🏢 DLF Property Management System - Project Documentation

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🎯 1. Project Overview

Business Problem

DLF Limited needs a centralized property ownership and document management system to handle 100,000+ properties and 50,000+ users with secure access, ownership management, and enquiry handling.

Key Requirements

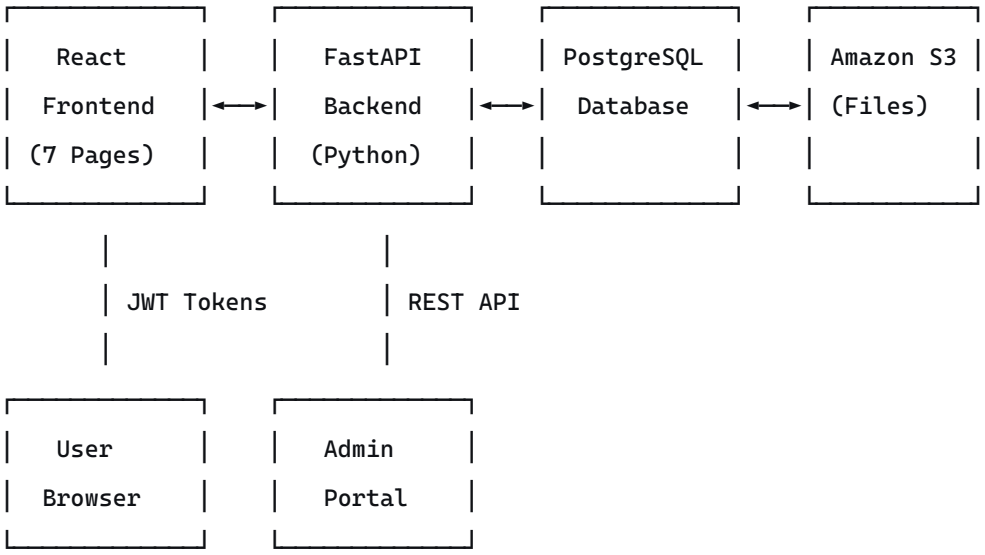
- ☑ Secure user authentication and authorization
- ☑ Property browsing and search (post-authentication)
- ☑ Secure document storage with Amazon S3
- ☑ Internal enquiry system between users and admins
- ☑ Ownership transfer functionality (admin-only)
- ☑ Scalable architecture to handle 100k+ properties efficiently.

Tech Stack

- **Frontend:** React
- **Backend:** Python FastAPI
- **Database:** PostgreSQL
- **File Storage:** Amazon S3
- **Authentication:** JWT + bcrypt
- **Deployment:** Docker

