

Step 1 - What are we building, Clone the starter repo

We're building a PayTM like application that let's users send money to each other given an initial dummy balance

Payments App

Hello, User U

Your Balance \$5000

Users

U1 User 1

U2 User 2

U3 User 3

Send Money

Send Money

Send Money

Things to do

Clone the 8.2 repository from <https://github.com/100xdevs-cohort-2/paytm>

```
git clone https://github.com/100xdevs-cohort-2/paytm
```



Please keep a MongoDB url handy before you proceed. This will be your primary database for this assignment

1. Create a free one here - <https://www.mongodb.com/>
2. There is a Dockerfile in the codebase, you can run mongo locally using it.

Explore the repository

The repo is a basic **express + react + tailwind boilerplate**

Backend

1. Express - HTTP Server
2. mongoose - ODM to connect to MongoDB
3. zod - Input validation

```
const express = require("express");
```

```
const app = express();
```

index.js

Frontend

1. React - Frontend framework
2. Tailwind - Styling framework

```
function App() {  
  
  return (  
    <div>  
      Hello world  
    </div>  
  )  
}  
  
export default App
```

App.jsx

Step 2 - User Mongoose schemas

We need to support 3 routes for user authentication

1. Allow user to sign up.
2. Allow user to sign in.
3. Allow user to update their information (firstName, lastName, password).

To start off, create the mongo schema for the users table

1. Create a new file (db.js) in the root folder
2. Import mongoose and connect to a database of your choice
3. Create the mongoose schema for the users table
4. Export the mongoose model from the file (call it User)

► Solution

Step 3 - Create routing file structure

In the index.js file, route all the requests to `/api/v1` to a apiRouter defined in `backend/routes/index.js`

Step 1

Create a new file `backend/routes/index.js` that exports a new express router.

(How to create a router - <https://www.geeksforgeeks.org/express-js-express-router-function/>)

► Solution

Step 2

Import the router in `index.js` and route all requests from `/api/v1` to it

► Solution

Step 4 - Route user requests

1. Create a new user router

Define a new router in `backend/routes/user.js` and import it in the index router.

Route all requests that go to `/api/v1/user` to the user router.

► Solution

2. Create a new user router

Import the userRouter in `backend/routes/index.js` so all requests to `/api/v1/user` get routed to the userRouter.

► Solution

Step 5 - Add cors, body parser and jsonwebtoken

1. Add cors

Since our frontend and backend will be hosted on separate routes, add the `cors` middleware to `backend/index.js`

- ▶ Hint
- ▶ Solution

2. Add body-parser

Since we have to support the JSON body in post requests, add the express body parser middleware to `backend/index.js`

You can use the `body-parser` npm library, or use `express.json`

- ▶ Hint
- ▶ Solution

3. Add jsonwebtoken

We will be adding authentication soon to our application, so install jsonwebtoken library. It'll be useful in the next slide

```
npm install jsonwebtoken
```

4. Export JWT_SECRET

Export a JWT_SECRET from a new file `backend/config.js`

- ▶ Solution

5. Listen on port 3000

Make the express app listen on PORT 3000 of your machine

- ▶ Solution

Step 6 - Add backend auth routes

In the user router (`backend/routes/user`), add 3 new routes.

1. Signup

This route needs to get user information, do input validation using zod and store the information in the database provided

1. Inputs are correct (validated via zod)
2. Database doesn't already contain another user

If all goes well, we need to return the user a jwt which has their user id encoded as follows -

```
{
  userId: "userId of newly added user"
}
```



Note - We are not hashing passwords before putting them in the database. This is standard practise that should be done, you can find more details here - <https://mojoauth.com/blog/hashing-passwords-in-nodejs/>

Method: POST

Route: `/api/v1/user/signup`

Body:

```
{
  username: "name@gmail.com",
  firstName: "name",
  lastName: "name",
  password: "123456"
}
```

Response:

Status code - 200

```
{
  message: "User created successfully",
  token: "jwt"
}
```

Status code - 411

```
{  
  message: "Email already taken / Incorrect inputs"  
}
```

► Solution

2. Route to sign in

Let's an existing user sign in to get back a token.

Method: POST

Route: /api/v1/user/signin

Body:

```
{  
  username: "name@gmail.com",  
  password: "123456"  
}
```

Response:

Status code - 200

```
{  
  token: "jwt"  
}
```

Status code - 411

```
{  
  message: "Error while logging in"  
}
```

► Solution

By the end, `routes/user.js` should look like follows

► Solution

Step 7 - Middleware

Now that we have a user account, we need to `gate` routes which authenticated users can hit.

For this, we need to introduce an auth middleware

Create a `middleware.js` file that exports an `authMiddleware` function

1. Checks the headers for an Authorization header (Bearer <token>)
2. Verifies that the token is valid
3. Puts the `userId` in the request object if the token checks out.
4. If not, return a 403 status back to the user

Header -

`Authorization: Bearer <actual token>`

► Solution

Step 8 - User routes

1. Route to update user information

User should be allowed to **optionally** send either or all of

1. password
2. firstName
3. lastName

Whatever they send, we need to update it in the database for the user.

Use the **middleware** we defined in the last section to authenticate the user

Method: PUT

Route: /api/v1/user

Body:

```
{
  password: "new_password",
  firstName: "updated_first_name",
  lastName: "updated_first_name",
}
```

Response:

Status code - 200

```
{
  message: "Updated successfully"
}
```

Status code - 411 (Password is too small...)

```
{
  message: "Error while updating information"
}
```

2. Route to get users from the backend, filterable via firstName/lastName

This is needed so users can search for their friends and send them money

Method: GET

Route: /api/v1/user/bulk

Query Parameter: `?filter=harkirat`

Response:

Status code - 200

```
{
  users: [{
    firstName: "",
    lastName: "",
    _id: "id of the user"
  }]
}
```

► Hints

► Solution

Step 9 - Create Bank related Schema

Update the `db.js` file to add one new schemas and export the respective models

Accounts table

The `Accounts` table will store the INR balances of a user.

The schema should look something like this -

```
{
  userId: ObjectId (or string),
  balance: float/number
}
```

In the real world, you shouldn't store `floats` for balances in the database. You usually store an integer which represents the INR value with decimal places (for eg, if someone has 33.33 rs in their account, you store 3333 in the database).

