

# NodeJS Backend Project

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# Project structure

- README.md: Contains information about the project and instructions.
- database.db: The SQLite database file.
- package-lock.json & package.json: Manage project dependencies.
- project.pdf: The project presentation.
- server.js: The main server file.
- sql/: Contains SQL scripts for creating, deleting, and inserting data into the database.

```
— project
  ├── README.md
  ├── database.db
  ├── package-lock.json
  ├── package.json
  ├── project.pdf
  ├── server.js
  └── sql
      ├── README
      ├── create.sql
      ├── delete.sql
      └── insert.sql
```

# Main functionalities

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- Create, read, update, and delete data in a SQLite database via a Node.js server.
- The server processes HTTP GET requests to retrieve data, POST requests to add data, UPDATE requests to modify data, and DELETE requests to remove data.
- It also handles errors and sends responses in JSON format.

# Technologies Used

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- Node.js
- SQLite
- Express.js

# Challenges

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1. Setting up and managing the SQLite database.
2. Implementing the HTTP methods with proper error handling.
3. Ensuring the server responses are in the correct JSON format.

# Solutions

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## 1. Express.js middleware for error handling

Use 'app.use()' to define a middleware function that checks for errors and responds with the appropriate HTTP status code and message.

## 2. Express.js 'res.json()' method

It automatically sends responses as JSON.

# Timeline

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1. Create necessary scripts to setup SQLite database
2. Connect to the SQLite database from the Node.js application
3. Implement GET HTTP request to retrieve data from the database
4. Implement POST HTTP request to add data to the database
5. Implement PUT HTTP request to update data in the database
6. Implement DELETE HTTP request to remove data from the database
7. Implement error handling for all HTTP methods
8. Test all endpoints and ensure they work as expected
9. Write documentation for the project, including setup and usage instructions

# Code

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## Create a basic Express server connected to a SQLite database

---

```
const express = require("express");
const sqlite3 = require("sqlite3").verbose();

// Connect to SQLite database
let db = new sqlite3.Database("./database.db");

// Initialize Express app
const app = express();

// Enable to parse JSON body in POST requests
app.use(express.json());

app.listen(8080, () => {
  console.log("Server is running on http://localhost:8080 ...");
});
```

## Retrieve existing records (HTTP GET method)

```
// Redirect from '/' to '/clothes'  
app.get("/", (req, res) => {  
  res.redirect("/clothes");  
});  
  
// HTTP GET endpoint  
app.get("/clothes", (req, res) => {  
  db.all("SELECT * FROM Clothes", [], (err, rows) => {  
    if (err) {  
      res.status(500).json({ error: err.message });  
      return;  
    }  
    res.json(rows);  
  });  
});  
  
// HTTP GET endpoint for a specific record  
app.get("/clothes/:id", (req, res) => {  
  const query = "SELECT * FROM Clothes WHERE id = ?";  
  const values = [req.params.id];  
  
  db.get(query, values, (err, row) => {  
    if (err) {  
      res.status(500).json({ error: err.message });  
      return;  
    }  
    res.json(row);  
  });  
});
```

# Create a new record (HTTP POST method)

```
// HTTP POST endpoint
app.post("/clothes", (req, res) => {
  const query =
    "INSERT INTO Clothes (name, type, size, color, price) VALUES (?, ?, ?, ?, ?,
?)";
  const values = [
    req.body.name,
    req.body.type,
    req.body.size,
    req.body.color,
    req.body.price,
  ];

  db.run(query, values, function (err) {
    if (err) {
      res.status(500).json({ error: err.message });
      return;
    }
    res.json({ id: this.lastID });
  });
});
```