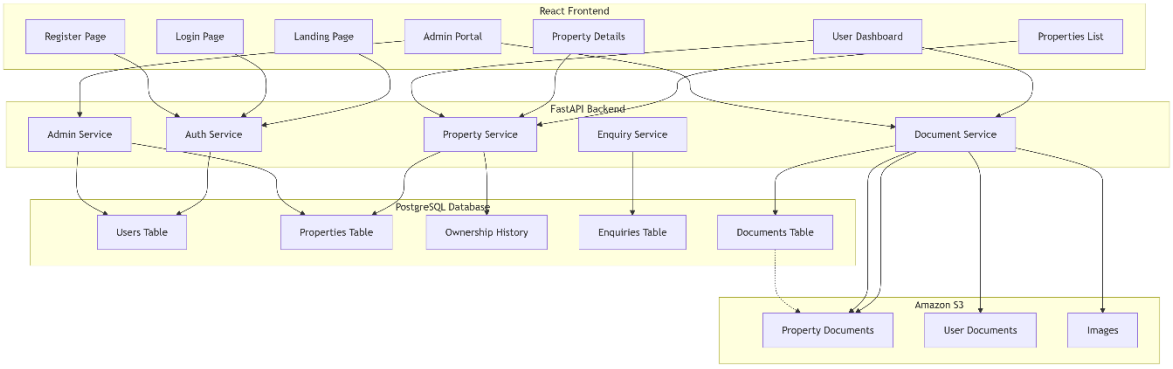
🏗 2. System Architecture

High-Level Architecture

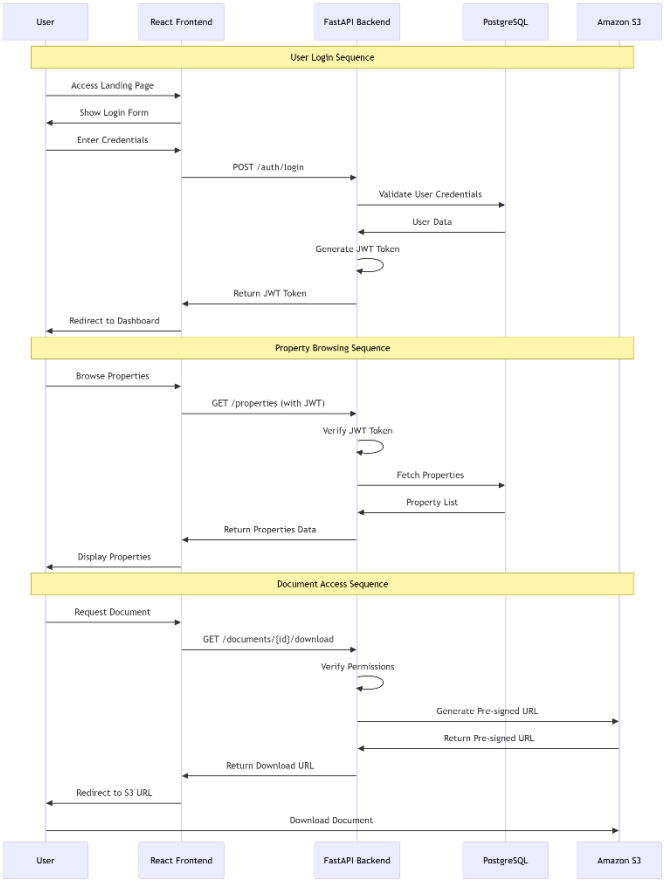


Diagramatic Explanation of DLF project:

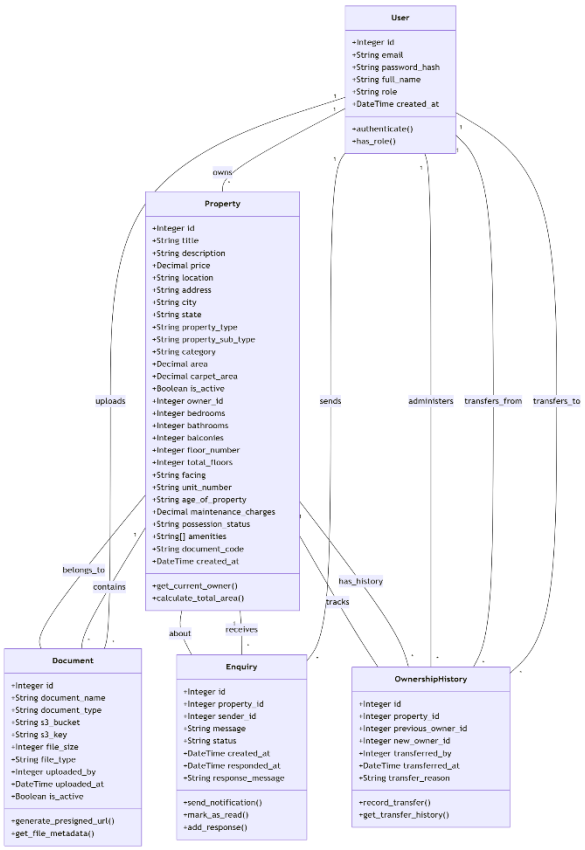
Component Diagram



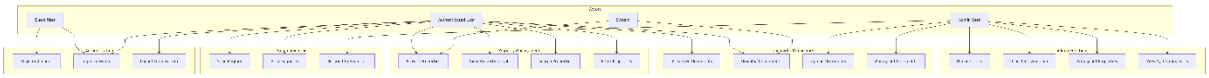
2. Sequence Diagram (User Login & Property Access)