There is a certain precision that you need to support (which for india is 2/4 decimal places) and this allows you to get rid of precision errors by storing integers in your DB

You should reference the users table in the schema (Hint -

<https://medium.com/@mendes.develop/joining-tables-in-mongodb-with-mongoose-489d72c84b60>)

► Solution

► By the end of it, `db.js` should look like this

Step 10 - Transactions in databases

A lot of times, you want multiple databases transactions to be **atomic**

Either all of them should update, or none should

This is super important in the case of a **bank**

Can you guess what's wrong with the following code -

```
const mongoose = require('mongoose');
const Account = require('./path-to-your-account-model');

const transferFunds = async (fromAccountId, toAccountId, amount) => {
  // Decrement the balance of the fromAccount
  await Account.findByIdAndUpdate(fromAccountId, { $inc: { balance: -amount } });

  // Increment the balance of the toAccount
  await Account.findByIdAndUpdate(toAccountId, { $inc: { balance: amount } });
}

// Example usage
transferFunds('fromAccountID', 'toAccountID', 100);
```

► Answer

Step 11 - Initialize balances on signup

Update the `signup` endpoint to give the user a random balance between 1 and 10000.

This is so we don't have to integrate with banks and give them random balances to start with.

► Solution

Step 12 - Create a new router for accounts

1. Create a new router

All user balances should go to a different express router (that handles all requests on `/api/v1/account`).

Create a new router in `routes/account.js` and add export it

► Solution

2. Route requests to it

Send all requests from `/api/v1/account/*` in `routes/index.js` to the router created in step 1.

► Solution

Step 13 - Balance and transfer Endpoints

Here, you'll be writing a bunch of APIs for the core user balances. There are 2 endpoints that we need to implement

1. An endpoint for user to get their balance.

Method: GET

Route: /api/v1/account/balance

Response:

Status code - 200

```
{  
  balance: 100  
}
```

► Solution

2. An endpoint for user to transfer money to another account

Method: POST

Route: /api/v1/account/transfer

Body

```
{  
  to: string,  
  amount: number  
}
```

Response:

Status code - 200

```
{  
  message: "Transfer successful"  
}
```

Status code - 400


```
{  
  message: "Insufficient balance"  
}
```

Status code - 400

```
{  
  message: "Invalid account"  
}
```

- ▶ Bad Solution (doesn't use transactions)
- ▶ Good solution (uses txns in db)
- ▶ Problems you might run into If you run into the problem mentioned above, feel free to proceed with the bad solution

Final Solution

- ▶ Finally, the account.js file should look like this

Experiment to ensure transactions are working as expected

-

Try running this code locally. It calls transfer twice on the same account ~almost concurrently

