Advance Data Management - Programming Project

Development of an application supported by a NoSQL Database

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Selection of the topic

The objective of this project is to develop a MERN (MongoDB, Express.js, React.js, Node.js) application tailored for an e-commerce website.

Description of the topic

The aim of this project is to design and implement a robust e-commerce website using the MERN (MongoDB, Express.js, React.js, Node.js) stack.
The website will serve as a platform for users to browse, search, and pur- chase products online.
It will provide an intuitive and seamless shopping experience for customers.

Specification of the topic

- User Authentication
- Product Catalog Management
- Shopping Cart Management
- Order Tracking
- Responsive Design
- Performance Optimization

Selection of NoSQL DB system suitable for the above topic.

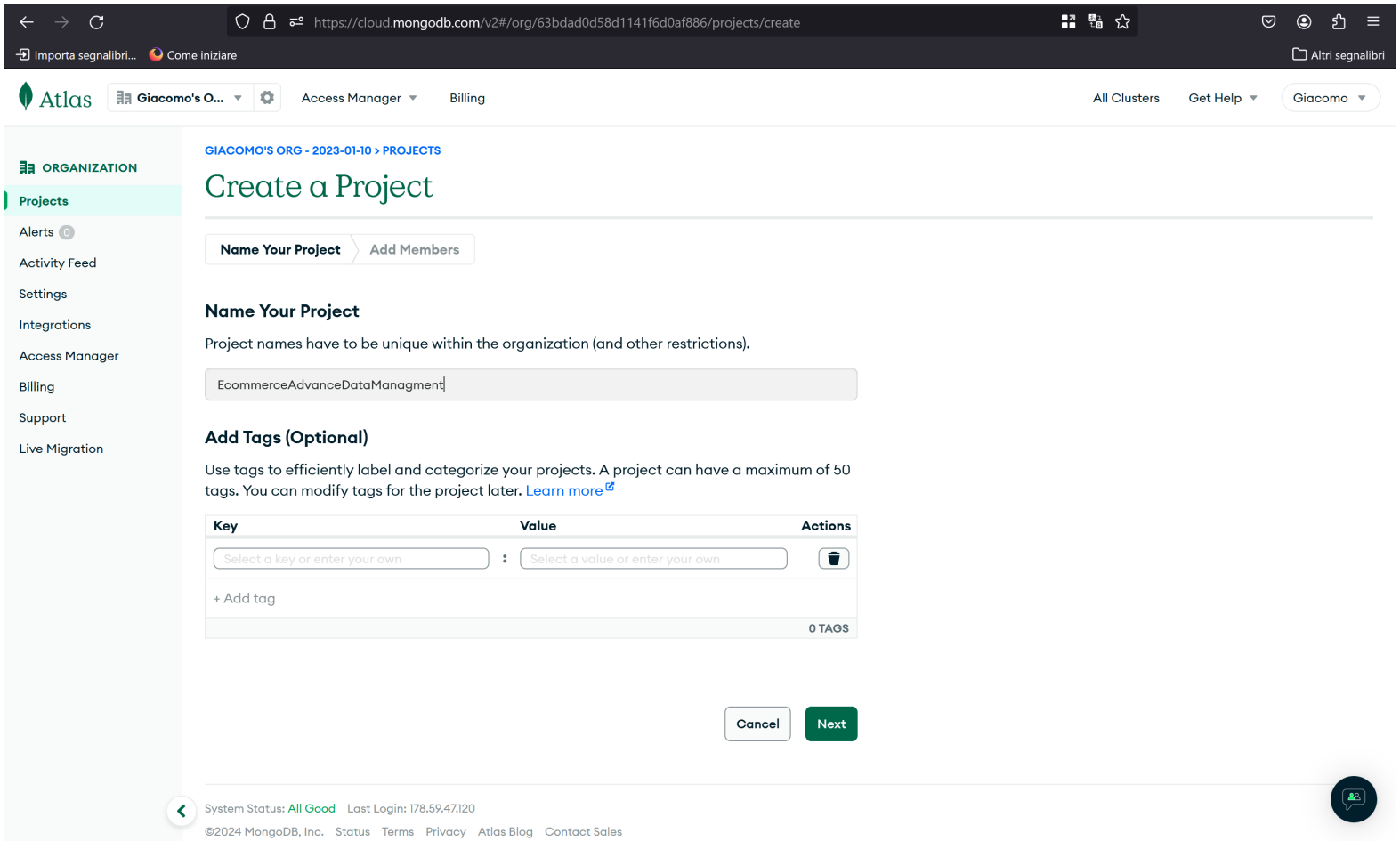
For this project, MongoDB has been selected as the NoSQL database system.
MongoDB's flexibility, scalability, and ability to handle unstructured data make it well-suited for the requirements of an e-commerce website. Its document-oriented data model allows for easy storage and retrieval of product information, user data, and transaction records.
Additionally, MongoDB's support for sharding and replication ensures high availability and fault tolerance, crucial aspects for an e-commerce platform handling large volumes of data and transactions.

Sign up for MongoDB Atlas

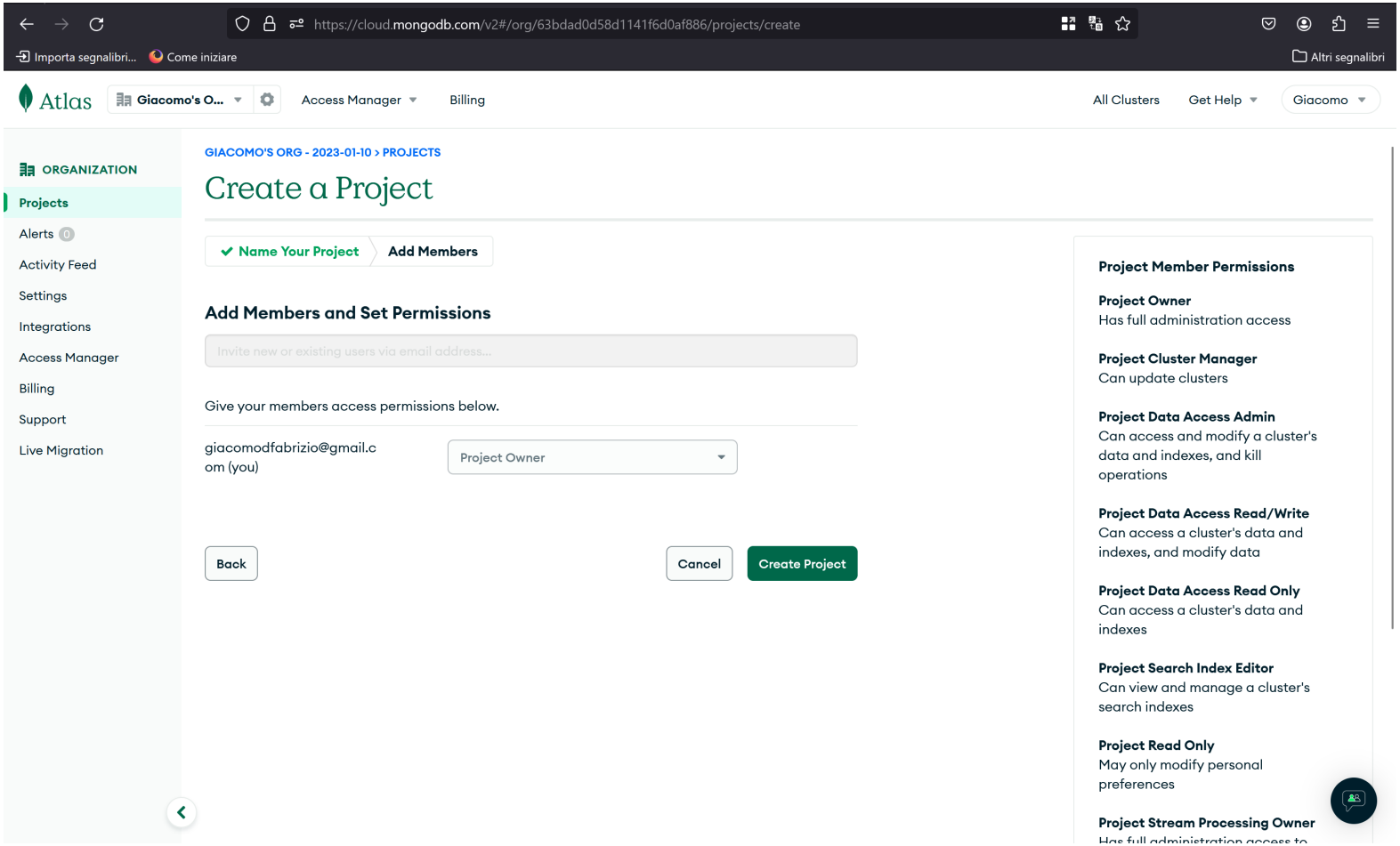
I visited the MongoDB Atlas website and signed up for an account. MongoDB Atlas offers a free tier, which is suitable for getting started with small-scale projects.

