**Project Design Phase-II**

**Solution Requirements (Functional & Non-functional)**

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| **Team ID :** | **LTVIP2025TMID58052** |
| **Project Name :** | **LearnHub: Your Center for Skill Enhancement** |

**1. Functional Requirements (What the System Must Do)**

Functional requirements define specific actions and services the system must perform to meet business needs, tied directly to user roles and system components.

**1.1. User Management & Authentication**

* **FR1.1.1:** The system shall allow new users (Customers) to register securely.
* **FR1.1.2:** The system shall allow registered users (Customers, Agents, Administrators) to log in securely using their credentials.
* **FR1.1.3:** The system shall provide a secure password recovery/reset mechanism.
* **FR1.1.4:** The system shall support role-based access control (Customer, Agent, Administrator) to restrict functionalities and data access.

**1.2. Complaint Submission**

* **FR1.2.1:** The system shall allow authenticated Customers to submit new complaints.
* **FR1.2.2:** The complaint submission form shall capture essential details (description, type, contact information).
* **FR1.2.3:** The system shall allow users to attach relevant files (images, documents) to complaints.

**1.3. Complaint Management & Tracking**

* **FR1.3.1:** The system shall display a personalized dashboard for Customers to view submitted complaints and statuses.
* **FR1.3.2:** The system shall provide real-time updates on complaint status changes in the Customer’s dashboard.
* **FR1.3.3:** The system shall allow Agents to view, update, and manage assigned complaints.
* **FR1.3.4:** The system shall allow Administrators to view all complaints, statuses, and assigned agents.
* **FR1.3.5:** The system shall allow Administrators to assign and reassign complaints to Agents.

**1.4. Communication & Notifications**

* **FR1.4.1:** The system shall provide integrated in-app messaging/chat between Customers and their assigned Agents.
* **FR1.4.2:** The system shall store and display the complete chat history for each complaint.
* **FR1.4.3:** The system shall send automated notifications (email/SMS) for key complaint events (submission, status changes, agent assignment, new messages).

**1.5. Data Management**

* **FR1.5.1:** The system shall reliably store and retrieve all user profiles, complaint details, chat messages, and attachment metadata in the database.

**2. Non-Functional Requirements (How Well the System Performs)**

Non-functional requirements specify quality attributes of the system and define how well it performs its functions.

**2.1. Performance**

* **NFR2.1.1:** Page loads, form submissions, and data retrieval shall complete within 2 seconds under normal load.
* **NFR2.1.2:** Real-time chat messages and complaint status updates shall have latency below 500 milliseconds.
* **NFR2.1.3:** The system shall support at least 100 concurrent users without significant performance degradation.

**2.2. Scalability**

* **NFR2.2.1:** The backend shall support horizontal scaling by adding server instances.
* **NFR2.2.2:** The MongoDB database shall support sharding for handling data volume and concurrency.
* **NFR2.2.3:** Socket.io infrastructure shall scale to support concurrent chat sessions efficiently.

**2.3. Security**

* **NFR2.3.1:** User passwords shall be securely hashed and stored; the system shall prevent brute-force attacks.
* **NFR2.3.2:** Access control shall be strictly enforced based on user roles (RBAC).
* **NFR2.3.3:** All data in transit shall be encrypted using HTTPS/SSL/TLS.
* **NFR2.3.4:** Sensitive data at rest shall be encrypted where applicable.
* **NFR2.3.5:** The system shall validate all user inputs to prevent XSS and injection attacks.
* **NFR2.3.6:** User data and complaint details shall remain confidential and accessible only by authorized personnel.
* **NFR2.3.7:** The system shall maintain logs of critical actions for auditing purposes.

**2.4. Reliability & Availability**

* **NFR2.4.1:** The system shall target an uptime of 99.9% annually.
* **NFR2.4.2:** Data shall be reliably stored and retrievable, ensuring minimal data loss.

**2.5. Usability (User Experience)**

* **NFR2.5.1:** The interface shall be intuitive and easy to navigate for all roles.
* **NFR2.5.2:** The interface shall be responsive across devices (desktop, tablet, mobile).
* **NFR2.5.3:** The system shall follow web accessibility standards to ensure usability for diverse users.

**2.6. Maintainability**

* **NFR2.6.1:** The codebase shall adhere to clean coding standards for readability and maintainability.
* **NFR2.6.2:** The system shall use modular components for independent development, testing, and deployment.
* **NFR2.6.3:** Adequate logging and monitoring shall be in place for diagnosing issues.

**2.7. Deployability**

* **NFR2.7.1:** The system shall support automated deployments via Git integration (e.g., Render).
* **NFR2.7.2:** The system shall support environment-specific configurations for development, staging, and production.