IT314: Software Engineering (Project Report)

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Project Title: Crowd-Powered Smart Complaint Management System

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GitHub Repository:

https://github.com/DhruvilMehta07/Crowd-Powered-Smart-Complaint-Management-System

Concept Poster:

Innovating for People | *Activity Templates* | **Concept Poster**

WHAT IS THE CONCEPT CALLED?
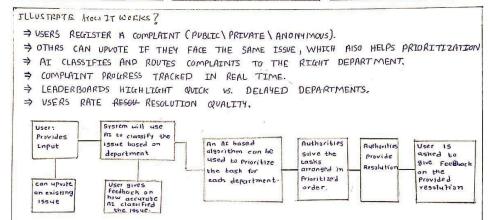CROWD-POWERED SMART COMPLAINT MANAGEMENT SYSTEM.

See it, Say it, Get is solved!

WHO IS IT FOR?
⇒ CITIZENS
⇒ AUTHORITIES RESPONSIBLE FOR RESOLVING COMPLAINTS

WHAT PROBLEM DOES IT SOLVE?
⇒ IT HELPS IN UNITING PEOPLE FOR A COMMON DISSENT AGAINST AN ISSUE IN OFFERING PROVIDED BY AN ORGANISATION.

WHAT IS THE BIG IDEA?
WE USE USER INPUT PLUS ML TO AUTOMATICALLY CLASSIFY & PRIORITIZE COMPLAINTS WHILE PRESERVING PRIVACY BY FL. THE SYSTEM LEARNS FROM FEEDBACK TO ASSIGN RIGHT TASK TO TEAM
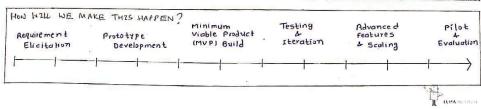
ILLUSTRATE HOW IT WORKS?
⇒ USERS REGISTER A COMPLAINT (PUBLIC\ PRIVATE \ ANONYMOUS).
⇒ OTHRS CAN UPVOTE IF THEY FACE THE SAME ISSUE, WHICH AlSO HELPS PRIORITIZATION
⇒ AI CLASSIFIES AND ROUTES COMPLAINTS TO THE RIGHT DEPARTMENT.
⇒ COMPLAINT PROGRESS TRACKED IN REAL TIME.
⇒ LEADERBOARDS HIGHLIGHT QUICK vs. DELAYED DEPARTMENTS.
⇒ USERS RATE ~~RESOL~~ RESOLUTION QUALITY.

User: Provides Input → System will use AI to classify the issue based on department → An AI based algorithm can be used to prioritize the task for each department. → Authorities solve the tasks arranged in Prioritized order. → Authorities Provide Resolution → User is asked to give Feedback on the Provided resolution

Can upvote an existing issue / User gives Feedback on how accurate AI classified the issue.

WHY MIGHT IT FAIL?
⇒ COMPLAINS GETTING SPAMMED & FAKE COMPLAINTS CAN INTERFERE WITH PRIORITIZING ALGORITHM.
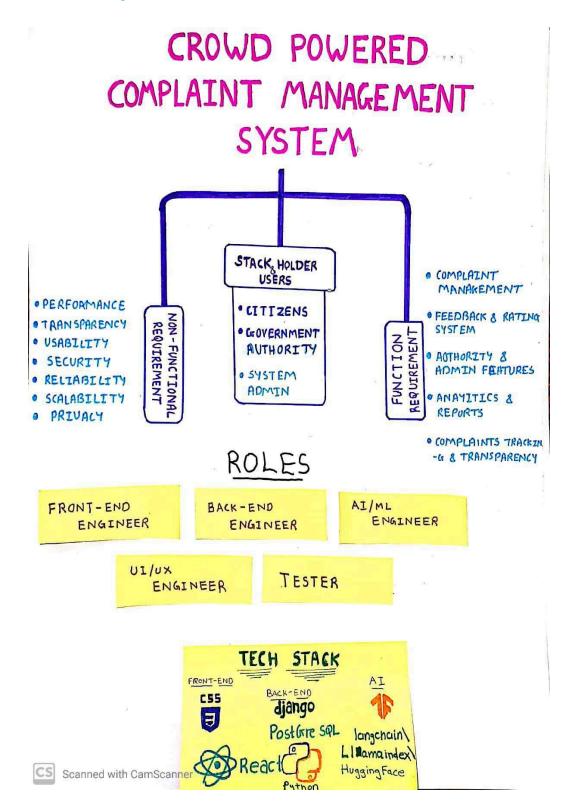⇒ CORRECT EVALUATION NEEDED WHETHER RESOLUTION DONE IS SATISFACTORY.