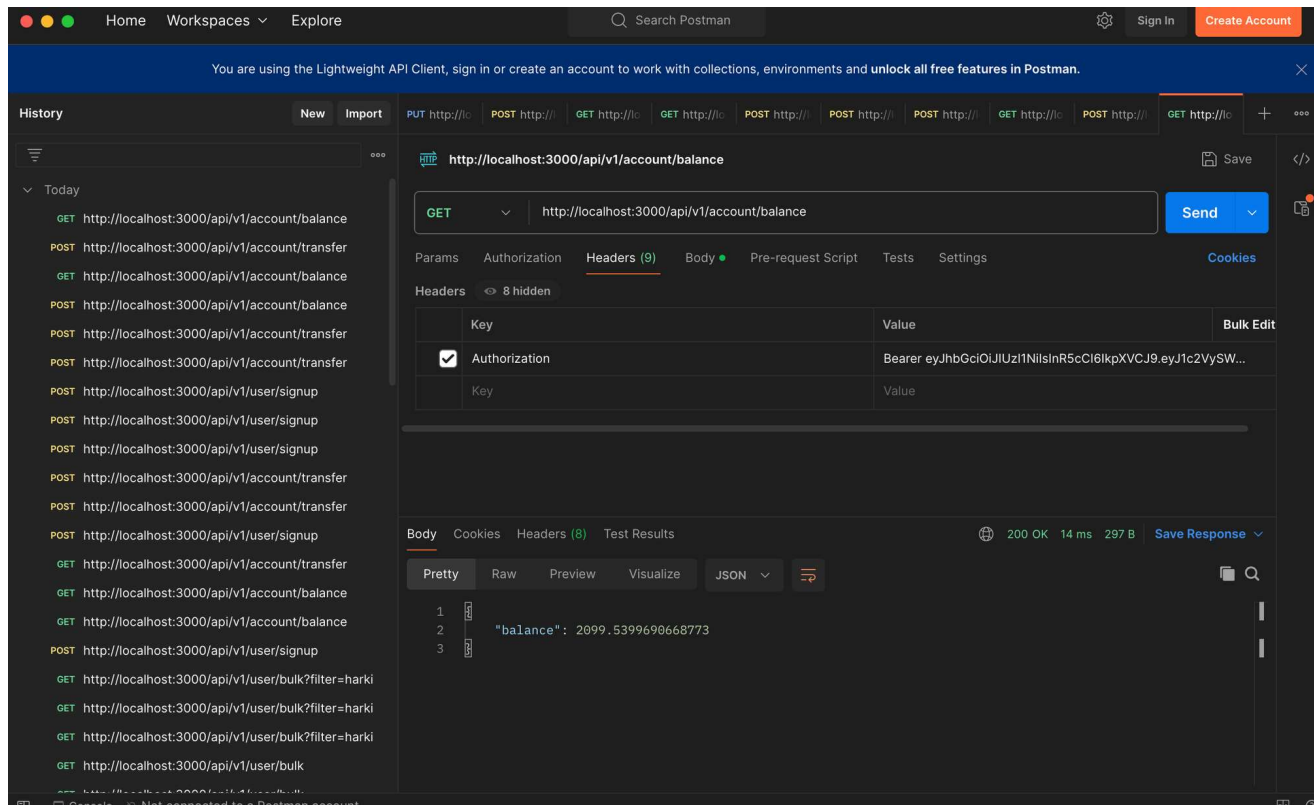
- ▶ Code
- ▶ Error

Step 14 - Checkpoint your solution

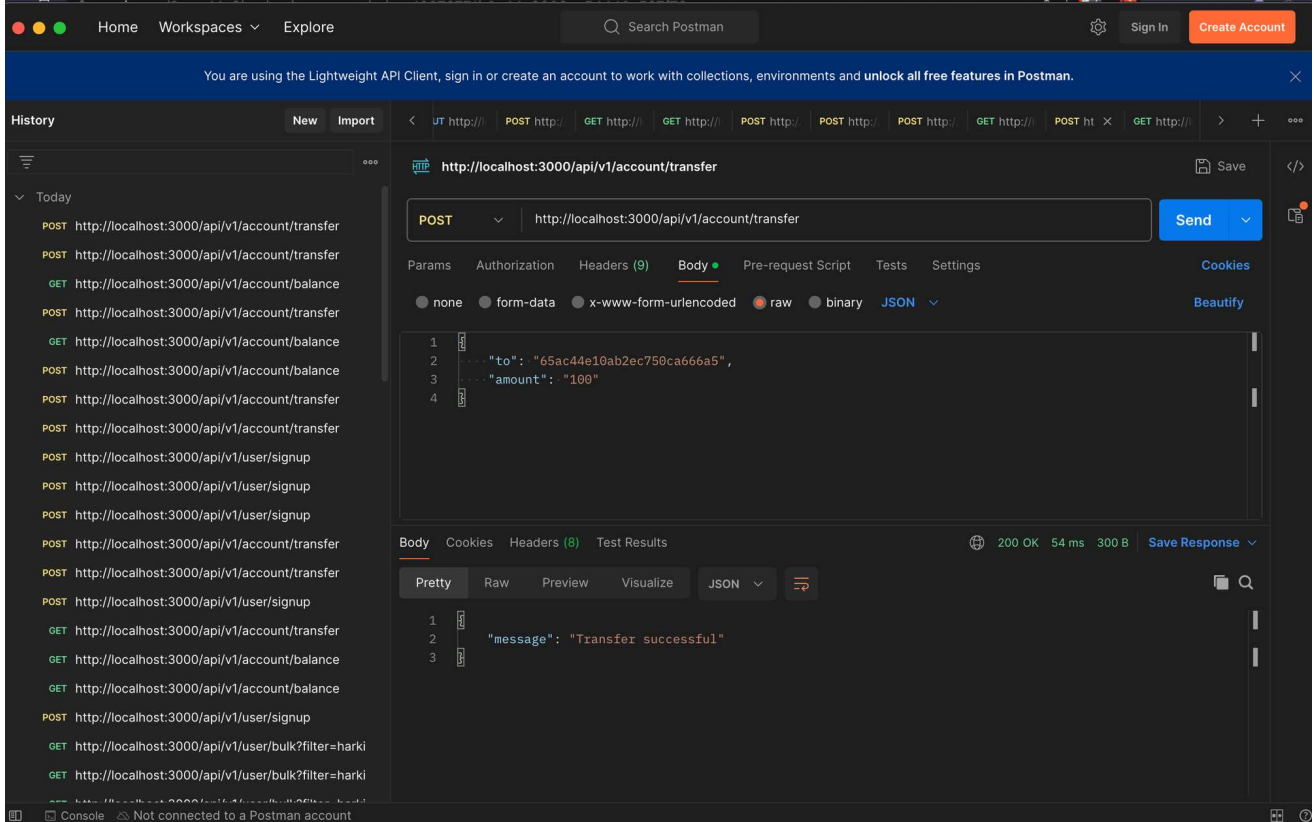
A completely working backend can be found here - <https://github.com/100xdevs-cohort-2/paytm/tree/backend-solution>

Try to send a few calls via postman to ensure you are able to sign up/sign in/get balance