Create a Project

After signing in to MongoDB Atlas, I created a new project.

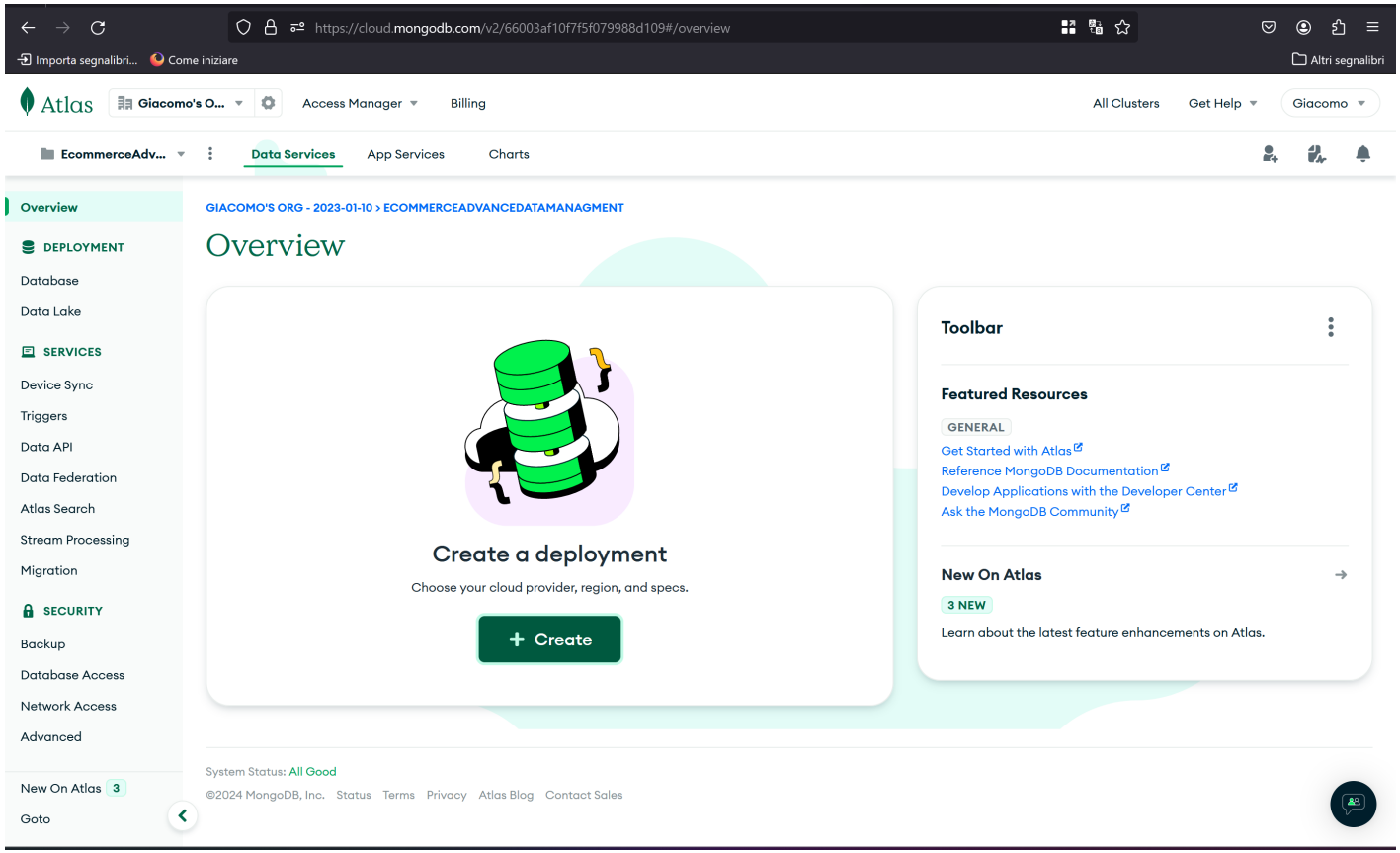


Create a Project



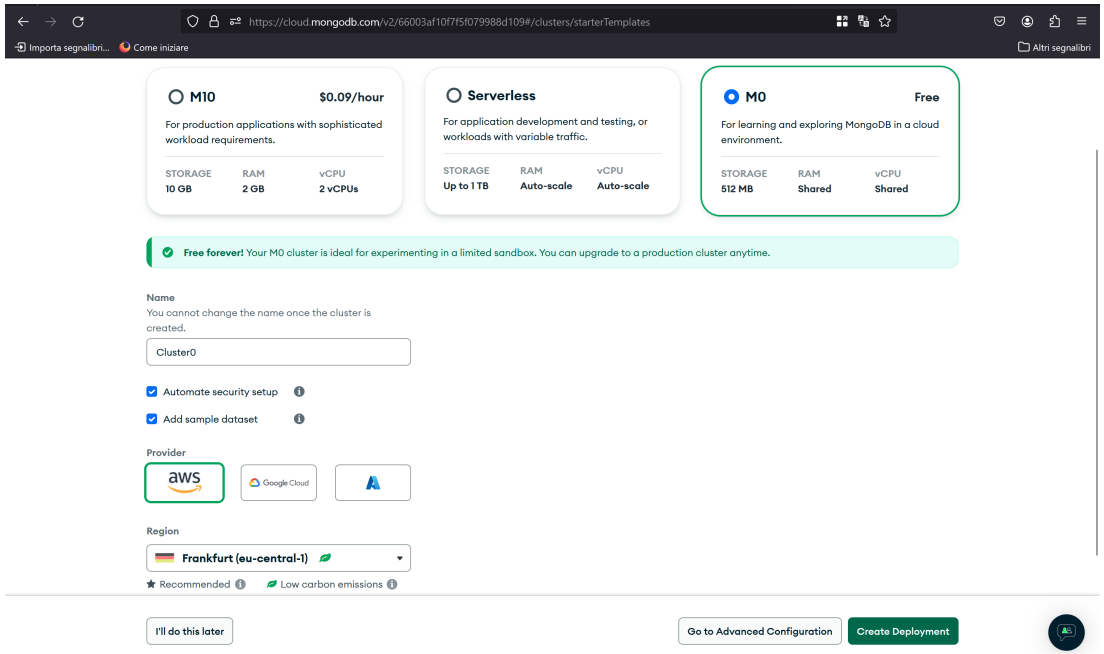
Create a Cluster

After creating a new project, I created a new cluster.
A cluster in MongoDB Atlas consists of one or more MongoDB instances running on the cloud.



