Full Stack Development with MERN

Online Complaint Registration and Management System

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1.Introduction

Project Title: Online Complaint Registration and Management System

Team Members:

- **A. Sachin** – Frontend Development, Database Development, and Project Implementation
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2. Project Overview

The system provides a centralized platform to manage complaints effectively, optimizing complaint resolution and improving customer satisfaction. Key features include user registration, complaint submission, and tracking, along with real-time notifications. Users can interact with assigned agents, while the system employs intelligent routing algorithms to assign complaints to appropriate personnel, ensuring efficient handling. Security and confidentiality are prioritized through robust authentication, data encryption, and compliance with data protection regulations.

Features:

User Registration and Authentication:

Users can securely register and log in to manage their complaints and monitor progress.

Complaint Submission:

Users can submit complaints by providing details such as their name, a description of the issue, and their address.

Progress Tracking and Notifications:

Users can track the status of their complaints, view updates, and receive notifications via email or SMS regarding any changes or resolutions.

Agent Interaction:

Users can directly communicate with the assigned agent to discuss or clarify complaint-related matters.

Complaint Assignment and Routing:

The system assigns complaints to the appropriate department or personnel based on intelligent routing algorithms to optimize resource allocation and ensure efficient resolution.

Security and Confidentiality:

User data and complaint details are safeguarded through robust security measures, including user authentication, data encryption, access controls, and compliance with data protection regulations.

3. Architecture:

Frontend Architecture:

The frontend is designed with React.js, focusing on modularity and reusability. The application follows a structured directory setup, ensuring clean organization and scalability. Core functionalities are implemented as reusable UI components (e.g., forms, buttons, navigation bars), promoting a consistent and intuitive design. React's state management and data binding enable dynamic updates and seamless integration with backend APIs for real-time interactions. Key features, including complaint registration, tracking, and admin dashboards, are styled for responsiveness and visual appeal using Material-UI and Bootstrap.

Backend Architecture:

The backend is powered by Node.js and Express.js, providing a robust and scalable server-side framework. The architecture adopts a well-structured directory hierarchy with modular routes for functionalities like authentication, complaint management, and admin operations. APIs interact with the MongoDB database via Mongoose for efficient data handling. Middleware such as body-parser and CORS ensures smooth data parsing and secure cross-origin communication.

Database Design:

The database leverages MongoDB for scalable and efficient data storage. Entities like users, complaints, assigned complaints, and messages are structured using Mongoose schemas, enabling seamless CRUD operations. Relationships are established through object references (e.g., `userId`, `complaintId`) to link users with their complaints and assigned agents. Collections are optimized for performance, supporting scalability, complex queries, and robust data retrieval, ensuring smooth database operations.

4. Setup Instructions

Prerequisites

To ensure the backend and frontend function seamlessly, the following libraries and tools are required:

Backend Libraries:

1. **Node.js**: Server-side JavaScript runtime.
2. **MongoDB**: NoSQL database for application data storage.
3. **Bcrypt**: For secure password hashing.
4. **Body-parser**: Middleware for parsing incoming request bodies.

Frontend Libraries:

1. **React.js**: JavaScript library for building user interfaces.
2. **Material-UI**: React component library for responsive design and styling.
3. **Bootstrap**: CSS framework for styling and layout.
4. **Axios**: Library for handling HTTP requests.

Installation

Node.js & npm:

Install Node.js to run server-side scripts and manage dependencies. Download Node.js

Express.js:

Set up the web application framework for APIs and routing using

```
npm install express
```

MongoDB:

Install the NoSQL database for storing data. Download MongoDB

React.js:

Install React.js for building dynamic user interfaces. React.js Setup Guide

HTML, CSS, JavaScript:

Use these core technologies for app structure, styling, and interactivity.

Database Connectivity:

Connect the Node.js server to MongoDB using **Mongoose** for seamless CRUD operations.

Libraries:

Integrate **Material-UI** and **Bootstrap** for enhanced styling and responsiveness.

