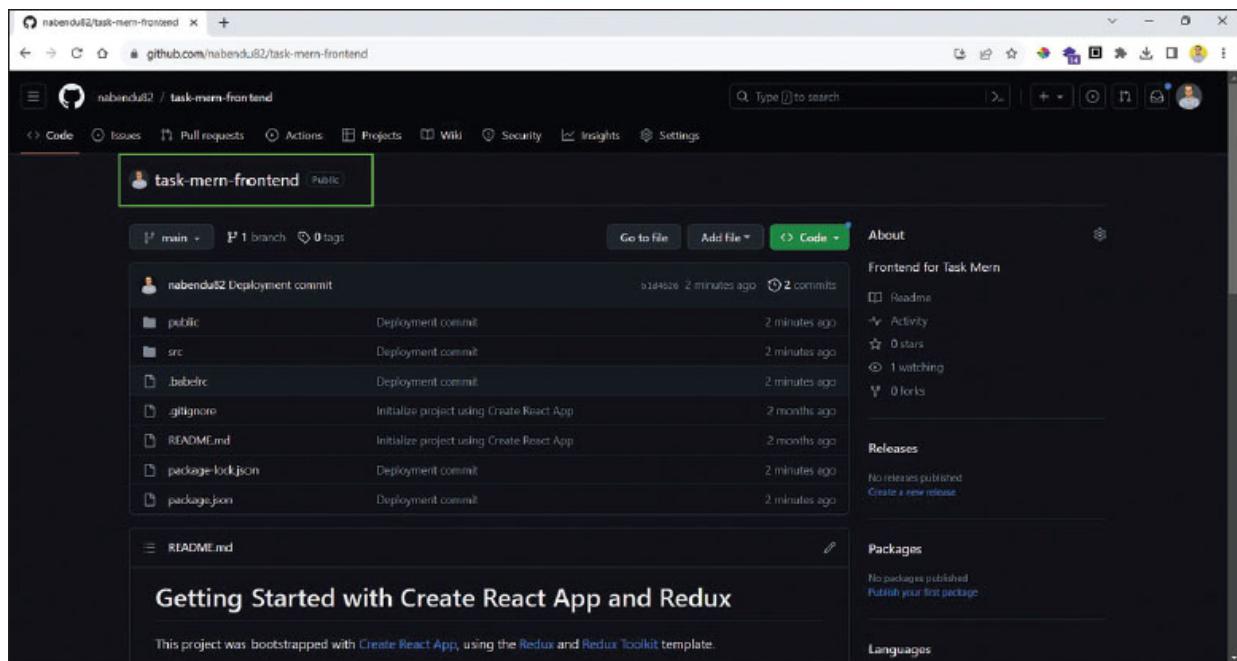


Figure 13.8: Frontend repo

Backend code repo creation

We will now create a repo for our backend code and transfer all code from the local computer to this remote GitHub repository. The steps will be exactly the same as the Frontend part.

Now, to create a new repo, we will again click on the plus(+) sign and then the **New repository**.

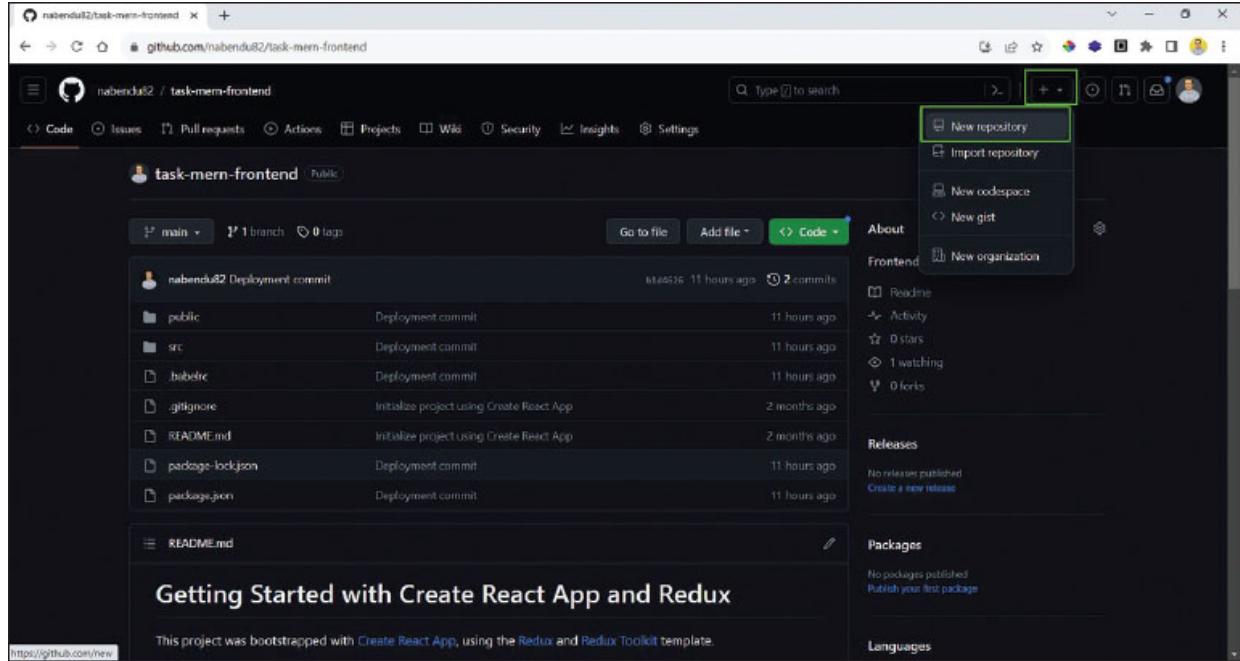


Figure 13.9: New repository

In the next screen, we will give the repository a name and description and then click on the **Create repository** button.

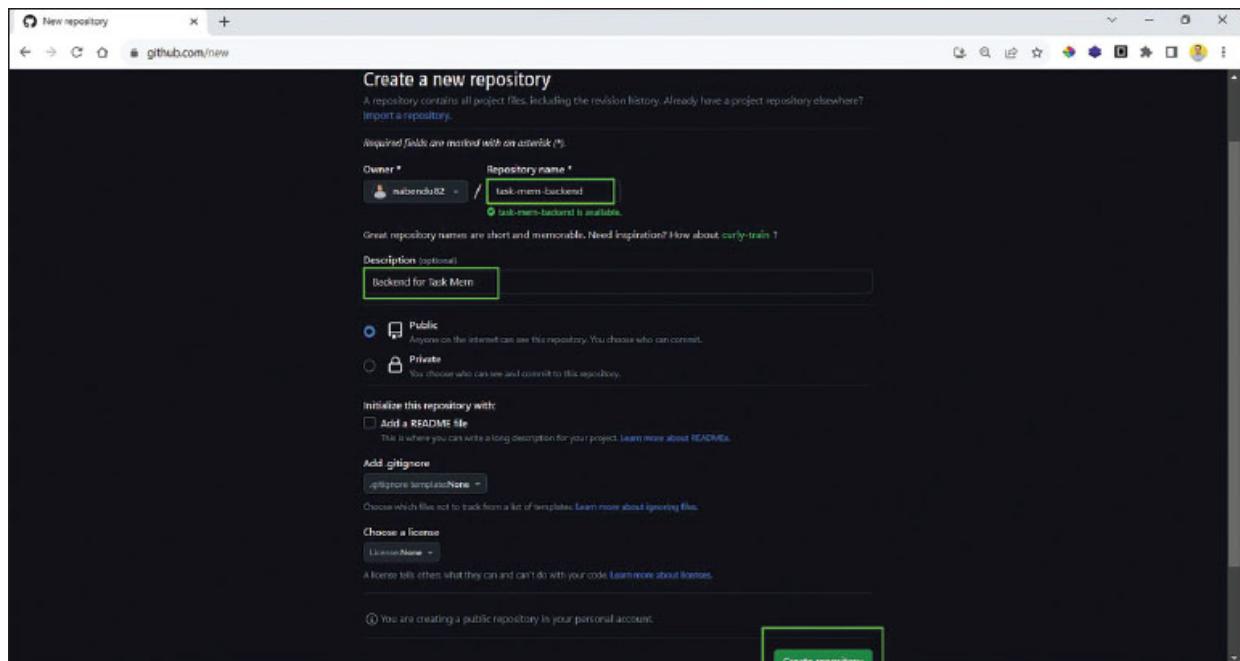


Figure 13.10: Backend repository

In the next screen, we will again get the set of commands to be given in the terminal. Note that here the path is different in the remote command with a unique link.

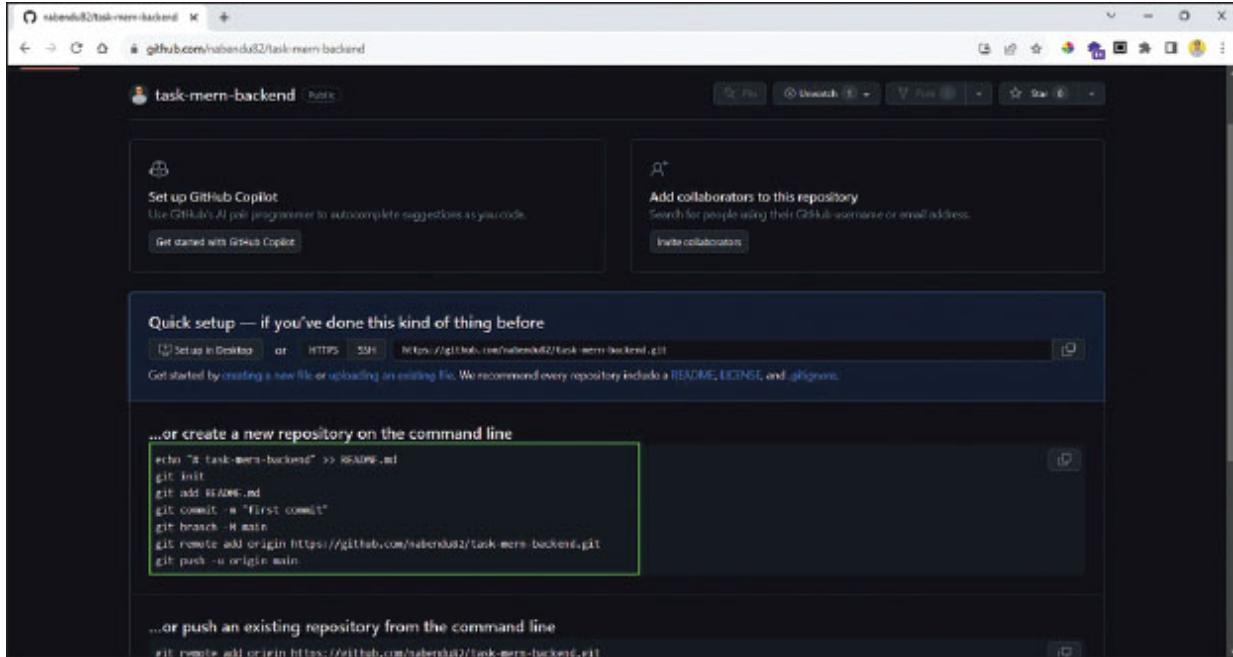
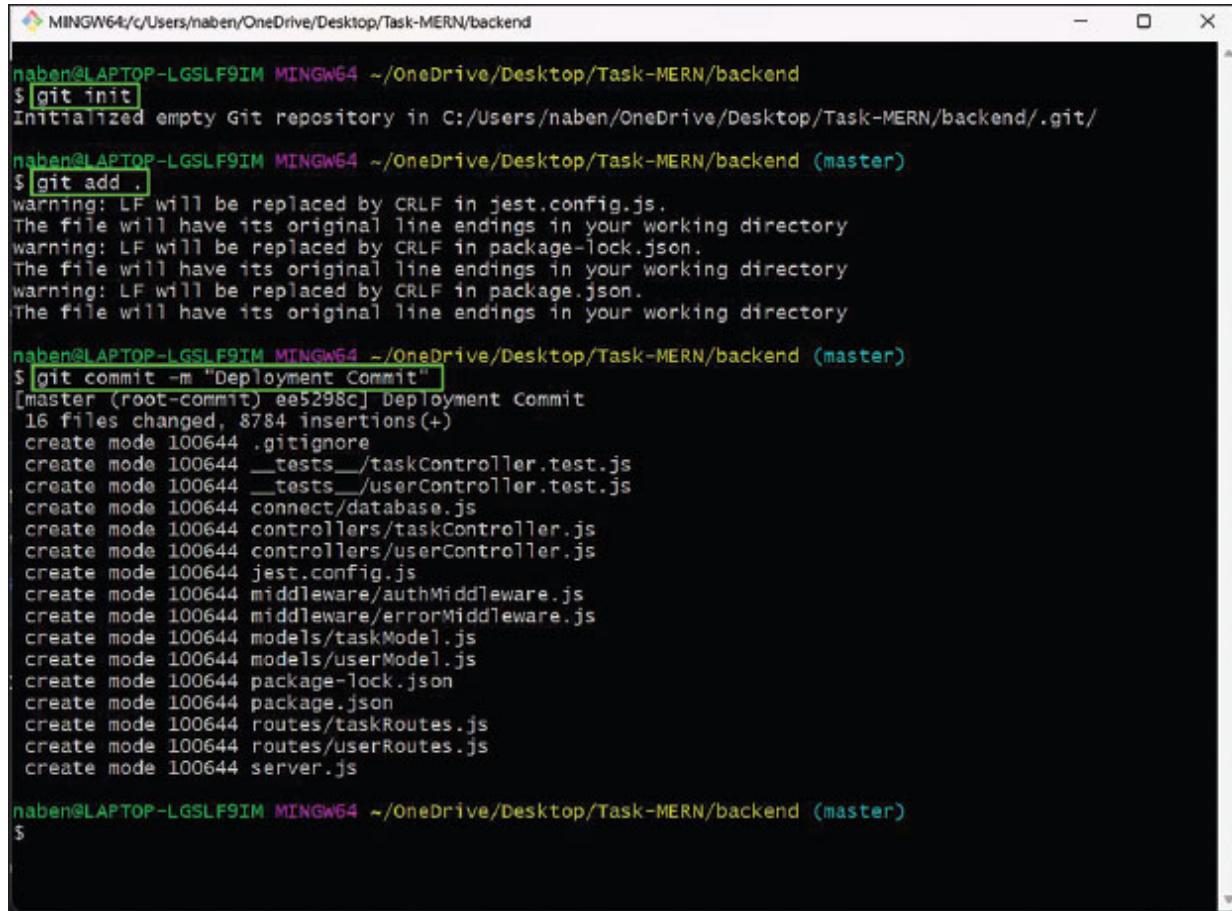


Figure 13.11: Backend repository commands

Again, we will enter the following three commands first. The first one is to initialize a Git repo, the second is to put the files in the staging area, and the third is to put the files in the commit area.

```
git init  
git add.  
git commit -m "Deployment commit"
```



```
MINGW64:/c/Users/naben/OneDrive/Desktop/Task-MERN/backend
naben@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/backend
$ git init
Initialized empty Git repository in C:/Users/naben/OneDrive/Desktop/Task-MERN/backend/.git/
naben@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/backend (master)
$ git add .
warning: LF will be replaced by CRLF in jest.config.js.
The file will have its original line endings in your working directory
warning: LF will be replaced by CRLF in package-lock.json.
The file will have its original line endings in your working directory
warning: LF will be replaced by CRLF in package.json.
The file will have its original line endings in your working directory
naben@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/backend (master)
$ git commit -m "Deployment Commit"
[master (root-commit) ee5298c] Deployment Commit
 16 files changed, 8784 insertions(+)
  create mode 100644 .gitignore
  create mode 100644 __tests__/taskController.test.js
  create mode 100644 __tests__/userController.test.js
  create mode 100644 connect/database.js
  create mode 100644 controllers/taskController.js
  create mode 100644 controllers/userController.js
  create mode 100644 jest.config.js
  create mode 100644 middleware/authMiddleware.js
  create mode 100644 middleware/errorMiddleware.js
  create mode 100644 models/taskModel.js
  create mode 100644 models/userModel.js
  create mode 100644 package-lock.json
  create mode 100644 package.json
  create mode 100644 routes/taskRoutes.js
  create mode 100644 routes/userRoutes.js
  create mode 100644 server.js

naben@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/backend (master)
$
```

Figure 13.12: git init, add and commit

The next three commands will be to create a branch, adding a remote path and pushing the code from the local computer to GitHub.

```
git branch -m main
git remote add origin https://github.com/nabendu82/task-mern-
backend.git
git push -u origin main
```

```

MINGW64:/c/Users/naben/OneDrive/Desktop/Task-MERN/backend
$ git branch -M main
naben@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/backend (main)
$ git remote add origin https://github.com/nabendu82/task-mern-backend.git
naben@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/backend (main)
$ git push -u origin main
Enumerating objects: 24, done.
Counting objects: 100% (24/24), done.
Delta compression using up to 12 threads
Compressing objects: 100% (22/22), done.
Writing objects: 100% (24/24), 90.21 KiB | 6.44 MiB/s, done.
Total 24 (delta 0), reused 0 (delta 0), pack-reused 0
To https://github.com/nabendu82/task-mern-backend.git
 * [new branch]      main -> main
Branch 'main' set up to track remote branch 'main' from 'origin'.

naben@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/backend (main)
$ |

```

Figure 13.13: Git push

Now, our backend code is also deployed successfully in GitHub.