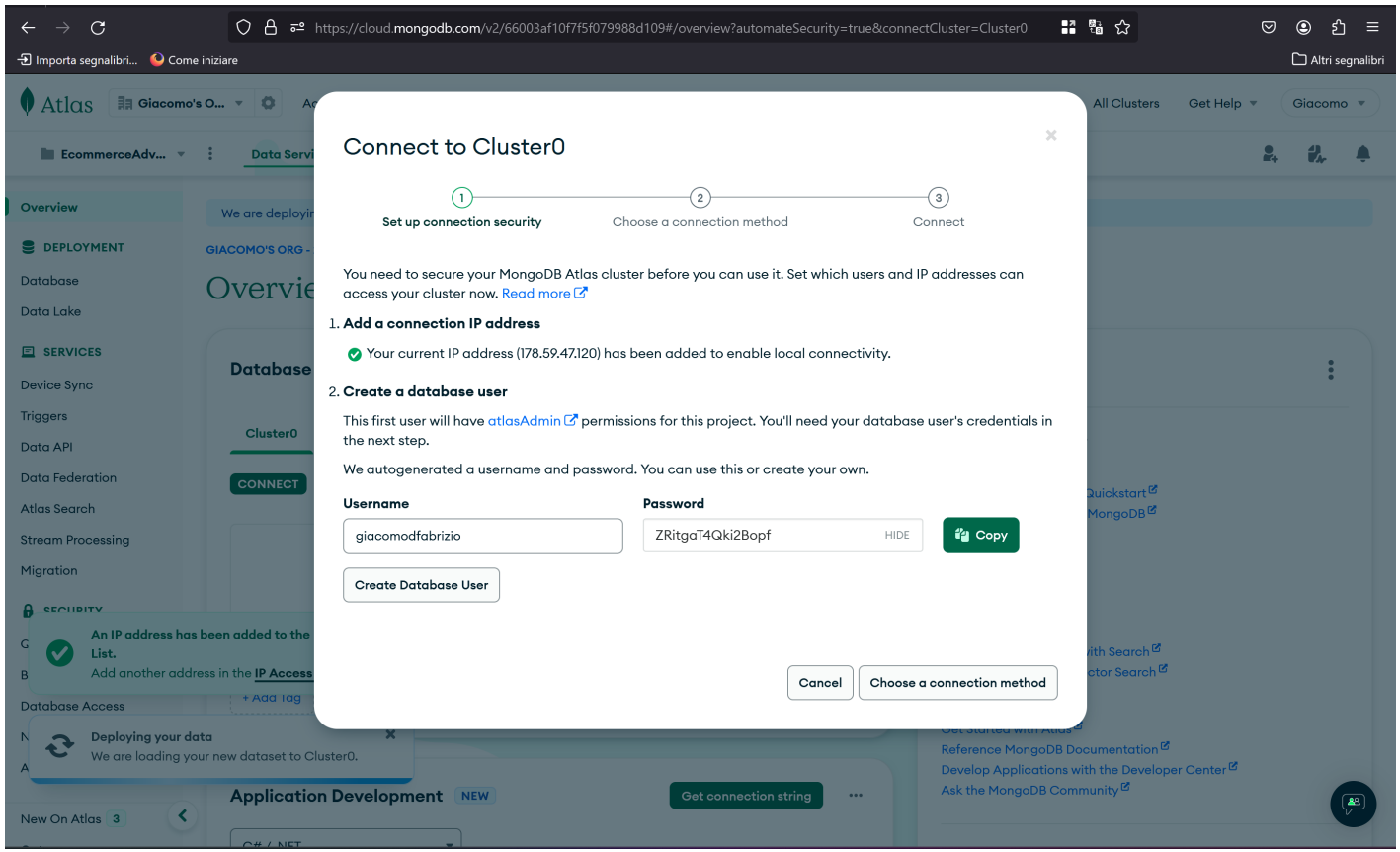
Configure Cluster Settings

During the cluster creation process, I configured settings such as the cloud service provider (e.g., AWS, Azure, GCP), region, and cluster tier based on my requirements and preferences. MongoDB Atlas provides options for high availability, automatic scaling, and backups to ensure data reliability and availability.

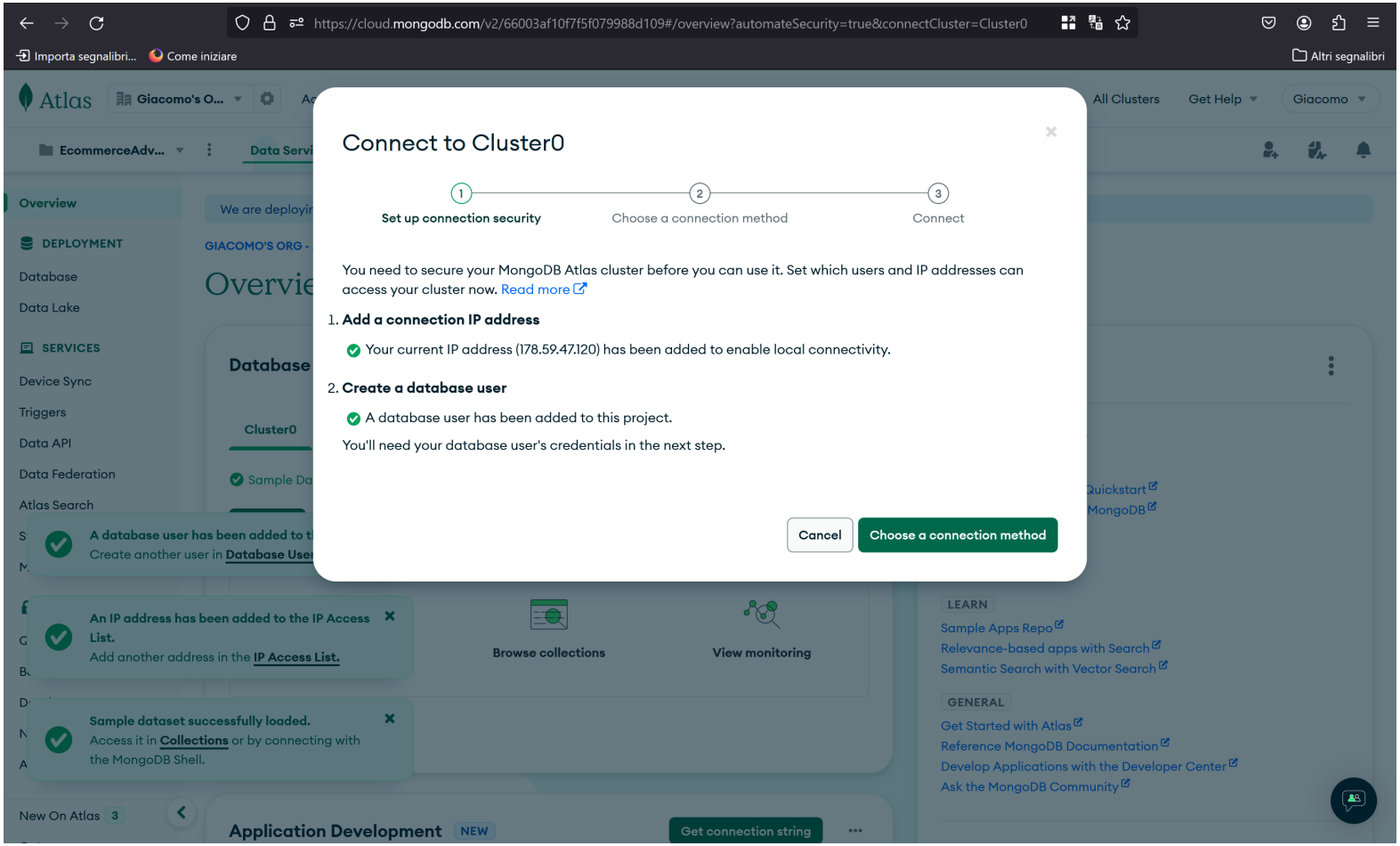


Set Up Security

I configured security settings for the cluster, including setting up IP whitelisting, creating database users with appropriate privileges, and enabling encryption at rest and in transit to protect data security.