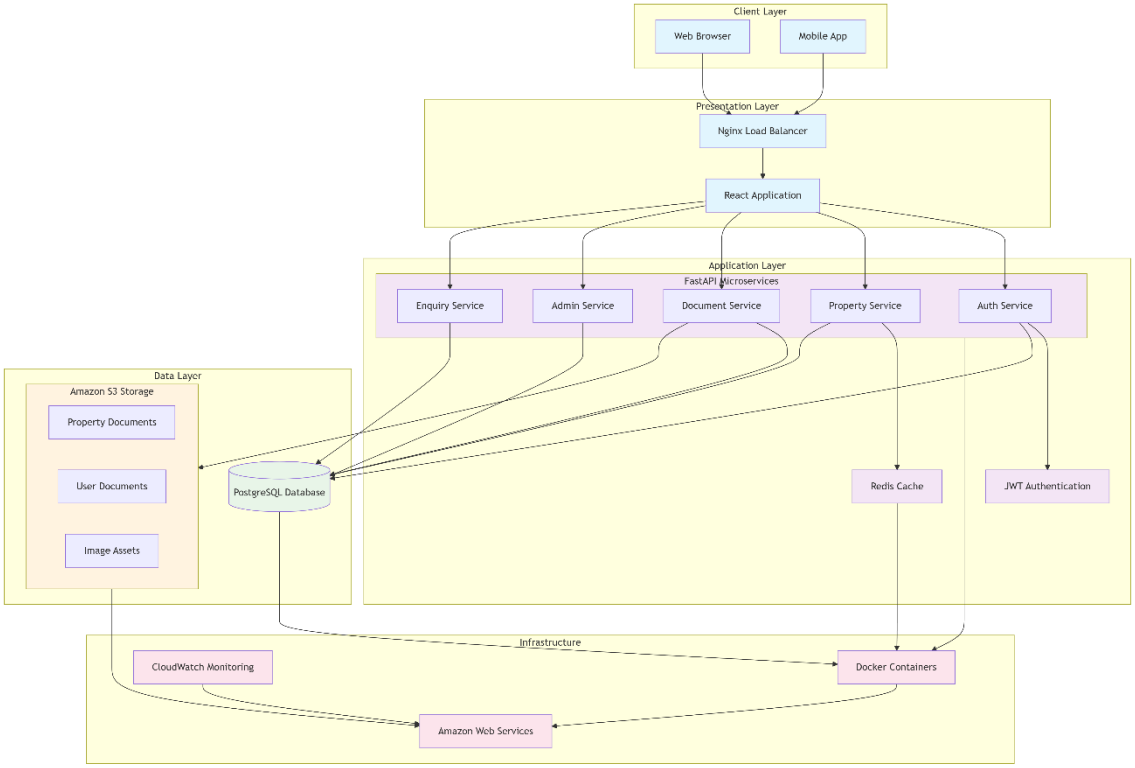
3. Class Diagram



4. Use Case Diagram



5. System Architecture Diagram



Component Responsibilities

- **Frontend (React):** Serves the user interface with 7 main routes, manages application state, and handles user interactions
- **Backend (FastAPI):** Provides RESTful API endpoints, business logic, authentication, and file handling
- **Database (PostgreSQL):** Stores all structured data including users, properties, ownership records, and enquiries
- **File Storage (Amazon S3):** Securely stores property documents, images, and user files with proper access control

🎨 3. Frontend Application (React)

7 Page Structure

Page 1: / - Landing Page

- **Purpose:** Entry point for all users
- **Features:**
    - Hero section with project description
    - Login/Register buttons
    - No property browsing (requires login)
- **Access:** Public

Page 2: /auth/login - Login Page

- **Purpose:** User and admin authentication
- **Features:**
    - Email/password form
    - Role detection (user/admin)
    - Redirect to appropriate portal
- **Access:** Public

Page 3: /auth/register - Registration Page

- **Purpose:** New user account creation
- **Features:**
    - Registration form with validation
    - Password strength indicator
    - Terms acceptance
- **Access:** Public

Page 4: /properties - Property Listings 🔒

- **Purpose:** Browse all properties
- **Features:**
    - Search and filter 100,000+ properties
    - Pagination for performance
    - Property cards with basic info
- **Access:** Authenticated users only

Page 5: /properties/[id] - Property Details 🔒

- **Purpose:** View individual property information
- **Features:**
    - Detailed property view
    - Image gallery (served from S3)
    - "Send Enquiry" button
- **Access:** Authenticated users only

Page 6: /dashboard - User Portal 🔒

- **Purpose:** Personal management dashboard
- **Features (Tabbed Interface):**
    - My Properties: Owned properties list
    - My Documents: Access to S3-stored documents
    - My Enquiries: Sent/received messages
- **Access:** Authenticated users only