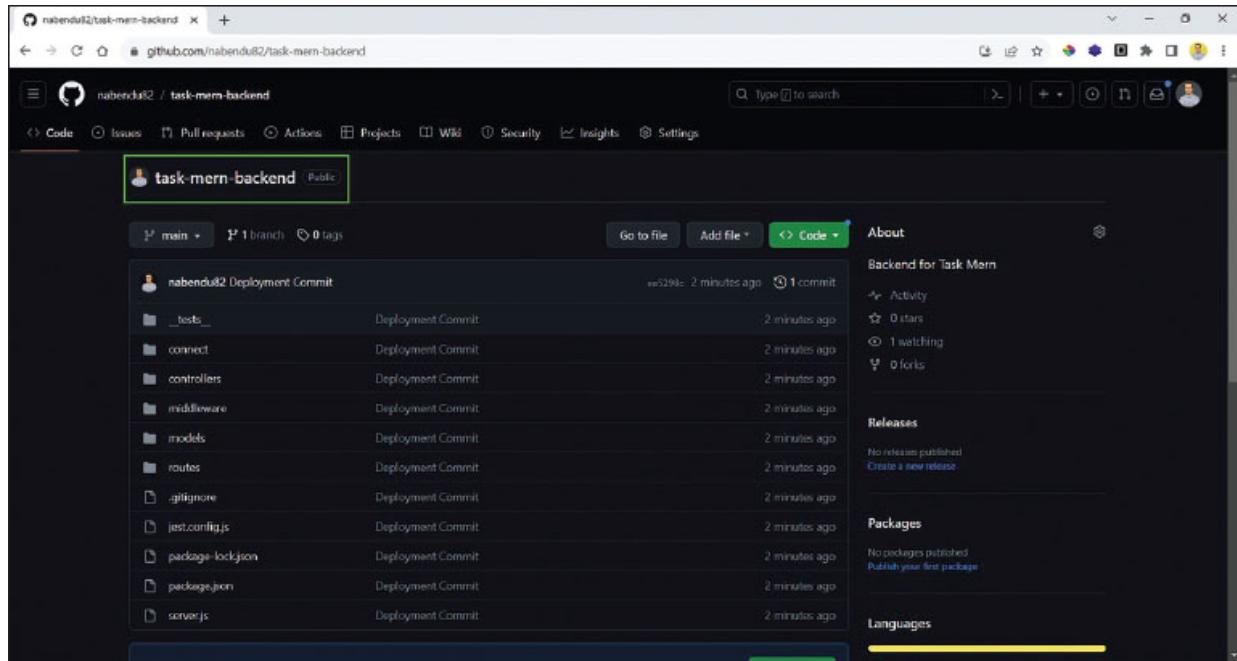


Figure 13.14: Backend repository

Backend deployment in Back4app

We will first deploy our backend code to an awesome free service called Back4app. So, first, head over to <https://www.back4app.com/> and sign up with Google.

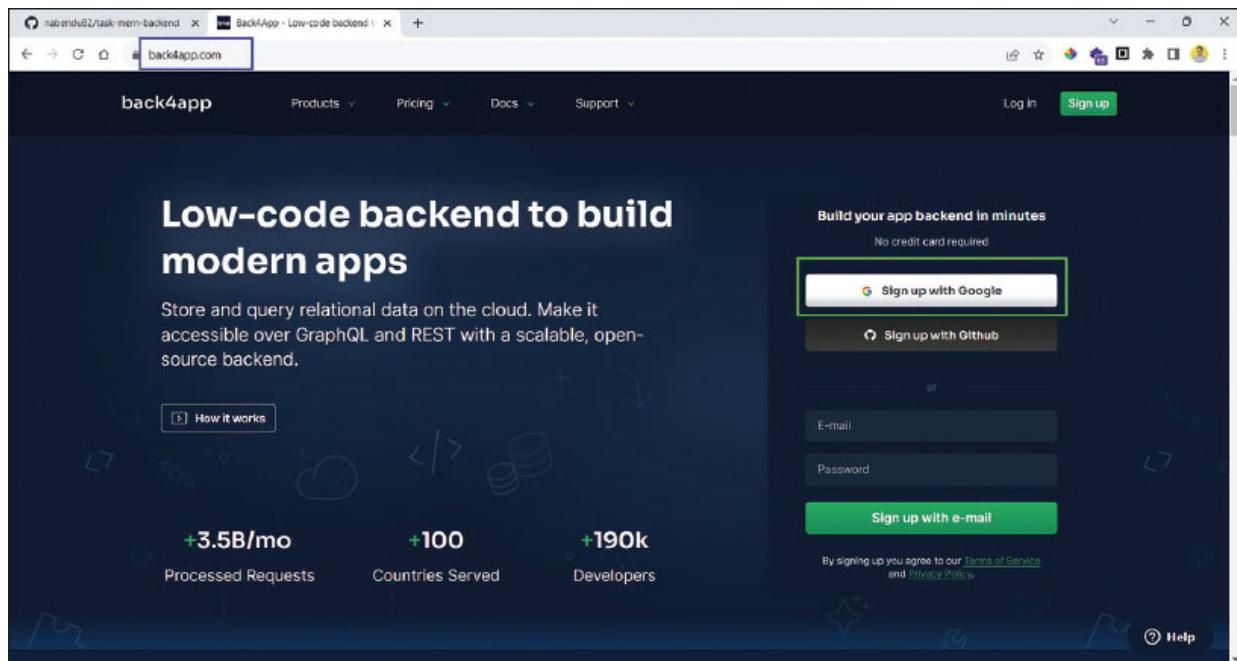


Figure 13.15: Back4app

Next, click on the **NEW APP** button in the top right corner.

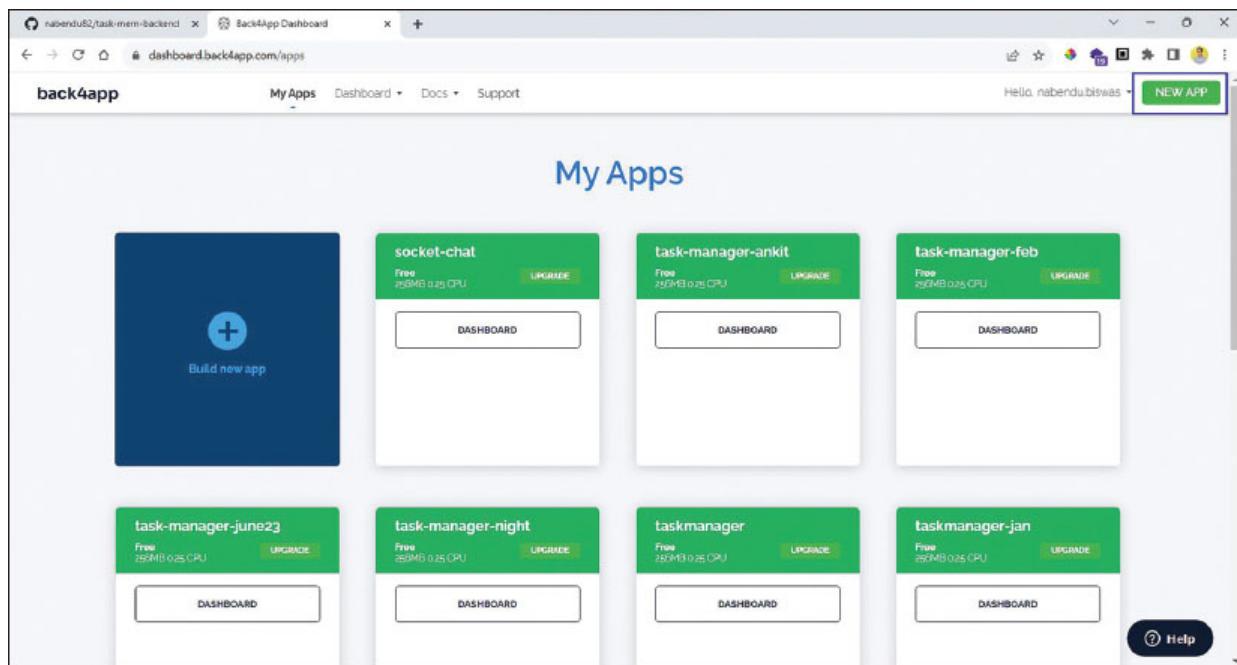


Figure 13.16: New app

In the next screen, click on **Containers as a Service** banner.

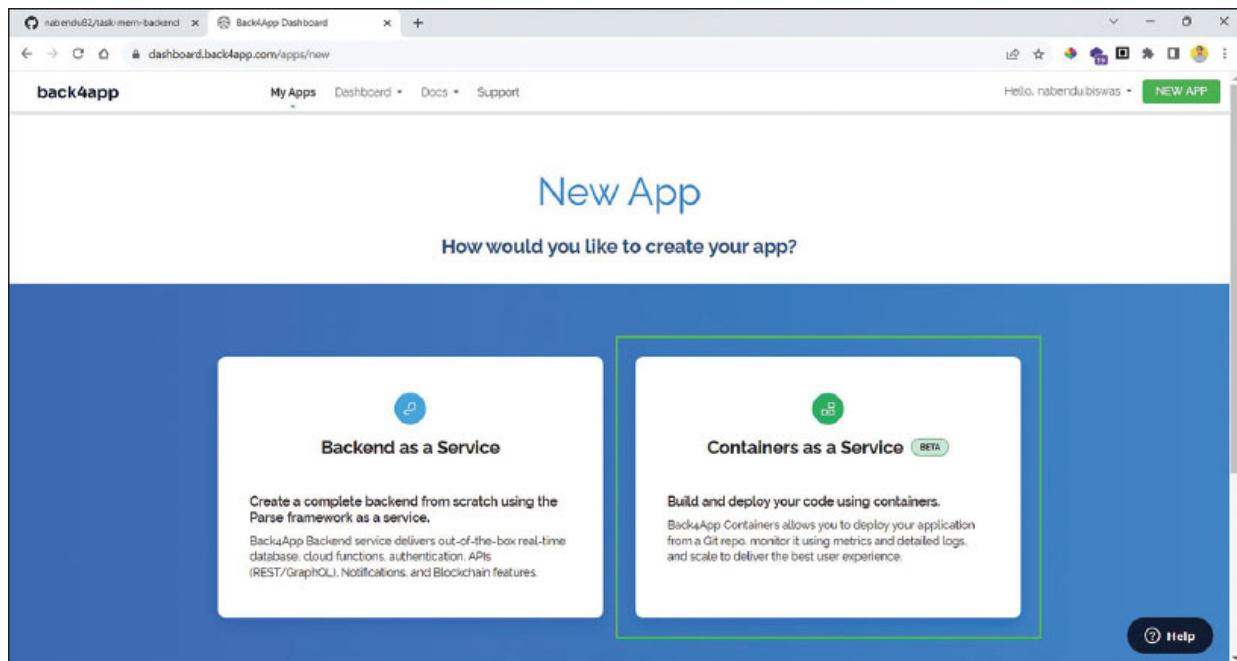


Figure 13.17: Containers as a Service

It will now ask us to select a Git repository containing our code.

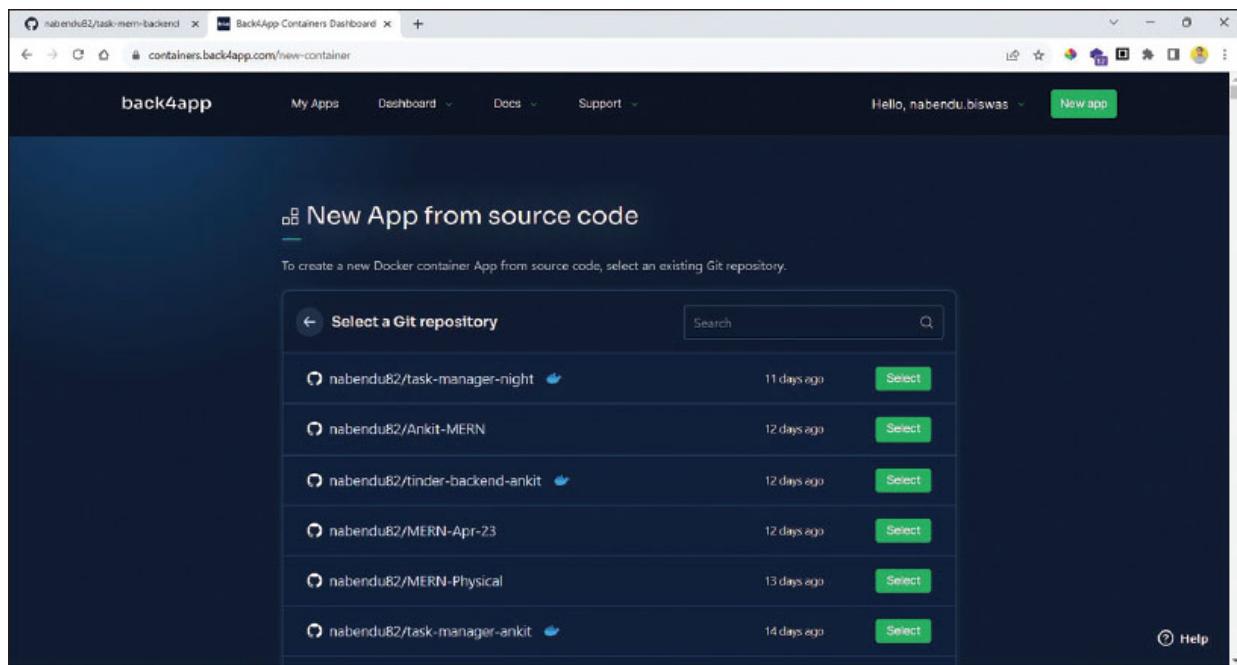


Figure 13.18: New repo addition

Now, we will search for our backend repository by typing task-mern. But since the permission is not given, we will not find it. Also, notice that a message of Dockerfile is mandatory is shown.