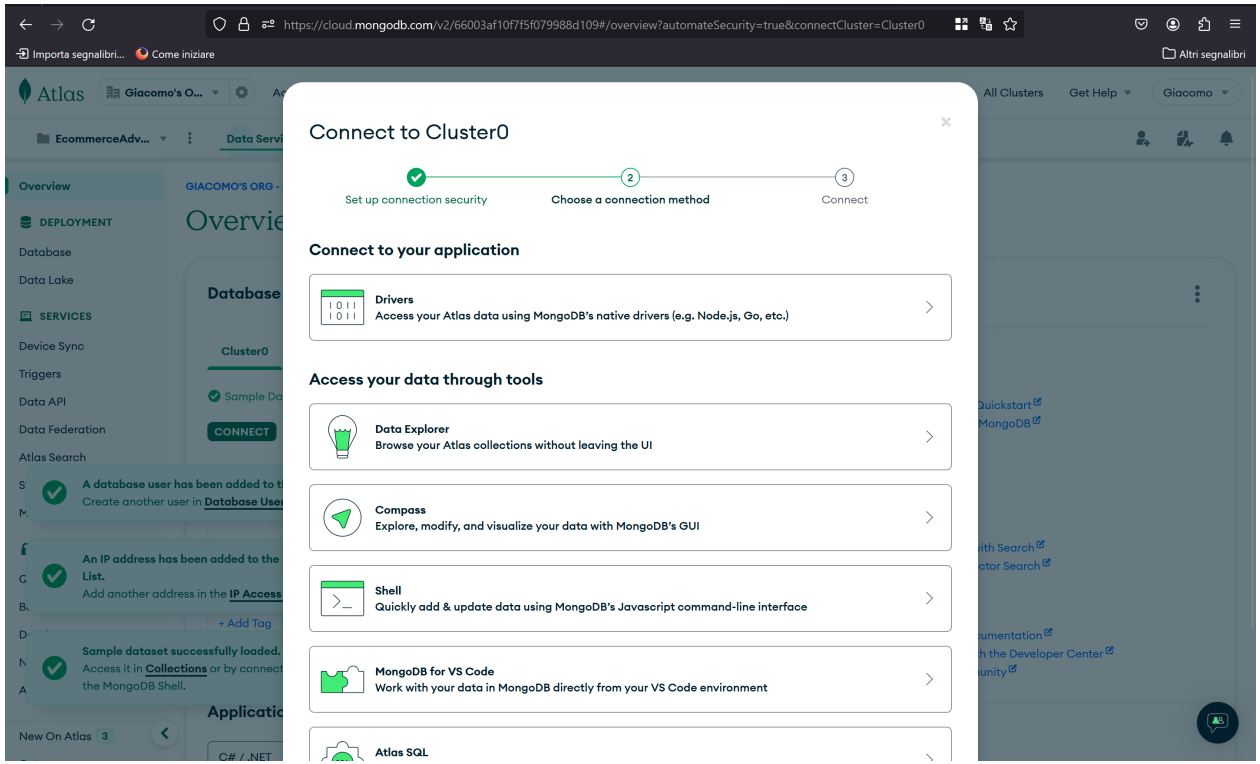


Set Up Security



Connect to the Cluster

MongoDB Atlas provides a connection string that I used to connect to the cluster from my application code.
This connection string includes authentication credentials and other necessary information to establish a connection securely.



Connect to the Cluster

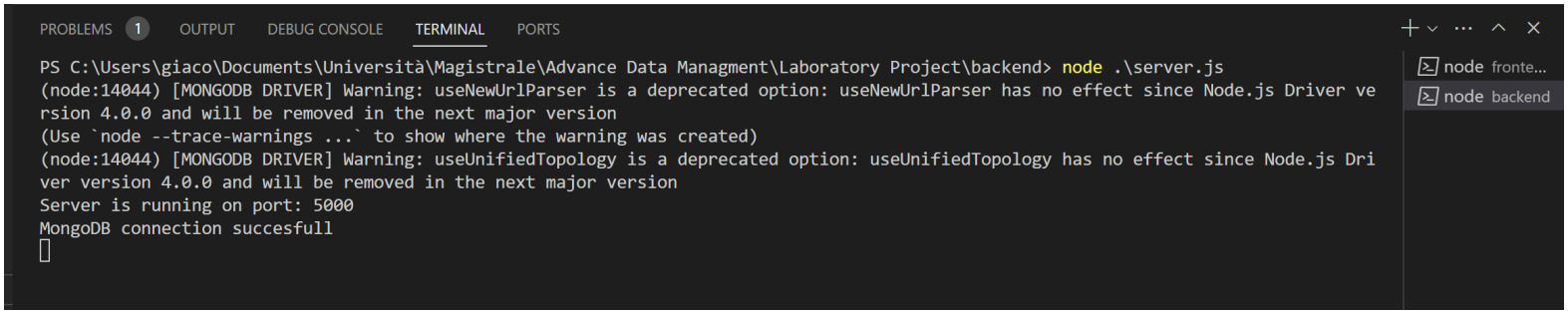
cartRoute.js | Orderpage.js | ChartCard.js | Chartpage.js 1 | NavBar.js | db.js

backend > db.js > ...

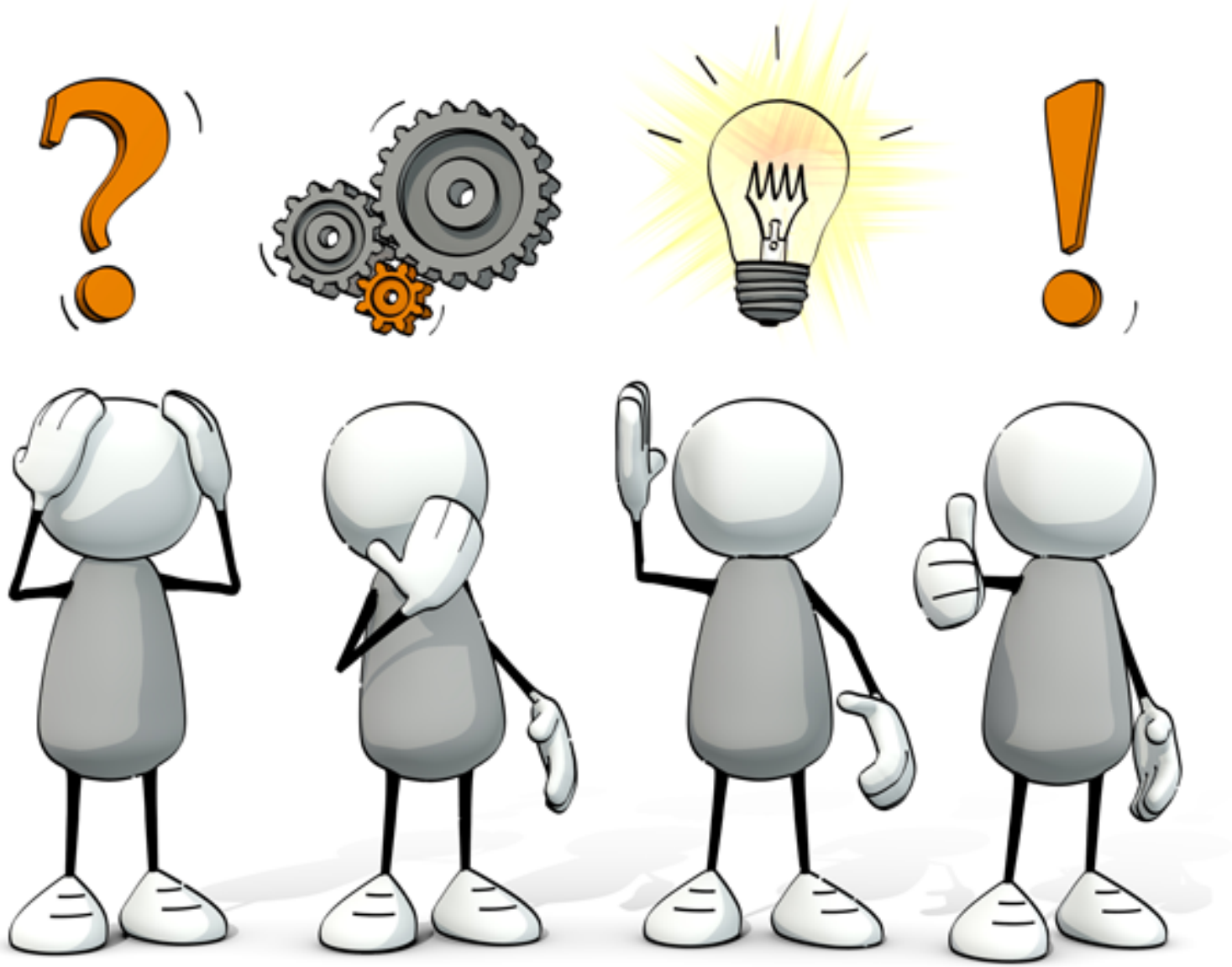
```
1   require('dotenv').config()
2   const mongoose = require('mongoose')
3   mongoose.set('strictQuery', false)
4   const uri = process.env.MONGO_CONNECTION
5   mongoose.connect(uri, { useUnifiedTopology: true, useNewUrlParser: true })
6   var connection = mongoose.connection
7   connection.on('error', () => {
8     console.log('MongoDB connection failed')
9   })
10  connection.on('connected', () => {
11    console.log('MongoDB connection succesfull')
12  })
13  module.exports = mongoose
14
```

Verify Connection

After configuring the connection, I tested the connection from my application to MongoDB Atlas to ensure that it was working correctly.
This involved connecting to the cluster using the provided connection string and performing basic database operations to verify functionality.