WHAT SHOULD WE PROTOTYPE & TEST?
WE WILL CREATE AN INTERACTIVE INTERFACE TO TEST USER EXPERIENCE WITH SMALL GROUP OF CITIZENS & OFFICIALS. THIS PROTOTYPE WILL BE USED TO GATHER FEEDBACK ON DESIGN & FUNCTIONALITY.

HOW MIGHT WE MEASURE SUCCESS
A GROWING NUMBER OF ACTIVE USERS & SUBMITTED COMPLAINTS WILL INDICATE SUCCESSFUL ADOPTION TO OUR SYSTEM. STEADY INCREASE IN NO. OF COMPLAINTS SUCCESSFULLY RESOLVED BY AUTHORITIES WILL BE OUR KEY METRIC

HOW WILL WE MAKE THIS HAPPEN?
Requirement Elicitation | Prototype Development | Minimum Viable Product (MVP) Build | Testing & Iteration | Advanced Features & Scaling | Pilot & Evaluation

Chart Paper:

CROWD POWERED COMPLAINT MANAGEMENT SYSTEM

STACK & HOLDER USERS
- CITIZENS
- GOVERNMENT AUTHORITY
- SYSTEM ADMIN

NON-FUNCTIONAL REQUIREMENT
- PERFORMANCE
- TRANSPARENCY
- USABILITY
- SECURITY
- RELIABILITY
- SCALABILITY
- PRIVACY

FUNCTION REQUIREMENT
- COMPLAINT MANAGEMENT
- FEEDBACK & RATING SYSTEM
- AUTHORITY & ADMIN FEATURES
- ANALYTICS & REPORTS
- COMPLAINTS TRACKING & TRANSPARENCY

ROLES

- FRONT-END ENGINEER
- BACK-END ENGINEER
- AI/ML ENGINEER
- UI/UX ENGINEER
- TESTER

TECH STACK

FRONT-END
- CSS
- React

BACK-END
- django
- PostGre SQL
- Python

AI
- langchain
- LlamaIndex
- Hugging Face

Identification of Stakeholders and End Users:

➜ Stakeholders:

1. Citizens:

- Primary users who submit complaints (road damage, garbage, streetlight, etc.).
- Require easy submission, live tracking, and transparency.

2. Government Organizations:

- Officials responsible for resolving complaints.
- Need a centralized dashboard, prioritization, and status update system.

3. System Administrators:

- Manage the application backend.
- Responsible for security, uptime, user roles, and escalations.

4. Technical Support Team:

- Provide user support. They assist citizens and government users with technical issues, account problems, and how-to questions.

5. Field Maintenance Crews (gov't employees or contractors):

- Execute the physical work. They receive tasks, navigate to locations, log work, and provide proof of resolution.

6. Elected Officials & Policy Makers:

- They analyze dashboards showing metrics, trends, and ROI to inform public policy and budgets.

➜ End Users:

Citizens:

- Can directly post their complaints (e.g., potholes, broken streetlights, illegal dumping) via a mobile app or web portal.
- They can upload photos, pin locations on a map, and provide detailed descriptions.
- After submitting, they can track the real-time status of their report (e.g., "Received," "In Progress," "Resolved"), receive notifications, and see official updates.
- They can also upvote or comment on existing complaints posted by others to indicate widespread issues and provide additional feedback.