Version Control:

Use **Git** for managing code versions. Download Git

Development Tools:
Utilize **Visual Studio Code** as the code editor for efficient development. Download VS Code

5. Folder Structure

Client (Frontend)

The React-based frontend is structured for modularity and scalability, with reusable components ensuring maintainability and a consistent design. Key features include:

1. **Component-Based Architecture:**
   UI is broken into modular components like Header, Footer, ComplaintForm, and AdminDashboard, each handling specific functionality.
2. **Routing:**
   Navigation between pages such as complaint submission, status tracking, and admin dashboards is implemented using React Router.
3. **State Management:**
   State is managed locally within components or globally using Context API for shared data across the application.
4. **Styling:**
   Material-UI and Bootstrap are used for a responsive and visually consistent user interface.
5. **API Integration:**
   Communication with the backend server for CRUD operations is handled via Axios or Fetch API.

Server (Backend)

The Node.js backend is designed with the MVC (Model-View-Controller) pattern, ensuring scalability, maintainability, and a clean codebase. Key elements include:

1. **Routing:**
   Express.js handles API endpoints for user management, complaint processing, and admin functions.
2. **Controllers:**
   Centralized business logic processes incoming requests and sends appropriate responses to the client.
3. **Models:**
   Mongoose schemas define the structure of MongoDB collections, such as User and Complaint.
4. **Middleware:**
   Middleware functions handle request validation, user authentication (e.g., JWT), and error

management.

5. **Database Integration:**
   MongoDB is connected via Mongoose for efficient and seamless CRUD operations.
6. **Environment Variables:**
   dotenv is used to securely manage configuration details, such as database URIs and API keys.

The system offers significant advantages to both users and administrators. Users benefit from the convenience of registering complaints from anywhere, while administrators enjoy streamlined workflows that save time and resources. The system also provides valuable insights into user concerns, helping organizations identify and address recurring issues.

6. Running the Application

Commands to Start Frontend and Backend Servers Locally

Frontend

1. **Navigate to the Frontend Directory:**

   Change the terminal directory to the frontend folder:

   cd complaint-registry/frontend

2.**Install Dependencies:**

   Ensure all required packages are installed:

   npm install

3.**Start the Development Server:**

   Launch the React development server:

   npm start

4.**Access the Application:**

   By default, the frontend will be available at:

   http://localhost:3080

Backend

1.**Navigate to the Backend Directory**:

Move to the backend code directory:

cd <project-directory>/backend

2.**Install Dependencies:**

Install all required packages (e.g., Express.js, Mongoose):

npm install

3.**Set Up Environment Variables:**

Ensure the `.env` file is configured with necessary values, such as:

Database connection string:**MONGO_URI**

JWT secret key: **JWT_SECRET**

Server port: **PORT**

4.Start the Backend Server:

Run the development server:

npm start

5. **Access the Backend:**

The backend will be available at the port specified in the `.env` file. For example, the default:

http://localhost:3080

7. API Documentation

Backend API Documentation

1. User Authentication

- **Register Endpoint**: Enables users to create an account by providing required details like name, email, and password.

- **Login Endpoint**: Allows registered users to authenticate themselves and receive an access token for secure interactions with the application.

2. Complaint Management

- **Submit Complaint**: Enables users to register complaints by providing details like issue description, address, and user ID.
- **View Complaint Status**: Provides users with the ability to track the progress of their complaints, including updates on the assigned agent and status.

3. Admin Operations

- **Assign Complaint**: Allows admins to allocate complaints to specific agents for resolution.
- **View All Complaints**: Enables administrators to review and manage all submitted complaints, including their status and assigned agents.

8. Authentication

Authorization ensures that users only access the resources or perform actions for which they have permission. The system enforces this using Role-based Access Control (RBAC), granting different levels of access based on user roles.

1. Roles

The system supports the following user roles, each with different levels of access:

- Customer: Can create complaints, view their own complaints, and chat with agents.
- Agent: Can view complaints assigned to them and communicate with customers.
- Admin: Can access all complaints, assign complaints to agents, view user data, and manage the entire system.