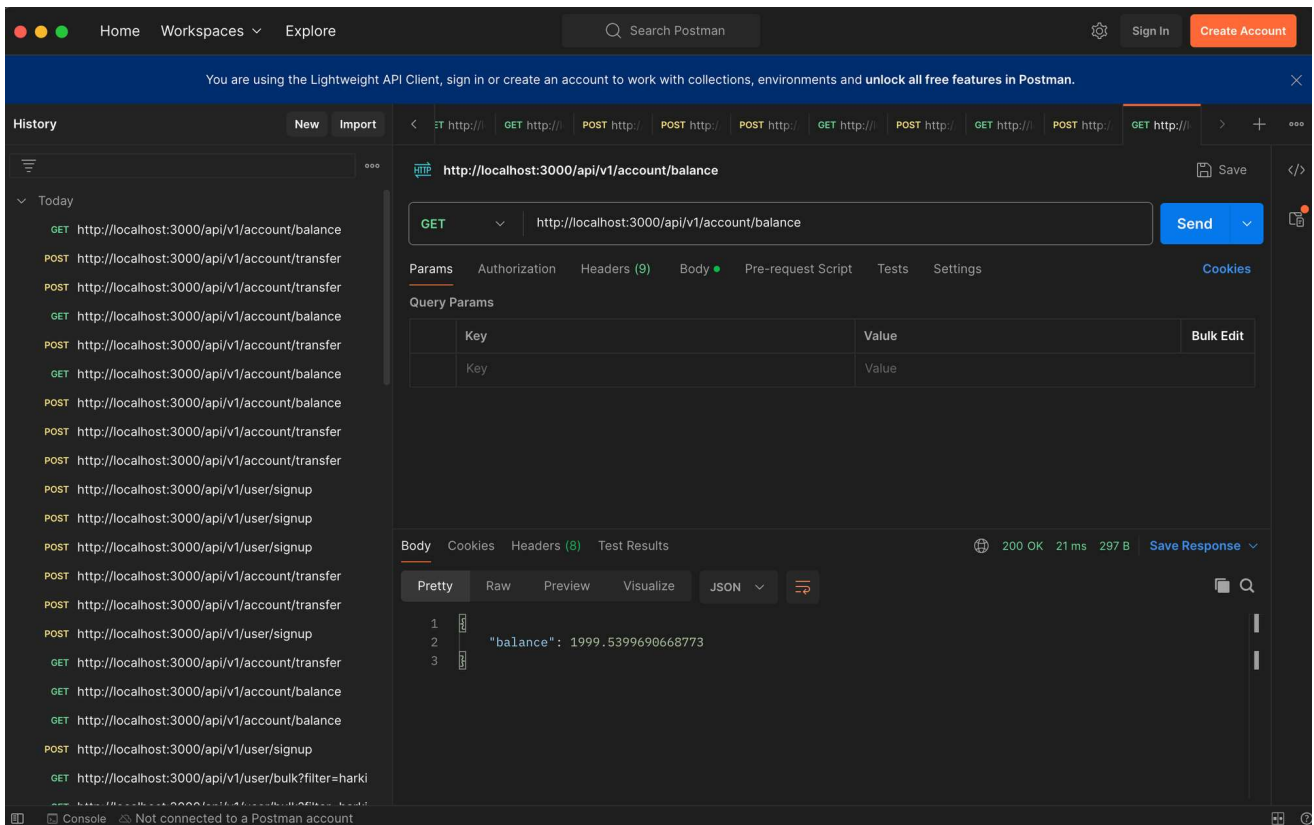
Get balance



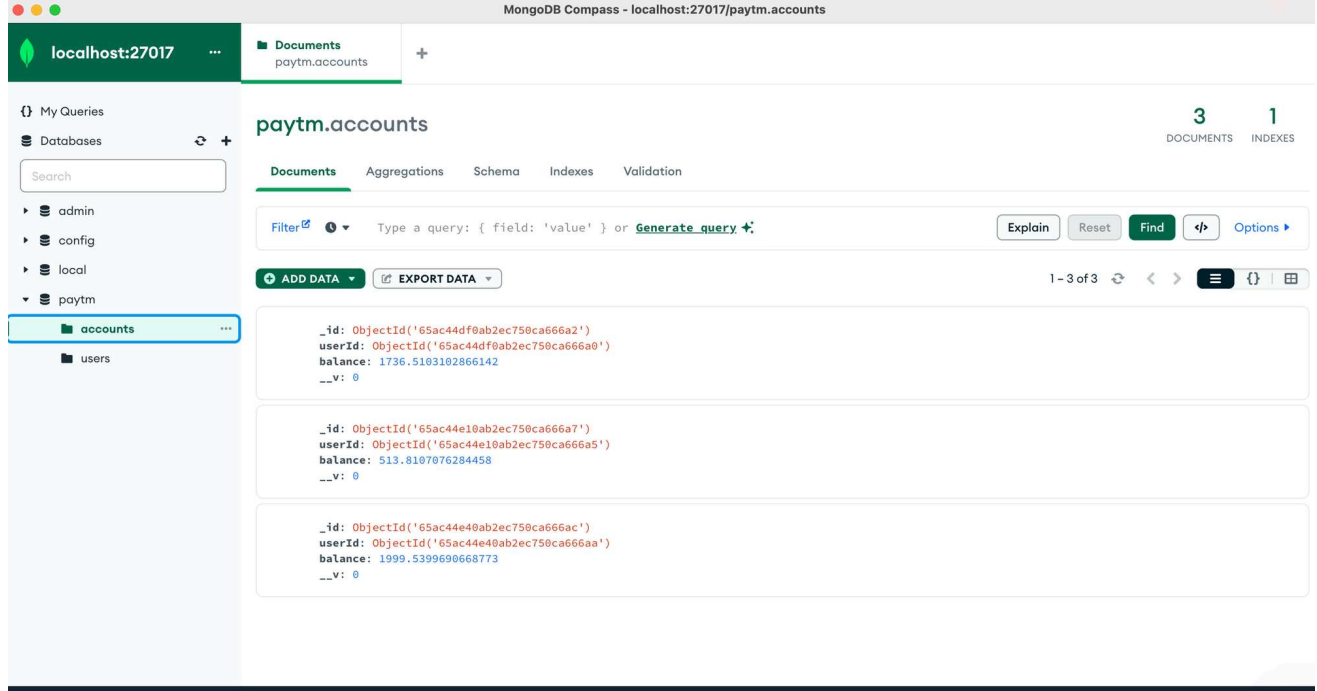
Make transfer



Get balance again (notice it went down)



Mongo should look something like this -



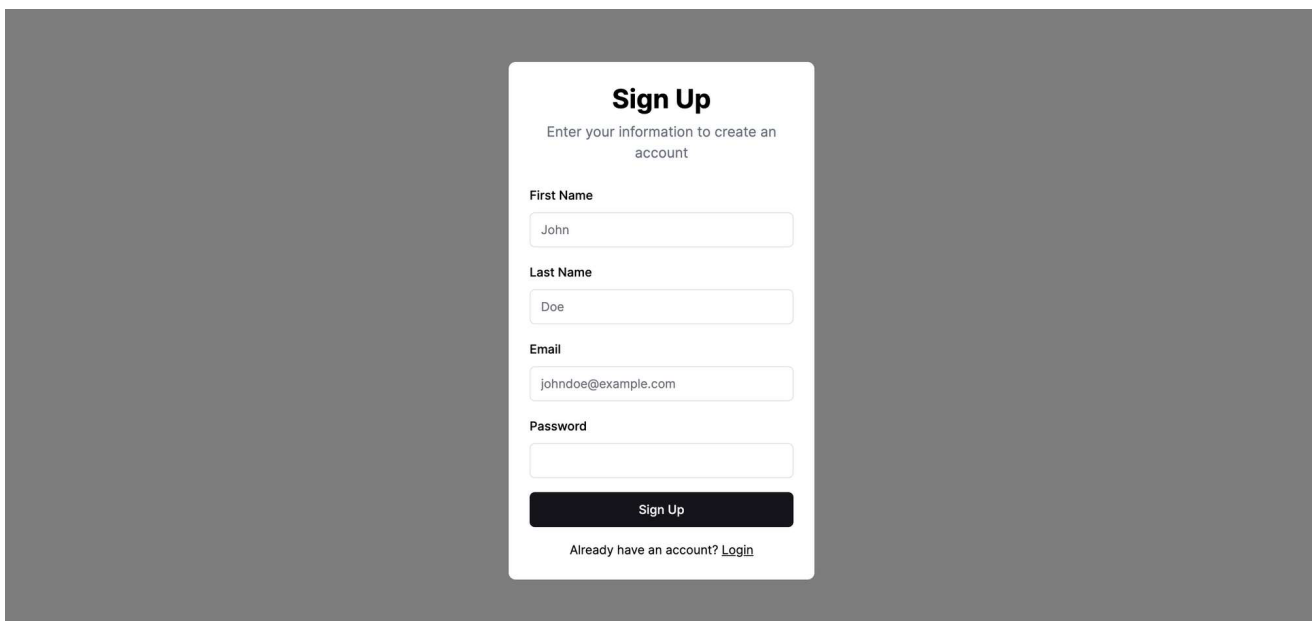
Step 1 - Add routing to the react app

Import `react-router-dom` into your project and add the following routes -

1. `/signup` - The signup page
2. `/signin` - The signin page
3. `/dashboard` - Balances and see other users on the platform.
4. `/send` - Send money to other users