# Update an existing record (HTTP PUT method)

```
// HTTP UPDATE endpoint
app.put("/clothes/:id", (req, res) => {
  const query =
    "UPDATE Clothes SET name = ?, type = ?, size = ?, color = ?, price = ? WHERE
  id = ?";
  const values = [
    req.body.name,
    req.body.type,
    req.body.size,
    req.body.color,
    req.body.price,
    req.params.id,
  ];

  db.run(query, values, function (err) {
    if (err) {
      res.status(500).json({ error: err.message });
      return;
    }
    res.json({ message: "Row updated", changes: this.changes });
  });
});
```

## Delete an existing record (HTTP DELETE method)

```
// HTTP DELETE endpoint
app.delete("/clothes/:id", (req, res) => {
  const query = "DELETE FROM Clothes WHERE id = ?";
  const values = [req.params.id];

  db.run(query, values, function (err) {
    if (err) {
      res.status(500).json({ error: err.message });
      return;
    }
    res.json({ message: "Row deleted", changes: this.changes });
  });
});
```

# Test calls to backend

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# GET all clothing items

---

```
jingjingyang@jingjings-MacBook-Pro ~ % curl http://localhost:8080  
Found. Redirecting to /clothes%
```

```
jingjingyang@jingjings-MacBook-Pro ~ % curl http://localhost:8080/clothes  
[{"id":1,"name":"Denim Jacket","type":"Jacket","size":"M","color":"Blue","price":59.99}, {"id":2,"name":"Leather Boots","type":"Shoes","size":"8","color":"Black","price":89.99}, {"id":3,"name":"Floral Dress","type":"Dress","size":"S","color":"Multicolor","price":45.99}, {"id":4,"name":"Cotton T-Shirt","type":"Shirt","size":"L","color":"White","price":15.99}]%
```

# GET a specific item

---

```
jingjingyang@jingjings-MacBook-Pro ~ % curl http://localhost:8080/clothes/1
{"id":1,"name":"Denim Jacket","type":"Jacket","size":"M","color":"Blue","price":59.99}%
```

# POST a new item

```
jingjingyang@jingjings-MacBook-Pro ~ % curl -X POST -H "Content-Type: application/json" -d '{"name":"Wool Sweater","type":"Sweater","size":"L","color":"Red","price":60.99}' http://localhost:8080/clothes  
{"id":5}%
```

```
jingjingyang@jingjings-MacBook-Pro ~ % curl http://localhost:8080/clothes  
[{"id":1,"name":"Denim Jacket","type":"Jacket","size":"M","color":"Blue","price":59.99}, {"id":2,"name":"Leather Boots","type":"Shoes","size":"8","color":"Black","price":89.99}, {"id":3,"name":"Floral Dress","type":"Dress","size":"S","color": "Multicolor","price":45.99}, {"id":4,"name":"Cotton T-Shirt","type":"Shirt","size":"L","color":"White","price":15.99}, {"id":5,"name":"Wool Sweater","type":"Sweater","size":"L","color":"Red","price":60.99}]%
```

# PUT to update(replace) an item

---

```
jingjingyang@jingjings-MacBook-Pro ~ % curl -X PUT -H "Content-Type: application/json" -d '{"name":"Denim Jacket","type":"Jacket","size":"XL","color":"Brown","price":50.99}' http://localhost:8080/clothes/1
{"message":"Row updated","changes":1}%
```

```
jingjingyang@jingjings-MacBook-Pro ~ % curl http://localhost:8080/clothes/1
{"id":1,"name":"Denim Jacket","type":"Jacket","size":"XL","color":"Brown","price":50.99}%
```

# DELETE an item

---

```
jingjingyang@jingjings-MacBook-Pro ~ % curl -X DELETE http://localhost:3000/clothes/1
{"message":"Row deleted","changes":1}%
```

```
jingjingyang@jingjings-MacBook-Pro ~ % curl http://localhost:8080/clothes/1
jingjingyang@jingjings-MacBook-Pro ~ % curl http://localhost:8080/clothes
[{"id":2,"name":"Leather Boots","type":"Shoes","size":"8","color":"Black","price":89.99}, {"id":3,"name":"Floral Dress","type":"Dress","size":"S","color":"Multi color","price":45.99}, {"id":4,"name":"Cotton T-Shirt","type":"Shirt","size":"L","color":"White","price":15.99}, {"id":5,"name":"Wool Sweater","type":"Sweater","size":"L","color":"Red","price":60.99}]%
```

