Backend Notes by me

Two types of dependency in node:

normal dependency:

using --save
ex: $npm i express --save
Package.json e always thakbe,amra use korte parbo
—save na dile boro project e package e jhamela hoy, dile git pull korle local machine e same dependency install hobe

Dev dependency:

Production e lagbe na, for development purpose only
ex: $npm i express --save-dev

commands

$node -v
$npm -v
$code .
$npm init
$npm init -y (for not answering any question)
$npm i express —save
$npm run start (main command $node server.js,jeta server.js file ta k execute kore, but package.json e eta start diye configure kora)

Initial code explanation

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

- **Import Express**: `express` is required to create a web server.
- **Initialize App**: `app` is an instance of the Express application.

```
//? Check Connection
app.get('/', (req, res) => {
  res.json({ message: 'welcome' });
});
```

- **Route Definition**: Defines a GET route for `/`.
- **Request Handler**: When `/` is accessed, the server responds with a JSON object: `{ message: 'welcome' }`.
- **Purpose**: Useful for a basic health check of the server (confirming it's running and responding). It is a **route handler**, not middleware.

```
const port = process.env.PORT || 3000;
```

- **Port Configuration**:
  - `process.env.PORT`: Retrieves the port number from the environment variables (useful for deployment, where the hosting platform specifies the port).
  - `|| 3000`: Falls back to port `3000` if no environment variable is set (e.g., during local development).

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

- **Start the Server**:
  - app.listen(port, callback): Starts the Express server, listening on the specified port.
  - The callback function logs a message to the console when the server starts successfully.

To install nodemon:

$npm i nodemon –save-dev

Then package.json => scripts => {”dev”: “nodemon server.js”}

To apply changes on the fly, give following command instead of “**$npm run start**”

$npm run dev

To run debugger:

- make sure that following two line is included in “package.json->{}scripts”

```
$"start": "node server.js”
$"dev": "nodemon server.js"
```

- click debug icon above script function
- click on dev from {start,test,dev} options.
- it will run a new javascript debug terminal

To make API call in postman:

- Click new(left upper one) -> click collection -> add request -> GET [address]

CRUD operation:

-create [POST] {ex: linkedin account creation}
-read [GET] {view profile}
-update [PUT/PATCH] {add info}
-delete [DELETE] {delete account}

Request er body pete hole

npm er body-parser package namaste hobe”
$npm i body-parser —save
Surute body-parser require korte hobe

Routes Overview

HTTP Method	Endpoint	Description
POST	/users	Create a new user
GET	/users	Retrieve all users
GET	/users/:id	Retrieve a user by ID
PUT	/users/:id	Update a user's details
DELETE	/users/:id	Delete a user by ID

To run debugger:

In terminal, give the command-
$npm run dev
Then server will start.
The line you want to debug, just add a breakpoint.
Reload from user end.
Then debug environment will appear with some floating options,use them to debug.

Remember: after yellow box appear around breakpoint, postman api call doesn’t work.
Remove the breakpoint to make api call again from postman

Route Implementations WIthout DB

Create a User (POST /users)

```
app.post('/users', (req, res) => {
  const user = req.body; // Extract user data from the request body
  user.id = ++lastid;    // Assign a unique ID to the new user
  users.push(user);      // Add the user to the users array (in-memory
storage)
  res.status(201).json(user);  // Respond with the created user and
HTTP status 201
});
```

Get All Users (GET /users)

```
app.get('/users', (req, res) => {
  res.json(users);
});
```

Get a User by ID (GET /users/:id)

```
app.get('/users/:id', (req, res) => {
  const id = parseInt(req.params.id);
  const user = users.find(u => u.id === id);
  user ? res.json(user) : res.status(404).json("user not found");
});
```

Update a User (PUT /users/:id)

```
app.put('/users/:id', (req, res) => {
  const id = parseInt(req.params.id); // Extract ID from the URL and
convert it to an integer
  const index = users.findIndex(u => u.id === id); // Find the index of
the user with the given ID

  if (index === -1) return res.status(404).json("user not found"); //
If user not found, return 404

  users[index] = { ...users[index], ...req.body }; // Merge existing
user data with updated data

  res.json(users[index]); // Respond with the updated user data
});
```

Delete a User (DELETE /users/:id)

```
app.delete('/users/:id', (req, res) => {
  const id = parseInt(req.params.id); // Extract user ID from URL and
convert it to an integer
  const index = users.findIndex(u => u.id === id); // Find the index of
the user with the given ID

  if (index === -1) return res.status(404).json("user not found");
```

```
  users.splice(index, 1); // Remove the user from the array
  res.json({ message: "user deleted" }); // Send success response
});
```

Middleware

To parse JSON request bodies:

app.use(express.json());