► Solution

Step 2 - Create and hook up Signup page



Sign Up

Enter your information to create an account

First Name

Last Name

Email

Password

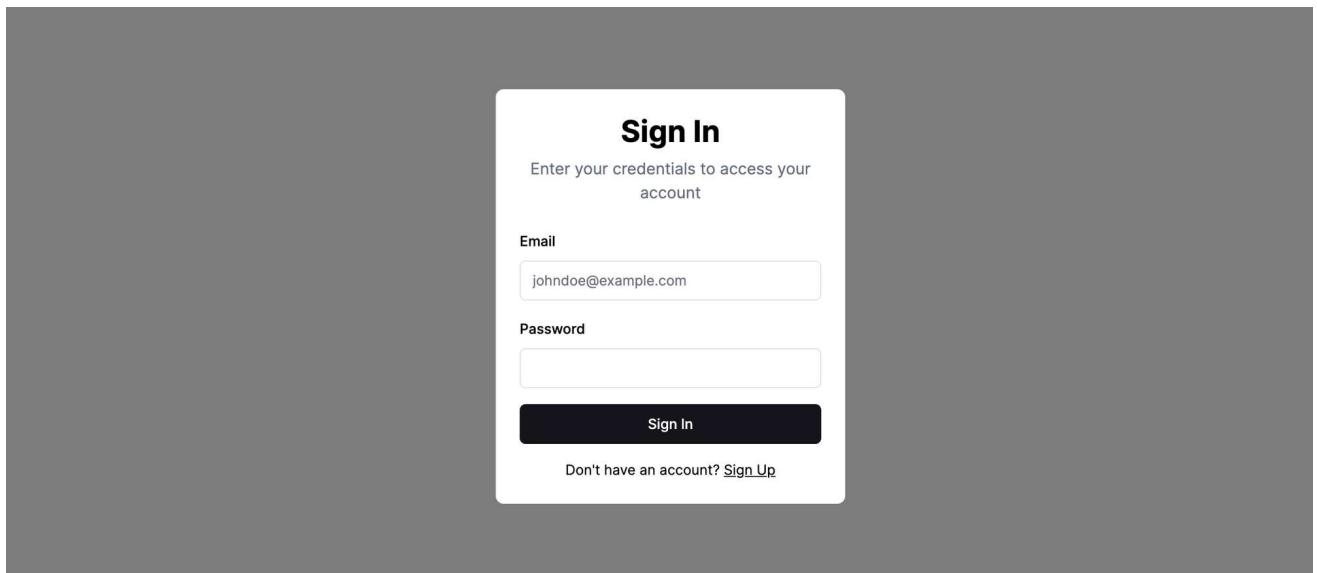
Sign Up

Already have an account? [Login](#)

If the user signup is successful, take the user to `/dashboard`

If not, show them an error message

Step 3 - Create the signin page



Sign In

Enter your credentials to access your account

Email

johndoe@example.com

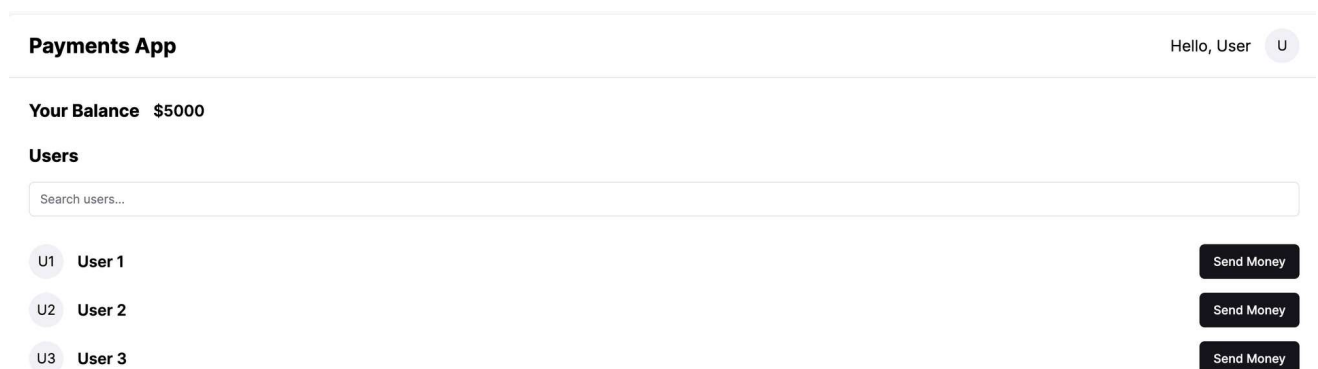
Password

Sign In

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

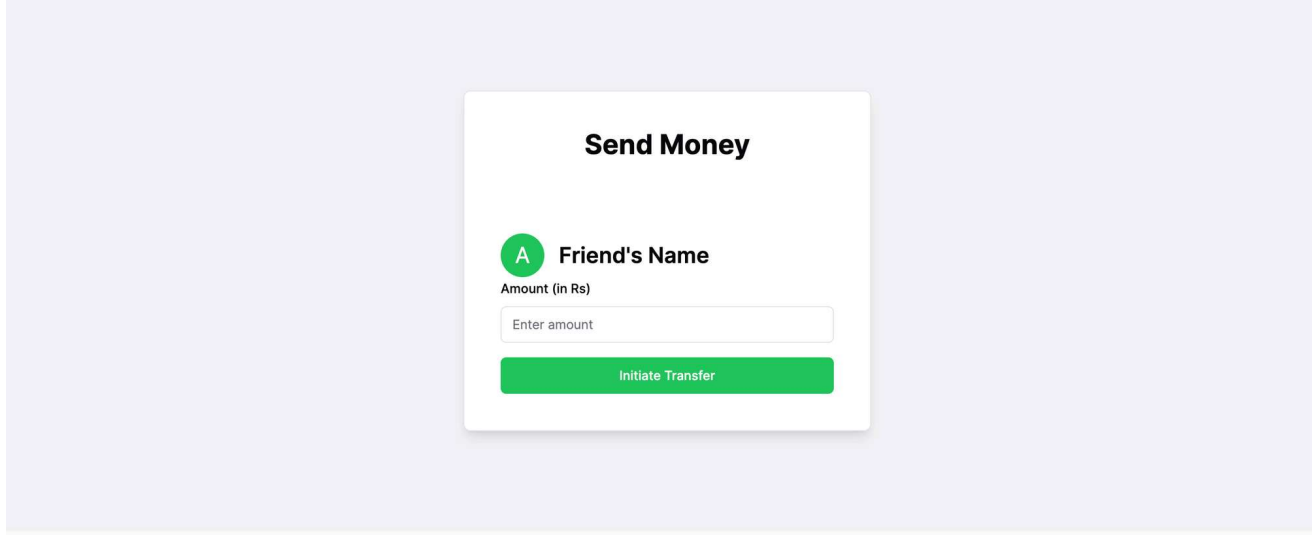
If the signin is successful, take the user to `/dashboard`