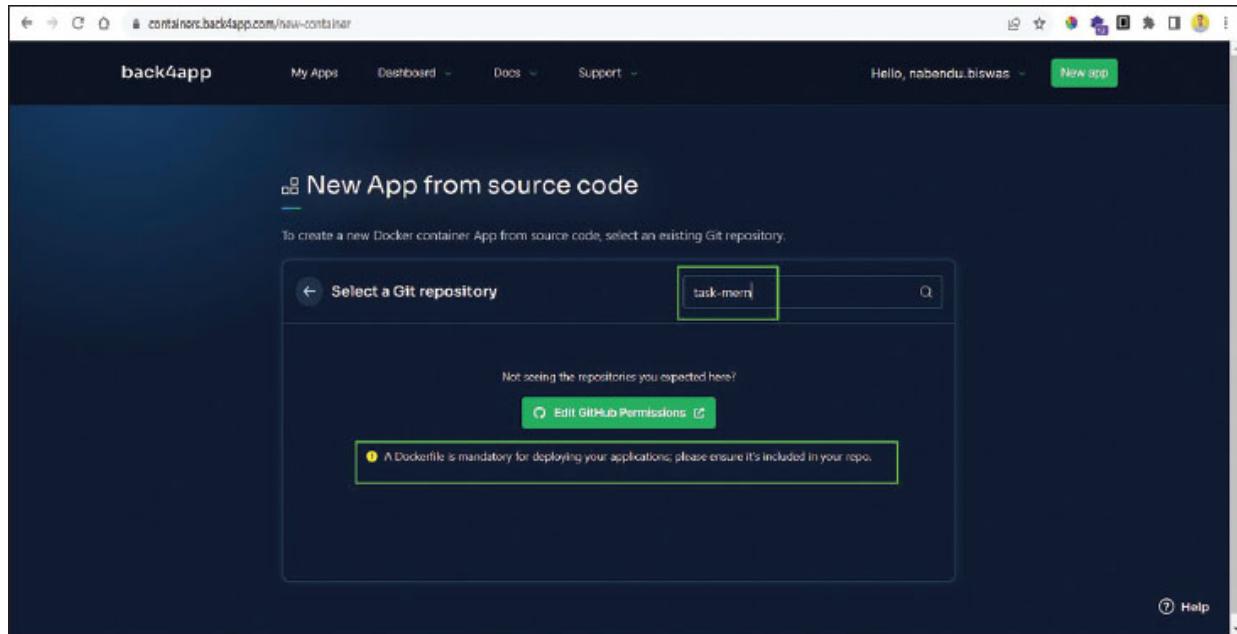


Figure 13.19: Searching for new repo

So, we need to first go back to our backend code and add a file **Dockerfile** in the root directory. Add the below content to it. Note that it should expose the correct port on which our backend code is running.

```
# Use the official Node.js image as the base image
FROM node:18

# Set the working directory in the container
WORKDIR /app

# Copy the application files into the working directory
COPY . /app

# Install the application dependencies
RUN npm install

EXPOSE 8000
# Define the entry point for the container
CMD ["npm", "start"]
```

The screenshot shows the Visual Studio Code interface with the title bar "Dockerfile - Task-MERN - Visual Studio Code". The left sidebar (EXPLORER) shows a project structure for "TASK-MERN" with a "backend" folder containing files like "_tests_", "connect", "controllers", "middleware", "models", "node_modules", "routes", ".env", ".gitignore", and "Dockerfile". The "Dockerfile" is selected and highlighted with a green border. The main editor area displays the Dockerfile content:

```
1 # Use the official Node.js image as the base image
2 FROM node:18
3
4 # Set the working directory in the container
5 WORKDIR /app
6
7 # Copy the application files into the working directory
8 COPY . /app
9
10 # Install the application dependencies
11 RUN npm install
12
13 EXPOSE 8000
14 # Define the entry point for the container
15 CMD ["npm", "start"]
```

The status bar at the bottom shows "Ln 15, Col 21" and other standard VS Code status indicators.

Figure 13.20: Adding Dockerfile

Since we have added a new file in our backend code, we need to push again this changed code to our GitHub repo. So, again we need to give the add, commit and push commands.

```
git add.  
git commit -m "Dockerfile added"  
git push
```

```

MINGW64:/c/Users/naben/OneDrive/Desktop/Task-MERN/backend
naben@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/backend (main)
$ git add .
naben@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/backend (main)
$ git commit -m "Dockerfile added"
[main 2e6e17c] Dockerfile added
 1 file changed, 15 insertions(+)
 create mode 100644 Dockerfile

naben@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/backend (main)
$ git push
Enumerating objects: 4, done.
Counting objects: 100% (4/4), done.
Delta compression using up to 12 threads
Compressing objects: 100% (3/3), done.
Writing objects: 100% (3/3), 492 bytes | 492.00 KiB/s, done.
Total 3 (delta 1), reused 0 (delta 0), pack-reused 0
remote: Resolving deltas: 100% (1/1), completed with 1 local object.
To https://github.com/nabendu82/task-mern-backend.git
  ee5298c..2e6e17c main -> main

naben@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/backend (main)
$
```

Figure 13.21: *git push*

Now, in GitHub for our backend code, we will find the **Dockerfile**.

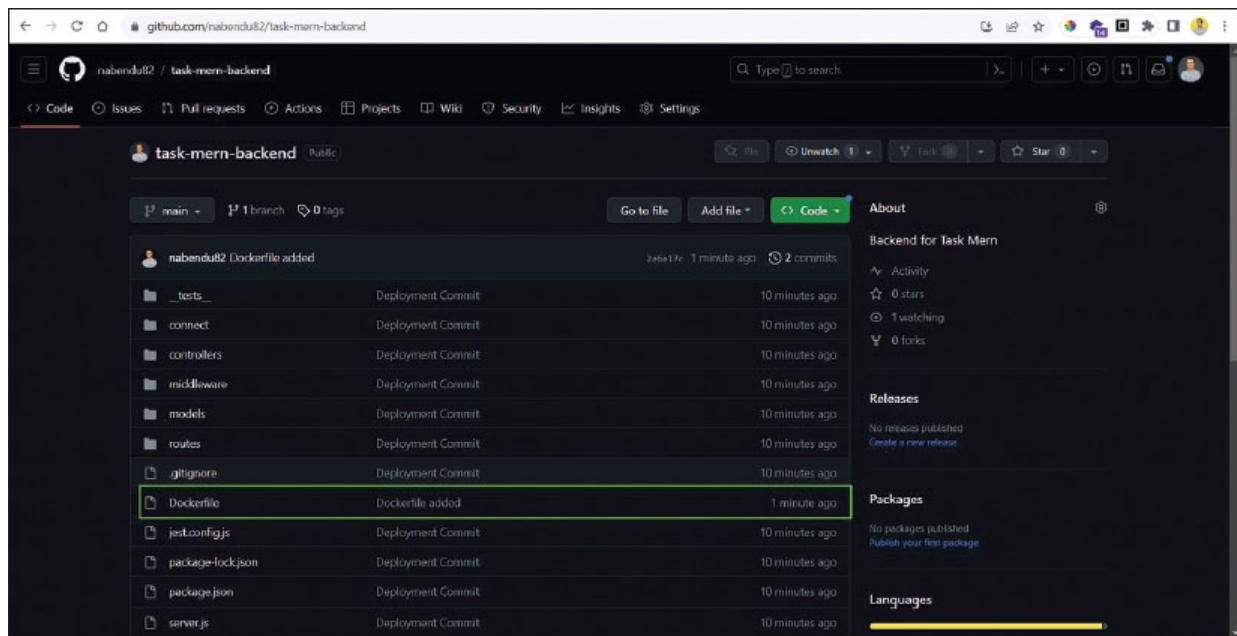


Figure 13.22: Dockerfile in GitHub

Back in Back4app, click on the **Edit GitHub Permissions** button.

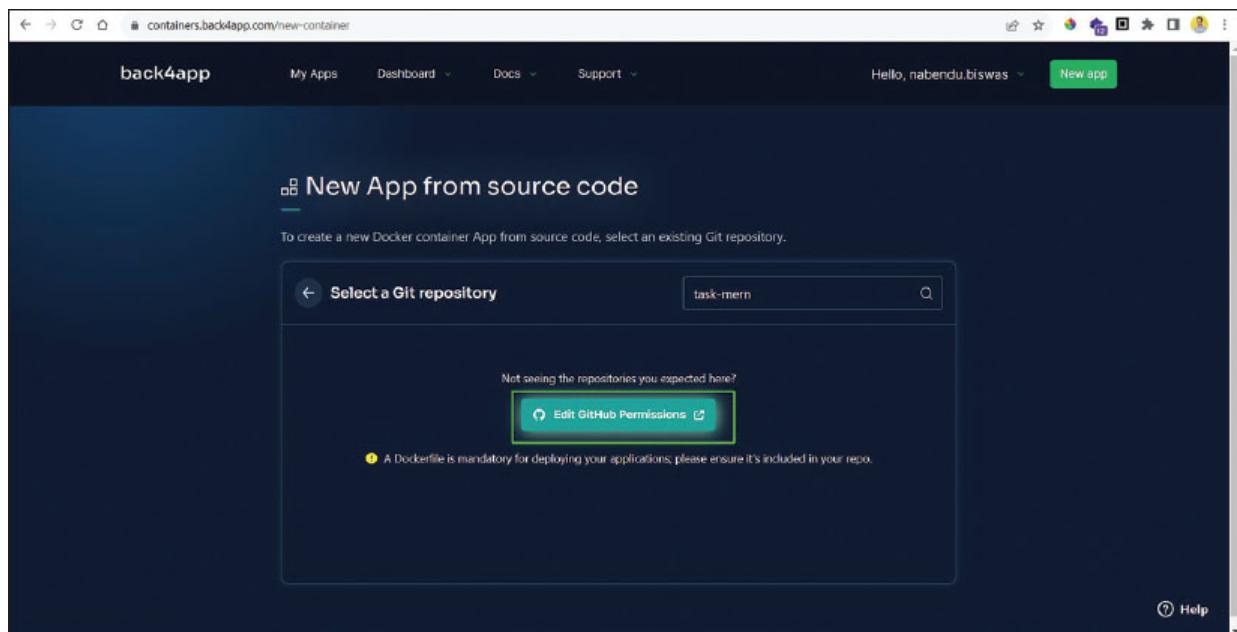


Figure 13.23: Adding backend code

We will get a pop-up in which we need to select the right account.

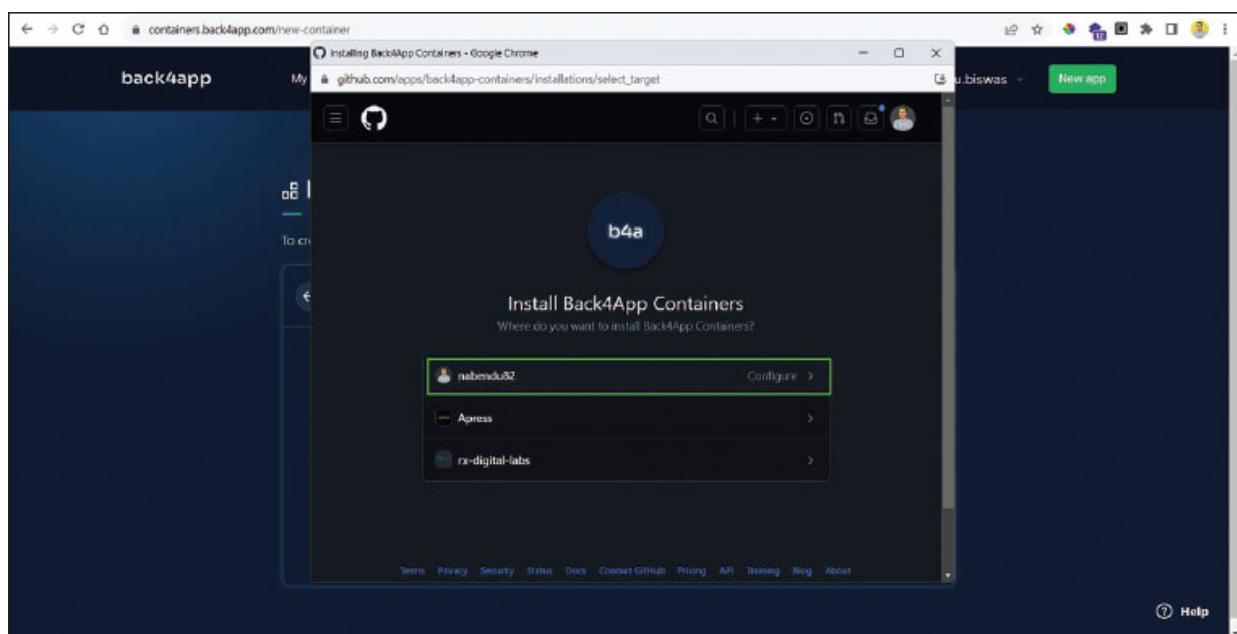


Figure 13.24: Selecting the GitHub account

In the next screen, we will select our backend repository of **task-mern-backend**.

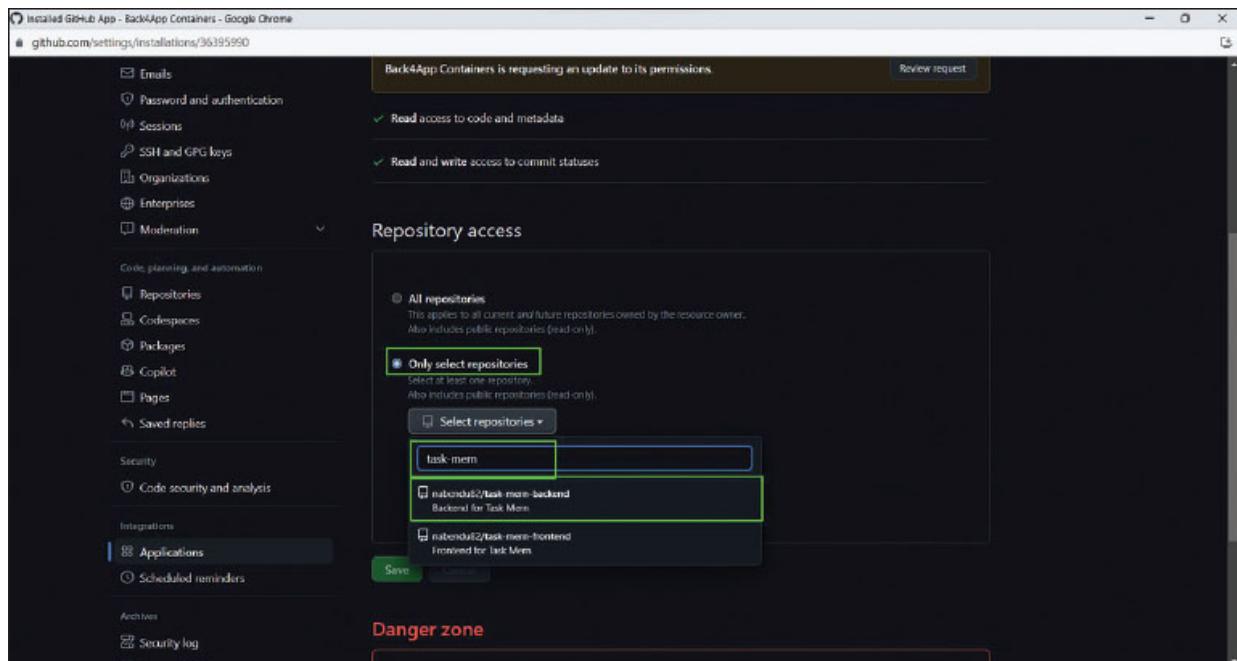


Figure 13.25: Adding backend repo

Next, click on the **save** button.

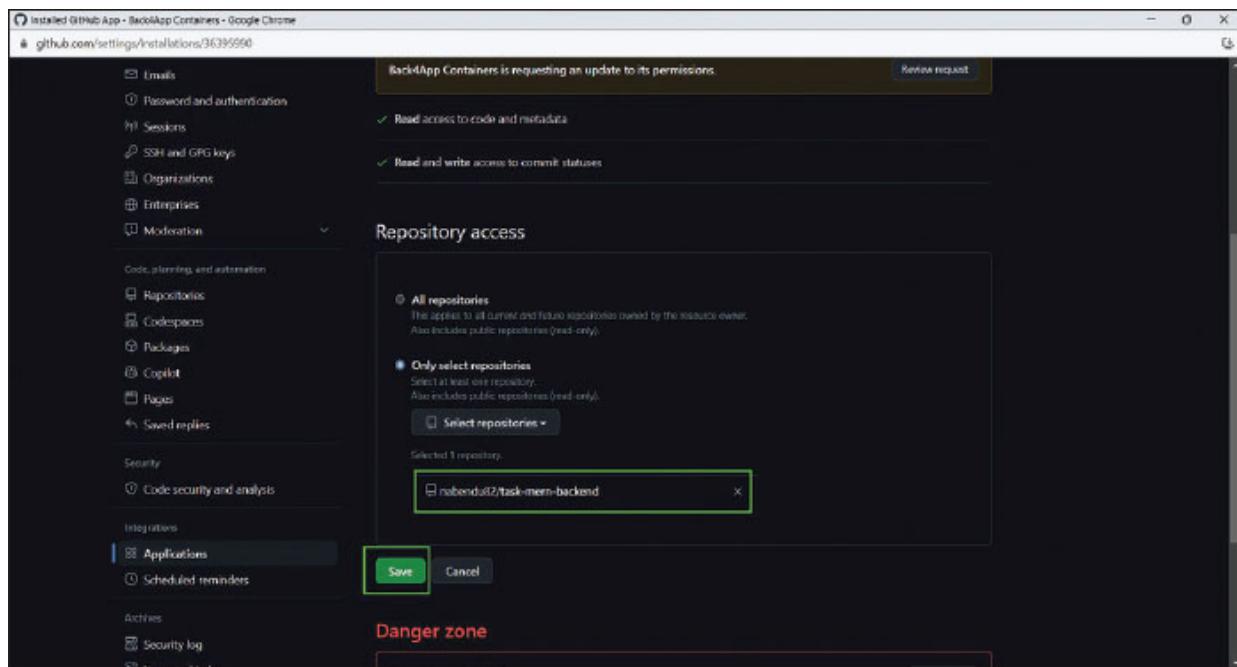


Figure 13.26: Saving backend repo

We will get back to Back4app and now we will see our repository. Here, click on the **select** button.

