САНКТ-ПЕТЕРБУРГСКИЙ НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ УНИВЕРСИТЕТ ИТМО

Дисциплина: Бэк-энд разработка

Отчет

Лабораторная работа №2

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Задача

По выбранному варианту необходимо было реализовать RESTful API средствами express + typescript (используя ранее написанный boilerplate).

Вариант: Сервис для аренды недвижимости

Требуемый функционал:

1) Вход
2) Регистрация
3) Личный кабинет пользователя (список арендованных и арендующихся объектов)
4) Поиск недвижимости с фильтрацией по типу, цене, расположению
5) Страница объекта недвижимости с фото, описанием и условиями аренды
6) История сообщений и сделок пользователя

Ход работы

1. Структура проекта

Проект организован по принципу разделения ответственности (Separation of Concerns) со следующей структурой:

```
rental-service/
├── package.json
├── tsconfig.json
├── .env                    # Настройки окружения
├── db.sqlite
├── src/
│   ├── config/
│   │   └── data-source.ts        # Настройка TypeORM
│   │   └── dotenv.ts
│   ├── entities/                 # Модели данных
│   │   ├── User.ts
│   │   ├── Property.ts
│   │   ├── Amenity.ts
│   │   ├── PropertyAmenity.ts
│   │   ├── Rental.ts
│   │   ├── Message.ts
│   │   └── Review.ts
│   ├── repositories/             # Работа с БД
│   │   ├── user.repository.ts
│   │   ├── property.repository.ts
│   │   ├── rental.repository.ts
│   │   ├── message.repository.ts
│   │   └── review.repository.ts
│   ├── services/                 # Бизнес-логика
```

```
│   │   ├── user.service.ts
│   │   ├── property.service.ts
│   │   ├── rental.service.ts
│   │   ├── message.service.ts
│   │   └── review.service.ts
│   ├── controllers/              # Контроллеры
│   │   ├── user.controller.ts
│   │   ├── property.controller.ts
│   │   ├── rental.controller.ts
│   │   ├── message.controller.ts
│   │   └── review.controller.ts
│   ├── routes/                   # Роуты
│   │   ├── user.routes.ts
│   │   ├── property.routes.ts
│   │   ├── rental.routes.ts
│   │   ├── message.routes.ts
│   │   └── review.routes.ts
│   ├── middleware/               # Middleware
│   │   ├── auth.ts
│   │   └── errorHandler.ts
│   └── index.ts                  # Точка входа приложения
└── README.md
```

2. Модели данных

Реализованы следующие сущности:

User (Пользователь)

```
import { Entity, PrimaryGeneratedColumn, Column, OneToMany, CreateDateColumn,
UpdateDateColumn } from "typeorm";
import { Property } from "./Property";
import { Rental } from "./Rental";
import { Message } from "./Message";
import { Review } from "./Review";


export type UserRole = 'owner' | 'tenant' | 'admin';


@Entity()
export class User {
@PrimaryGeneratedColumn("uuid")
id!: string;


@Column()
first_name!: string;


@Column()
last_name!: string;


@Column({ unique: true })
email!: string;
```

```
@Column({ nullable: true })
phone_number?: string;


@Column()
password_hash!: string;


@Column({ type: "text", default: "tenant" })
role!: UserRole;


@CreateDateColumn()
created_at!: Date;


@UpdateDateColumn()
updated_at!: Date;


@OneToMany(() => Property, (p) => p.owner)
properties!: Property[];


@OneToMany(() => Rental, (r) => r.tenant)
rentals!: Rental[];


@OneToMany(() => Message, (m) => m.sender)
sent_messages!: Message[];


@OneToMany(() => Message, (m) => m.receiver)
received_messages!: Message[];


@OneToMany(() => Review, (rev) => rev.reviewer)
reviews!: Review[];
}
```