Step 4 - Dashboard page



Show the user their balance, and a list of users that exist in the database

Clicking on **Send money** should open a modal that lets the user send money

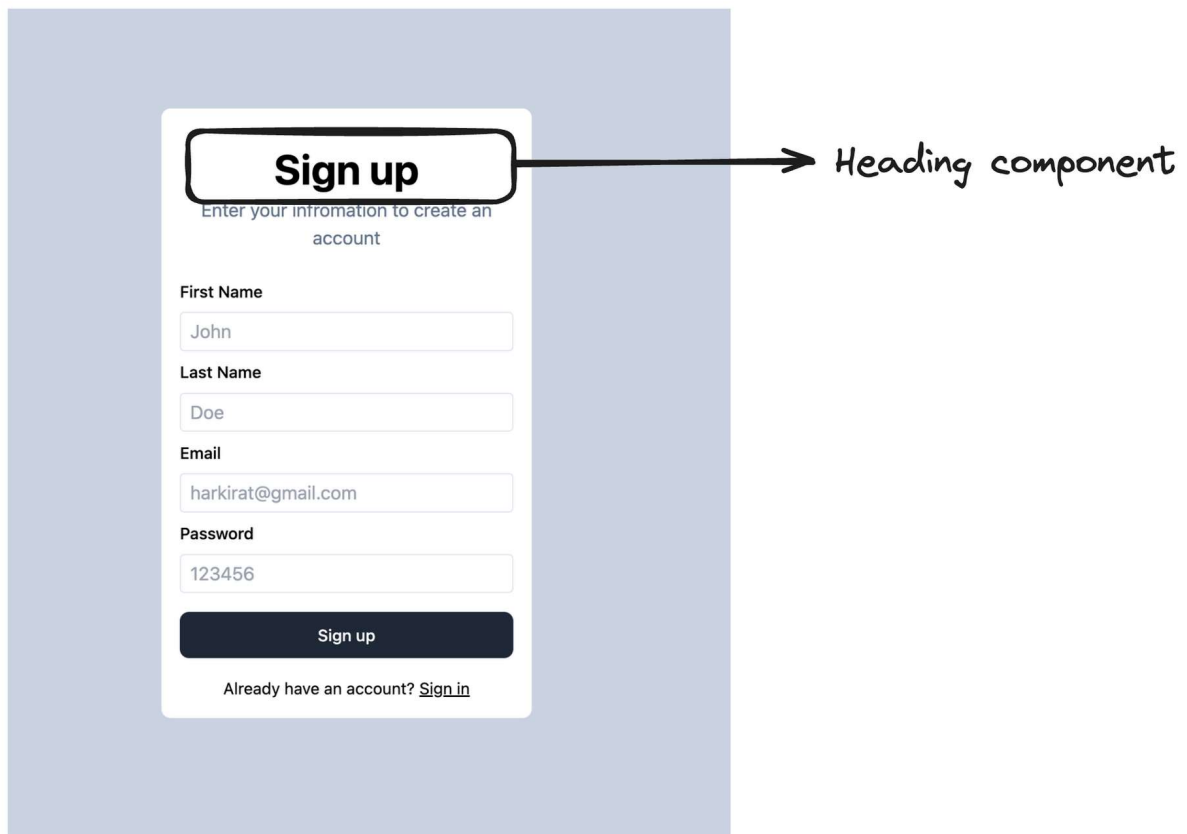


Step 5 - Auth Components

Full Signup component

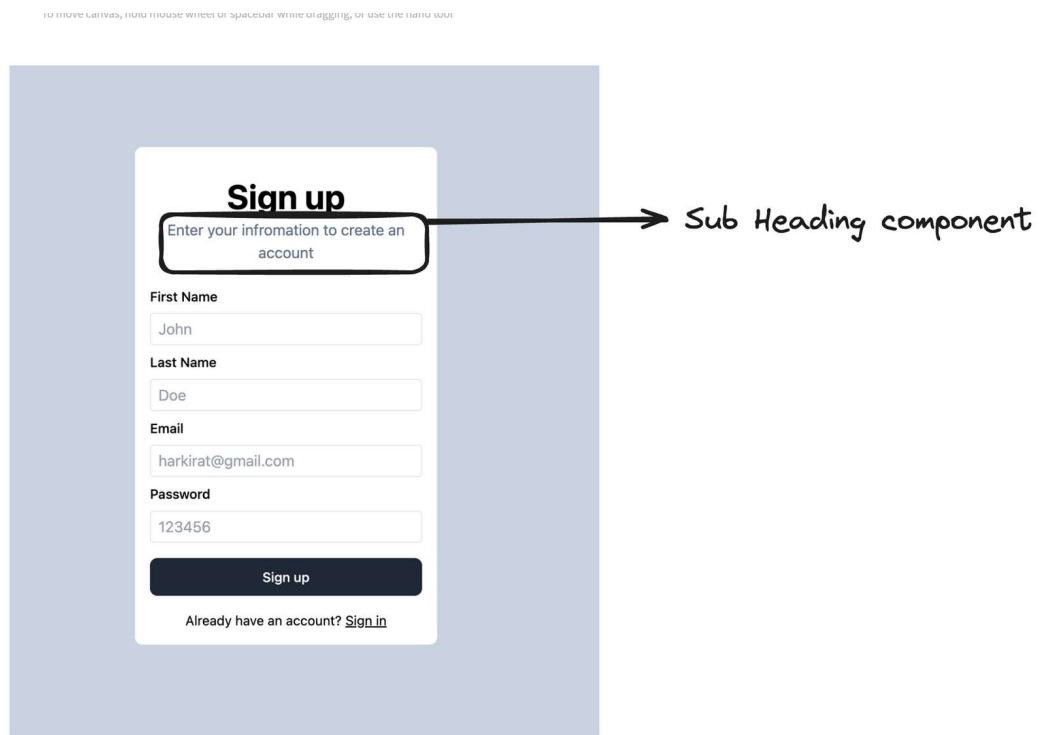
You can break down the app into a bunch of components. The code only contains the styles of the component, not any onclick functionality.