Mongodb-compass and mongoose installation

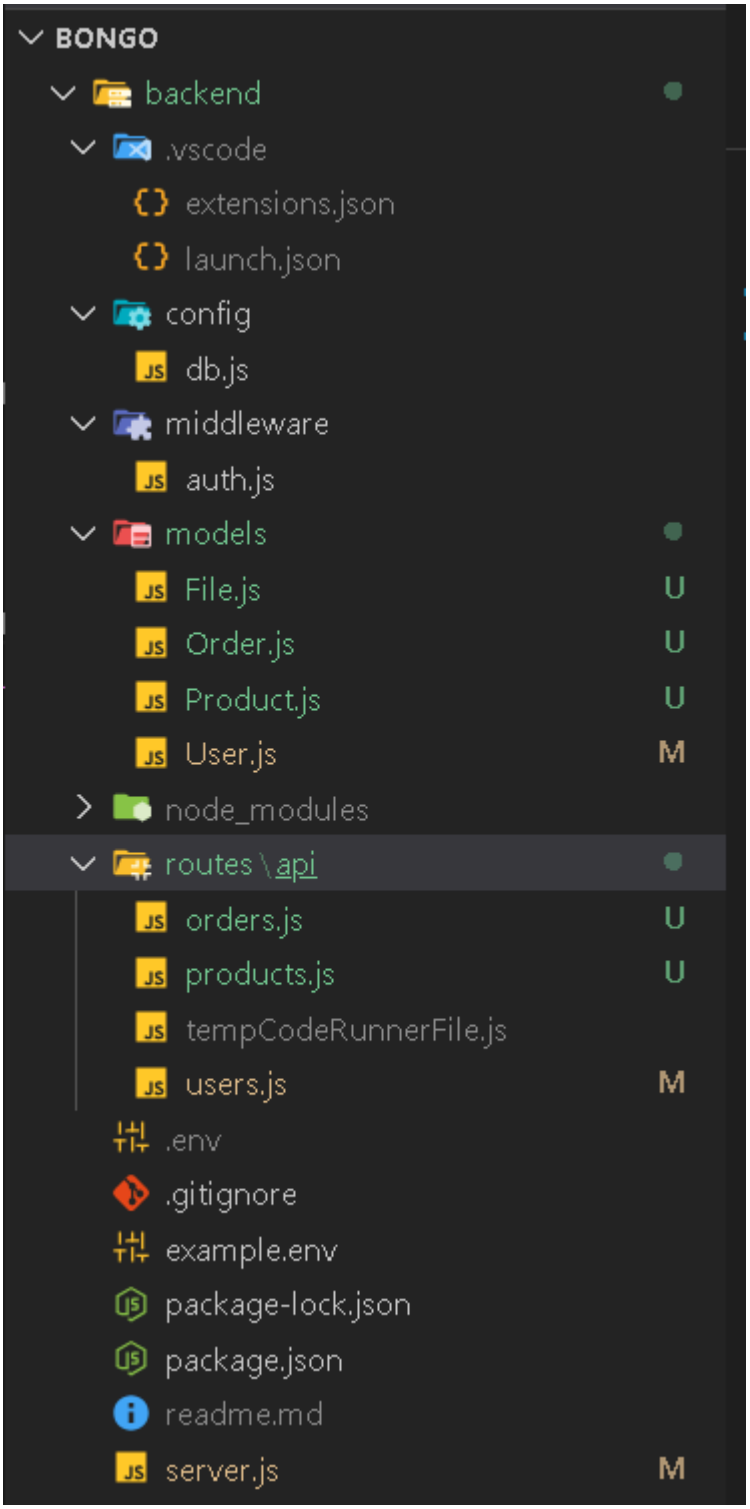
TO SEE INSTALLATION OF MONGODB-Compass AND CONNECT MONGOOSE to vscode(google by mongoose npm) SEE VIDEO no 045

To install mongoose:

&npm i mongoose –save

Route Implementations WIth DB

Folder Structure:



/server.js:

```
const express = require('express');  // Import Express framework to
create server and handle routing
const app = express();  // Initialize an Express application instance
const bodyParser = require('body-parser');  // Import body-parser to
parse incoming request bodies
const connectDB = require('./config/db');  // Import the database
connection function

//? Parse Request Body Middleware
app.use(bodyParser.json());
// Middleware that allows the app to parse JSON request bodies,
enabling access via req.body

//? Connect to MongoDB
connectDB();
// Calls the function to establish a connection with the MongoDB
database

//? API Routes
app.use('/api/users', require('./routes/api/users'));
// This line mounts the user routes (CRUD operations on users) under
the '/api/users' endpoint

//? Check Connection Endpoint
app.get('/', (req, res) => {
  res.json({ message: 'welcome' });
  // Sends a JSON response to the root URL ('/') to confirm the server
is running
});

//? Server Port Configuration
const port = process.env.PORT || 3000;
// Sets the server to listen on the port specified in the environment
variable or defaults to 3000

app.listen(port, () => {
  console.log(`Server running on port ${port}`);
  // Starts the server and logs a message indicating the port it's
running on
});
```

/config/db.js:

```
const mongoose = require('mongoose');  // Import Mongoose for database
interaction

const uri =
'mongodb+srv://nodejs-c1:nodejs-c1@nodejs-c1.530gk.mongodb.net/';  //
MongoDB connection URI

const connectDB = async () => {
  try {
    await mongoose.connect(uri);  // Connect to MongoDB using the
provided URI
    console.log('Mongoose Connect');  // Log success message if
connection succeeds
  }
  catch (error) {
    console.error(error.message);  // Log the error message if the
connection fails
  }
}

module.exports = connectDB;  // Export the connectDB function to be
used elsewhere in the application
```

/models/User.js:

```
const mongoose = require('mongoose');  // Import Mongoose to interact
with MongoDB

const UserSchema = new mongoose.Schema({
  fname: {
    type: String  // Field 'fname' should be of type String
  },
  lname: {
    type: String  // Field 'lname' should be of type String
  },
  email: {
    type: String  // Field 'email' should be of type String
  }
```

```
}, {
  timestamps: true  // Automatically adds 'createdAt' and 'updatedAt'
fields to the schema
});

module.exports = mongoose.model('User', UserSchema);  // Export the
Mongoose model named 'User'
```