# Include the HTTP response headers in curl

# GET all clothing items

---

```
(base) jingjingyang@jingjings-MacBook-Pro ~ % curl --silent --include http://loc  
alhost:8080  
HTTP/1.1 302 Found  
X-Powered-By: Express  
Location: /clothes  
Vary: Accept  
Content-Type: text/plain; charset=utf-8  
Content-Length: 30  
Date: Tue, 12 Dec 2023 10:40:59 GMT  
Connection: keep-alive  
Keep-Alive: timeout=5  
  
Found. Redirecting to /clothes%
```

# GET all clothing items

---

```
(base) jingjingyang@jingjings-MacBook-Pro ~ % curl --silent --include http://loc
alhost:8080/clothes
HTTP/1.1 200 OK
X-Powered-By: Express
Content-Type: application/json; charset=utf-8
Content-Length: 357
ETag: W/"165-20EAdHwAIDZ0E8V902NHHPCAnwE"
Date: Tue, 12 Dec 2023 10:29:28 GMT
Connection: keep-alive
Keep-Alive: timeout=5

[{"id":1,"name":"Denim Jacket","type":"Jacket","size":"M","color":"Blue","pric
e":59.99}, {"id":2,"name":"Leather Boots","type":"Shoes","size":"8","color":"Blac
k","price":89.99}, {"id":3,"name":"Floral Dress","type":"Dress","size":"S","colo
r":"Multicolor","price":45.99}, {"id":4,"name":"Cotton T-Shirt","type":"Shirt","s
ize":"L","color":"White","price":15.99}]%
```

# GET a specific item

---

```
(base) jingjingyang@jingjings-MacBook-Pro ~ % curl --silent --include http://loc  
alhost:8080/clothes/1  
HTTP/1.1 200 OK  
X-Powered-By: Express  
Content-Type: application/json; charset=utf-8  
Content-Length: 86  
ETag: W/"56-aGu82n/Q/4/aqfNMoVuUmqfb98w"  
Date: Tue, 12 Dec 2023 10:30:44 GMT  
Connection: keep-alive  
Keep-Alive: timeout=5  
  
{"id":1,"name":"Denim Jacket","type":"Jacket","size":"M","color":"Blue","price":  
59.99}%
```

# GET a non-existing resource

(Content-Length: 0)

---

```
(base) jingjingyang@jingjings-MacBook-Pro ~ % curl --silent --include http://  
localhost:8080/clothes/88  
HTTP/1.1 200 OK  
X-Powered-By: Express  
Content-Type: application/json; charset=utf-8  
Date: Tue, 12 Dec 2023 10:54:35 GMT  
Connection: keep-alive  
Keep-Alive: timeout=5  
Content-Length: 0
```

# POST a new item

---

```
(base) jingjingyang@jingjings-MacBook-Pro ~ % curl --silent --include -X POST -H "Content-Type: application/json" -d '{"name":"Wool Sweater","type":"Sweater","size":"L","color":"Red","price":60.99}' http://localhost:8080/clothes
HTTP/1.1 201 Created
X-Powered-By: Express
Content-Type: application/json; charset=utf-8
Content-Length: 8
ETag: W/"8-4U72Xq+t/P6Xscj7oQblSpGEbo"
Date: Tue, 12 Dec 2023 10:49:24 GMT
Connection: keep-alive
Keep-Alive: timeout=5

{"id":5}%
```