Property (Объект недвижимости)

```
import { Entity, PrimaryGeneratedColumn, Column, ManyToOne, OneToMany }
from "typeorm";
import { User } from "./User";
import { Rental } from "./Rental";
import { PropertyAmenity } from "./PropertyAmenity";


@Entity()
export class Property {
@PrimaryGeneratedColumn("uuid")
id: string;


@ManyToOne(() => User, (user) => user.properties)
owner: User;


@Column()
title: string;
```

```
@Column("text")
description: string;


@Column()
type: string;


@Column()
location: string;


@Column("decimal")
price_per_month: number;


@Column("simple-array")
photos: string[];


@Column({ type: "date" })
available_from: Date;


@Column({ type: "date" })
available_to: Date;


@Column({ type: "datetime", default: () => "CURRENT_TIMESTAMP" })
created_at: Date;


@Column({ type: "datetime", default: () => "CURRENT_TIMESTAMP", onUpdate:
"CURRENT_TIMESTAMP" })
updated_at: Date;


@OneToMany(() => PropertyAmenity, (pa) => pa.property)
amenities: PropertyAmenity[];


@OneToMany(() => Rental, (rental) => rental.property)
rentals: Rental[];
}
```

Rental (Аренда)

```
import { Entity, PrimaryGeneratedColumn, Column, ManyToOne, OneToMany }
from "typeorm";
import { User } from "./User";
import { Property } from "./Property";
import { Review } from "./Review";


@Entity()
export class Rental {
@PrimaryGeneratedColumn("uuid")
```

```
id: string;


@ManyToOne(() => Property, (property) => property.rentals)
property: Property;


@ManyToOne(() => User, (user) => user.rentals)
tenant: User;


@Column({ type: "date" })
start_date: Date;


@Column({ type: "date" })
end_date: Date;


@Column()
status: string;


@Column({ type: "datetime", default: () => "CURRENT_TIMESTAMP" })
created_at: Date;


@OneToMany(() => Review, (review) => review.rental)
reviews: Review[];
}
```

Message (Сообщение)

```
import { Entity, PrimaryGeneratedColumn, Column, ManyToOne } from
"typeorm";
import { User } from "./User";
import { Rental } from "./Rental";


@Entity()
export class Message {
@PrimaryGeneratedColumn("uuid")
id: string;


@ManyToOne(() => User, (user) => user.sent_messages)
sender: User;


@ManyToOne(() => User, (user) => user.received_messages)
receiver: User;


@ManyToOne(() => Rental, (rental) => rental.id)
rental: Rental;


@Column("text")
```

```
content: string;


@Column({ type: "datetime", default: () => "CURRENT_TIMESTAMP" })
timestamp: Date;
}
```

Review (Отзыв)

```
import { Entity, PrimaryGeneratedColumn, Column, ManyToOne } from
"typeorm";
import { Rental } from "./Rental";
import { User } from "./User";


@Entity()
export class Review {
@PrimaryGeneratedColumn("uuid")
id: string;


@ManyToOne(() => Rental, (rental) => rental.reviews)
rental: Rental;


@ManyToOne(() => User, (user) => user.reviews)
reviewer: User;


@Column("int")
rating: number;


@Column("text")
comment: string;


@Column({ type: "datetime", default: () => "CURRENT_TIMESTAMP" })
created_at: Date;

}
```

Amenity (Удобства)

```
import { Entity, PrimaryGeneratedColumn, Column, OneToMany } from
"typeorm";
import { PropertyAmenity } from "./PropertyAmenity";


@Entity()
export class Amenity {
@PrimaryGeneratedColumn("uuid")
id: string;
```

```
@Column()
name: string;


@Column({ nullable: true })
description: string;


@OneToMany(() => PropertyAmenity, (pa) => pa.amenity)
propertyAmenities: PropertyAmenity[];
}
```

PropertyAmenity (Удобства объекта недвижимости)

```
import { Entity, PrimaryGeneratedColumn, ManyToOne } from "typeorm";
import { Property } from "./Property";
import { Amenity } from "./Amenity";


@Entity()
export class PropertyAmenity {
@PrimaryGeneratedColumn("uuid")
id: string;


@ManyToOne(() => Property, (property) => property.amenities)
property: Property;


@ManyToOne(() => Amenity, (amenity) => amenity.propertyAmenities)
amenity: Amenity;
}
```

3. Сервисы

Реализованы следующие сущности:

UserService

```
import { userRepository } from "../repositories/user.repository";
import { User } from "../entities/User";

export class UserService {
 static async create(data: Partial<User>) {
   const user = userRepository.create(data);
   return await userRepository.save(user);
 }

 static async findAll(skip = 0, take = 20) {
   return await userRepository.find({ skip, take });
 }

 static async findById(id: string) {
```

```
    return await userRepository.findOneBy({ id });
  }

  static async findByEmail(email: string) {
    return await userRepository.findOneBy({ email });
  }

  static async update(id: string, data: Partial<User>) {
    const user = await userRepository.findOneBy({ id });
    if (!user) return null;
    userRepository.merge(user, data);
    return await userRepository.save(user);
  }

  static async delete(id: string) {
    return await userRepository.delete(id);
  }
}
```

PropertyService

```
import { propertyRepository } from "../repositories/property.repository";
import { Property } from "../entities/Property";

export class PropertyService {
  static async create(data: Partial<Property>) {
    const entity = propertyRepository.create(data);
    return await propertyRepository.save(entity);
  }

  static async findAll(skip = 0, take = 20) {
    return await propertyRepository.find({ skip, take });
  }

  static async findById(id: string) {
    return await propertyRepository.findOneBy({ id });
  }

  static async update(id: string, data: Partial<Property>) {
    const entity = await propertyRepository.findOneBy({ id });
    if (!entity) return null;
    propertyRepository.merge(entity, data);
    return await propertyRepository.save(entity);
  }

  static async delete(id: string) {
    return await propertyRepository.delete(id);
  }
}
```

RentalService

```
import { rentalRepository } from "../repositories/rental.repository";
import { Rental } from "../entities/Rental";

export class RentalService {
  static async create(data: Partial<Rental>) {
    const entity = rentalRepository.create(data);
    return await rentalRepository.save(entity);
  }
```

```
 static async findAll(skip = 0, take = 20) {
   return await rentalRepository.find({ skip, take });
 }

 static async findById(id: string) {
   return await rentalRepository.findOneBy({ id });
 }

 static async update(id: string, data: Partial<Rental>) {
   const entity = await rentalRepository.findOneBy({ id });
   if (!entity) return null;
   rentalRepository.merge(entity, data);
   return await rentalRepository.save(entity);
 }

 static async delete(id: string) {
   return await rentalRepository.delete(id);
 }
}
```

MessageService

```
import { messageRepository } from "../repositories/message.repository";
import { Message } from "../entities/Message";

export class MessageService {
 static async create(data: Partial<Message>) {
   const entity = messageRepository.create(data);
   return await messageRepository.save(entity);
 }

 static async findAll(skip = 0, take = 20) {
   return await messageRepository.find({ skip, take });
 }

 static async findById(id: string) {
   return await messageRepository.findOneBy({ id });
 }

 static async update(id: string, data: Partial<Message>) {
   const entity = await messageRepository.findOneBy({ id });
   if (!entity) return null;
   messageRepository.merge(entity, data);
   return await messageRepository.save(entity);
 }

 static async delete(id: string) {
   return await messageRepository.delete(id);
 }
}
```

AmenityService

```
import { amenityRepository } from "../repositories/amenity.repository";
import { Amenity } from "../entities/Amenity";

export class AmenityService {
 static async create(data: Partial<Amenity>) {
```

```
    const entity = amenityRepository.create(data);
    return await amenityRepository.save(entity);
  }

  static async findAll(skip = 0, take = 20) {
    return await amenityRepository.find({ skip, take });
  }

  static async findById(id: string) {
    return await amenityRepository.findOneBy({ id });
  }

  static async update(id: string, data: Partial<Amenity>) {
    const entity = await amenityRepository.findOneBy({ id });
    if (!entity) return null;
    amenityRepository.merge(entity, data);
    return await amenityRepository.save(entity);
  }

  static async delete(id: string) {
    return await amenityRepository.delete(id);
  }
}
```