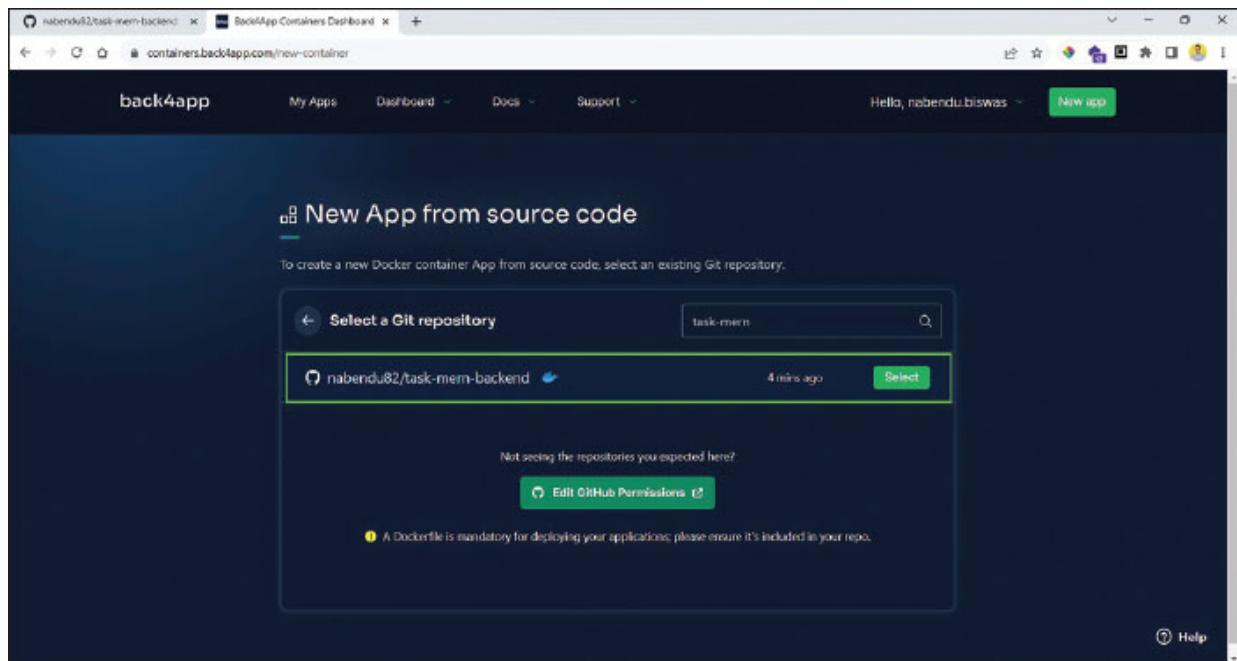


Figure 13.27: Selecting repo in Back4app

Since, our backend code also contains environment variables in the `.env` file, we need to give them in the next screen.

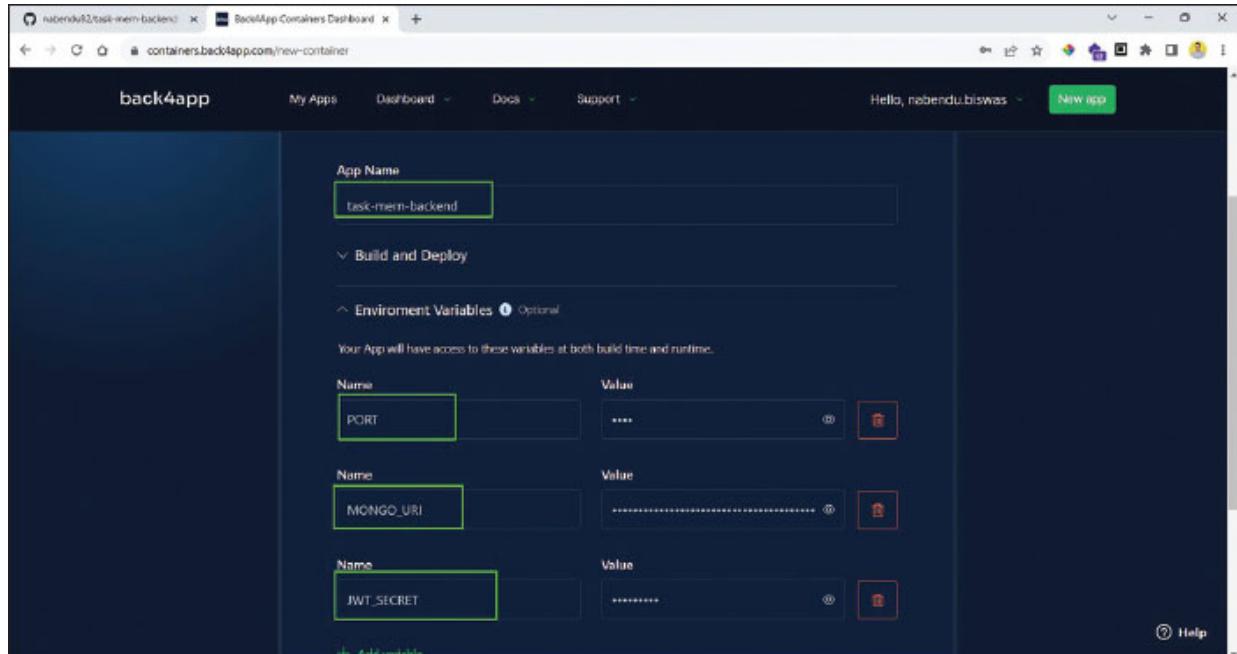


Figure 13.28: Adding environment variables

After that, scroll down and click on the `Create App` button.

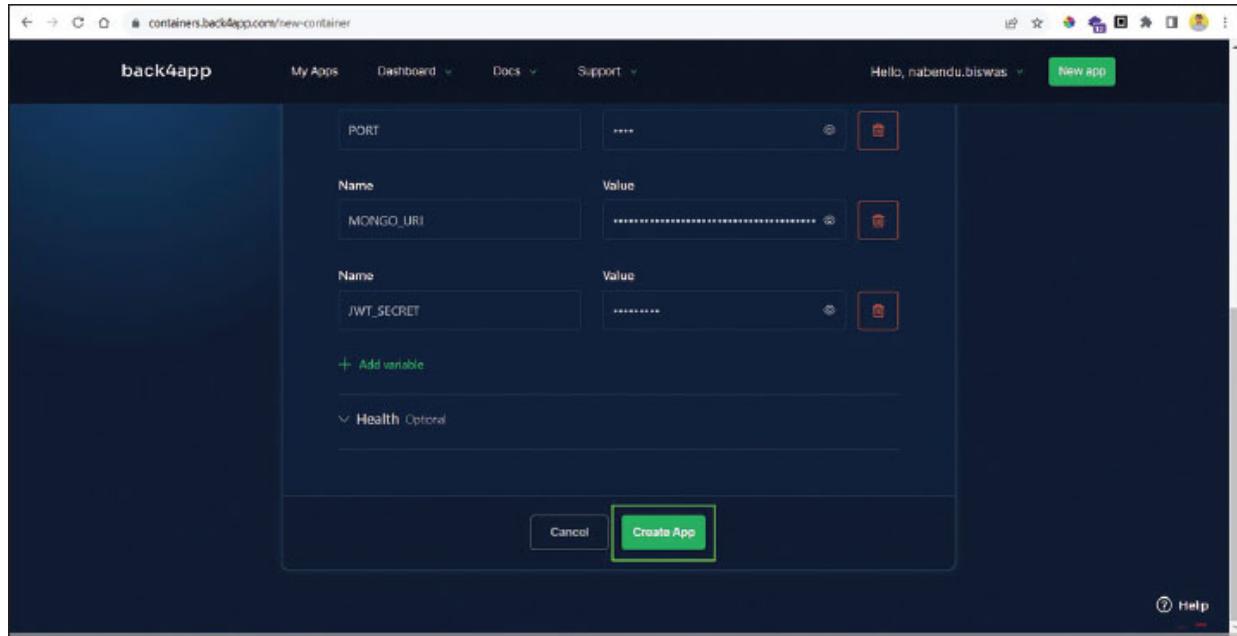


Figure 13.29: Create App

In the next screen, we will see all the logs when the deployment happens.

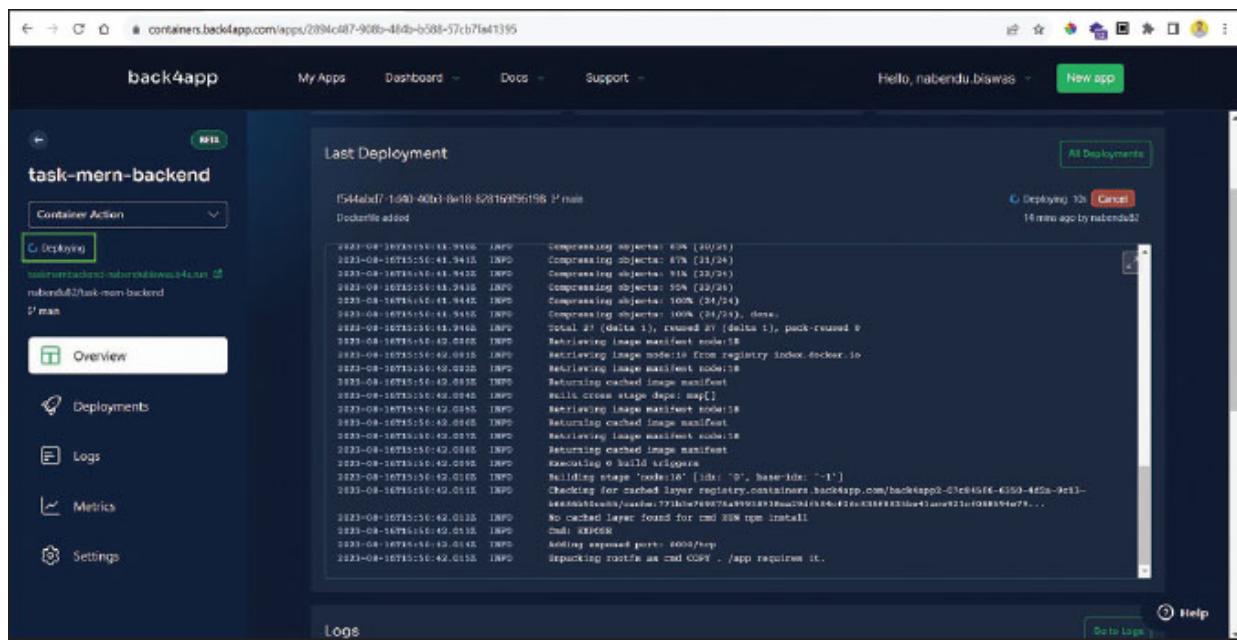


Figure 13.30: Deploying in Back4app

After some time, we will get the **DEPLOYMENT READY** message on the logs. We will also get the link to the deployment on the left side.

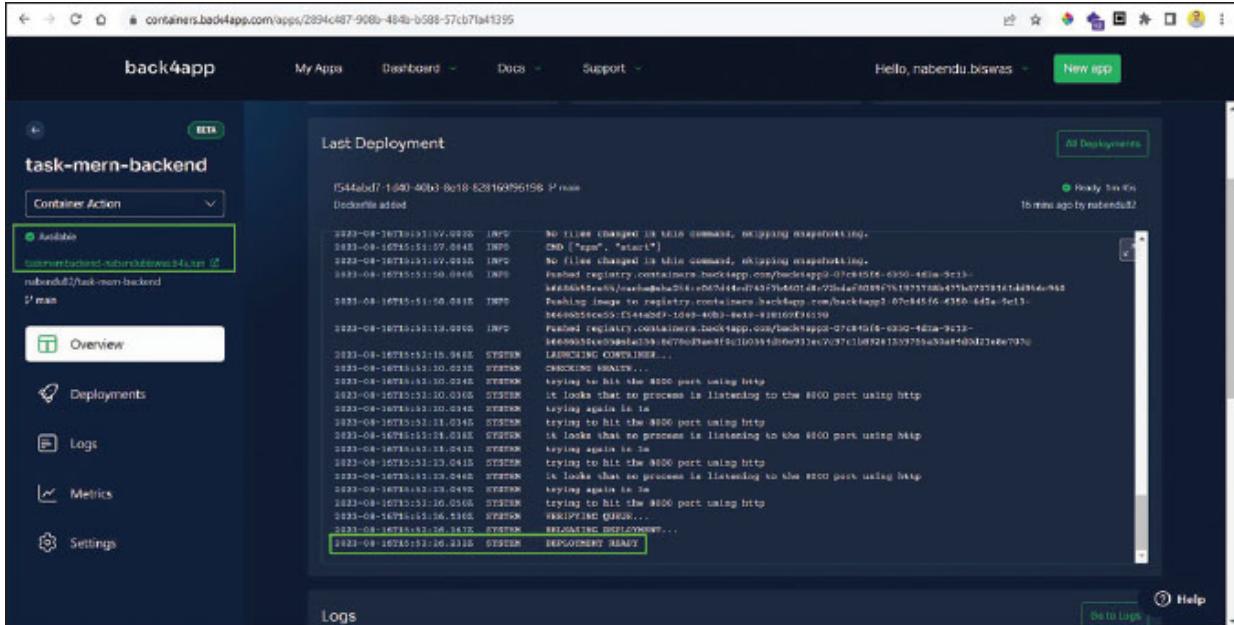


Figure 13.31: Deployment successful

Backend integration with frontend

We will now do the backend integration with the front end. But first, take the newly created backend endpoint and test the `Register User` route in Postman.

Here, we are able to use this route to create new users.

The screenshot shows the Postman application interface. At the top, there are tabs for Home, Workspaces, API Network, and Explore. A search bar says 'Search Postman' and an 'Upgrade' button is visible. Below the header, there are three requests listed: 'GET https://furniture-store...', 'GET https://furniture-store...', and 'POST Register User'. The 'Register User' request is selected. The 'Body' tab is active, showing a form-data structure with fields: 'name' (value: 'Robin'), 'email' (value: 'robin@gmail.com'), and 'password' (value: 'robin1234'). The 'Pretty' tab in the results section displays the JSON response:

```
1
2   "id": "64dcf31ab2d2b9f5a811bac1",
3   "name": "Robin",
4   "email": "robin@gmail.com",
5   "token": "eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJpZCI6Ijy92GMnRzFiyj3k#jg52jVh00ExYnFjMSIsImlihdC16HTYSHjIaMTc3N5nizXhrIjoxNjkyWjMczU1dQ.15gb-XMFxD4W8dc5YfuTXsE5AXza-5aRZOPNfcSb3Rc"
```

Figure 13.32: Register user in Postman

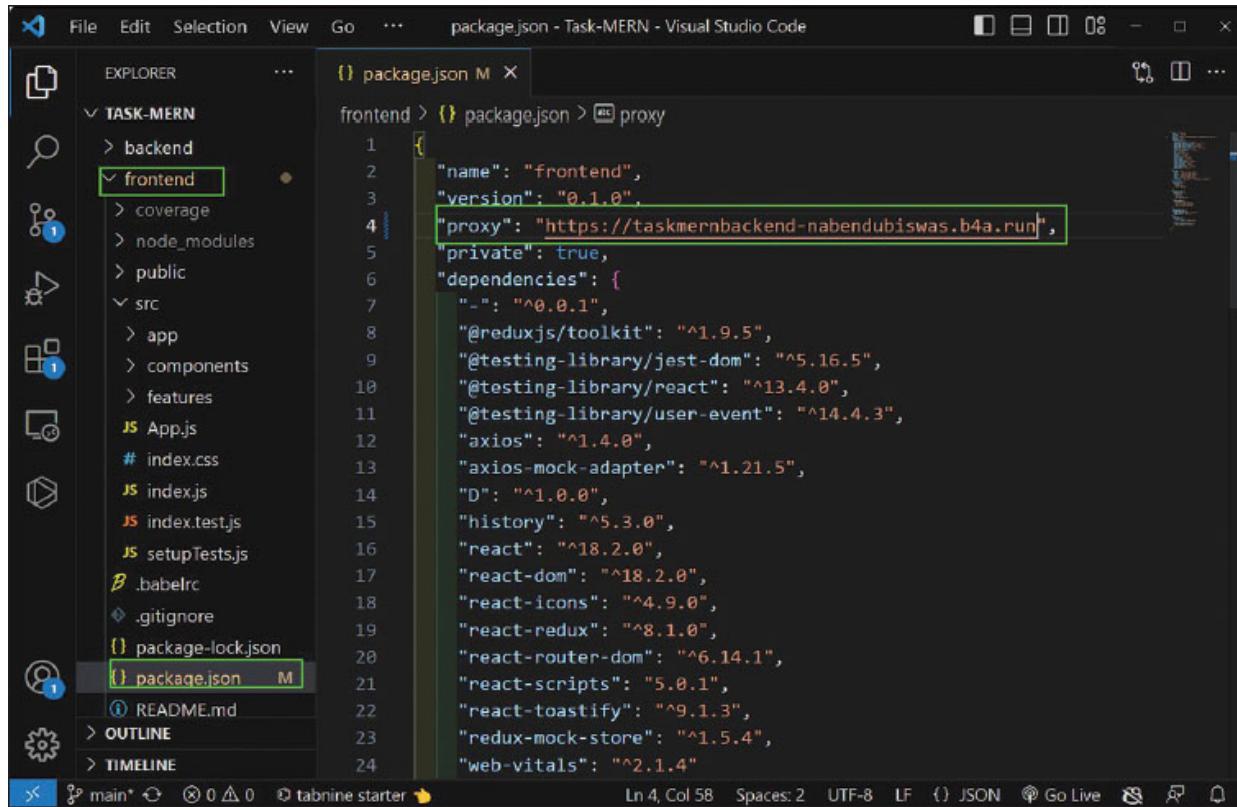
We are also able to log in with this newly created user in the login route.