# PUT to update(replace) an item

---

```
(base) jingjingyang@jingjings-MacBook-Pro ~ % curl --silent --include -X PUT -H "Content-Type: application/json" -d '{"name":"Denim Jacket","type":"Jacket","size":"XL","color":"Brown","price":50.99}' http://localhost:8080/clothes/1
HTTP/1.1 200 OK
X-Powered-By: Express
Content-Type: application/json; charset=utf-8
Content-Length: 37
ETag: W/"25-JB1Tin60AHjLd750N4t0/Q1kVD8"
Date: Tue, 12 Dec 2023 10:31:07 GMT
Connection: keep-alive
Keep-Alive: timeout=5

{"message":"Row updated","changes":1}%
```

# PUT with invalid data

("changes":0)

---

```
(base) jingjingyang@jingjings-MacBook-Pro ~ % curl --silent --include -X PUT  
-H "Content-Type: application/json" -d '{"name":"Denim Jacket","type":"Jacke  
t","size":"XL","color":"Brown","price":50.99}' http://localhost:8080/clothes/  
88  
HTTP/1.1 200 OK  
X-Powered-By: Express  
Content-Type: application/json; charset=utf-8  
Content-Length: 37  
ETag: W/"25-H9XUMJUwB1GDqSwx5WsIscmVTlk"  
Date: Tue, 12 Dec 2023 10:59:55 GMT  
Connection: keep-alive  
Keep-Alive: timeout=5  
  
{"message":"Row updated","changes":0}%
```

# DELETE an item

---

```
(base) jingjingyang@jingjings-MacBook-Pro ~ % curl --silent --include -X DELETE  
http://localhost:8080/clothes/1  
HTTP/1.1 204 No Content  
X-Powered-By: Express  
ETag: W/"25-F8iueZV101Skkf6zApRwls6i7iU"  
Date: Tue, 12 Dec 2023 10:32:35 GMT  
Connection: keep-alive  
Keep-Alive: timeout=5
```

# Test via Postman

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# GET all clothing items

Sample Footer Text

The screenshot shows a UI tool with two parallel API requests. Both requests are GET methods to `http://localhost:8080`. The left request has a status of 200 OK, time 4 ms, size 594 B, and the right request has a status of 200 OK, time 8 ms, size 594 B. Both requests have an empty body. The left request's response is displayed in a JSON viewer, and the right request's response is also displayed in a JSON viewer.

**Left Request (Status: 200 OK, Time: 4 ms, Size: 594 B)**

```
1 [  
2   {  
3     "id": 1,  
4     "name": "Denim Jacket",  
5     "type": "Jacket",  
6     "size": "M",  
7     "color": "Blue",  
8     "price": 59.99  
9   },  
10  {  
11    "id": 2,  
12    "name": "Leather Boots",  
13    "type": "Shoes",  
14    "size": "8",  
15    "color": "Black",  
16    "price": 89.99  
17  },  
18  {  
19    "id": 3,  
20    "name": "Floral Dress",  
21    "type": "Dress",  
22    "size": "S",  
23    "color": "Multicolor",  
24    "price": 45.99  
25  },  
26  {  
27    "id": 4,  
28    "name": "Cotton T-Shirt",  
29    "type": "Shirt",  
30    "size": "L",  
31    "color": "White",  
32    "price": 15.99  
33  }  
34 ]
```

**Right Request (Status: 200 OK, Time: 8 ms, Size: 594 B)**

```
1 [  
2   {  
3     "id": 1,  
4     "name": "Denim Jacket",  
5     "type": "Jacket",  
6     "size": "M",  
7     "color": "Blue",  
8     "price": 59.99  
9   },  
10  {  
11    "id": 2,  
12    "name": "Leather Boots",  
13    "type": "Shoes",  
14    "size": "8",  
15    "color": "Black",  
16    "price": 89.99  
17  },  
18  {  
19    "id": 3,  
20    "name": "Floral Dress",  
21    "type": "Dress",  
22    "size": "S",  
23    "color": "Multicolor",  
24    "price": 45.99  
25  },  
26  {  
27    "id": 4,  
28    "name": "Cotton T-Shirt",  
29    "type": "Shirt",  
30    "size": "L",  
31    "color": "White",  
32    "price": 15.99  
33  }  
34 ]
```