/routes/api/users.js:

```
const express = require('express');  // Import Express framework to
handle routing functionalities.
const router = express.Router();  // Create an instance of the Express
router to define API routes.
const User = require('../../models/User');  // Import the User model to
interact with the MongoDB collection.

//? Create a new user (POST request)
router.post('/', async (req, res) => {
  try {
    // Extract user details from the request body.
    // Why: This helps to separate the incoming data and prepare it for
database storage.
    const userObj = {
      fname: req.body.fname,  // First name is extracted from the
request body.
      lname: req.body.lname,  // Last name is extracted from the
request body.
      email: req.body.email,  // Email is extracted from the request
body.
    };

    // Create a new user instance using the Mongoose model.
    // Why: This step helps in ensuring data adheres to the defined
schema before saving.
    const user = await User(userObj);

    // Save the new user to the database.
    // How: The `save()` function writes the new user to the database.
    await user.save();
```

```
    // Send a response with HTTP status 201 (Created) and return the
created user.
    // Why: HTTP 201 indicates successful resource creation.
    return res.status(201).json(user);
  }
  catch (err) {
    // Handle any errors and respond with a generic message.
    // Why: To avoid exposing sensitive error details to the client.
    res.status(500).json({ message: "Something went wrong" });
  }
});

//? Get all users (GET request)
router.get('/', async (req, res) => {
  try {
    // Retrieve all users from the database.
    // How: The `find({})` method fetches all documents from the
collection.
    const users = await User.find({});

    // Return all users with HTTP status 200 (OK).
    // Why: HTTP 200 indicates a successful data retrieval.
    return res.status(200).json(users);
  }
  catch (err) {
    // Handle any errors that occur during database query execution.
    res.status(500).json({ message: "Something went wrong" });
  }
});

//? Get a specific user by ID (GET request)
router.get('/:id', async (req, res) => {
  try {
    // Extract the user ID from the request parameters.
    // How: `req.params.id` retrieves the ID from the URL.
    const id = req.params.id;

    // Find the user by ID in the database.
    // How: `findById(id)` searches the collection for a matching
document.
    const user = await User.findById(id);
```

```
    if (user) {
      // If user is found, return the user data.
      return res.json(user);
    } else {
      // If no user is found, return a 404 (Not Found) status.
      return res.status(404).json("user not found");
    }
  }
  catch {
    // Catch block to handle any unexpected errors.
    res.status(500).json({ message: "Something went wrong" });
  }
});

//? Update an existing user (PUT request)
router.put('/:id', async (req, res) => {
  try {
    // Extract the user ID from the request parameters.
    // Why: The ID is needed to identify which record to update.
    const id = req.params.id;

    // Extract updated user data from the request body.
    const userBody = req.body;

    // Find the user by ID and update with new data.
    // How: `findByIdAndUpdate` takes ID, new data, and `{ new: true }`
to return updated data.
    const updatedUser = await User.findByIdAndUpdate(id, userBody, {
new: true });

    // Optional comments to clarify update options
    // Only update `fname` field: `User.findByIdAndUpdate(id, { fname:
req.body.fname }, { new: true })`
    // Show old values after update: `User.findByIdAndUpdate(id, {
fname: req.body.fname })`

    if (updatedUser) {
      // If update is successful, return the updated user data.
      return res.json(updatedUser);
    } else {
      // If no user is found, return a 404 (Not Found) response.
      return res.status(404).json("user not found");
    }
```

```
  }
  catch {
    // Handle any errors that might occur during the update process.
    res.status(500).json({ message: "Something went wrong" });
  }
});

//? Delete a user
router.delete('/:id', async (req, res) => {
  try {
    const id = req.params.id;  // Extract the user ID from the request URL parameter

    // Attempt to delete the user by ID from the database
    const deletedUser = await User.findByIdAndDelete(id);

    if (deletedUser) {
      // If user is found and deleted, return success message with deleted user details
      return res.json({ "following user deleted": deletedUser });
    } else {
      // If no user is found with the given ID, return 404 Not Found status
      return res.status(404).json("user not found");
    }
  } catch (err) {
    // Handle any errors that may occur during the operation and respond with 500 Internal Server Error
    res.status(500).json({ message: "Something went wrong", error: err.message });
  }
});

module.exports = router;  // Export the router to be used in the main server file.
```

Some Explanation

1. Understanding `async` and `await`:

`async` (Asynchronous Function)

- The `async` keyword is used to define a function that returns a **Promise** implicitly.
- It allows the function to handle asynchronous operations in a readable way.
- Functions declared with `async` can contain the `await` keyword.

`await`

- The `await` keyword is used inside an `async` function to pause execution until the Promise is resolved.
- It ensures that the function waits for an asynchronous operation to complete before moving to the next line of code.
- Instead of using traditional `.then()` promise chains, `await` makes the code look synchronous and cleaner.

Example:

```
async function fetchData() {
  const data = await someAsyncFunction();  // Waits until
someAsyncFunction resolves
  console.log(data);
}
```

How it works:

1. The function is marked `async` to indicate it contains asynchronous operations.
2. `await` makes the function wait until `someAsyncFunction()` completes, then assigns the result to `data`.
3. The next line executes only after the Promise resolves.

2. `findByIdAndUpdate()` Function Structure

Syntax:

```
Model.findByIdAndUpdate(id, updateObject, options);
```

Explanation of Parameters:

1. `id`: The unique identifier (usually `_id`) of the document to be updated.
2. `updateObject`: An object containing the fields to be updated.
3. `options` (optional):
    - `{ new: true }`: Returns the updated document instead of the old one.

- `{ upsert: true }`: If the document does not exist, create a new one.
- `{ runValidators: true }`: Runs schema validators before updating.

Example:

```
const updatedUser = await User.findByIdAndUpdate(
  "65a3b4cde78",  // Example document ID
  { fname: "Updated Name" },  // Fields to update
  { new: true, runValidators: true }  // return updated data and
validate
);
```

How it works:

- The method searches for a user by the given ID.
- If found, it updates the `fname` field with "Updated Name".
- It returns the updated document because of `{ new: true }`.

3. `find({})` Function Structure

Syntax:

```
Model.find(query, projection, options);
```

Explanation of Parameters:

1. `query`: An object that specifies conditions to filter documents (empty `{}` means no filters, returning all documents).
2. `projection` (optional): Specifies which fields to include/exclude.
3. `options` (optional): Additional query options such as sorting, limiting, and pagination.

Example:

```
const users = await User.find({}, "fname lname", { limit: 5 });
```

How it works:

- `{}` as query means all records will be retrieved.
- `"fname lname"` projection means only `fname` and `lname` fields are returned.
- `{ limit: 5 }` option means only 5 records will be returned.

4. Clarifying `const users = await User.find({})`

Why it uses `User.find({})` and not `users.find({})`?

- In your code:

```
const users = await User.find({});
```

Explanation:

- `User` is the **Mongoose model**, which represents the MongoDB collection.
- The `find({})` method is called on the `User` model to retrieve data from the `users` collection in the database.
- The result of this query is stored in the variable `users`, which contains the list of retrieved user documents.

Why not `users.find({})`?

- The variable `users` only stores the data returned by `User.find({})`, but it does not have access to Mongoose methods like `.find()`.
- The correct syntax is always `Model.find()` where `Model` is the schema model, such as `User` in this case.

Example Breakdown:

```
const users = await User.find({});
console.log(users); // Array of user objects from the database
```

Step-by-step explanation:

1. `User.find({})` → Fetches all records from the database.
2. The result is stored in the variable `users`.