PropertyAmenityService

```
import { propertyAmenityRepository } from
"../repositories/propertyAmenity.repository";
import { PropertyAmenity } from "../entities/PropertyAmenity";

export class PropertyAmenityService {
  static async create(data: Partial<PropertyAmenity>) {
    const entity = propertyAmenityRepository.create(data);
    return await propertyAmenityRepository.save(entity);
  }

  static async findAll(skip = 0, take = 20) {
    return await propertyAmenityRepository.find({ skip, take });
  }

  static async findById(id: string) {
    return await propertyAmenityRepository.findOneBy({ id });
  }

  static async update(id: string, data: Partial<PropertyAmenity>) {
    const entity = await propertyAmenityRepository.findOneBy({ id });
    if (!entity) return null;
    propertyAmenityRepository.merge(entity, data);
    return await propertyAmenityRepository.save(entity);
  }

  static async delete(id: string) {
    return await propertyAmenityRepository.delete(id);
  }
}
```

ReviewService

```
import { reviewRepository } from "../repositories/review.repository";
import { Review } from "../entities/Review";
```

```
export class ReviewService {
 static async create(data: Partial<Review>) {
   const entity = reviewRepository.create(data);
   return await reviewRepository.save(entity);
 }

 static async findAll(skip = 0, take = 20) {
   return await reviewRepository.find({ skip, take });
 }

 static async findById(id: string) {
   return await reviewRepository.findOneBy({ id });
 }

 static async update(id: string, data: Partial<Review>) {
   const entity = await reviewRepository.findOneBy({ id });
   if (!entity) return null;
   reviewRepository.merge(entity, data);
   return await reviewRepository.save(entity);
 }

 static async delete(id: string) {
   return await reviewRepository.delete(id);
 }
}
```

4. Контроллеры

UserController

```
import { Request, Response } from "express";
import { UserService } from "../services/user.service";

export class UserController {
 static async create(req: Request, res: Response) {
   try {
     const saved = await UserService.create(req.body);
     res.status(201).json(saved);
   } catch (err: any) {
     res.status(500).json({ error: err.message });
   }
 }

 static async findAll(req: Request, res: Response) {
   try {
     const { skip = 0, take = 20, email } = req.query as any;

     if (email) {
       // API-эндпоинт для поиска по email
       const user = await UserService.findByEmail(email);
       return res.json(user);
     }

     const users = await UserService.findAll(Number(skip), Number(take));
     res.json(users);
   } catch (err: any) {
     res.status(500).json({ error: err.message });
   }
```

```
 }

 static async findById(req: Request, res: Response) {
   try {
     const user = await UserService.findById(req.params.id);
     if (!user) return res.status(404).json({ message: "User not found" });
     res.json(user);
   } catch (err: any) {
     res.status(500).json({ error: err.message });
   }
 }

 static async update(req: Request, res: Response) {
   try {
     const updated = await UserService.update(req.params.id, req.body);
     if (!updated) return res.status(404).json({ message: "User not found"
});
     res.json(updated);
   } catch (err: any) {
     res.status(500).json({ error: err.message });
   }
 }

 static async delete(req: Request, res: Response) {
   try {
     const result = await UserService.delete(req.params.id);
     res.json(result);
   } catch (err: any) {
     res.status(500).json({ error: err.message });
   }
 }
}
```

PropertyController

```
import { Request, Response } from "express";
import { PropertyService } from "../services/property.service";

export class PropertyController {
 static async create(req: Request, res: Response) {
   try {
     const saved = await PropertyService.create(req.body);
     res.status(201).json(saved);
   } catch (err: any) {
     res.status(500).json({ error: err.message });
   }
 }

 static async findAll(req: Request, res: Response) {
   try {
     const { skip = 0, take = 20 } = req.query as any;
     const properties = await PropertyService.findAll(Number(skip),
Number(take));
     res.json(properties);
   } catch (err: any) {
     res.status(500).json({ error: err.message });
   }
 }
```

```
 static async findById(req: Request, res: Response) {
   try {
     const property = await PropertyService.findById(req.params.id);
     if (!property) return res.status(404).json({ message: "Property not
found" });
     res.json(property);
   } catch (err: any) {
     res.status(500).json({ error: err.message });
   }
 }

 static async update(req: Request, res: Response) {
   try {
     const updated = await PropertyService.update(req.params.id, req.body);
     if (!updated) return res.status(404).json({ message: "Property not
found" });
     res.json(updated);
   } catch (err: any) {
     res.status(500).json({ error: err.message });
   }
 }

 static async delete(req: Request, res: Response) {
   try {
     const result = await PropertyService.delete(req.params.id);
     res.json(result);
   } catch (err: any) {
     res.status(500).json({ error: err.message });
   }
 }
}
```