The screenshot shows the Postman application interface. At the top, there are tabs for 'Home', 'Workspaces', 'API Network', and 'Explore'. A search bar says 'Search Postman' and an 'Upgrade' button is visible. Below the header, a list of requests includes 'POST Register User' and 'POST Login User'. The 'Login User' request is selected. The 'Body' tab is active, showing a POST request to 'https://taskmembackend-nabendubiswas.b4a.run/api/users/login'. The 'Body' type is set to 'x-www-form-urlencoded'. Two parameters are defined: 'email' with value 'robin@gmail.com' and 'password' with value 'robin12345'. The response status is 'Status: 200 OK' with a time of '1078 ms' and a size of '668 B'. The response body is displayed in JSON format:

```
1 "id": "64dcf110b20289f5a$11bacl",
2 "name": "Robin",
3 "email": "robin@gmail.com",
4 "token": "eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJpZCI6IjYjY0ZGNmZlYjMjg5ZjVhODExYmFjMSIsImhdCI6MTY0MjIwNTg0MCwiZXhwIjoxNjkyNjM2ODQwfQ.CVGaTR0gQAbnE8bzYebJLs9s_sNs]2-EOCZuGe9xQTL"
```

Figure 13.33: Login user in Postman

Now, in the **package.json** file in proxy, we will change the earlier localhost route with this backend route. Again, don't give / at the end.



```
File Edit Selection View Go ... package.json - Task-MERN - Visual Studio Code
EXPLORER TASK-MERN
frontend > package.json > proxy
1  {
2    "name": "frontend",
3    "version": "0.1.0",
4    "proxy": "https://taskmernbackend-nabendubiswas.b4a.run",
5    "private": true,
6    "dependencies": {
7      "-": "^0.0.1",
8      "@reduxjs/toolkit": "^1.9.5",
9      "@testing-library/jest-dom": "^5.16.5",
10     "@testing-library/react": "^13.4.0",
11     "@testing-library/user-event": "^14.4.3",
12     "axios": "^1.4.0",
13     "axios-mock-adapter": "^1.21.5",
14     "D": "^1.0.0",
15     "history": "^5.3.0",
16     "react": "^18.2.0",
17     "react-dom": "^18.2.0",
18     "react-icons": "^4.9.0",
19     "react-redux": "^8.1.0",
20     "react-router-dom": "^6.14.1",
21     "react-scripts": "5.0.1",
22     "react-toastify": "^9.1.3",
23     "redux-mock-store": "^1.5.4",
24     "web-vitals": "^2.1.4"
}
Ln 4, Col 58 Spaces: 2 UTF-8 LF {} JSON ⚡ Go Live ⚡ ⚡ ⚡
```

Figure 13.34: Proxy in package.json

Now in `http://localhost:3000/`, we will log in with the newly created user and it will work properly.

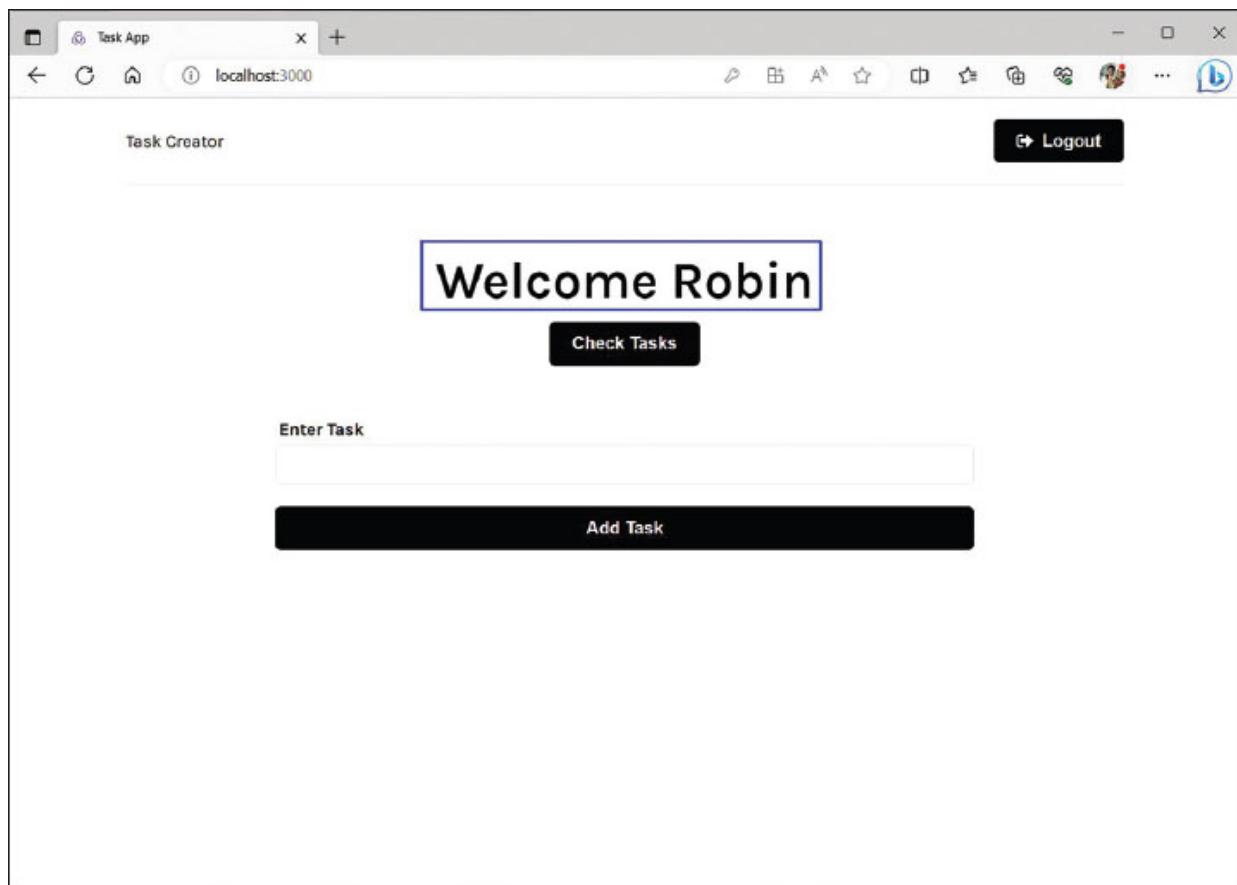


Figure 13.35: Login to frontend

Since we have made changes in the frontend code, we will stage, commit, and push this code to GitHub.

```
git add.  
git commit -m "Backend integrated"  
git push
```

```
MINGW64:/c/Users/naben/OneDrive/Desktop/Task-MERN/frontend
naben@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/frontend (main)
$ git add .
warning: LF will be replaced by CRLF in package-lock.json.
The file will have its original line endings in your working directory
warning: LF will be replaced by CRLF in package.json.
The file will have its original line endings in your working directory

naben@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/frontend (main)
$ git commit -m "Backend integrated"
[main 82cbf22] Backend integrated
 1 file changed, 1 insertion(+), 1 deletion(-)

naben@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/frontend (main)
$ git push
Enumerating objects: 5, done.
Counting objects: 100% (5/5), done.
Delta compression using up to 12 threads
Compressing objects: 100% (3/3), done.
Writing objects: 100% (3/3), 337 bytes | 337.00 KiB/s, done.
Total 3 (delta 0), reused 0 (delta 0), pack-reused 0
remote: Resolving deltas: 100% (2/2), completed with 2 local objects.
To https://github.com/nabendu82/task-mern-frontend.git
 b1d4626..82cbf22 main -> main

naben@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/frontend (main)
$
```

Figure 13.36: *git push*

Frontend deployment in Netlify

We will now deploy our project in Netlify. So, open Netlify at <https://www.netlify.com/> and click on the **sign up** button, if you don't have an account.

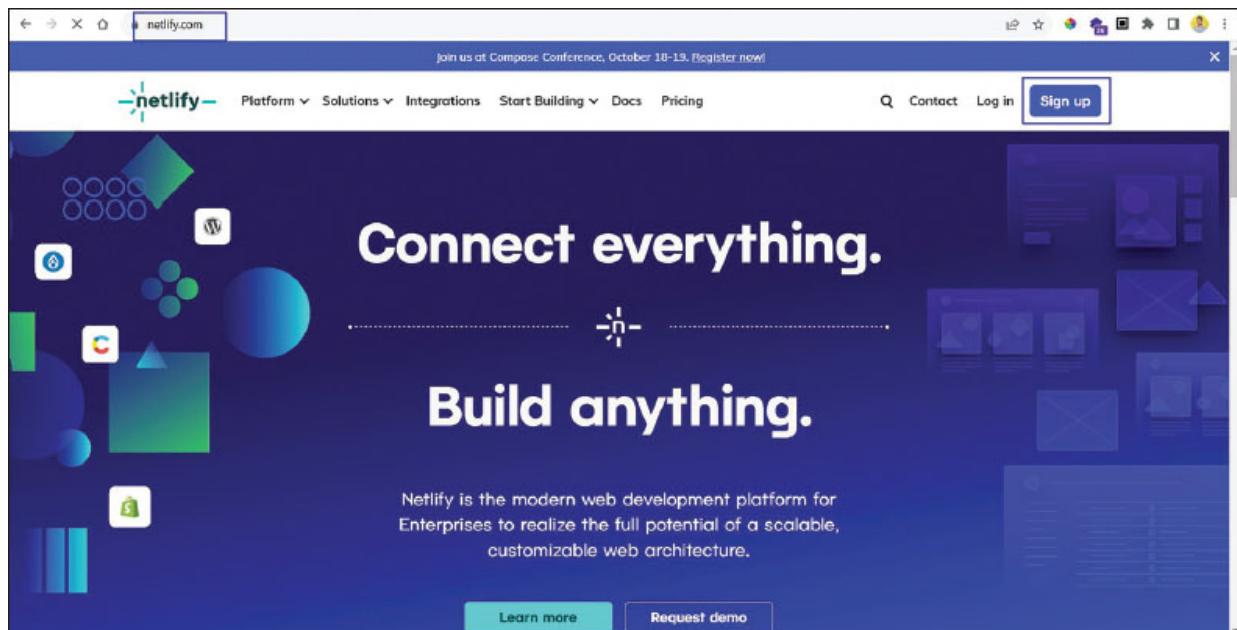


Figure 13.37: *Netlify*

Netlify requires you to Sign up or log in with any Git cloud account like GitHub Gitlab and Bitbucket. **Login with GitHub**, since our code is in GitHub.

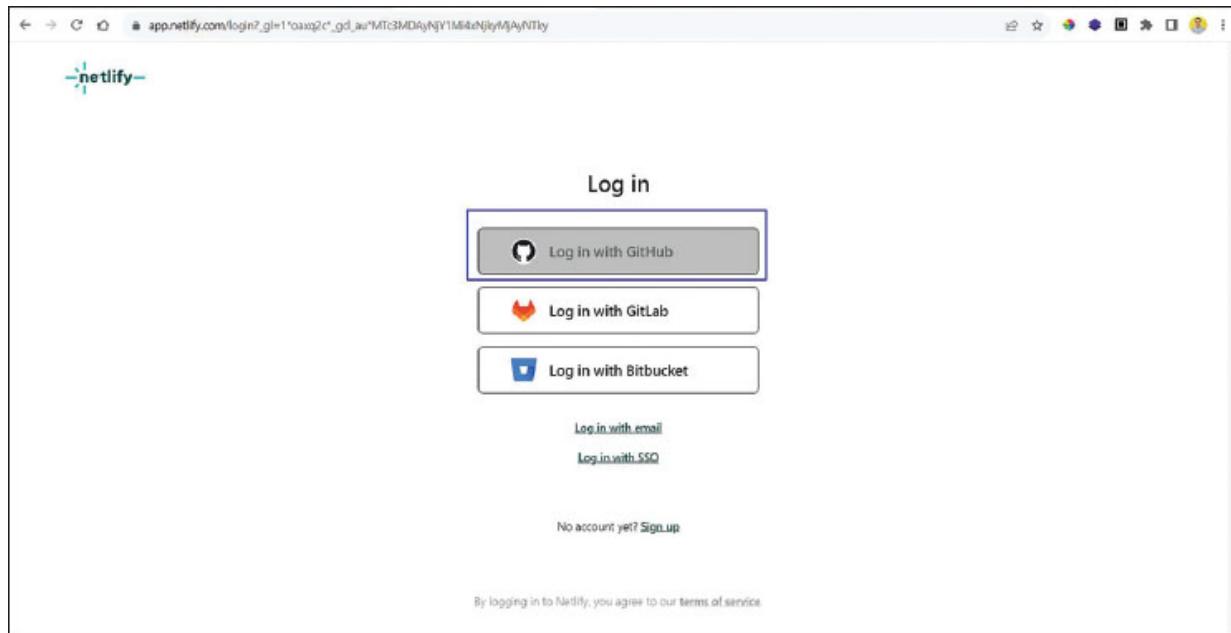


Figure 13.38: Netlify login

Since we have a lot of deployed projects, it will show all the sites. If you don't have any, it will show blank.

A screenshot of the Netlify dashboard for the team 'Nabendu's team'. The URL in the address bar is app.netlify.com/teams/nabendu82/overview. The left sidebar shows navigation options: Team overview (selected), Sites, Builds, Integrations, Domains, Members, Audit log, Billing, and Team settings. A 'Upgrade' button is at the bottom. The main area shows 'Nabendu's team Starter' usage statistics: Bandwidth (262 MB/100 GB), Build minutes (0/300), Concurrent builds (0/1), and Team members (1). A purple 'N' logo is displayed. Below this, there's a note about importing environment variables. The 'Sites' section lists two sites: 'thewebdev.tech' (Deployed from GitHub) and 'amazinghampi.com' (Deployed from GitHub). The 'Builds' section lists three failed builds: 'restaurant-bangalore', 'recipes-homemade', and 'ccg-gatsby', each with a Deploy Preview link.

Figure 13.39: Netlify dashboard

Now, click on **Sites** first and then the **Add new site** button on the top-right. Here, from the drop-down menu, click on **Import an existing project**.