# GET a specific item

Sample Footer Text

The screenshot shows a REST client interface with the following details:

- Method:** GET
- URL:** http://localhost:8080/clothes/1
- Params:** None
- Query Params:** None
- Body:** Status: 200 OK Time: 7 ms Size: 321 B
- Response Preview:** JSON (Pretty)

```
1 {  
2   "id": 1,  
3   "name": "Denim Jacket",  
4   "type": "Jacket",  
5   "size": "M",  
6   "color": "Blue",  
7   "price": 59.99  
8 }
```

# POST a new item

The screenshot shows the Postman application interface. At the top, there are tabs for Params, Authorization, Headers (10), Body (green dot), Pre-request Script, Tests, Settings, Code, and Cookies. The Headers tab is currently selected, displaying a table with one row: Content-Type set to application/json. Below this, the URL `http://localhost:8080/clothes` is entered in the address bar, along with a POST method. The Body tab is selected, showing raw JSON data: 

```
1 {"name": "Wool Sweater", "type": "Sweater", "size": "L", "color": "Red", "price": 60.99}
```

. The Body content type is set to raw. The response at the bottom shows a status of 200 OK with a time of 25 ms and a size of 241 B. The response body is: 

```
1 {  
2   "id": 5  
3 }
```

.

Sample Footer Text

# POST a new item

Sample Footer Text

The screenshot shows the Postman application interface. At the top, it displays the URL `http://localhost:8080/clothes`. Below the URL, there are tabs for `GET`, `Save`, and `No Environment`. The `Headers (8)` tab is currently selected. The `Body` tab is also visible. The `Test Results` section shows a status of `200 OK`, time `9 ms`, and size `681 B`. The `Body` section is expanded and shows the following JSON data:

```
[{"id": 1, "name": "Denim Jacket", "type": "Jacket", "size": "M", "color": "Blue", "price": 59.99}, {"id": 2, "name": "Leather Boots", "type": "Shoes", "size": "8", "color": "Black", "price": 89.99}, {"id": 3, "name": "Floral Dress", "type": "Dress", "size": "S", "color": "Multicolor", "price": 45.99}, {"id": 4, "name": "Cotton T-Shirt", "type": "Shirt", "size": "L", "color": "White", "price": 15.99}, {"id": 5, "name": "Wool Sweater", "type": "Sweater", "size": "L", "color": "Red", "price": 60.99}]
```

# PUT to update an item

The screenshot shows the Postman application interface for making a PUT request to update a clothes item.

**Request Headers:**

Key	Value
Content-Type	application/json
Key	Value

**Request URL:** http://localhost:8080/clothes/1

**Method:** PUT

**Body (raw JSON):**

```
1  [{"name": "Denim Jacket", "type": "Jacket", "size": "XL", "color": "Brown", "price": 50.99}]
```

**Response Status:** 200 OK

**Response Body (Pretty JSON):**

```
1  {
2      "message": "Row updated",
3      "changes": 1
4  }
```

Sample Footer Text

# PUT to update an item

Sample Footer Text

The screenshot shows the Postman application interface. At the top, the URL `http://localhost:8080/clothes/1` is entered into the address bar, along with the method `GET`. To the right are buttons for `Save`, `No Environment`, and a gear icon. Below the address bar is a search bar containing the same URL and method. A large blue `Send` button is positioned to the right of the search bar.

Below the search bar, there are several tabs: `Params`, `Authorization`, `Headers (8)` (which is currently selected), `Body`, `Pre-request Script`, `Tests`, and `Settings`. To the right of these are links for `Code` and `Cookies`.