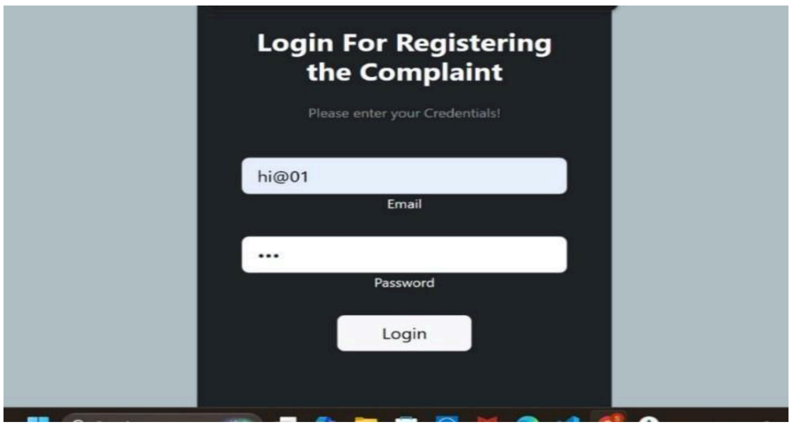
2. Protected Routes

Certain API endpoints are protected to ensure that only authenticated and authorized users can access them:

- Admins can access routes to view all complaints, assign complaints, and manage users.
- Agents can only view complaints assigned to them and interact with customers.

Before granting access to a protected route, the server validates the JWT token and checks if the user's role matches the required role for that specific endpoint. If the token is invalid or the role is incorrect, the request is denied.

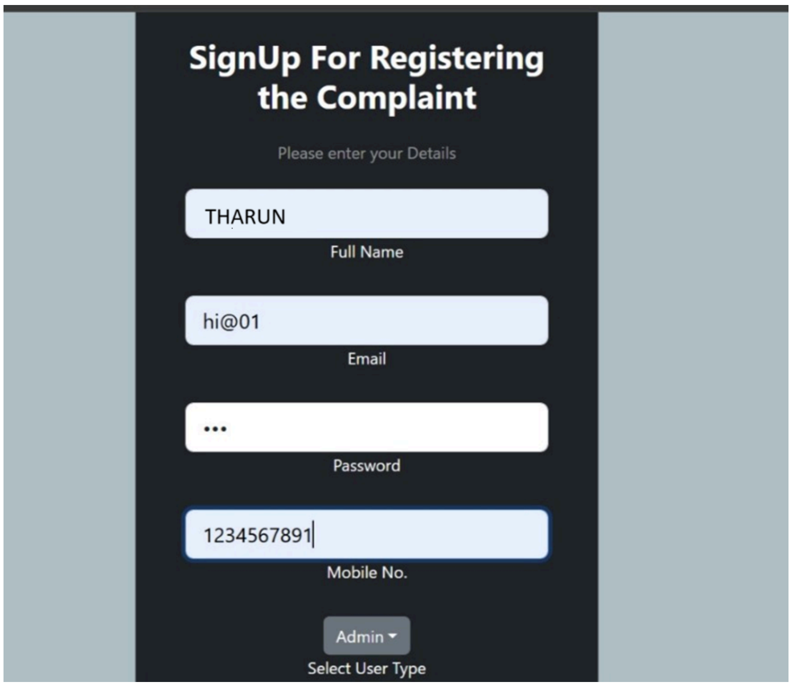
9. User Interface


Login For Registering the Complaint

Please enter your Credentials!

Email: hi@01

Password: •••


SignUp For Registering the Complaint

Please enter your Details

Full Name: THARUN

Email: hi@01

Password: •••

Mobile No.: 1234567891

Select User Type: Admin

10. Testing

Testing Approach for the Online Complaint Registration and Management System

The testing strategy for the Online Complaint Registration and Management System ensures that all components — frontend, backend, and database — function as expected. The approach involves the following stages:

1. Unit Testing

Objective: Validate individual components, functions, or modules in isolation to ensure each part performs as intended.

Examples:

- Frontend: Verify that React components render correctly with the expected props.
- Backend: Test utility functions, middleware (e.g., token verification), and request parsing logic.
- Database: Confirm that CRUD operations on MongoDB models perform as expected.

2. Integration Testing

Objective: Test the interaction and data flow between different modules or services to ensure they work together as expected.

Examples:

- Frontend & Backend: Verify that API endpoints work correctly when invoked from React components.
- Backend & Database: Ensure database queries return the expected results in response to API requests.

3. End-to-End (E2E) Testing

Objective: Simulate real-world user interactions with the system to ensure the entire application functions seamlessly.

Examples:

- A customer logs in, registers a complaint, and checks the complaint status.
- An admin assigns a complaint to an agent, who then resolves it.