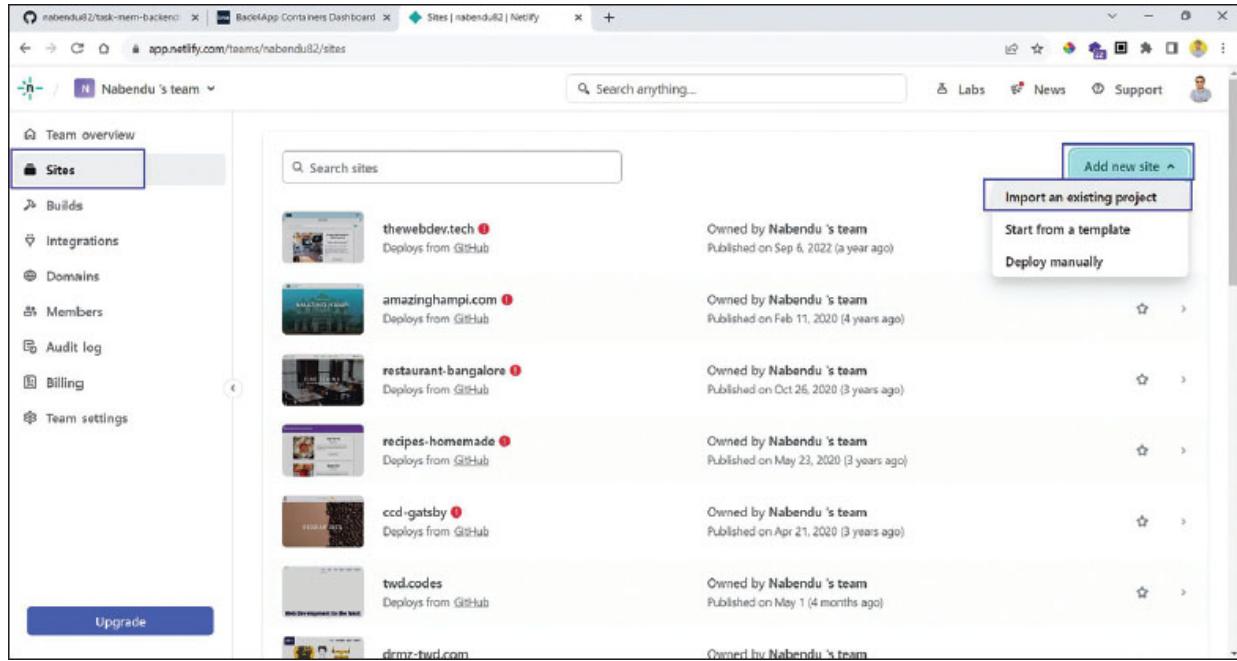


Figure 13.40: Import existing project

In the next screen click on **Deploy with GitHub** button.

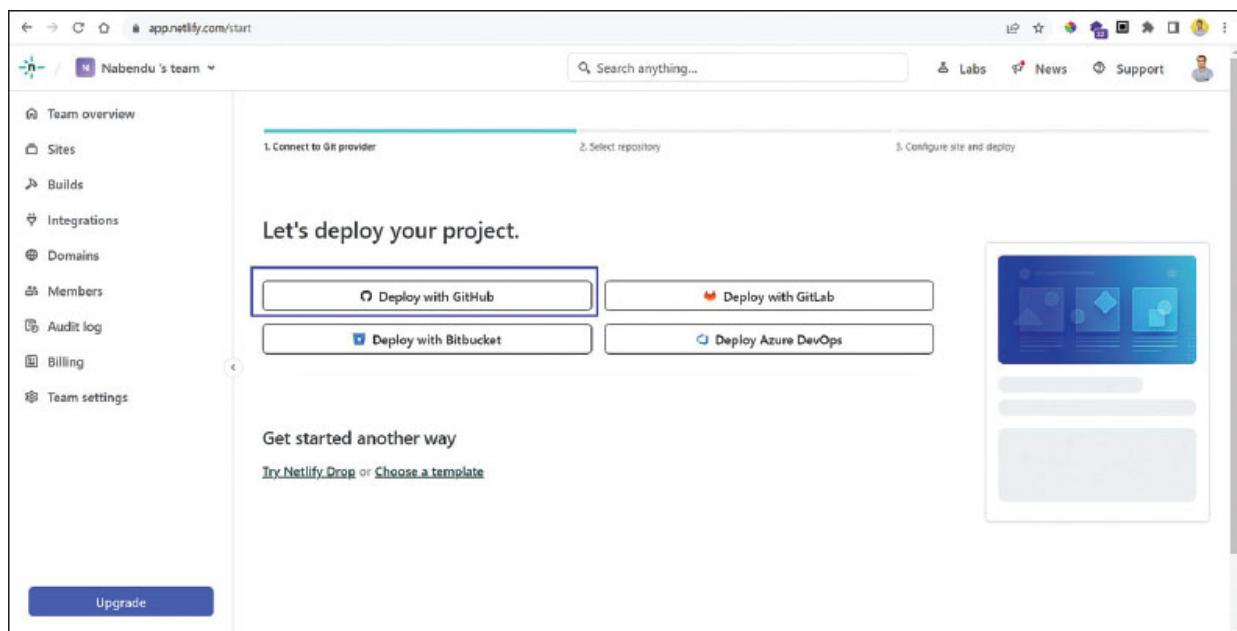


Figure 13.41: Deploy with GitHub

Now, in the GitHub access screen, we will select the `task-mern-frontend` after clicking on the **only select repository**.

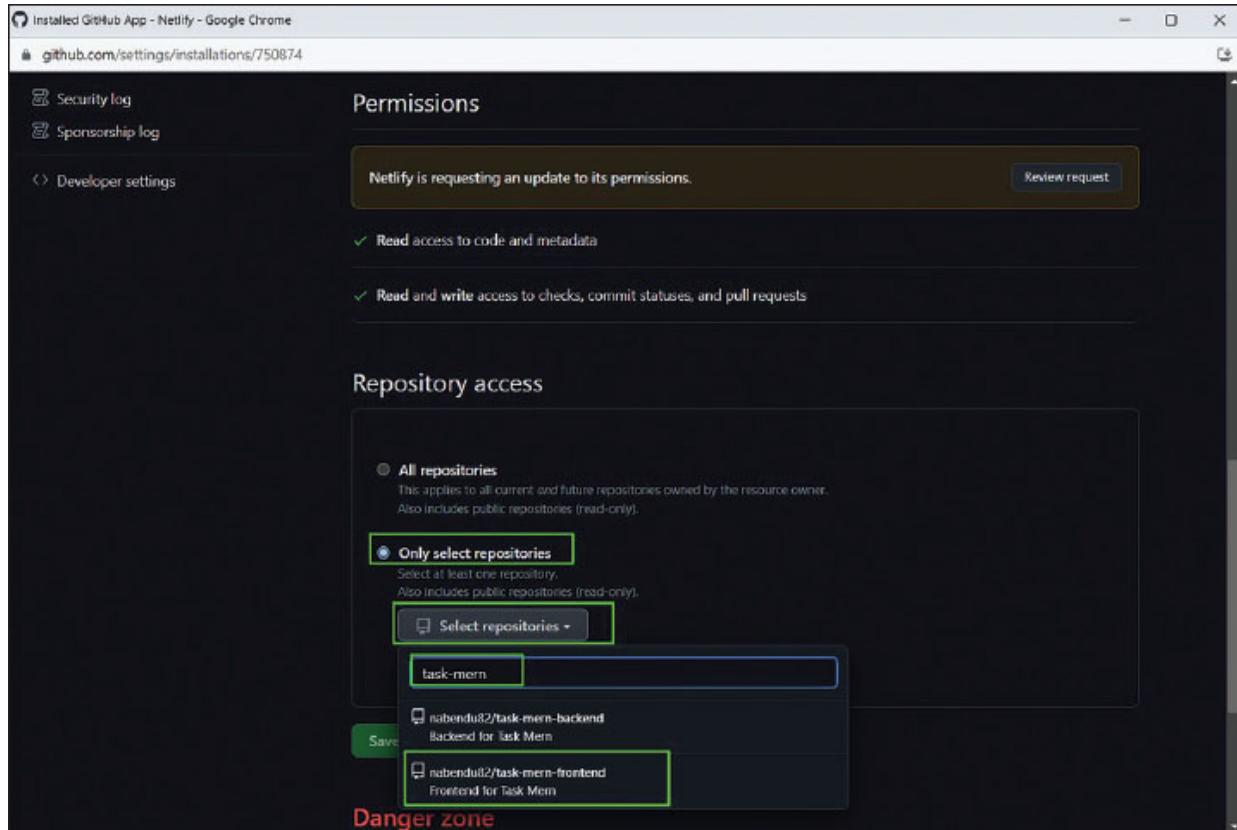


Figure 13.42: Selecting in GitHub

After selecting the repository, click on the **Save** button.

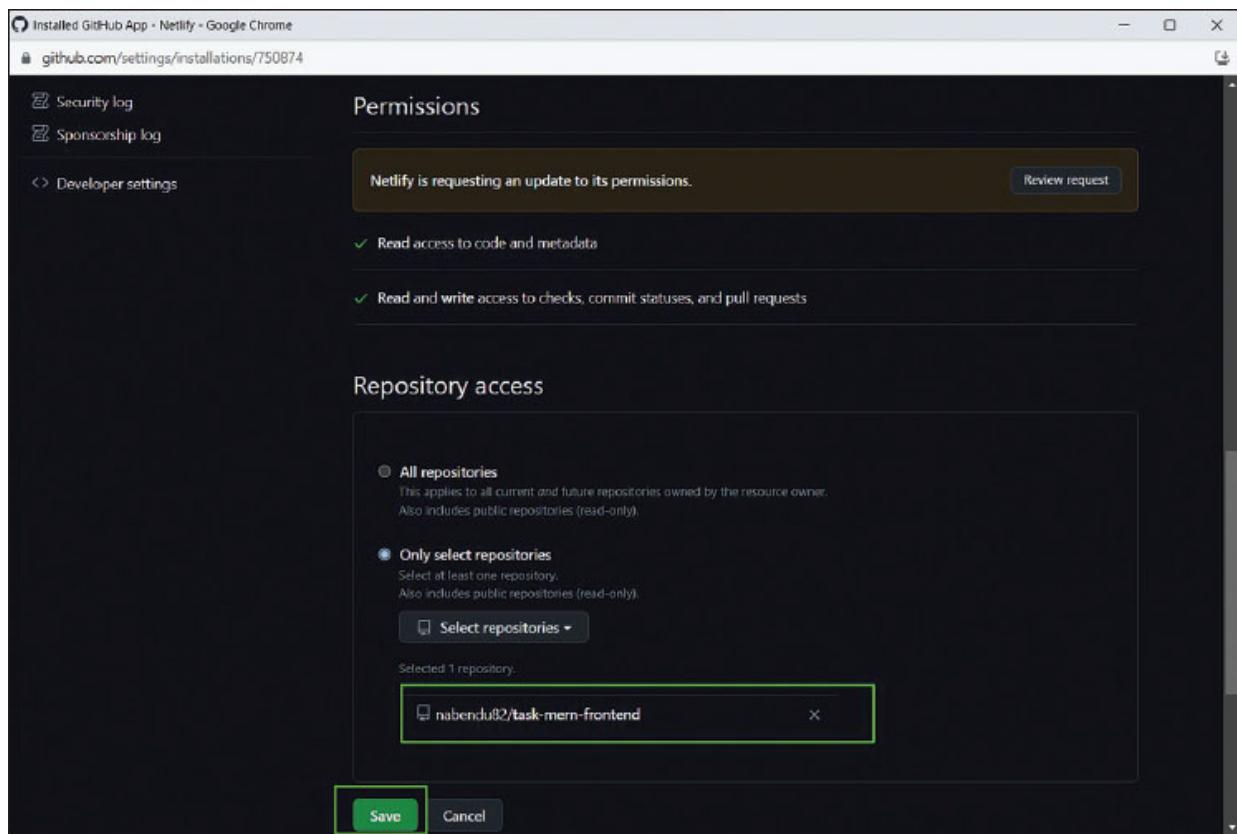


Figure 13.43: Access in GitHub

Again, it will ask the permission to install the repository. Click on the **Install** button next.

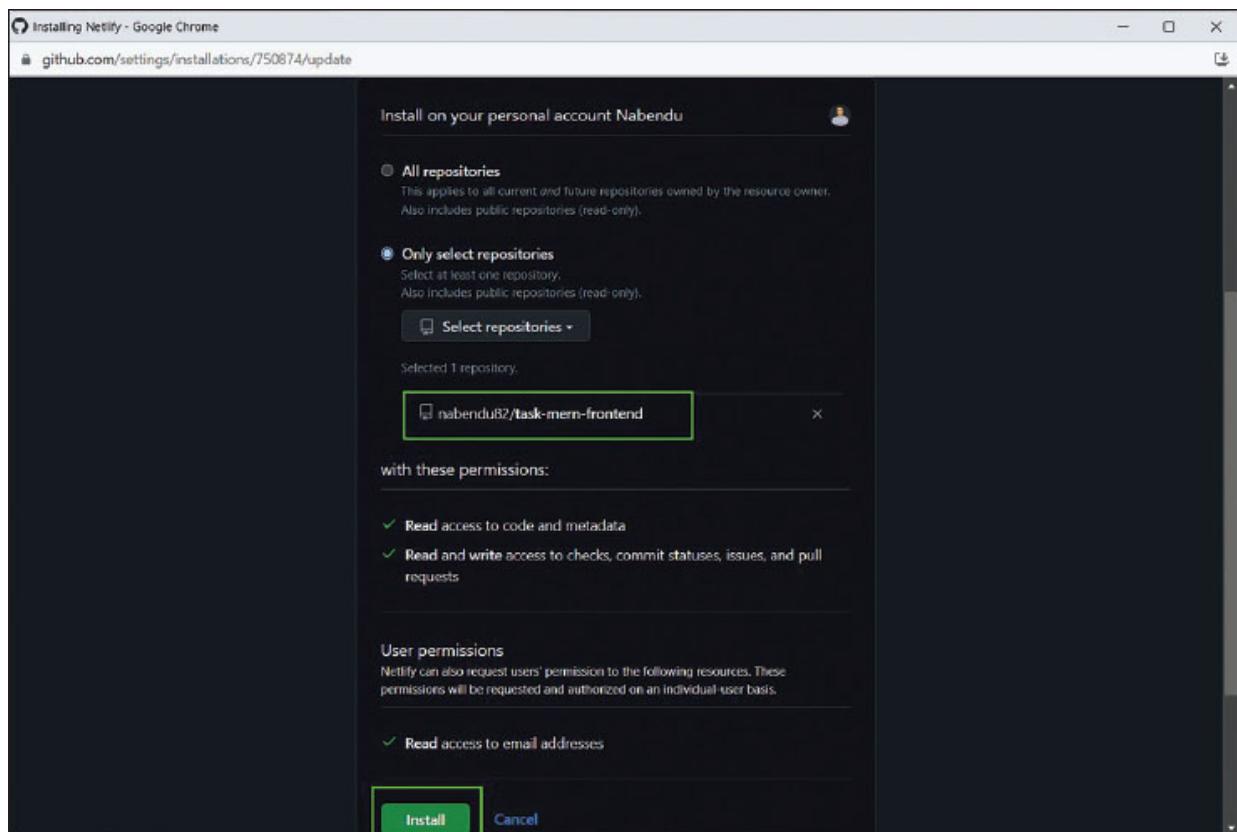


Figure 13.44: Install in GitHub

We will now get back to the Netlify screen. Here, we will now see the new repository. Click on the new repository.

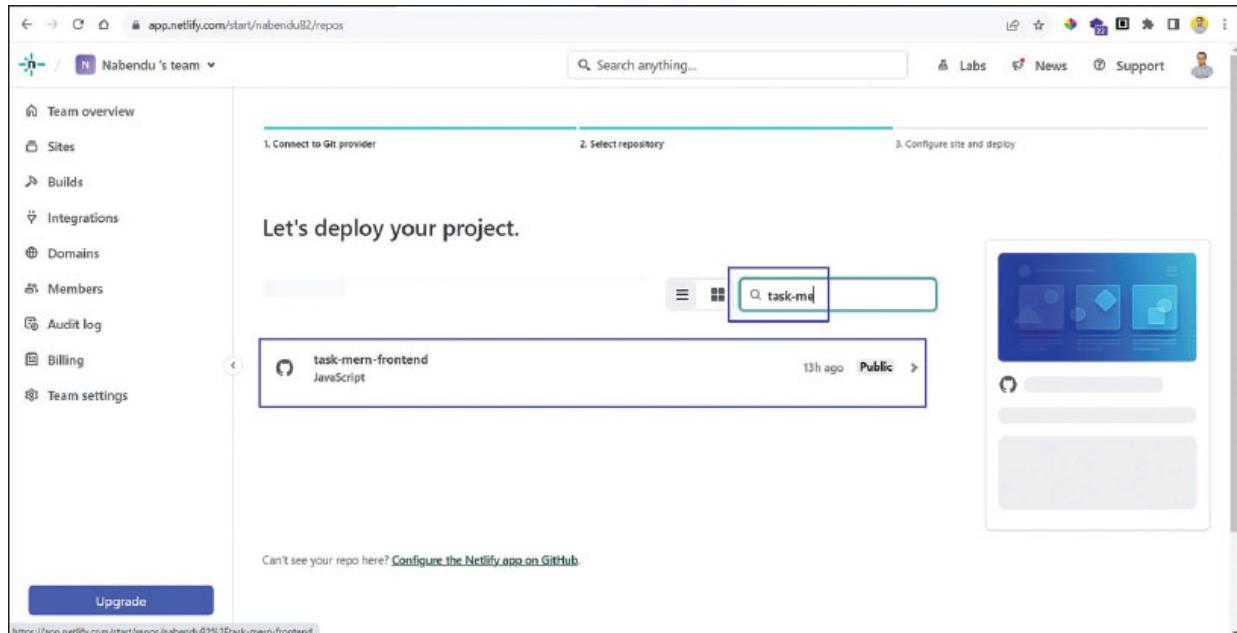


Figure 13.45: Selecting GitHub in Netlify

In the next screen, we will see the branch for deploying the project. Here, make sure it's the main branch.