RentalController

```
import { Request, Response } from "express";
import { RentalService } from "../services/rental.service";

export class RentalController {
 static async create(req: Request, res: Response) {
   try {
     const saved = await RentalService.create(req.body);
     res.status(201).json(saved);
   } catch (err: any) {
     res.status(500).json({ error: err.message });
   }
 }

 static async findAll(req: Request, res: Response) {
   try {
     const { skip = 0, take = 20 } = req.query as any;
     const rentals = await RentalService.findAll(Number(skip),
Number(take));
     res.json(rentals);
   } catch (err: any) {
     res.status(500).json({ error: err.message });
   }
 }

 static async findById(req: Request, res: Response) {
```

```
    try {
      const rental = await RentalService.findById(req.params.id);
      if (!rental) return res.status(404).json({ message: "Rental not found"
});
      res.json(rental);
    } catch (err: any) {
      res.status(500).json({ error: err.message });
    }
  }

  static async update(req: Request, res: Response) {
    try {
      const updated = await RentalService.update(req.params.id, req.body);
      if (!updated) return res.status(404).json({ message: "Rental not found"
});
      res.json(updated);
    } catch (err: any) {
      res.status(500).json({ error: err.message });
    }
  }

  static async delete(req: Request, res: Response) {
    try {
      const result = await RentalService.delete(req.params.id);
      res.json(result);
    } catch (err: any) {
      res.status(500).json({ error: err.message });
    }
  }
}
```

MessageController

```
import { Request, Response } from "express";
import { MessageService } from "../services/message.service";

export class MessageController {
  static async create(req: Request, res: Response) {
    try {
      const saved = await MessageService.create(req.body);
      res.status(201).json(saved);
    } catch (err: any) {
      res.status(500).json({ error: err.message });
    }
  }

  static async findAll(req: Request, res: Response) {
    try {
      const { skip = 0, take = 20 } = req.query as any;
      const messages = await MessageService.findAll(Number(skip),
Number(take));
      res.json(messages);
    } catch (err: any) {
      res.status(500).json({ error: err.message });
    }
  }

  static async findById(req: Request, res: Response) {
    try {
```

```
    const message = await MessageService.findById(req.params.id);
    if (!message) return res.status(404).json({ message: "Message not found"
});
    res.json(message);
  } catch (err: any) {
    res.status(500).json({ error: err.message });
  }
 }

 static async update(req: Request, res: Response) {
  try {
    const updated = await MessageService.update(req.params.id, req.body);
    if (!updated) return res.status(404).json({ message: "Message not found"
});
    res.json(updated);
  } catch (err: any) {
    res.status(500).json({ error: err.message });
  }
 }

 static async delete(req: Request, res: Response) {
  try {
    const result = await MessageService.delete(req.params.id);
    res.json(result);
  } catch (err: any) {
    res.status(500).json({ error: err.message });
  }
 }
}
```