Identification of useful queries for the application.



User Authentication and Authorization

- Verify user credentials during login: Find a user by email and compare hashed passwords.
- Register a new user: Check if the user already exists and then save the user details with a hashed password.
- Verify user role: Decode the JWT token and extract the isAdmin field to determine user role.

User Profile

- Retrieve user details: Decode the JWT token to extract user information for profile display.

Product Management

- Get specific product details: Find a product by its unique identifier.
- Filter products by category: Retrieve products belonging to a specific category.
- Get all products: Retrieve all products available in the catalog.

Order Management

- Add a new order: Create a new order by retrieving items from the user's cart, updating product quantities, and calculating the total cost.
- Get user's order history: Find orders associated with a specific user and include product details for each order.

Cart Management

- Retrieve user's cart: Find the user's cart and retrieve details of products added to it.
- Add object to cart: Update the user's cart by adding a new object or increasing the quantity of an existing object.
- Delete object from cart: Remove an object from the user's cart based on the product ID.
- Delete user's entire cart: Delete all objects from the user's cart.

Catalog Management

- Add object to catalog: Add a new product to the catalog or update the quantity of an existing product.
- Get quantity available for a product: Retrieve the quantity available for a specific product in the catalog.

Creating data using data generator or finding ready-made data.

For the creation of data in the e-commerce application, I utilized original product data obtained from an external source.
This data consists of various products with details such as title, price, description, category, image, and ratings.
To prepare this data for insertion into MongoDB, I filtered and transformed it into a format suitable for database insertion.
The filtered data includes essential product details such as name, description, price, category, and image

Designing the DB model and implementing it in the NoSQL DB system.

For designing the database model and implementing it in the NoSQL DB system, I structured the data using Mongoose schemas in MongoDB.

Cart Model

JS Cart.js × JS Catalog.js JS Order.js JS Products.js

backend > model > JS Cart.js > ...

```
1   const mongoose = require('mongoose')
2   const Schema = mongoose.Schema
3
4   const cartSchema = new Schema({
5     userid: {
6       type: Schema.Types.ObjectId,
7       ref: 'User',
8     },
9     items: [
10      {
11        productid: {
12          type: Schema.Types.ObjectId,
13          ref: 'Product',
14        },
15        quantity: {
16          type: Number,
17          required: true,
18        },
19      },
20    ],
21  })
22
23  module.exports = mongoose.model('Cart', cartSchema)
24
```

Catalog Model

Cart.js | Catalog.js | Order.js | Products.js

ackend > model > Catalog.js > ...

```
1   const mongoose = require('mongoose')
2   const Schema = mongoose.Schema
3
4   const catalogSchema = new Schema({
5     product: {
6       type: Schema.Types.ObjectId,
7       ref: 'Product',
8     },
9     quantity: {
10      type: Number,
11      required: true,
12    },
13  })
14
15  module.exports = mongoose.model('Catalog', catalogSchema)
16
```

Order Model

Cart.js | Catalog.js | Order.js | Products.js

backend > model > Order.js > orderSchema

```
1   const mongoose = require('mongoose')
2   const Schema = mongoose.Schema
3
4   const orderSchema = new Schema({
5     userid: {
6       type: Schema.Types.ObjectId,
7       ref: 'User',
8     },
9     items: [
10      {
11        productid: {
12          type: Schema.Types.ObjectId,
13          ref: 'Product',
14        },
15        quantity: {
16          type: Number,
17          required: true,
18        },
19      },
20    ],
21    cost: {
22      type: Number,
23      required: true,
24    },
25    status: {
26      type: String,
27      required: true,
28      default: 'Processing',
29    },
30  })
31
32  module.exports = mongoose.model('Order', orderSchema)
33
```

Product Model

Cart.js | Catalog.js | Order.js | Products.js | User.js

backend > model > Products.js > productSchema

```
1   const mongoose = require('mongoose')
2
3   const productSchema = mongoose.Schema(
4     {
5       name: { type: String, required: true },
6       description: { type: String, required: true },
7       price: { type: String, required: true },
8       category: { type: String, required: true },
9       image: { type: String, required: true },
10    },
11    {
12      timestamp: true,
13    }
14  )
15
16  const productModel = mongoose.model('Product', productSchema)
17  module.exports = productModel
18
```

User Model

Cart.js | Catalog.js | Order.js | Products.js | User.js

backend > model > User.js > ...

```
1   const mongoose = require('mongoose')
2
3   const userSchema = mongoose.Schema(
4     {
5       firstname: { type: String, required: true },
6       lastname: { type: String, required: true },
7       email: { type: String, required: true },
8       password: { type: String, required: true },
9       street: { type: String, required: true },
10      money: { type: Number, default: 1000 },
11      isAdmin: { type: Boolean, default: false },
12    },
13    {
14      timestamp: true,
15    }
16  )
17
18  const userModel = mongoose.model('User', userSchema)
19  module.exports = userModel
20
```

Loading the data into the DB.

To load the data into the NoSQL database, I utilized a JSON file containing the product information and implemented a route in the backend to insert this data into the database.

Creating code for CRUD data operations.

To implement CRUD (Create, Read, Update, Delete) operations for the data in the MongoDB database, several routes have been created in the backend server using Express.js.

Products Routes (‘products.js‘)

- Read Product by ID:
  - Route: ‘GET /product/:id‘
  - Retrieves a product by its ID from the database.
- Read Products by Category
  - Route: ‘GET /product/category/:category‘
  - Retrieves all products belonging to a specific category.
- Read All Products:
  - Route: ‘GET /getallproduct‘
  - Retrieves all products from the database.
- Create Products from JSON File:
  - Route: ‘GET /addallproduct‘
  - Inserts all products from a JSON file into the database.

Cart Routes (‘cart.js‘)

- Read Cart Items:
  - Route: ‘POST /getcart‘
  - Retrieves the items in the user’s cart.
- Delete Cart:
  - Route: ‘POST /deletecart‘
  - Deletes the entire cart of the user.
- Delete Item from Cart:
  - Route: ‘POST /deleteobjectcart‘
  - Deletes a specific item from the user’s cart.
- Add Item to Cart:
  - Route: ‘POST /addobjectcart‘
  - Adds a new item (and its quantity) to the user’s cart.

Catalog Routes (‘catalog.js‘)

- Add Product to Catalog:
  - Route: ‘POST /addtocatalog‘
  - Adds a product to the catalog with its quantity.
- Read Product Quantity:
  - Route: ‘GET /quantity/:id‘
  - Retrieves the available quantity of a product.