`users` now contains an array of all user documents, e.g.:

```
[
  { _id: '1', fname: 'John', lname: 'Doe' },
  { _id: '2', fname: 'Jane', lname: 'Doe' }
]
```

3. If you tried `users.find({})`, it would result in an error because `users` is just an array, not a Mongoose model.

Concept	Explanation
`async`	Declares an asynchronous function that returns a Promise implicitly.
`await`	Waits for an asynchronous operation to complete before continuing.
`findByIdAndUpdate()`	Updates a document by ID and returns the updated document if `{ new: true }` is passed.
`find({})`	Retrieves documents from the database based on filter criteria (empty `{}` returns all).
`User.find({})`	Correct usage, because `User` is the Mongoose model that interacts with the database.

To install dotenv:

$npm i dotenv –save

To install encryption package to protect password:

$npm i bcrypt –save

To install jsonwebtoken to generate token to access password:

$npm i jsonwebtoken –save

Bcrypt Password Encryption - Key Notes

1. Why Encrypt Passwords?
   - Protects against unauthorized access.
   - Prevents rainbow table and brute-force attacks.
   - Ensures passwords are stored securely (hashed, not plain text).

---

2. Steps in Password Encryption

Step 1: Generate Salt
const salt = await bcrypt.genSalt(10);

- Adds randomness to prevent duplicate hashes.
- 10 is the salt round (higher = more secure, but slower).

Step 2: Hash the Password
const hashedPassword = await bcrypt.hash(req.body.password, salt);

- Combines salt with password and applies hashing.
- Hashed password stored securely in the database.

---

3. Password Verification

```
const isMatch = await bcrypt.compare(req.body.password, storedHashedPassword);
```

- **Compares input password with stored hash.**
- **Returns `true` if they match, else `false`.**

---

4. Key Benefits of Bcrypt

- **Adaptive hashing (slows down with increasing computation power).**
- **Automatic salting (no need to manually add salt).**
- **Slowness for security (mitigates brute-force attacks).**

---

5. Important Considerations

- **Always use `app.use(express.json());` to parse request bodies.**
- **Never store plain-text passwords.**
- **Recommended salt rounds: 10-12 for a balance between security and performance.**
- **Use async/await to avoid blocking the server.**

Authentication:

/routes/api/users.js:

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

```
const bcrypt = require('bcrypt');
const jwt = require('jsonwebtoken');

//? Create a new user
router.post('/', async (req, res) => {
  try {
    // 🔐 Password Security Steps:
    // 1. Make random 'salt' to mix with password (like special
seasoning)
    const salt = await bcrypt.genSalt(10); // 10 = security strength

    // 2. Hash password = password + salt → scrambled text
    const password = await bcrypt.hash(req.body.password, salt);

    // 📦 Prepare user data package
    const userObj = {
      fname: req.body.fname,
      lname: req.body.lname,
      email: req.body.email,
      password: password, // Store HASHED password, never raw password!
    }

    // 💾 Save to database
    const user = await User(userObj) // Create new user document
    await user.save(); // Actually save to database

    // ⚠️ SECURITY WARNING: We're sending back hashed password!
    // Should remove password before sending response
    return res.status(201).json(user) // 201 = Created success status

  } catch (err) {
    // 🚨 Handle errors (like duplicate email or database issues)
    res.status(500).json({ message: "Something wrong " }); // 500 =
Server error
  }
});

// 1. Route Setup
// router.post('/', async (req, res) => {
// What it does: Handles POST requests to the website's root URL (/)
// Like: A registration form submission handler

// 2. Password Security (Most Important Part!)
```

```
// const salt = await bcrypt.genSalt(10);
// const password = await bcrypt.hash(req.body.password, salt);
// Step 1: Makes a "salt" - random data for password protection
// genSalt(10) = Security level (higher number = more secure but
slower)
// Step 2: Mixes the user's password with the salt to create a secure
hash
// Why: Never store passwords as plain text!

// 3. Building the User
// const userObj = {
//   fname: req.body.fname,
//   lname: req.body.lname,
//   email: req.body.email,
//   password: password, // This is the hashed password now
// }
// What's happening: Creates a user object with:
// First name
// Last name
// Email
// Securely hashed password (not the real password!)

// 4. Saving to Database
// const user = await User(userObj)
// await user.save();
// Step 1: User(userObj) creates a new user document
// Step 2: user.save() stores it in the database

// 5. Success Response
// return res.status(201).json(user)
// 201 Status: "Created" success message
// Sends back: The created user data (but we'll talk about this later)

// 6. Error Handling
// catch (err) {
//   res.status(500).json({ message: "Something wrong " });
// }
// Catches: Any errors that happen in the process
// Responds: Generic error message (500 = Internal Server Error)

//? Login
router.post('/login', async (req, res) => {
  try {
```

```
    const { type, email, password, refreshToken } = req.body;

    // Currently only handling email/password login
    if (type === 'email') {
      // 🔍 Find user by email (like looking up in phonebook)
      const user = await User.findOne({ email: email });

      if (!user) {
        return res.status(404).json({ message: "user not found" }); //
404 = Not found
      }
      else {
        // 🔑 Verify password & handle login
        await handleEmailLogin(password, user, res)
      }
    }
    else {
      if (!refreshToken) {
        return res.status(404).json({ message: "Refresh token not
found" });
      }
      else {
        await handleRefreshToken(refreshToken, res);
      }
    }
  } catch (error) {
    res.status(500).json({ message: "Something wrong " });
  }
});


// This is a login route handler:
// router.post('/login', async (req, res) => {
// It handles POST requests to the /login URL
// async means it contains asynchronous operations (like database
queries)
// req is the incoming request, res is the response we'll send back

// Getting user input:
// const { type, email, password, refreshToken } = req.body;
// Extracts data from the request body (what the user sent)
// Possible fields: type, email, password, refreshToken
```

```
// Check the login type:
// if (type === 'email') {
// The code currently only handles email/password login
// There might be other types (like 'google' or 'facebook') in the
future

// Find the user:
// const user = await User.findOne({ email: email });
// Searches the database for a user with this email
// await means we wait for the database response before continuing

// Handle user not found:
// if (!user) {
//   return res.status(404).json({ message: "user not found" });
// }
// If no user exists with that email:
// Send back 404 status (Not Found)
// Return a JSON error message
// return stops further execution

// Handle existing user:
// else {
//   await handleEmailLogin(password, user, res)
// }
// If user exists, call a helper function handleEmailLogin
// This function would typically:
// Compare passwords
// Generate authentication tokens
// Send response back to client

// Error handling:
// } catch (error) {
//   res.status(500).json({ message: "Something wrong " });
// }
// Catches any errors that occur in the try block
// Sends a generic 500 error (Internal Server Error)
// Note: In real applications, you might want to log the actual error


//?Get user profile
router.get('/profile', authenticateToken, async (req, res) => {
  try {
    // Step 1: Get the user's ID from the authenticated request
```

```
    const id = req.user._id;

    // Step 2: Find the user in the database using their ID
    const user = await User.findById(id);

    // Step 3: If the user exists, return their profile
    if (user) {
      return res.json(user);
    }
    // Step 4: If the user doesn't exist, return a 404 error
    else {
      return res.status(404).json("user not found");
    }
  }
  // Step 5: Handle any unexpected errors
  catch {
    res.status(500).json({ message: "Something went wrong" });
  }
});



//? Get all users
router.get('/', async (req, res) => {
  try {
    const users = await User.find({})
    return res.status(200).json(users)
  }
  catch (err) {
    res.status(500).json({ message: "Something went wrong" });
  }
})

//?Get one user
router.get('/:id', async (req, res) => {
  try {
    const id = req.params.id
    const user = await User.findById(id)
    if (user) {
      return res.json(user)
    }
    else {
      return res.status(404).json("user not found")
```

```
    }
  }
  catch {
    res.status(500).json({ message: "Something went wrong" });
  }
})

//? Update 1 user
router.put('/:id', async (req, res) => {
  try {
    const id = req.params.id;
    const userBody = req.body
    const updatedUser = await User.findByIdAndUpdate(id, userBody, {
new: true })
    // only fname update korte chaile (id, fname, {new: true})
    // update kore old value e dekhate chaile (id, fname)

    if (updatedUser) {
      return res.json(updatedUser)
    }
    else {
      return res.status(404).json("user not found")
    }
  }
  catch {
    res.status(500).json({ message: "Something went wrong", error:
err.message });
  }
})


//? Delete a user
router.delete('/:id', async (req, res) => {
  try {
    const id = req.params.id;
    const deletedUser = await User.findByIdAndDelete(id)
    if (deletedUser) {
      return res.json({ "following user deleted": deletedUser })
    }
    else {
      return res.status(404).json("user not found")
    }
  } catch (err) {
```

```
    res.status(500).json({ message: "Something went wrong", error:
err.message });
  }
});

module.exports = router

// 🔑 Helper function for email/password login
async function handleEmailLogin(password, user, res) {
  // 🔐 Compare user input with stored hash
  const isValidPassword = await bcrypt.compare(password, user.password)

  if (isValidPassword) {
    // ✅ Correct password: Create token package
    const userObj = await generateUserObj(user)
    return res.json(userObj);
  }
  else {
    // ❌ Wrong password: Unauthorized access
    return res.status(401).json({ message: "login failed" }); // 401 =
Unauthorized
  }
}
// What it does:
// Takes the password you entered and the user's stored password (which
is encrypted)
// Uses bcrypt.compare() to check if they match
// If correct: Creates a special user object with security tokens
// If wrong: Sends "login failed" error (401 = Unauthorized)
// Key Concepts:
// Never store passwords as plain text (always encrypted/hashed)
// bcrypt is a library for safe password comparison

// 🎟️ Token Creation Helpers
function generateUserObj(user) {
  // Create access/refresh tokens (like special event tickets)
  const { accessToken, refreshToken } = generateToken(user);

  // Convert MongoDB user document to plain object
  const userObj = user.toJSON()

  // Add tokens to user object
  userObj['accessToken'] = accessToken // Short-lived token (1 day)
```

```
  userObj['refreshToken'] = refreshToken // Long-lived token (20 days)

  return userObj;
}
// What it does:
// Gets security tokens from generateToken()
// Converts database user data to a simple JSON object
// Adds the tokens to this object
// Returns the final package ready to send to the client
// Why this matters:
// Tokens act like temporary digital keys for accessing protected
features
// Separates database data from what we send to the client

// 🔏 Token Generation (JWT)
function generateToken(user) {
  // Access Token (daily use)
  const accessToken = jwt.sign(
    { email: user.email, _id: user.id }, // Payload (user info)
    process.env.JWT_SECRET, // Secret key (like password for tokens)
    { expiresIn: '1d' } // Expires in 1 day
  );


  // Refresh Token (for getting new access tokens)
  const refreshToken = jwt.sign(
    { email: user.email, _id: user.id },
    process.env.JWT_SECRET,
    { expiresIn: '20d' } // Expires in 20 days
  );

  return { accessToken, refreshToken };
}

// What it does:
// Uses jsonwebtoken (JWT) library to create two tokens:
// Access Token: Short-lived (1 day) for daily use
// Refresh Token: Long-lived (20 days) to get new access tokens
// Key Concepts:
// jwt.sign(payload, secret, options) creates a token
// Tokens are like digital ID cards with expiration dates
// process.env.JWT_SECRET is a secret key stored in your server's
environment (like a password for your tokens)
```

```
function handleRefreshToken(refreshToken, res) {
  jwt.verify(refreshToken, process.env.JWT_SECRET, async (err, payload)
=> {
    if (err) {
      return res.status(401).json({ message: "UnauthorizedError" })
    }
    else {
      const user = await User.findById(payload._id);
      if (user) {
        const userObj = generateUserObj(user);
        return res.status(200).json(userObj);
      } else {
        return res.status(401).json({ message: "UnauthorizedError" })
      }
    }
  })
}
```

What the “jwt_secret” actually do?

What is JWT_SECRET?
It’s a secret key (like a password) that only your server knows.
It’s used to sign and verify JWTs.
Example: "mySuperSecretKey123!" (but much longer and more random in real apps).

What does JWT_SECRET actually do?
The JWT_SECRET has two main jobs:

1. Signing Tokens (Creating JWTs)
When a user logs in, the server creates a JWT using the JWT_SECRET.
The JWT_SECRET is used to generate a signature for the token.
The signature ensures the token hasn’t been tampered with.