AmenityController

```
import { Request, Response } from "express";
import { AmenityService } from "../services/amenity.service";

export class AmenityController {
 static async create(req: Request, res: Response) {
  try {
    const saved = await AmenityService.create(req.body);
    res.status(201).json(saved);
  } catch (err: any) {
    res.status(500).json({ error: err.message });
  }
 }

 static async findAll(req: Request, res: Response) {
  try {
    const { skip = 0, take = 20 } = req.query as any;
    const amenities = await AmenityService.findAll(Number(skip),
Number(take));
    res.json(amenities);
  } catch (err: any) {
    res.status(500).json({ error: err.message });
  }
 }

 static async findById(req: Request, res: Response) {
  try {
    const amenity = await AmenityService.findById(req.params.id);
```

```
    if (!amenity) return res.status(404).json({ message: "Amenity not found"
});
    res.json(amenity);
  } catch (err: any) {
    res.status(500).json({ error: err.message });
  }
 }

 static async update(req: Request, res: Response) {
  try {
    const updated = await AmenityService.update(req.params.id, req.body);
    if (!updated) return res.status(404).json({ message: "Amenity not found"
});
    res.json(updated);
  } catch (err: any) {
    res.status(500).json({ error: err.message });
  }
 }

 static async delete(req: Request, res: Response) {
  try {
    const result = await AmenityService.delete(req.params.id);
    res.json(result);
  } catch (err: any) {
    res.status(500).json({ error: err.message });
  }
 }
}
```

PropertyAmenityController

```
import { Request, Response } from "express";
import { PropertyAmenityService } from "../services/propertyAmenity.service";

export class PropertyAmenityController {
 static async create(req: Request, res: Response) {
  try {
    const saved = await PropertyAmenityService.create(req.body);
    res.status(201).json(saved);
  } catch (err: any) {
    res.status(500).json({ error: err.message });
  }
 }

 static async findAll(req: Request, res: Response) {
  try {
    const { skip = 0, take = 20 } = req.query as any;
    const items = await PropertyAmenityService.findAll(Number(skip),
Number(take));
    res.json(items);
  } catch (err: any) {
    res.status(500).json({ error: err.message });
  }
 }

 static async findById(req: Request, res: Response) {
  try {
    const item = await PropertyAmenityService.findById(req.params.id);
    if (!item) return res.status(404).json({ message: "Item not found" });
```

```
      res.json(item);
    } catch (err: any) {
      res.status(500).json({ error: err.message });
    }
  }

  static async update(req: Request, res: Response) {
    try {
      const updated = await PropertyAmenityService.update(req.params.id,
req.body);
      if (!updated) return res.status(404).json({ message: "Item not found"
});
      res.json(updated);
    } catch (err: any) {
      res.status(500).json({ error: err.message });
    }
  }

  static async delete(req: Request, res: Response) {
    try {
      const result = await PropertyAmenityService.delete(req.params.id);
      res.json(result);
    } catch (err: any) {
      res.status(500).json({ error: err.message });
    }
  }
}
```

ReviewController

```
import { Request, Response } from "express";
import { ReviewService } from "../services/review.service";

export class ReviewController {
  static async create(req: Request, res: Response) {
    try {
      const saved = await ReviewService.create(req.body);
      res.status(201).json(saved);
    } catch (err: any) {
      res.status(500).json({ error: err.message });
    }
  }

  static async findAll(req: Request, res: Response) {
    try {
      const { skip = 0, take = 20 } = req.query as any;
      const reviews = await ReviewService.findAll(Number(skip),
Number(take));
      res.json(reviews);
    } catch (err: any) {
      res.status(500).json({ error: err.message });
    }
  }

  static async findById(req: Request, res: Response) {
    try {
      const review = await ReviewService.findById(req.params.id);
      if (!review) return res.status(404).json({ message: "Review not found"
});
```

```
      res.json(review);
    } catch (err: any) {
      res.status(500).json({ error: err.message });
    }
  }

  static async update(req: Request, res: Response) {
    try {
      const updated = await ReviewService.update(req.params.id, req.body);
      if (!updated) return res.status(404).json({ message: "Review not found"
});
      res.json(updated);
    } catch (err: any) {
      res.status(500).json({ error: err.message });
    }
  }

  static async delete(req: Request, res: Response) {
    try {
      const result = await ReviewService.delete(req.params.id);
      res.json(result);
    } catch (err: any) {
      res.status(500).json({ error: err.message });
    }
  }
}
```

5. Роуты

Пример маршрутов пользователей с использованием middleware для аутентификации:

```
import { Router } from "express";
import { UserController } from "../controllers/user.controller";

const router = Router();

router.post("/", UserController.create);
router.get("/", UserController.findAll);
router.get("/:id", UserController.findById);
router.put("/:id", UserController.update);
router.delete("/:id", UserController.delete);

export default router;
```