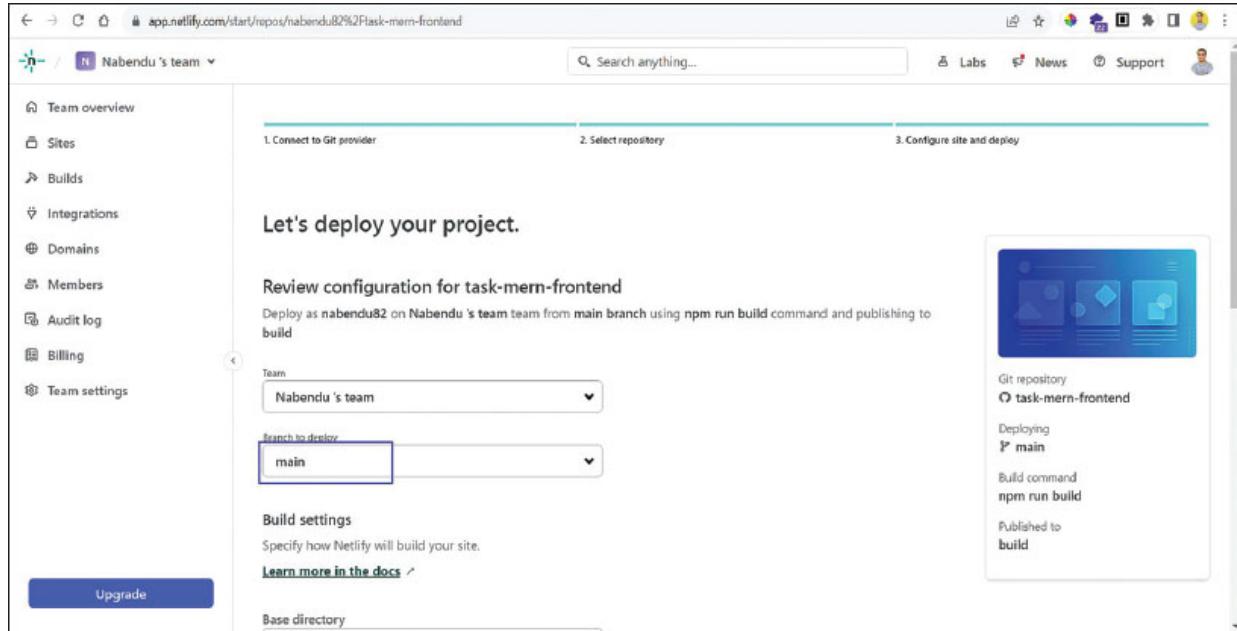


Figure 13.46: Branch of GitHub

On scrolling down on the same screen we will find the Build command and the publish directory. Both of them are right, so click on the **Deploy task-mean-frontend** button.

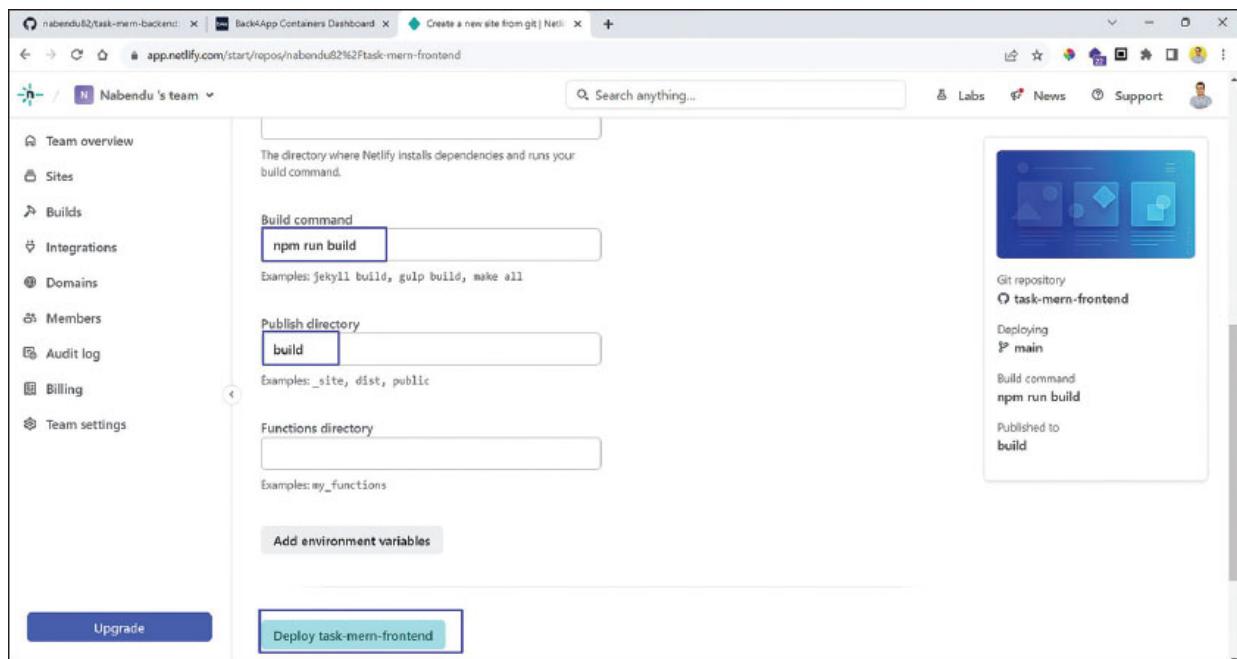


Figure 13.47: Built commands

In the next screen, we will see the site deploy in progress.

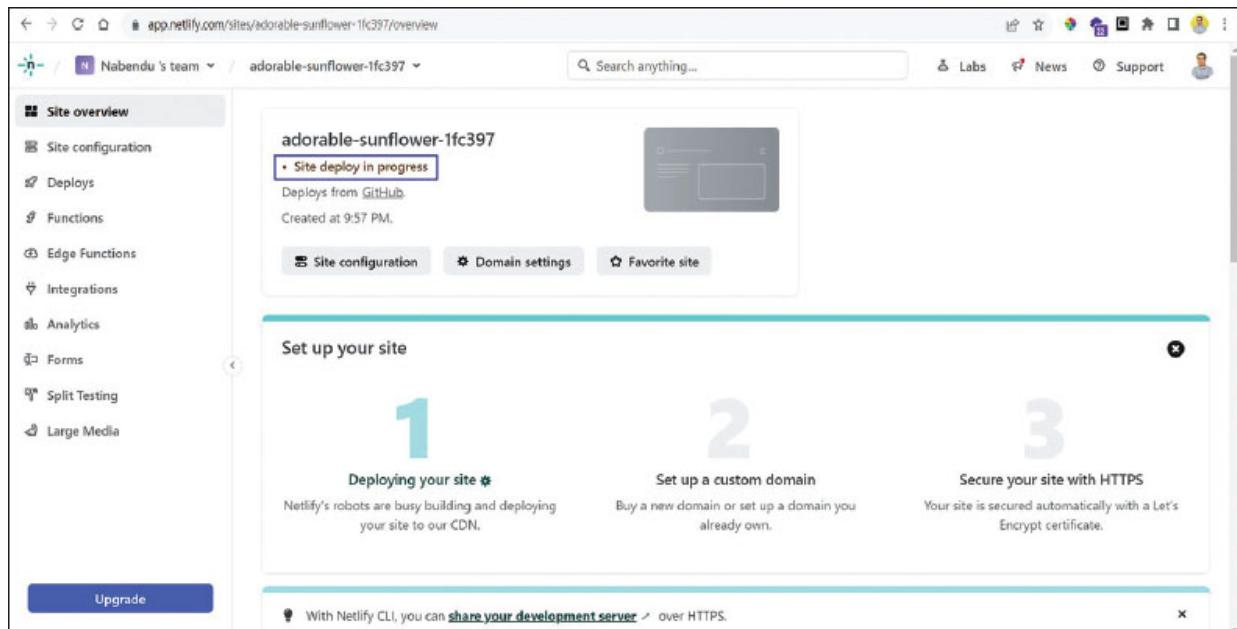


Figure 13.48: Deploy in progress

Once the site deployment is successful, click on the **Open production deploy** button.

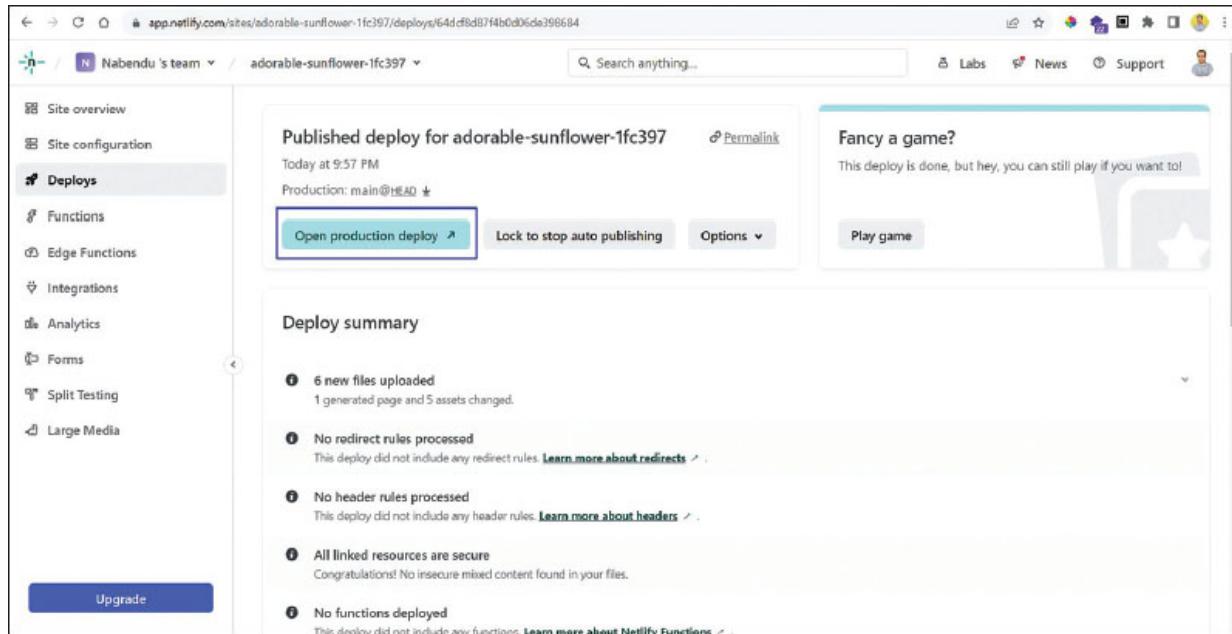


Figure 13.49: Deployment successful

Fixing CORS errors and final deployments

We will now try to log in with the credentials created earlier in the deployed site.

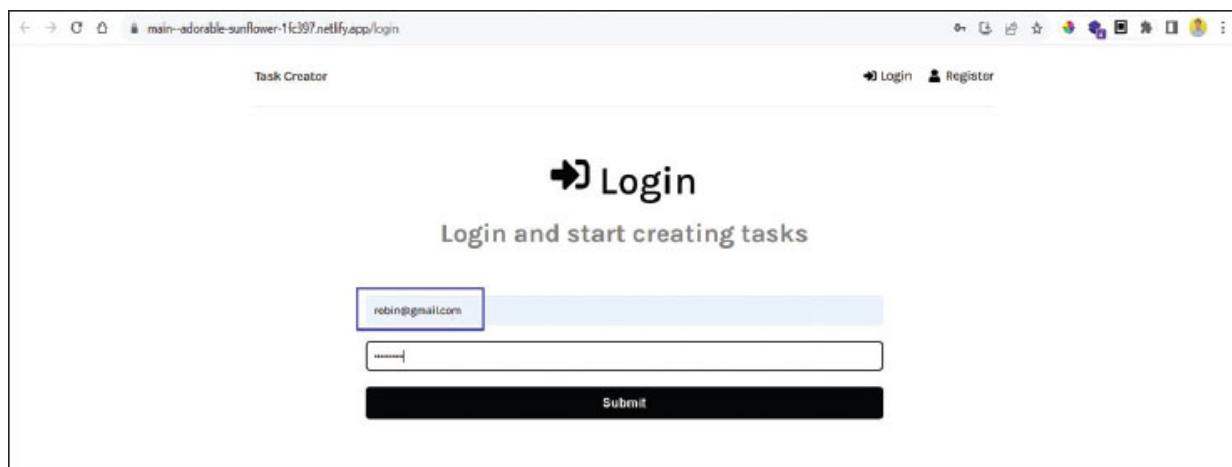


Figure 13.50: Login to the deployed site

But we got the error of Request failed with status code **404**.

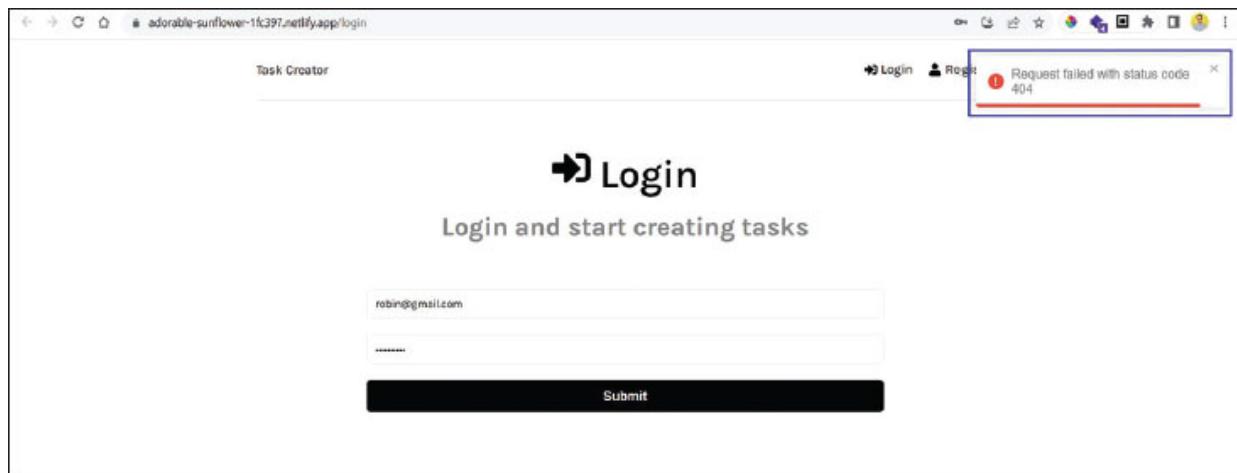


Figure 13.51: Failure to Login

On checking the network tab, we found out it was due to a CORS error. This error comes when our backend and frontend are on different domains and they are not able to communicate with each other, due to strict internet CORS(Cross Origin Request Service) policies.

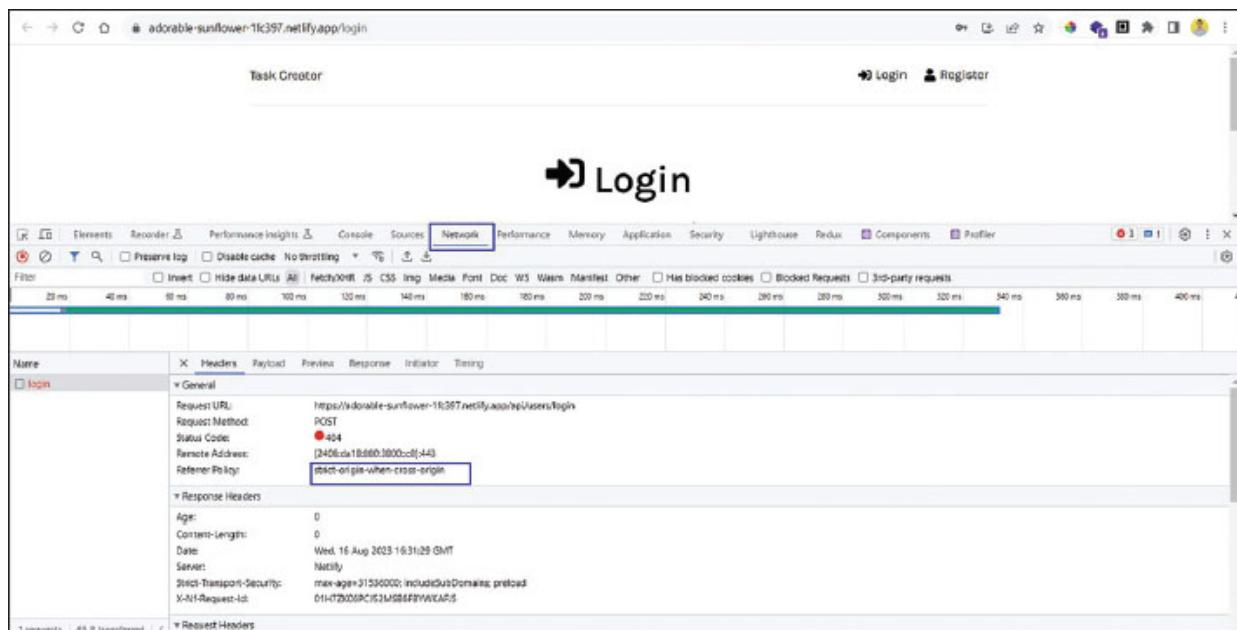


Figure 13.52: CORS error

To fix this issue, we need to first install the `cors` package in the backend folder. We are doing the same by giving the `npm i cors` command in the integrated terminal.