Example:

```
const token = jwt.sign(
  { email: "alice@example.com" }, // Payload (user data)
  process.env.JWT_SECRET, // Secret key
  { expiresIn: '1d' } // Expires in 1 day
);
```

2. Verifying Tokens (Validating JWTs)
When the client sends a JWT back to the server, the server uses the JWT_SECRET to verify the token.
The server checks:
Is the token's signature valid? (Was it signed with the correct JWT_SECRET?)
Has the token expired?
Has the token been tampered with?

Example:
```
const decoded = jwt.verify(token, process.env.JWT_SECRET);
```
How does JWT_SECRET work under the hood?

Step 1: Creating a JWT
The server takes the payload (user data, e.g., email, ID).
It adds a header (describes the token type and algorithm).
It combines the header and payload into a string.
It uses the JWT_SECRET to generate a signature for the string.
The final JWT is a combination of:

Header
Payload
Signature

Example JWT:

eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJlbWFpbCI6ImFsaWNlQGV4YW1wbGUuY29tIiwiaWF0IjoxNTE2MjM5MDIyfQ.SflKxwRJSMeKKF2QT4fwpMeJf36POk6yJV_adQssw5c

Step 2: Verifying a JWT
The server receives the JWT from the client.
It splits the JWT into its three parts:

Header
Payload
Signature

It uses the JWT_SECRET to re-calculate the signature for the header and payload.
It compares the re-calculated signature with the signature in the JWT:
If they match → The token is valid.
If they don't match → The token is invalid (tampered with or signed with the wrong key).

Why is JWT_SECRET necessary?

Prevents Tampering:
Without the JWT_SECRET, anyone could modify the payload (e.g., change the email or ID) and create a fake token.
The signature ensures the token hasn't been altered.

Ensures Authenticity:
Only your server knows the JWT_SECRET, so only your server can create valid tokens. Clients can't forge tokens.

Stateless Authentication:
The server doesn't need to store tokens. Instead, it embeds user info in the token and verifies it using the JWT_SECRET.

Real-World Analogy:
Imagine you're issuing tickets for a concert:
JWT_SECRET: Your special ink stamp.
Token: A ticket with:
Header: "This is a valid ticket."
Payload: "Alice can enter until 8 PM."
Signature: Your stamp on the ticket.
Verification:
At the door, the bouncer checks:
Is the stamp real? (Uses JWT_SECRET to verify the signature.)
Is the ticket still valid? (Checks the expiration time.)

Use of access token:

We can view users profile by using access token which is generated at login time

Differentiate between guest and registered user by access token

Explanation of Access Tokens for Guest and Registered Users

What is an Access Token?
An access token is a digital credential (like a temporary key) that grants a user permission to interact with specific resources or services in an application. It is often used in APIs and web services for authentication and authorization.

Why Access Tokens Are Needed

User Type	Purpose of Access Token	Example Use Cases

Registered Users	Grants full access to personalized resources after authentication (e.g., account data).	- Viewing profiles - Making purchases - Accessing private data
Guest Users	Provides limited access for basic interactions (no authentication required).	- Browsing public content - Adding items to a cart - Accessing trial features

---

Key Differences

Feature	Registered Users	Guest Users
Token Scope	Full access to personal data and features.	Limited access to public/unrestricted features.
Token Lifespan	Long-lived (e.g., hours/days).	Short-lived (e.g., minutes/hours).
Security Level	High (linked to user identity).	Low (anonymous, no personal data).

How It Works

1. **Registered Users**:
    - **Step 1**: Log in with email/password.
    - **Step 2**: Server issues an access token (e.g., JWT).
    - **Step 3**: Token is sent with every request to access protected resource

```
// Example: Token generation for registered users
const token = jwt.sign(
  { userId: "123", role: "user" },
  process.env.JWT_SECRET,
  { expiresIn: "1d" });
```

2. **Guest Users**:
    - **Step 1**: Visit the app without logging in.
    - **Step 2**: Server issues a temporary guest token (optional).
    - **Step 3**: Token allows limited actions (e.g., browsing

```
// Example: Token generation for guests
const guestToken = jwt.sign(
  { sessionId: "abc", role: "guest" },
  process.env.JWT_SECRET,
  { expiresIn: "1h" });
```

Why Guests Might Need Tokens

- **Session Management**: Track guest activity (e.g., cart items).
- **Rate Limiting**: Prevent abuse of public APIs.
- **Security**: Enforce token-based policies even for anonymous users.

/middleware/auth.js:

```
// Import the jsonwebtoken library to work with JWTs (JSON Web Tokens)
const jwt = require('jsonwebtoken');

// Export a middleware function that will be used to authenticate
requests
module.exports = function (req, res, next) {
  // Step 1: Check if the request has an Authorization header
  const authHeader = req.headers.authorization;

  // If there's no Authorization header, block the request
  if (!authHeader) {
    // Send a 401 Unauthorized response with an error message
    res.status(401).json({ message: 'Invalid authorization' });
  }
  // If the Authorization header exists, proceed to extract the token
  else {
    // Step 2: Extract the token from the Authorization header
    // The header usually looks like: "Bearer <token>"
    // Split the header by spaces and take the second part (the actual
token)
    const token = authHeader && authHeader.split(' ')[1];

    // Step 3: Check if the token exists
    if (token) {
      // Step 4: Verify the token using the JWT_SECRET
      // jwt.verify() checks if the token is valid and not tampered
with
```

```
      jwt.verify(token, process.env.JWT_SECRET, (err, payLoad) => {
        // If there's an error (e.g., token is expired or invalid),
block the request
        if (err) {
          // Send a 401 Unauthorized response with an error message
          res.status(401).json({ message: 'Invalid authorization' });
        }
        // If the token is valid, proceed to the next step
        else {
          // Step 5: Attach the payload (user data) to the request
object
          // The payload contains the user's information (e.g., userId,
email)
          req.user = payLoad;

          // Step 6: Call next() to pass control to the next middleware
or route handler
          next();
        }
      });
    }
    // If the token doesn't exist, block the request
    else {
      // Send a 401 Unauthorized response with an error message
      res.status(401).json({ message: 'Invalid authorization' });
    }
  }
};
```

Explanation:

Step 1: Check for the Authorization Header

```
const authHeader = req.headers.authorization;
```

- **What**: The client sends a token in the `Authorization` header (e.g., `Bearer eyJhbGci...`).
- **Why**: This is the standard way to send tokens in HTTP requests.
- **How**: Extract the header value to check for a token.