4. Performance Testing

Objective: Evaluate the application's performance under varying conditions to ensure responsiveness and scalability.

Examples:

- Measure the backend response time for API calls under load conditions.
- Test database query execution time for high-volume transactions.

5. Security Testing

Objective: Identify potential vulnerabilities and ensure the system's data security protocols are effective.

Examples:

- Test for SQL injection vulnerabilities in API endpoints.
- Ensure password hashing and storage practices meet security standards to protect sensitive user data.

6. Manual Testing

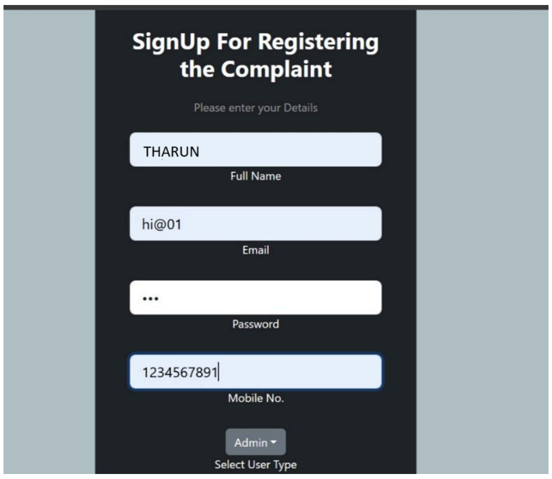
Objective: Perform exploratory testing to identify edge cases, unexpected behaviors, and usability issues.

Examples:

- Test UI responsiveness across different screen sizes and devices.
- Verify role-based access control (RBAC) properly restricts users to their assigned functionalities.

This comprehensive testing approach ensures the system's functionality, performance, security, and usability are rigorously assessed, providing a high-quality user experience.

11. Screenshots or Demo



SignUp For Registering the Complaint

Please enter your Details

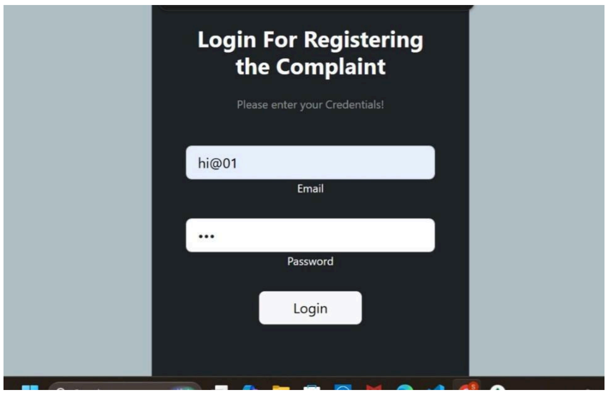
Full Name: THARUN

Email: hi@01

Password: •••

Mobile No.: 1234567891

Select User Type: Admin

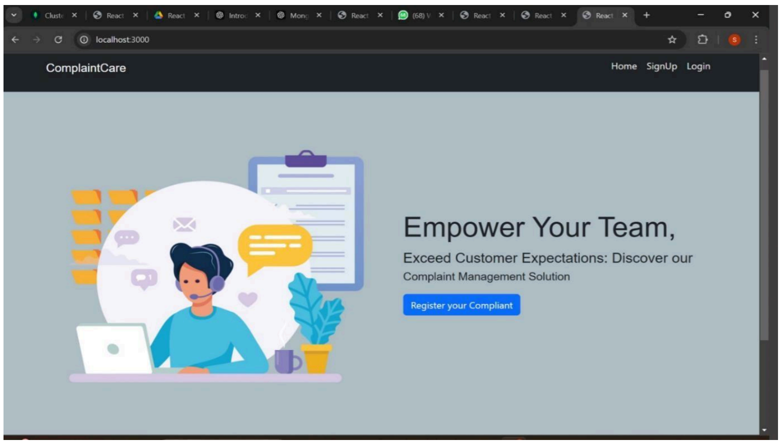


Login For Registering the Complaint

Please enter your Credentials!

Email: hi@01

Password: •••



12. Known Issues

1. Delayed Real-Time Updates

In certain cases, the chat interface does not update immediately after a new message is sent. This issue may be caused by delays in message synchronization between the client and server. Users may experience a brief lag before seeing the newly sent message appear in the chat window.