Page 7: /admin - Admin Portal 🔒

- **Purpose:** System administration
- **Features (Tabbed Interface):**
    - All Properties: Manage 100k+ properties
    - Transfer Ownership: Critical feature (2 fields only)
    - All Users: User management
    - Document Management: Upload/Manage files in S3
- **Access:** Admin users only

⚙️ 4. Backend API Service (FastAPI)

File Structure

```
backend/
├── app/
│   ├── main.py              # FastAPI app setup
│   ├── auth.py              # JWT authentication
│   ├── database.py          # PostgreSQL connection
│   ├── models.py            # SQLAlchemy models
│   ├── schemas.py           # Pydantic schemas
│   ├── crud.py              # Database operations
│   ├── config.py            # Environment config
│   ├── s3_client.py         # Amazon S3 file operations
│   └── routes/              # API endpoints
│       ├── auth.py
│       ├── properties.py
│       ├── enquiries.py
│       ├── documents.py
│       └── admin.py
├── scripts/
│   ├── seed_data.py         # Fake data generation
│   └── database_init.py     # DB setup
└── requirements.txt
```

Key Backend Features

- **JWT Authentication:** Secure token-based authentication system
- **Role-Based Access Control:** User/Admin permission management
- **Amazon S3 Integration:** Secure file upload, download, and management
- **API Validation:** Pydantic schema validation for all requests
- **Error Handling:** Comprehensive error responses and logging

5. Database Schema (PostgreSQL)

Core Tables

- **users:** User accounts and profiles
- **properties:** Property details and information
- **ownership_history:** Property ownership tracking
- **enquiries:** User enquiry messages
- **documents:** File metadata and S3 references

Relationships

- One-to-Many: User → Properties (owned)
- One-to-Many: User → Enquiries (sent)
- One-to-Many: Property → Documents
- Many-to-Many: Property → Users (through ownership_history)

5 Table Schema

1. Users Table

```
CREATE TABLE users (
    id SERIAL PRIMARY KEY,
    email VARCHAR(255) UNIQUE NOT NULL,
    password_hash VARCHAR(255) NOT NULL,
    full_name VARCHAR(255) NOT NULL,
    role VARCHAR(20) CHECK (role IN ('user', 'admin')) DEFAULT 'user',
    created_at TIMESTAMP DEFAULT CURRENT_TIMESTAMP
);
```

2. Properties Table

```
CREATE TABLE properties (
    id SERIAL PRIMARY KEY,
    title VARCHAR(500) NOT NULL,
    description TEXT,
    price DECIMAL(15,2),
    location VARCHAR(255),
    address TEXT NOT NULL,
    city VARCHAR(100) NOT NULL,
    state VARCHAR(100) NOT NULL,
    property_type VARCHAR(50),
    property_sub_type VARCHAR(50),
    category VARCHAR(50),
    area DECIMAL(10,2),
    carpet_area DECIMAL(10,2),
    is_active BOOLEAN DEFAULT true,
    owner_id INTEGER NOT NULL,
    bedrooms INTEGER,
    bathrooms INTEGER,
```

```
    balconies INTEGER,
    floor_number INTEGER,
    total_floors INTEGER,
    facing VARCHAR(50),
    unit_number VARCHAR(50),
    age_of_property VARCHAR(50),
    maintenance_charges DECIMAL(10,2),
    possession_status VARCHAR(50),
    amenities TEXT[],
    document_code VARCHAR(100),
    created_at TIMESTAMP DEFAULT CURRENT_TIMESTAMP,
    FOREIGN KEY (owner_id) REFERENCES users(id)
);
```

3. Documents Table (DEMO Mode)

```
CREATE TABLE documents (
    id SERIAL PRIMARY KEY,
    property_id INTEGER NOT NULL,
    document_name VARCHAR(255) NOT NULL,
    document_type VARCHAR(50) CHECK (document_type IN ('deed', 'tax_receipt', 'agr
eement', 'plan', 'certificate')),
    s3_bucket VARCHAR(255) NOT NULL,
    s3_key VARCHAR(500) NOT NULL,
    file_size INTEGER,
    file_type VARCHAR(100),
    uploaded_by INTEGER NOT NULL,
    uploaded_at TIMESTAMP DEFAULT CURRENT_TIMESTAMP,
    is_active BOOLEAN DEFAULT true,
    FOREIGN KEY (property_id) REFERENCES properties(id),
    FOREIGN KEY (uploaded_by) REFERENCES users(id)
);
```