Step 2: Handle Missing Token

```
if (!authHeader) {
  res.status(401).json({ message: 'Invalid authorization' });
}
```

- **What**: If there's no token, block the request.
- **Why**: No token = No proof of identity.
- **How**: Send a `401 Unauthorized` error.

Step 3: Extract the Token

```
const token = authHeader.split(' ')[1];
```

- **What**: Split the header value to get the token.
  - Example: `Bearer abc123` → `abc123`.
- **Why**: The token is prefixed with `Bearer` by convention.
- **How**: Split the string by spaces and take the second part.

Step 4: Verify the Token

```
jwt.verify(token, process.env.JWT_SECRET, (err, payload) => { ... });
```

- **What**: Use the server's secret key (`JWT_SECRET`) to validate the token.
- **Why**: Ensures the token wasn't tampered with and is still valid.
- **How**:
  - `jwt.verify` decodes the token.
  - If valid → `payload` contains user data (e.g., `userId`, `email`).
  - If invalid → `err` explains why (expired, fake, etc.).

Step 5: Grant or Deny Access

```
if (err) {
  res.status(401).json({ message: 'Invalid authorization' });
} else {
  req.user = payload; // Attach user data to the request
  next(); // Allow access to the protected route
}
```

- **Valid Token**:
  - Attach the user's data to `req.user` (e.g., `req.user.email`).
  - `next()` passes control to the next middleware or route handler.
- **Invalid Token**:
  - Block access with a `401 Unauthorized` error.

Key Concepts Explained

What is a JWT?

- A **JSON Web Token** (JWT) is a secure way to transmit user data between the client and server.
- Structure: `Header.Payload.Signature`
    - **Header**: Algorithm used (e.g., `HS256`).
    - **Payload**: User data (e.g., `userId`, `email`).
    - **Signature**: Ensures the token is valid (created using `JWT_SECRET`).

What is `JWT_SECRET`?

- A secret key **only the server knows** (stored in `.env`).
- Used to:
    - **Sign tokens**: Create the token's signature.
    - **Verify tokens**: Confirm the token is authentic.

Why Use `Bearer` in the Header?

- It's a convention to prefix tokens with `Bearer` to indicate the type of authentication.
- Example: `Authorization: Bearer abc123`.

Example Flow

1. **User Logs In**:
    - Server creates a JWT and sends it to the client.
2. **User Requests Protected Data**:
    - Client sends the JWT in the `Authorization` header.
3. **Middleware Checks Token**:
    - Valid token → Access granted.
    - Invalid token → Access denied.

Common Questions

Q: What if the token expires?

- The `jwt.verify` check will fail, and the user must log in again.

Q: Where is `JWT_SECRET` stored?

- In a `.env` file (never in code!) to keep it secure:
- env
- Copy
- JWT_SECRET=your_super_secret_key_here

Q: Why attach `payload` to `req.user`?

- So downstream routes/middleware can access the user's data (e.g., `req.user.email`).

Clarification:

Why attach payload to req.user?

The line `req.user = payload;` is a crucial part of the middleware. It attaches the **decoded payload** (user data) from the JWT to the `req.user` object. Let's break down **why this is done** and **how it works** in simple terms.

What is `payload`?

- The `payload` is the **decoded data** from the JWT.
- It typically contains user information, such as:

```
{
  "userId": "123",
  "email": "user@example.com",
  "role": "user"
```

- }
- This data is embedded in the JWT when the token is created (e.g., during login).

Why Attach `payload` to `req.user`?

1. Share User Data Across Middleware and Routes

- In Express, the `req` object is passed through all middleware and route handlers.
- By attaching the `payload` to `req.user`, you make the user's data available to any subsequent middleware or route handler.
- Example:

```
app.get('/profile', (req, res) => {
  console.log(req.user); // { userId: "123", email: "user@example.com" }
  res.send(`Welcome, ${req.user.email}!`);
```

- });

2. Avoid Repeated Token Decoding

- Without attaching `payload` to `req.user`, you'd need to decode the JWT in every route handler that requires user data.
- Example of **bad practice**:

```
app.get('/profile', (req, res) => {
  const token = req.headers.authorization.split(' ')[1];
  const payload = jwt.verify(token, process.env.JWT_SECRET); // Decode again
  res.send(`Welcome, ${payload.email}!`);
```

- });
- This is inefficient and redundant.

3. Simplify Access Control

- You can use `req.user` to check permissions or roles in downstream middleware or routes.
- Example:

```
app.get('/admin', (req, res) => {
  if (req.user.role === 'admin') {
    res.send('Welcome, Admin!');
  } else {
    res.status(403).send('Access Denied');
  }
```

- });

How Does It Work?

1. **Token Verification**:
   - The middleware decodes the JWT using `jwt.verify`.
   - If valid, the `payload` contains the user's data.
2. **Attach Payload to `req.user`**:
3. req.user = payload;
   - This adds the user's data to the `req` object.
4. **Use `req.user` in Routes**:
   - Any route handler or middleware after this can access `req.user`.

why this ?

```
  const id = req.user._id;
```

why not:

```
  const id = req.user.id;??
```

Great question! The difference between req.user._id and req.user.id depends on how the JWT payload is structured and how your database schema is designed. Let's break it down:

1. Why req.user._id?

In MongoDB (and Mongoose), the unique identifier for a document is stored in the _id field by default.
When you create a JWT payload, it's common to include the user's _id from the database:

```
const token = jwt.sign(
  { _id: user._id, email: user.email }, // Payload
  process.env.JWT_SECRET,
  { expiresIn: '1d' }
);
```

So, when the token is decoded in the middleware, req.user will contain:
req.user = { _id: "123", email: "user@example.com" };
Therefore, you access the user's ID using req.user._id.

2. Why req.user.id?
Some developers prefer to use id instead of _id in the JWT payload for simplicity.
If the payload is structured like this:

```
const token = jwt.sign(
  { id: user._id, email: user.email }, // Payload
  process.env.JWT_SECRET,
  { expiresIn: '1d' }
);
```

Then, when the token is decoded, req.user will contain:
req.user = { id: "123", email: "user@example.com" };
In this case, you would use req.user.id.