6. Middleware аутентификации

JWT-based middleware для защиты маршрутов:

```
import { Request, Response, NextFunction } from "express";
import jwt from "jsonwebtoken";
import { AppDataSource } from "../config/data-source";
import { User } from "../entities/User";

export interface AuthRequest extends Request {
  user?: User;
}
```

```
export const authMiddleware = async (req: AuthRequest, res: Response, next:
NextFunction) => {
 try {
   const token = req.header("Authorization")?.replace("Bearer ", "");
   if (!token) return res.status(401).json({ message: "Access denied. No
token provided." });

   const decoded = jwt.verify(token, process.env.JWT_SECRET ||
"fallback-secret") as any;
   const userRepository = AppDataSource.getRepository(User);
   const user = await userRepository.findOne({ where: { id: decoded.userId }
});

   if (!user) return res.status(401).json({ message: "Invalid token." });

   req.user = user;
   next();
 } catch (error) {
   res.status(401).json({ message: "Invalid token." });
 }
};
```

Middleware для логгирования:

```
import { Request, Response, NextFunction } from "express";

export const loggerMiddleware = (req: Request, res: Response, next:
NextFunction) => {
 console.log(`[${new Date().toISOString()}] ${req.method} ${req.path}`);
 next();
};
```

Middleware для обработки ошибок:

```
import { Request, Response, NextFunction } from "express";

export const errorMiddleware = (err: any, req: Request, res: Response, next:
NextFunction) => {
 console.error(err.stack);
 res.status(err.status || 500).json({
   message: err.message || "Internal Server Error",
 });
};
```

7. Файл входа в приложение

```
import express from "express";
import { AppDataSource } from "./config/data-source";

import userRoutes from "./routes/user.routes";
import propertyRoutes from "./routes/property.routes";
import rentalRoutes from "./routes/rental.routes";
import messageRoutes from "./routes/message.routes";
import reviewRoutes from "./routes/review.routes";
import amenityRoutes from "./routes/amenity.routes";
```

```
import { loggerMiddleware } from "./middleware/loggerMiddleware";
import { errorMiddleware } from "./middleware/errorMiddleware";

const app = express();
app.use(express.json());

// Логирование всех запросов
app.use(loggerMiddleware);

// Роуты
app.use("/api/users", userRoutes);
app.use("/api/properties", propertyRoutes);
app.use("/api/rentals", rentalRoutes);
app.use("/api/messages", messageRoutes);
app.use("/api/reviews", reviewRoutes);
app.use("/api/amenities", amenityRoutes);

// Глобальная обработка ошибок
app.use(errorMiddleware);

const PORT = process.env.PORT || 5000;

AppDataSource.initialize()
 .then(() => {
   console.log("Data Source initialized");
   app.listen(PORT, () => console.log(`Server running on port ${PORT}`));
 })
 .catch(err => console.error("Error during Data Source initialization",
err));
```

Вывод

В ходе выполнения лабораторной работы был успешно реализован RESTful API для сервиса аренды недвижимости на базе Express.js и TypeScript с использованием TypeORM.

Достигнутые результаты:

1. Реализована система аутентификации с JWT-токенами, включая middleware для защиты маршрутов.
2. Создана регистрация и вход пользователей с ролями (tenant, owner, admin).
3. Реализован личный кабинет пользователя с отображением списка арендованных и арендующихся объектов.
4. Реализован поиск недвижимости с возможностью фильтрации по типу, цене и расположению.
5. Создана система управления объектами недвижимости и их удобствами.
6. Реализована система аренды (Rental) для отслеживания сделок и сроков аренды.

7. Реализована система сообщений между пользователями и история сообщений.
8. Реализована система отзывов (Review) для объектов аренды.
9. Обеспечена безопасность: хеширование паролей, JWT-аутентификация, централизованная обработка ошибок.
10. Настроено логирование всех запросов для удобства отладки и мониторинга.
11. Проект имеет модульную структуру, легко расширяется новым функционалом (дополнительные фильтры, интеграции с внешними сервисами, расширение системы сообщений и уведомлений).