1. Heading component



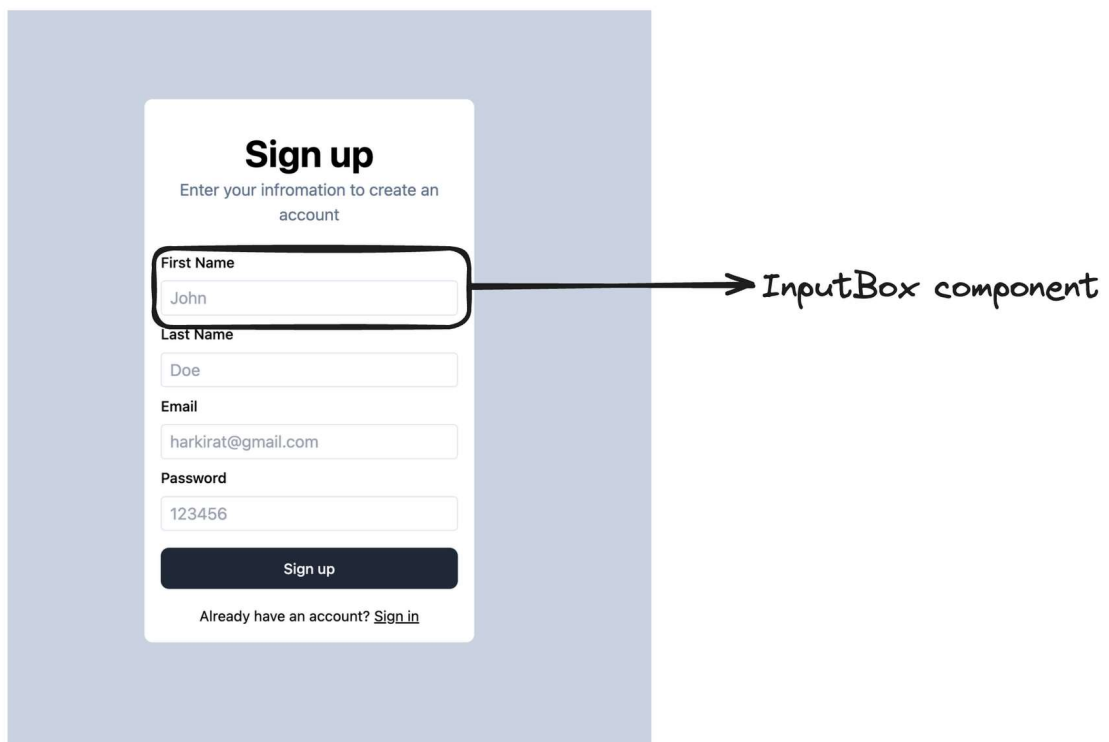
► Code

2. Sub Heading component



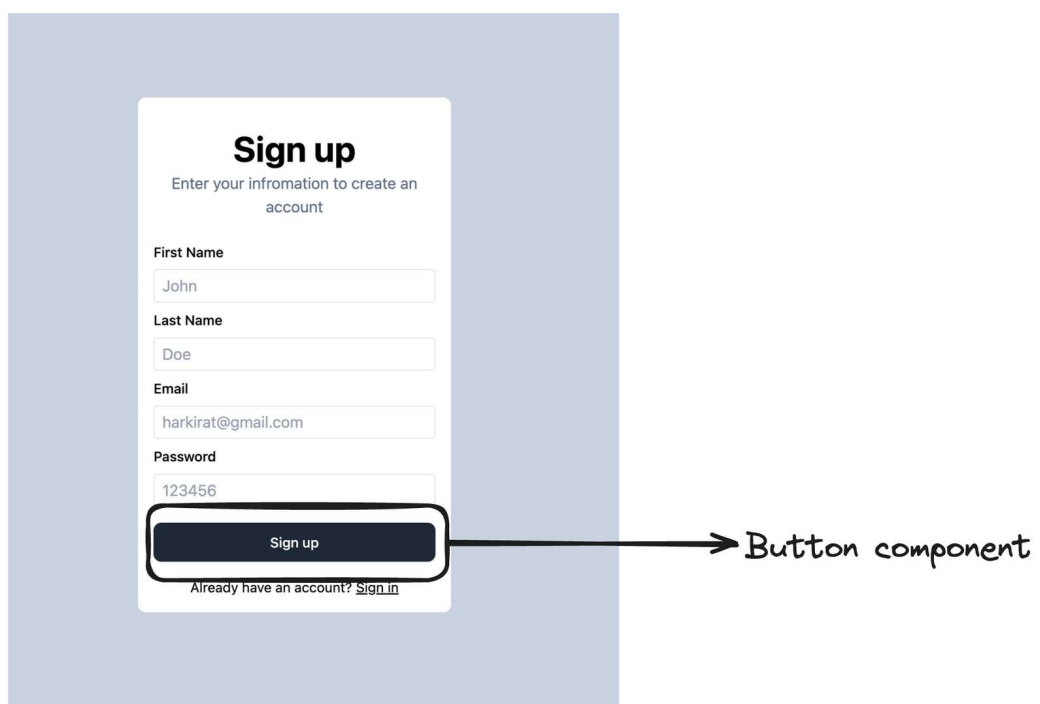
► Code

3. InputBox component



► Code

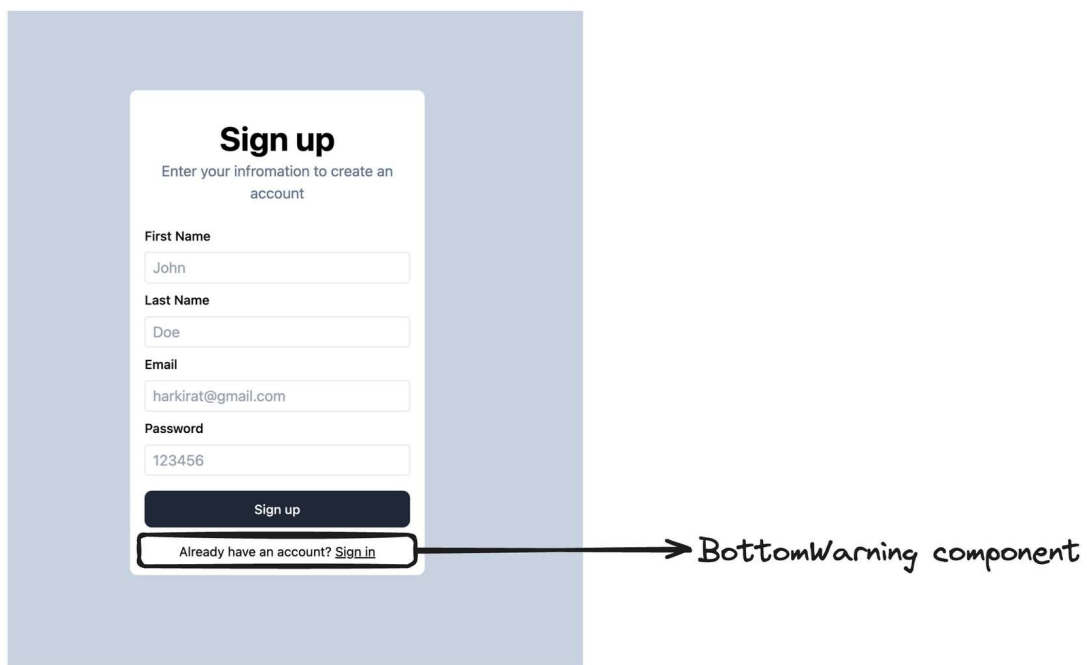
4. Button Component



► Code

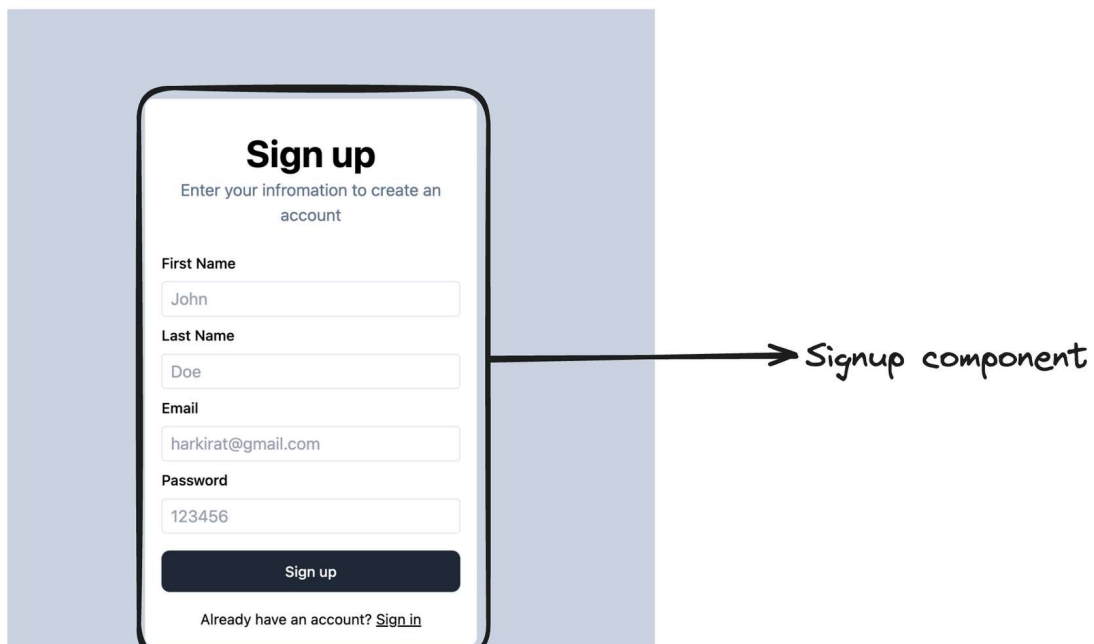
This section was blindly copied from <https://flowbite.com/docs/components/buttons/>

5. BottomWarning



► Code

Full Signup component



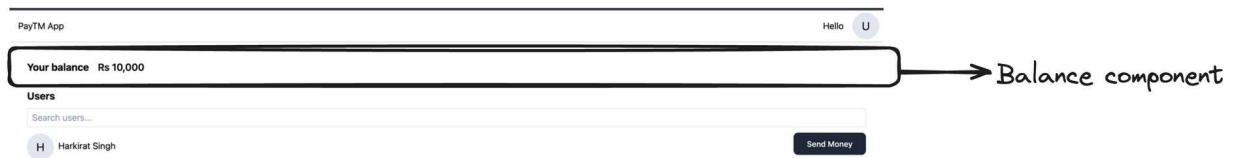
Step 6 - Signin-ed Comonents

1. Appbar



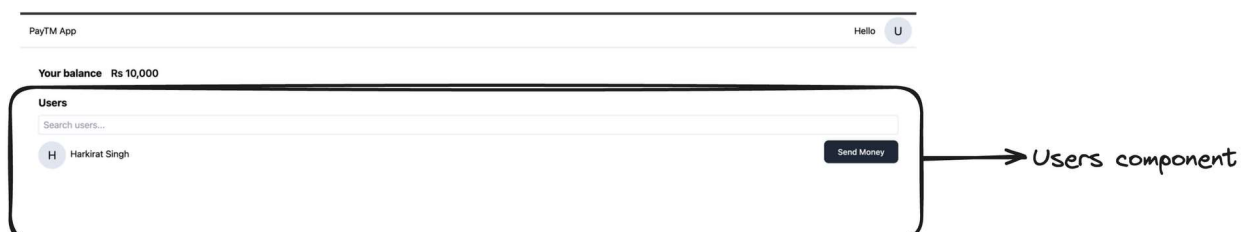
► Code

2. Balance



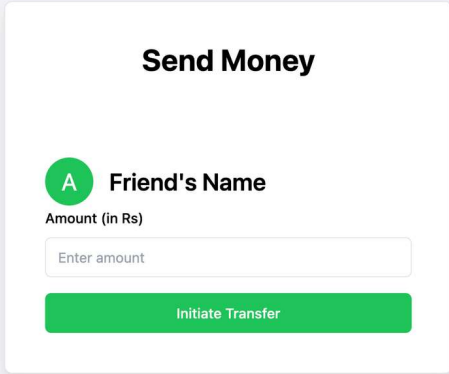
► Code

3. Users component



► Code

4. SendMoney Component



The image shows a UI component titled "Send Money" centered on a light purple background. The component is a white card with a green border. It contains a green circle with a white letter 'A' next to the text "Friend's Name". Below this is the label "Amount (in Rs)" followed by a text input field with the placeholder "Enter amount". At the bottom of the card is a green button with the text "Initiate Transfer".

► Code

Step 7 - Wiring up the backend calls

You can use

1. fetch or
2. axios

to wire up calls to the backend server.

The final code looks something like this -

<https://github.com/100xdevs-cohort-2/paytm/tree/complete-solution> (complete-solution branch on the repo)

The important bits here are -

1. Signup call - <https://github.com/100xdevs-cohort-2/paytm/blob/complete-solution/frontend/src/pages/Signup.jsx#L36>
2. Call to get all the users given the filter - <https://github.com/100xdevs-cohort-2/paytm/blob/complete-solution/frontend/src/components/Users.jsx#L13>
3. Call to transfer money b/w accounts - <https://github.com/100xdevs-cohort-2/paytm/blob/complete-solution/frontend/src/pages/SendMoney.jsx#L45>