Which One Should You Use?
It depends on how the JWT payload is created:
If the payload uses _id:
Use req.user._id.
If the payload uses id:
Use req.user.id.

Best Practice
Be consistent with how you structure your JWT payload.
If you're using MongoDB/Mongoose, it's common to use _id because that's the default field name for the unique identifier in the database.
Example:

```
const token = jwt.sign(
  { id: user._id, email: user.email }, // Payload
  process.env.JWT_SECRET,
  { expiresIn: '1d' }
);
```

Then, in your route:

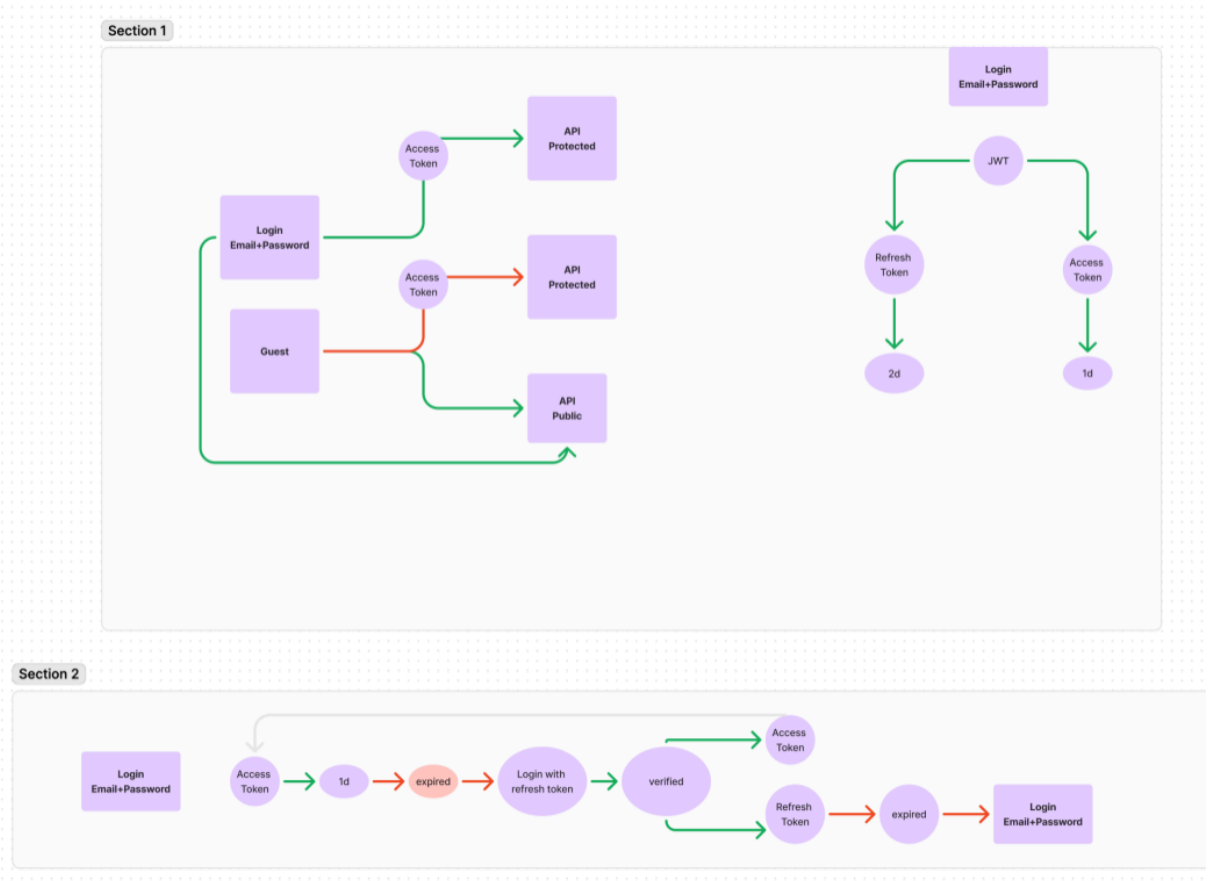
const id = req.user._id; // Access _id

Why Not Both?
You can include both _id and id in the payload if you want flexibility:

```
const token = jwt.sign(
  { _id: user._id, id: user._id, email: user.email }, // Include both
  process.env.JWT_SECRET,
  { expiresIn: '1d' }
);
```

Then, you can use either req.user._id or req.user.id in your code.

Auth Flow:



Example for using another Object Reference:

We should write like this:

```
productId: {
      type: mongoose.Types.ObjectId,
      ref: "Product",
    },
```

The `ref: "Product"` establishes a relationship between the `Order` schema and the `Product` schema

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

const OrderSchema = new mongoose.Schema(
  {
    qty: {
      type: Number,
    },
    total: {
      type: Number,
    },
    userId: {
      type: mongoose.Types.ObjectId,
      ref: "user",
    },
    // productId: {
    //   type: mongoose.Types.ObjectId,
    //   ref: "Product",
    // },
    deliveryLocation: {
      type: String,
    },
    expectedDeliveryDate: {
      type: Date,
    },
    purchaseDate: {
```

```
      type: Date,
    },
    deliveryStatus: {
      type: String,
      enum: ["delivered", "cancelled", "in-progress"],
      default: "in-progress",
    },
  },
  {
    timestamps: true,
  }
);

module.exports = mongoose.model("Order", OrderSchema);
```

Multer Definition:

Multer is a middleware for handling `multipart/form-data`, primarily used for uploading files in Node.js applications.

Key Features:

- Works with Express.js
- Supports single and multiple file uploads
- Allows file filtering and size limits
- Stores files in memory or disk

Installation:

```
npm install --save multer
```

Basic Usage:

```
// Configure storage settings for multer
const storage = multer.diskStorage({
  // Set the destination folder for uploaded files
  destination: function (req, file, cb) {
```

```
    // Save files in the "/tmp/my-uploads" directory
    cb(null, "/tmp/my-uploads");
  },
  // Define the naming convention for uploaded files
  filename: function (req, file, cb) {
    // Generate a unique suffix using the current timestamp and a
random number
    const uniqueSuffix = Date.now() + "-" + Math.round(Math.random() *
1e9);
    // Set the file name as the field name plus the unique suffix
    cb(null, file.fieldname + "-" + uniqueSuffix);
  },
});
```