We also need to import and use it in the `server.js` file.

```

const Cors = require('cors');
app.use(Cors());

```

The screenshot shows the Visual Studio Code interface with the 'server.js' file open. The code editor has tabs for 'package.json', 'authService.js', 'taskService.js', and 'server.js'. The 'server.js' tab is active, showing the following code:

```

4  const connectDB = require('./connect/database');
5  const Cors = require('cors');
6  const port = process.env.PORT || 5000;
7
8  connectDB();
9  const app = express();
10
11 app.use(express.json());
12 app.use(express.urlencoded({ extended: false }));
13 app.use(Cors());
14

```

The line `app.use(Cors());` is highlighted with a yellow box. Below the code editor is a terminal window showing the command `npm i cors` being run and its output:

```

naber@LAPTOP-LGSLF9IM MINGW64 ~\OneDrive\Desktop\Task-MERN\backend (main)
$ npm i cors
added 2 packages, and audited 398 packages in 3s
42 packages are looking for funding
  run `npm fund` for details
4 vulnerabilities (3 moderate, 1 critical)

```

Figure 13.53: Adding CORS in the backend

Since we made changes in the backend code, we need to **add**, **commit**, and **push** the code through the familiar git commands.

```

git add.
git commit -m "Cors Added"
git push

```

```

naben@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/backend (main)
$ git add .
warning: LF will be replaced by CRLF in package-lock.json.
The file will have its original line endings in your working directory
warning: LF will be replaced by CRLF in package.json.
The file will have its original line endings in your working directory

naben@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/backend (main)
$ git commit -m "Cors Added"
[main a58797f] Cors Added
 3 files changed, 38 insertions(+)

naben@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/backend (main)
$ git push
Enumerating objects: 9, done.
Counting objects: 100% (9/9), done.
Delta compression using up to 12 threads

```

main ⌂ ✘ 0 △ 0 ⌂ tabnine starter ➔ Ln 10, Col 1 Spaces: 4 UTF-8 CRLF {} JavaScript ⌂ Go Live & ⌂ ⌂

Figure 13.54: git push

We also need to delete the proxy code from the **package.json** file of the client.

```

{
  "name": "frontend",
  "version": "0.1.0",
  "private": true,
  "dependencies": {
    ...
  }
}

```

File Edit Selection View Go ... package.json - Task-MERN - Visual Studio Code

frontend > package.json > ...

Ln 3, Col 22 Spaces: 2 UTF-8 LF {} JSON ⌂ Go Live & ⌂ ⌂

Figure 13.55: Deleting proxy

Next, we will update our **authService.js** file to contain the full backend URL.

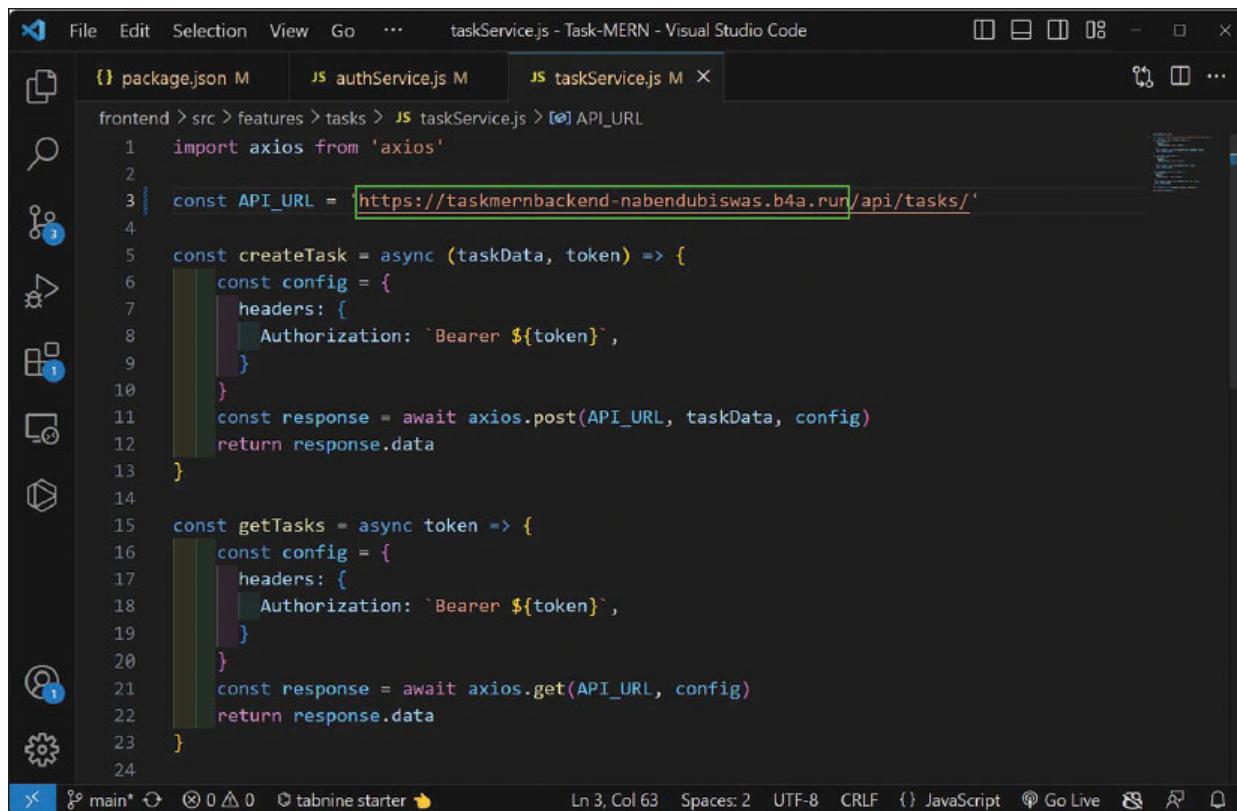
The screenshot shows the Visual Studio Code interface with the title bar "authService.js - Task-MERN - Visual Studio Code". The left sidebar contains icons for file operations like Open, Save, Find, and others. The main editor area displays the following code:

```
1 import axios from 'axios'
2 const API_URL = 'https://taskmernbackend-nabendubiswas.b4a.run/api/users/'
3
4 const register = async (userData) => {
5   const response = await axios.post(API_URL, userData)
6   if (response.data) {
7     localStorage.setItem('user', JSON.stringify(response.data))
8   }
9   return response.data
10 }
11
12 const login = async (userData) => {
13   const response = await axios.post(API_URL + 'login', userData)
14   if (response.data) {
15     localStorage.setItem('user', JSON.stringify(response.data))
16   }
17   return response.data
18 }
19
20
21 const logout = () => localStorage.removeItem('user')
22
23 const authService = { register, logout, login }
```

The URL 'https://taskmernbackend-nabendubiswas.b4a.run/api/users/' is highlighted in green, indicating it is a live link.

Figure 13.56: Deployed link in authService.js

We will also do the same in the **taskService.js** file.



A screenshot of Visual Studio Code showing the file `taskService.js`. The code defines two functions: `createTask` and `getTasks`, both using the `axios` library to interact with a deployed API endpoint. The URL is highlighted with a green box.

```
1 import axios from 'axios'
2
3 const API_URL = 'https://taskmernbackend-nabendubiswas.b4a.run/api/tasks/'
4
5 const createTask = async (taskData, token) => {
6   const config = {
7     headers: {
8       Authorization: `Bearer ${token}`
9     }
10  }
11  const response = await axios.post(API_URL, taskData, config)
12  return response.data
13}
14
15 const getTasks = async token => {
16   const config = {
17     headers: {
18       Authorization: `Bearer ${token}`
19     }
20  }
21  const response = await axios.get(API_URL, config)
22  return response.data
23}
24
```

Figure 13.57: Deployed link in taskService.js

Since we made changes in the frontend code, we need to `add`, `commit`, and `push` the code through the familiar git commands.

```
git add.
git commit -m "Cors Added"
git push
```

```

MINGW64:/c/Users/naben/OneDrive/Desktop/Task-MERN/frontend
nahen@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/frontend (main)
$ git add .
warning: LF will be replaced by CRLF in package.json.
The file will have its original line endings in your working directory

nahen@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/frontend (main)
$ git commit -m "Cors added"
[main e66debb] Cors added
 3 files changed, 2 insertions(+), 3 deletions(-)

nahen@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/frontend (main)
$ git push
Enumerating objects: 17, done.
Counting objects: 100% (17/17), done.
Delta compression using up to 12 threads
compressing objects: 100% (9/9), done.
Writing objects: 100% (9/9), 757 bytes | 757.00 KiB/s, done.
Total 9 (delta 6), reused 0 (delta 0), pack-reused 0
remote: Resolving deltas: 100% (6/6), completed with 6 local objects.
To https://github.com/nabendu82/task-mern-frontend.git
  82cbf22..e66debb main -> main

nahen@LAPTOP-LGSLF9IM MINGW64 ~/OneDrive/Desktop/Task-MERN/frontend (main)
$
```

Figure 13.58: git push

Once we push the code to GitHub, it will automatically deploy to the front end. Now, when we go to our deployed app, everything will work perfectly.

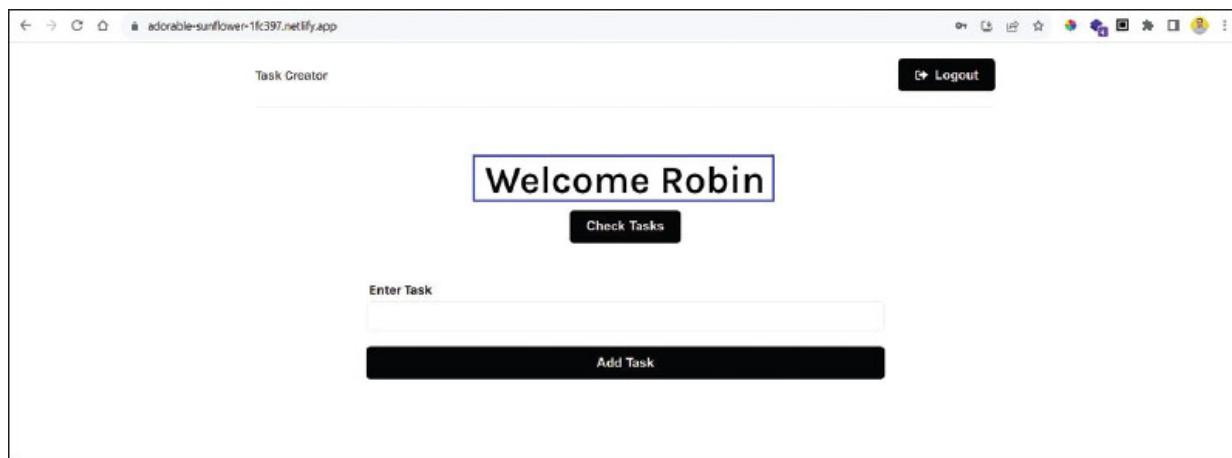


Figure 13.59: Successful deployment

Conclusion

In this final chapter, we have learned to deploy both the frontend and backend code. We deployed the frontend code using the service of Netlify. And deployed the backend code using the service of Back4app.

Points to remember

- Uploading code from the local machine to GitHub using the command line
- Deploying backend code in Back4app
- Deploying frontend code in Netlify
- Solving CORS issue which occurs due to frontend and backend on different URLs

Index

A

API_URL variable [178](#)
Async Thunk
 used, for creating task [176-182](#)
Auth middleware
 creating [76-78](#)
auth service [129-133](#)
auth slice [129-133](#)

B

Back4app
 backend deployment [251-260](#)
backend code repository
 creating [249-251](#)
backend deployment
 in Back4app [251-260](#)
backend integration
 with frontend [260-263](#)
backend testing
 setting up [223-225](#)
boilerplate files
 deleting [95-108](#)

C

components
 creating [111](#)
Header component, creating [112, 113](#)
controllers
 creating [28-31](#)
CORS errors and deployments
 fixing [269-274](#)

D

dashboard logic
 changing [162-164](#)
DELETE API [11](#)
DELETE route [56, 57, 84-89](#)

E

error handling [33-36](#)

Express

about [3, 4](#)

using [20-22](#)

F

frontend

creating, with ReactJS [93-95](#)

used, for integrating backend [260-263](#)

frontend app

checking [220, 221](#)

configuring [220, 221](#)

frontend code repository

creating [244-248](#)

frontend deployment

in Netlify [263-269](#)

frontend testing

setting up [202-206](#)

G

GET API [9](#)

GET route [81-84](#)

getTasks controller

testing [232-237](#)

getTaskSpy variable [211](#)

H

hashed password

used, for registering user [65-68](#)

Header component

creating [112-114](#)

J

Jest

used, for testing task service [206-214](#)

used, for testing task slice [206-214](#)

JSON

using [31-33](#)

JSON Web Token (JWT)

about [71](#)

reference link [71](#)

using [72-74](#)

L

login form [154-157](#)
login functionality
 implementing [151-153](#)
Login page
 creating [119-122](#)
logout functionality
 implementing [143-150](#)

M

MERN project
 overview [12](#)
model
 creating [50-52](#)
MongoDB [2, 3](#)
MongoDB database
 about [38, 39](#)
 basic setup [40-44](#)
 collection URL, adding [45, 46](#)
 connection URL, adding [47](#)
MongoDB, Express, React, and NodeJS (MERN)
 about [1, 2](#)
 stacks [7](#)
Mongoose
 connecting through [48-50](#)

N

Netlify
 frontend deployment [263-269](#)
 reference link [263](#)
NodeJS [6](#)
NodeJS application
 package installation [15-17](#)
 project folder structure [13-15](#)
 project, running [17, 18](#)
 setting up [12, 13](#)

P

pages
 creating [111](#)
Login page, creating [119-122](#)

Register page, creating [115-119](#)

POST API [8](#)

Postman

reference link [27](#)

used, for testing Routes [27](#)

POST route [52-54, 81-84](#)

PUT API [10, 11](#)

PUT route [54, 55, 84-89](#)

R

ReactJS [4, 5](#)

used, for creating frontend [93-95](#)

react router

setting up [109-111](#)

React testing library

testing [214-219](#)

Redux toolkit

setting up [124-128](#)

Register page

creating [115-119](#)

registerUser controller

testing [226-232](#)

registration form [134-138](#)

REST API

alternatives [11, 12](#)

REST APIs

about [7, 8](#)

DELETE [11](#)

GET [9](#)

POST [8](#)

PUT [10, 11](#)

RESTful endpoints [7](#)

Routes

about [22](#)

all routes [24-26](#)

creating [52](#)

DELETE route [56, 57](#)

initial routes [23, 24](#)

POST route [52-54](#)

protect function, using [79, 80](#)

PUT route [54, 55](#)

testing, through Postman [27, 28](#)

S

server

used, for fetching task [182-186](#)

setTask controller

testing [232-237](#)

T

task

creating, with Async Thunk [176-182](#)

deleting [195-201](#)

displaying [186-195](#)

fetching, from server [182-186](#)

task form

creating [168-172](#)

task routes

DELETE route [84-89](#)

GET route [81-84](#)

POST route [81-84](#)

protecting [81](#)

PUT route [84-89](#)

task service

testing, with Jest [206-214](#)

task slice

creating [165-168](#)

testing, with Jest [206-214](#)

U

updateTask controller

testing [238-243](#)

user login [69-71](#)

testing [157-160](#)

user model and controller [59-64](#)

user registration

testing [139-142](#)

with hashed password [65-68](#)