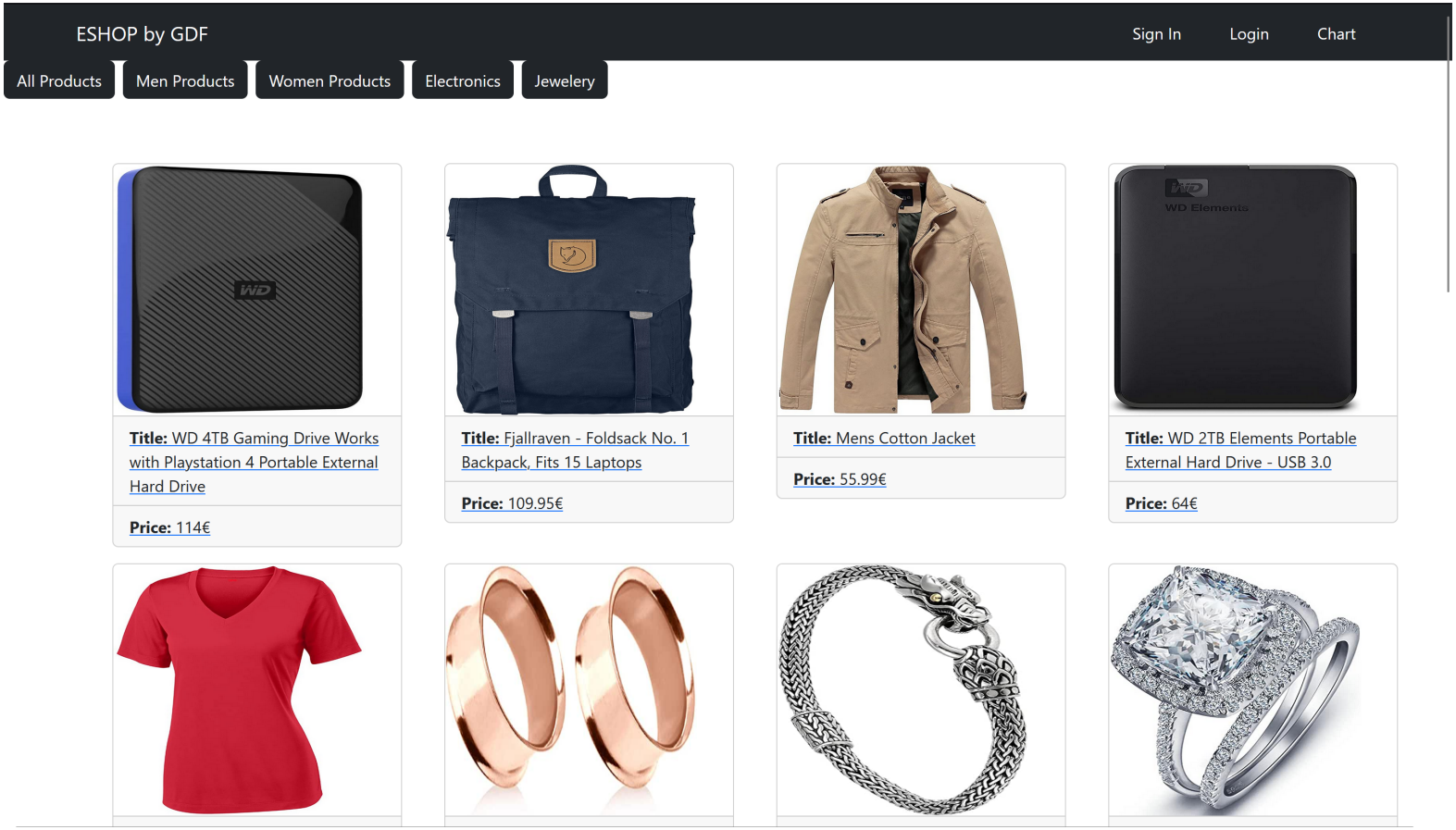
Order Routes (‘orders.js‘)

- Add Order:
  - Route: ‘POST /addorder‘
  - Creates a new order with the user’s cart items, deducts the total cost from the user’s balance, and updates the catalog quantities.
- Read User Orders:
  - Route: ‘POST /getorders‘
  - Retrieves all orders made by the user along with product details.

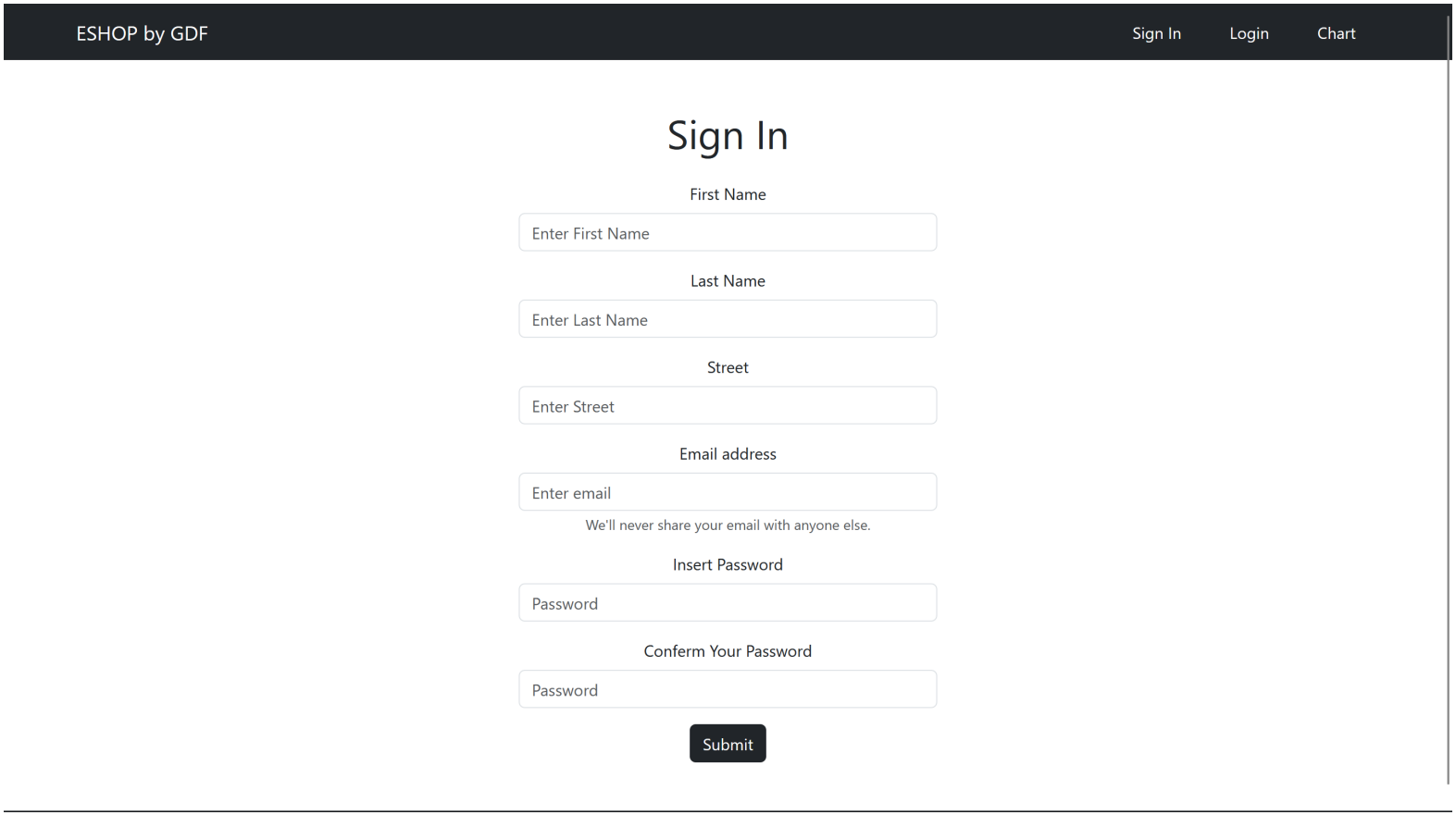
User Authentication Routes (‘auth.js‘)

- User Login:
  - Route: ‘POST /login‘
  - Authenticates the user with email and password, generates a JWT token.
- User Registration:
  - Route: ‘POST /register‘
  - Registers a new user with hashed password and generates a JWT token.
- Verify User Role:
  - Route: ‘POST /verifyrole‘
  - Verifies if the user is an admin based on the JWT token.
- Get User Info:
  - Route: ‘POST /user‘
  - Retrieves user information from the JWT token.
- Get User Money Balance:
  - Route: ‘POST /getmoneyaviable‘
  - Retrieves the available money balance of the user from the JWT token.