Workaround: To see the most recent messages, refresh the chat page manually. A permanent solution is being explored to improve real-time message synchronization.

2. Pagination Not Implemented

Currently, large datasets, such as complaints, are displayed in full without pagination. This can cause the dashboard to become sluggish when browsing through large amounts of data, leading to slower load times and potential performance issues, especially on lower-spec devices or networks.

Impact: Users may experience significant delays in data retrieval when attempting to view or filter large complaint records.

Workaround: Use filters to narrow down the data displayed, minimizing the impact of the unpaginated data. We are working on implementing pagination to enhance performance and improve the user experience when dealing with large datasets.

3. Error Message Clarity

Some error responses generated by the system do not provide clear or user-friendly messages. As a result, end-users may find it difficult to understand the issue or how to resolve it. These vague or technical error messages may lead to confusion, especially for non-technical users.

Examples: Generic error messages like "An error occurred" or "Something went wrong" offer no context or guidance on how to resolve the issue.

Plan: We are in the process of improving error messages to provide more specific, actionable descriptions. This will help users understand the nature of the issue and take the necessary steps to resolve it, reducing confusion and support requests.

4. Mobile Responsiveness Issues

The application has some layout and usability issues on mobile devices, particularly with certain UI elements overlapping or being too small to interact with comfortably. This is especially noticeable on smaller screen sizes or devices with low resolution.

Impact: Mobile users may experience difficulties navigating through the system, with buttons and inputs being hard to tap or interact with due to improper scaling or layout issues.

Workaround: Use a desktop or tablet device for an optimal experience until the mobile-responsive design is improved.

5. Slow Search Functionality

The search functionality may be slow or unresponsive when querying large datasets or when searching for terms that are more complex or broad in scope. This can result in delays in retrieving the relevant search results, negatively impacting the user experience.

Workaround: Try refining your search query with more specific terms or filters to speed up the results. A performance optimization for the search feature is currently being developed.

6. Session Expiration Without Notification

Some users have reported that their session expires unexpectedly without any warning, causing them to lose progress or data they had entered.

Workaround: Save your progress frequently to avoid data loss. We are working to implement a session expiration warning system that will notify users before their session times out.

13. Future Enhancements

1. Improved Chat Functionality

To enhance the communication experience, we plan to introduce advanced features for the chat interface. This includes real-time message syncing, multimedia support (e.g., image, video, and document sharing), typing indicators, and read receipts. The goal is to make the chat system more interactive and responsive, ensuring seamless communication between users (customers, agents, and admins).

Future Plans: Implement features such as chat history search, chat archiving, and improved notification settings for better user control over conversations.

2. Advanced Analytics for Admin

Currently, the admin panel offers basic management features, but we plan to expand its capabilities by adding advanced analytics tools. These tools will allow admins to view detailed reports and insights on system usage, complaint trends, user activity, and agent performance.

Key Features:

- Real-time dashboards to track complaint status and agent workload.
- Data-driven insights on customer satisfaction and complaint resolution efficiency.
- Customizable reporting tools to filter and analyze data based on various parameters.

3. Mobile App Integration

To enhance accessibility and user experience, we are working towards developing a mobile application version of the complaint registration and management system. The app will allow users to access all the key features of the platform on their mobile devices, improving the convenience of submitting and managing complaints while on the go.

Key Features:

- Push notifications for real-time updates.
- Mobile-optimized user interface for smooth navigation.
- Offline functionality, allowing users to view complaints and submit them once they are back

  online.

4. Enhanced User Notifications

We plan to introduce a more robust notification system that will keep users informed about updates related to their complaints, messages, or system activities. This will include customizable notifications via email, SMS, and in-app alerts.

Future Features:

- Customizable alert settings, allowing users to choose when and how they are notified.
- Enhanced notification system to update users on complaint status changes (e.g., when an agent is assigned or when a complaint is resolved).
- Integration with calendar apps to schedule reminders or follow-ups for pending complaints.

5. Multilingual Support

To ensure the system is accessible to a broader audience, we aim to implement multilingual support. This will allow users to interact with the platform in their preferred language, improving user experience, especially in regions with diverse linguistic backgrounds.

Key Features:

- Support for major global languages like Spanish, French, and Mandarin, with future plans to expand to regional languages.
- Automatic language detection based on user preferences or browser settings.

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