4. Enquiries Table

```
CREATE TABLE enquiries (
    id SERIAL PRIMARY KEY,
    property_id INTEGER NOT NULL,
    sender_id INTEGER NOT NULL,
    message TEXT NOT NULL,
```

```
    status VARCHAR(20) CHECK (status IN ('unread', 'read', 'replied')) DEFAULT 'un
read',
    created_at TIMESTAMP DEFAULT CURRENT_TIMESTAMP,
    responded_at TIMESTAMP,
    response_message TEXT,
    FOREIGN KEY (property_id) REFERENCES properties(id),
    FOREIGN KEY (sender_id) REFERENCES users(id)
);
```

5. Ownership History Table

```
CREATE TABLE ownership_history (
    id SERIAL PRIMARY KEY,
    property_id INTEGER NOT NULL,
    previous_owner_id INTEGER NOT NULL,
    new_owner_id INTEGER NOT NULL,
    transferred_by INTEGER NOT NULL,
    transferred_at TIMESTAMP DEFAULT CURRENT_TIMESTAMP,
    transfer_reason TEXT,
    FOREIGN KEY (property_id) REFERENCES properties(id),
    FOREIGN KEY (previous_owner_id) REFERENCES users(id),
    FOREIGN KEY (new_owner_id) REFERENCES users(id),
    FOREIGN KEY (transferred_by) REFERENCES users(id)
);
```

🌐 6. API Endpoints

Authentication

- `POST /auth/register` - User registration
- `POST /auth/login` - User login
- `POST /auth/logout` - User logout

Properties

- `GET /properties` - List all properties (with pagination)
- `GET /properties/{id}` - Get property details
- `POST /properties/{id}/enquiry` - Send enquiry

Documents

- `GET /documents` - List user documents
- `GET /documents/{id}/download` - Generate S3 pre-signed URL
- `POST /admin/documents/upload` - Upload document to S3 (admin)

Admin

- `POST /admin/ownership/transfer` - Transfer property ownership
- `GET /admin/users` - List all users
- `GET /admin/properties` - Manage properties
- `properties` - Get all properties

🔄 7. User Flows

User Registration Flow

1. Landing Page → Register → Email/Password → Account Created → Login → User Dashboard

Property Browsing Flow

1. Login → Properties Page → Search/Filter → Property Details → Send Enquiry

Document Access Flow

1. User Dashboard → My Documents → View List → Click Document → S3 Pre-signed URL → Download

Admin Ownership Transfer

1. Admin Login → Admin Portal → Transfer Ownership → Select Property & User → Confirm Transfer

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🗂 8. File Storage with Amazon S3

S3 Bucket Structure

```
s3://dlf-property-documents/
├── properties/
│   ├── {property_id}/
│   │   ├── deeds/
│   │   ├── agreements/
│   │   └── images/
├── users/
│   ├── {user_id}/
│   │   ├── identification/
│   │   └── contracts/
```

Security Features

- **IAM Roles:** Secure access credentials
- **Bucket Policies:** Restrict public access
- **Pre-signed URLs:** Time-limited download links
- **Encryption:** Server-side encryption for all files

File Operations

- **Upload:** Admin users can upload documents via secure API
- **Download:** Users get pre-signed URLs for secure file access
- **Metadata:** All file information stored in PostgreSQL for tracking

9. Deployment & Infrastructure

Docker Configuration

- **Frontend Container:** React application served via Nginx
- **Backend Container:** FastAPI application with Uvicorn
- **Database Container:** PostgreSQL with persistent volume
- **Reverse Proxy:** Nginx for routing and SSL termination

Environment Setup

- **Development:** Local Docker Compose with mock S3
- **Staging:** AWS environment with test S3 bucket
- **Production:** AWS ECS/EKS with production S3 bucket

AWS Services Integration

- **Amazon S3:** File storage and document management

- **IAM:** Secure access management for S3
- **CloudWatch:** Application monitoring and logging

👥 10. Team Responsibilities

Frontend Team (React)

- Implement 7-page application structure
- State management and API integration
- Responsive UI/UX design

Backend Team (FastAPI)

- REST API development and documentation
- Authentication and authorization system
- PostgreSQL database design and optimization
- Amazon S3 integration and file handling

Deployment Team

- Docker containerization and orchestration
- AWS infrastructure setup (S3, ECS, etc.)

QA Team

- API endpoint testing
- User flow validation
- File upload/download testing
- Performance testing with 100k+ properties