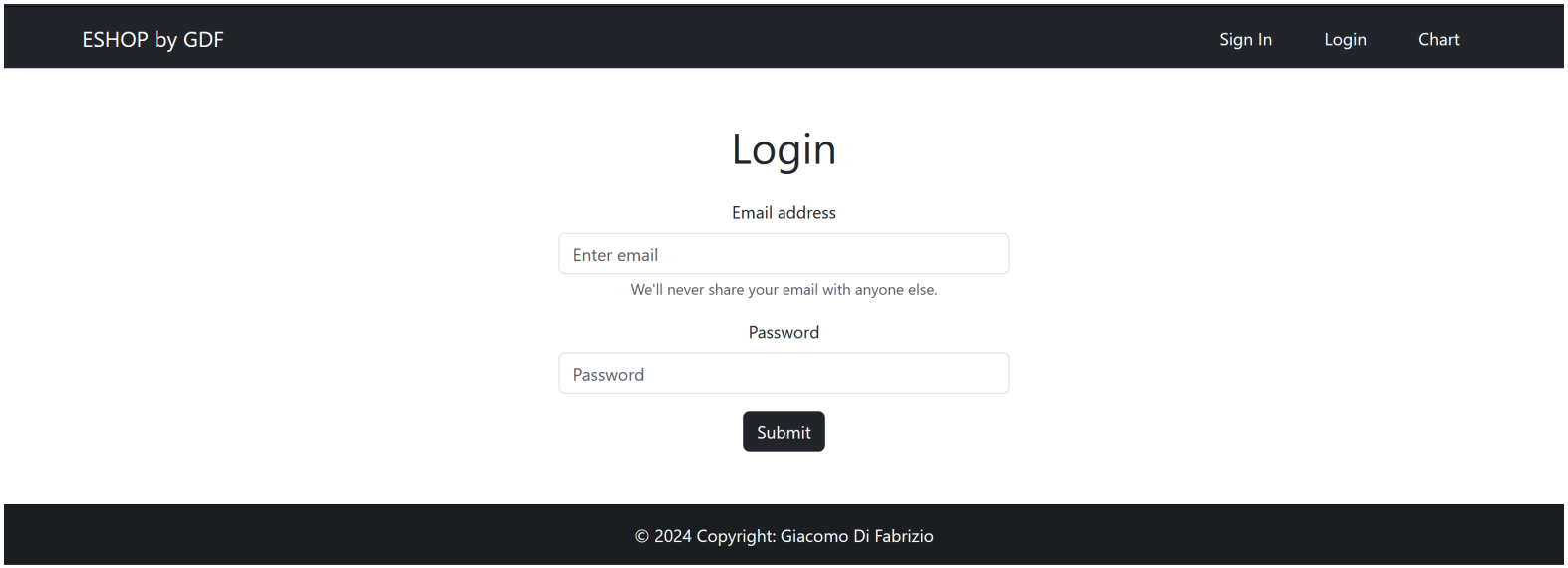
Graphical User Interface



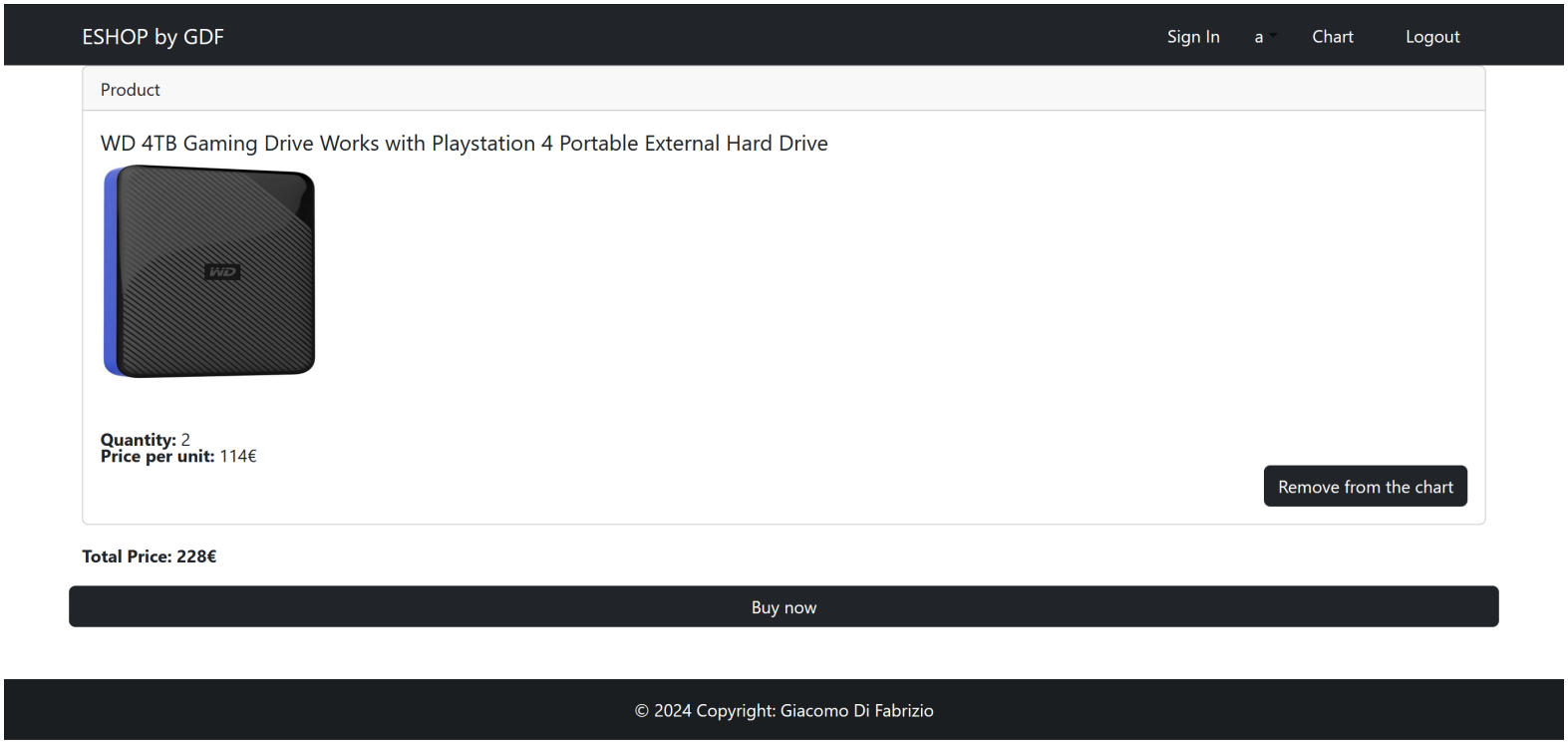
Graphical User Interface



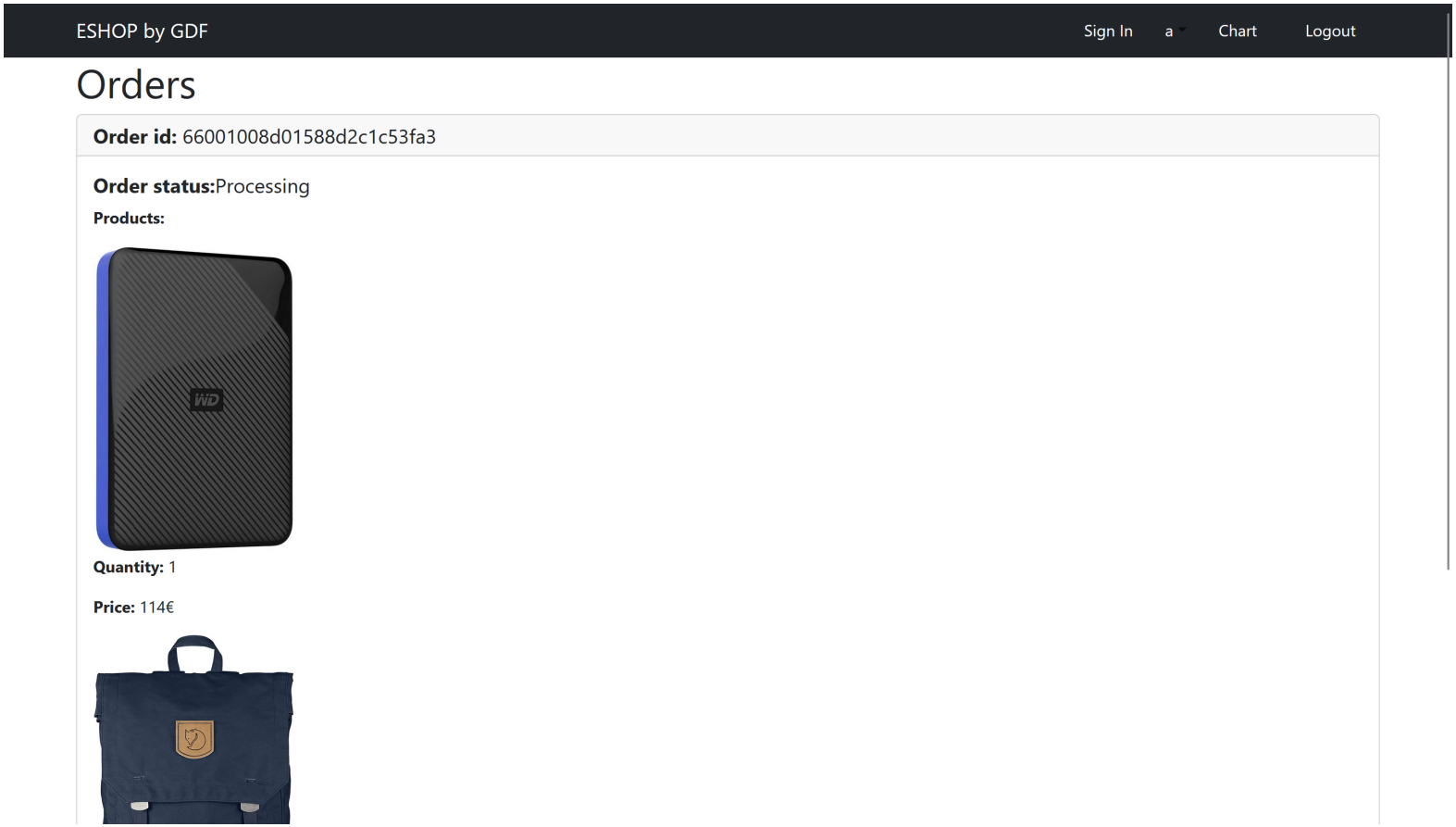
Graphical User Interface



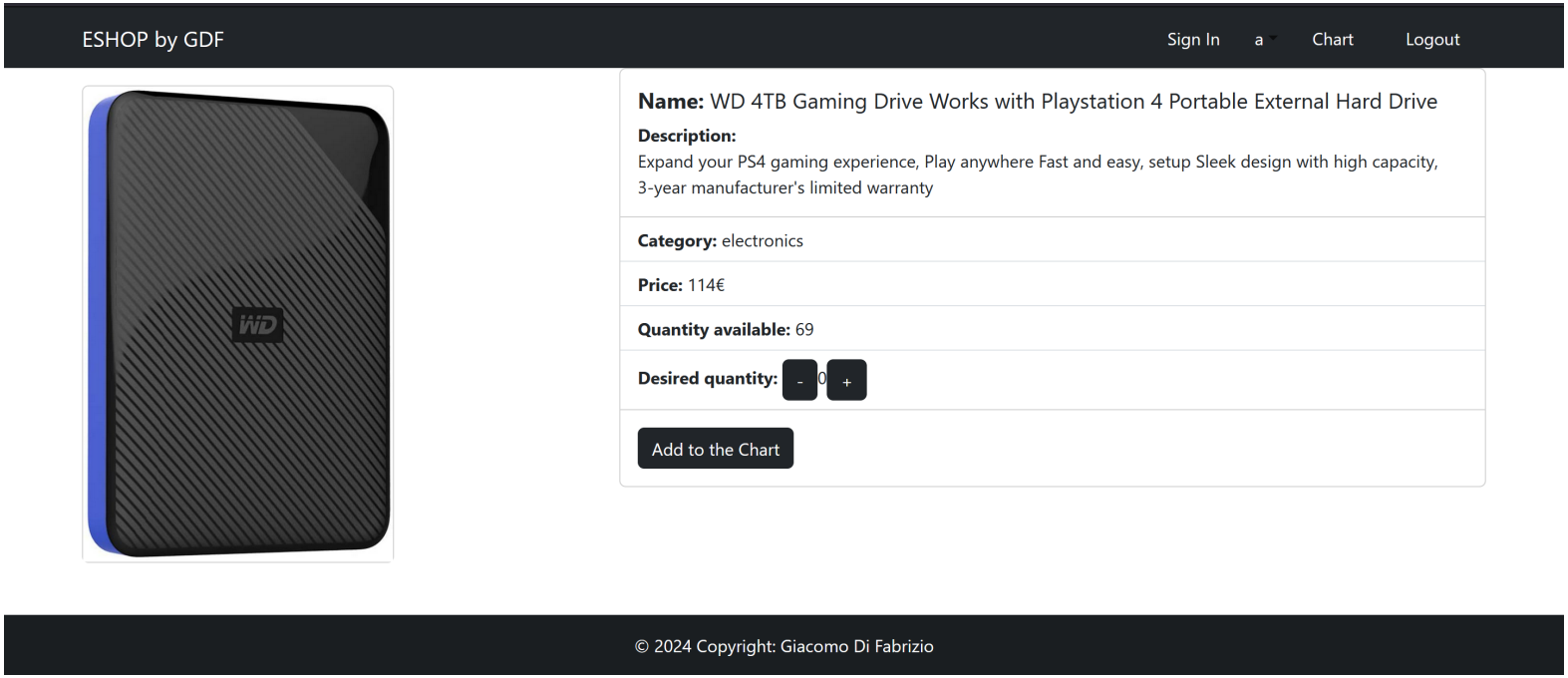
Graphical User Interface



Graphical User Interface



Graphical User Interface



Graphical User Interface

Implementation of the queries in the DB.

cartRoute.js

backend > routes > cartRoute.js > router.post('/addobjectcart') callback

```
88  //Route for add object (and his quantity) in the cart
89  router.post('/addobjectcart', async (req, res) => {
90    try {
91      const { id, productid, quantity } = req.body
92      const user = await User.findOne({ _id: id })
93      const userId = user.id
94
95      let cart = await Cart.findOne({ userid: userId })
96
97      if (!cart) {
98        cart = new Cart({
99          userid: userId,
100         items: [{ productid: productid, quantity }],
101       })
102     } else {
103       const existingItem = cart.items.find(
104         (item) => String(item.productid) === String(productid)
105       )
106
107       if (existingItem) {
108         existingItem.quantity += parseInt(quantity)
109       } else {
110         cart.items.push({ productid, quantity: parseInt(quantity) })
111       }
112     }
113
114     await cart.save()
115     res.status(200).json({ message: 'Object added to cart successfully', cart })
116   } catch (error) {
117     console.log(error)
118     res.status(500).json({ error: 'Error adding object in the cart' })
119   }
120 })
```

Implementation of the queries in the DB.

orderRoute.js

backend > routes > orderRoute.js > ...

```
router.post('/addorder', async (req, res) => {
  try {
    const { id } = req.body
    // Find user by email
    const user = await User.findOne({ _id: id })
    if (!user) {