The `Headers` section displays the following table:

	Key	Value
<input type="checkbox"/>	Content-Type	application/json
	Key	Value

Below the headers, there are tabs for `Body`, `Cookies`, `Headers (7)`, and `Test Results`. The `Body` tab is selected. It contains three tabs: `Pretty` (selected), `Raw`, and `Preview`. To the right of the body tabs, status information is displayed: `Status: 200 OK Time: 4 ms Size: 323 B`. There are also icons for copy, search, and refresh.

The `Pretty` tab shows the JSON response with line numbers:

```
1 {  
2   "id": 1,  
3   "name": "Denim Jacket",  
4   "type": "Jacket",  
5   "size": "XL",  
6   "color": "Brown",  
7   "price": 50.99  
8 }
```

# DELETE an item

HTTP <http://localhost:8080/clothes/1> Save | No Environment |

**DELETE** ▾ http://localhost:8080/clothes/1 **Send**

Params Authorization Headers (8) Body Pre-request Script Tests Settings Code Cookies

Headers

	Key	Value
<input type="checkbox"/>	Content-Type	application/json
	Key	Value

Body Cookies Headers (7) Test Results Status: 200 OK Time: 5 ms Size: 272 B ...

Pretty Raw Preview JSON

```
1 {  
2   "message": "Row deleted",  
3   "changes": 1  
4 }
```

Sample Footer Text

# DELETE an item

The screenshot shows the Postman application interface. At the top, the URL is set to `http://localhost:8080/clothes/1`. The method is selected as `DELETE`. Below the URL, there are tabs for `Params`, `Authorization`, `Headers (8)`, `Body`, `Pre-request Script`, `Tests`, and `Settings`. The `Headers (8)` tab is currently active. It displays a table with two rows:

	Key	Value
<input type="checkbox"/>	Content-Type	application/json
	Key	Value

Below the headers, the `Body` tab is active. It shows a status message: `Status: 200 OK Time: 5 ms Size: 192 B`. There are buttons for `Pretty`, `Raw`, `Preview`, and `JSON`. A small number `1` is visible at the bottom left of the body section.

Sample Footer Text

# Test the various errors

# POST with invalid data

## (HTTP\_STATUS\_INTERNAL\_SERVER\_ERROR = 500)

```
(base) jingjingyang@jingjings-MacBook-Pro ~ % curl --silent --include -X POST  
-H "Content-Type: application/json" -d '{"Name":"Wool Sweater","type":"Sweate  
r","size":"L","color":"Red","price":60.99}' http://localhost:8080/clothes  
HTTP/1.1 500 Internal Server Error  
X-Powered-By: Express  
Content-Type: application/json; charset=utf-8  
Content-Length: 128  
ETag: W/"80-B/PeHB4EmU5cnsDI1dkBPK43RQ0"  
Date: Tue, 12 Dec 2023 11:01:55 GMT  
Connection: keep-alive  
Keep-Alive: timeout=5  
  
{"error":"SQLITE_CONSTRAINT: NOT NULL constraint failed: Clothes.name","cod  
e":"SQLITE_CONSTRAINT","details":{},"stack":"hidden"}%
```

# DELETE a non-existing resource

(HTTP\_STATUS\_NO\_CONTENT = 204)

---

```
(base) jingjingyang@jingjings-MacBook-Pro ~ % curl --silent --include -X DELETE http://localhost:8080/clothes/88
HTTP/1.1 204 No Content
X-Powered-By: Express
ETag: W/"25-EMgarNurQ4RT+HU/18cr5LeBED4"
Date: Tue, 12 Dec 2023 11:02:23 GMT
Connection: keep-alive
Keep-Alive: timeout=5
```

# Summary

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- In conclusion, I have successfully implemented a backend server using Node.js and SQLite in this project. I created a basic HTTP server, handled different types of HTTP requests, and connected to a SQLite database. I ensured to incorporate error handling and provide responses in JSON format, which are crucial for effective communication with clients. This project has been a foundational step in my journey towards mastering backend development.