      return res.status(404).json({ error: 'User not found' })
    }
    const userId = user._id
    // Find items in user's cart
    const carts = await Cart.find({ userid: userId })
    if (!carts) {
      return res.status(404).json({ error: 'Cart not found' })
    }
    let productsInfo = []
    for (const cart of carts) {
      for (const item of cart.items) {
        const product = await Product.findById(item.productid)
        // Se il prodotto esiste, aggiungi titolo, immagine e quantità all'array 'productsInfo'
        if (product) {
          productsInfo.push({
            productid: product._id,
            quantity: item.quantity,
            price: product.price,
          })
          // Aggiorna la quantità disponibile nel catalogo
          await Catalog.findOneAndUpdate(
            { product: product._id },
            { $inc: { quantity: -item.quantity } }
          )
        }
      }
    }
    let totalcost = 0
    for (const item of productsInfo) {
      totalcost += parseInt(item.quantity) * parseFloat(item.price)
    }
    // Create new order
    const newOrder = new Order({
      userid: userId,
      items: productsInfo,
      cost: totalcost,
    })
    user.money -= totalcost
    if (user.money < 0) {
      res.status(404).json({ error: "You don't have enough money" })
    } else {
      await newOrder.save()
      await user.save()
      res
        .status(201)
        .json({ message: 'Order added successfully', order: newOrder })
    }
  } catch (error) {
    console.error(error)
    res.status(500).json({ error: 'Error adding order' })
  }
})
```

Implementation of the queries in the DB.

```
_id: ObjectId('66000fc3d01588d2c1c53f35')
firstname: "a"
lastname: "a"
email: "a"
password: "$2b$10$Spx3ja2d2jl97Ur9pyGXV.DpKlYuDElAwlI976Fje7ExbnrGIeLuy"
street: "a"
money: 666.1
isAdmin: false
__v: 0
```

Thank You For The Attention