Government Officials:

- Use a centralized dashboard to receive, manage, and resolve citizen complaints.
- They can view a prioritized queue of issues, automatically sorted by the AI based on urgency, location, and public feedback.
- They assign tasks to specific departments or field crews, update the status of complaints, and post public responses.
- They also generate reports to analyze performance metrics like resolution times and common problem areas.

Field Maintenance Crews:

- Receive assigned tasks directly on a mobile device.
- The app provides them with the complaint details, photos, and precise location for navigation.
- They use the app to update their status (e.g., "En Route," "Work Started"), log completed work, and upload photographic proof of resolution before closing out the ticket, all from the field.

System Administrators:

- Manage the backend infrastructure of the entire platform.
- They provision user accounts and roles for government employees, monitor server health and application uptime, perform security audits, manage databases, and ensure the overall stability and security of the system.

Technical Support Team:

- Assist all other end users when they encounter problems.
- They help citizens with account issues and app functionality, aid government officials with dashboard features, and support field crews with their mobile devices.

Elicitation Techniques:

Stack Holder/End User	Elicitation Techniques	Reason
Citizen	Surveys, Group discussion, User Stories	Since citizens form a large and diverse group, well-crafted surveys can be an effective way to capture general expectations and opinions from a broad population. Surveys provide structured insights and help identify common priorities. In addition, group discussions allow for deeper engagement by giving citizens a platform to voice their perspectives, share experiences, and debate ideas in detail. This helps uncover nuanced viewpoints that may not surface in surveys and fosters

		collective understanding.
Government Authorities	Interview	Interviews with government authorities provide insights into existing complaint-handling mechanisms, challenges, and priorities. They help understand how issues are currently addressed and identify opportunities to improve responsiveness and efficiency.
System Admin	Prototype	Engaging system administrators through prototypes allows hands-on evaluation of technical feasibility, usability, and potential system limitations. Prototyping provides a practical way to gather feedback on design choices and identify areas for improvement before full-scale implementation.
Field Maintenance Crews	Interview	Interviews with field maintenance crews provide practical insights into operational challenges, workflow efficiency, and resource requirements. They help identify common issues faced during maintenance and gather suggestions for improving procedures.
Tech support team	Workshops, Brainstorming	Workshops with the tech support team provide an interactive platform to explore system functionalities, troubleshoot potential issues, and discuss best practices. They help

		gather practical insights from the team who directly manage user queries and technical problems. In addition, brainstorming sessions encourage creative problem-solving, generate innovative ideas for improving processes, and identify new approaches to enhance system efficiency and user support.

Functional Requirements

Functional Requirements for Citizens

1. Complaint Submission

- Submit complaints with a photo, description, and category.
- Option to submit complaints anonymously.
- Automatic generation of a unique complaint ID for each submission.

2. Complaint Tracking

- View the status of complaints through stages: **Received ➜ In Progress ➜ Resolved**.
- Receive notifications/alerts when the complaint status changes.

3. Community Engagement

- Upvote or support existing complaints in their area to indicate priority or urgency.
- Comment on complaints to provide additional information or feedback.

4. Search and Filtering

- Search complaints by keywords, category, or location.
- Filter complaints based on status, category, or timeframe.

5. Additional Features (Suggested Enhancements)

- Ability to edit or update a submitted complaint before it is resolved.
- Access a history of all submitted complaints.
- Integration of a map view to see complaints geographically (optional but useful).

6. Feedback and Ratings

- Provide feedback or ratings for resolved complaints to evaluate satisfaction and service quality.

Functional Requirements for Government Authorities

1. Dashboard and Complaint Management

- View all complaints on a centralized dashboard.
- Complaints are automatically categorized and prioritized using AI/ML algorithms.
- Update complaint status through stages: **Received ➜ In Progress ➜ Resolved**.
- Assign complaints to relevant departments or field teams for resolution.

2. Feedback Handling

- Access citizen feedback and ratings on resolved complaints.
- Analyze trends in feedback to identify recurring issues or service gaps.

3. Search and Filtering

- Search complaints by ID, category, location, or status.

● Filter complaints by priority, department, or timeframe.

4. Additional Features (Suggested Enhancements)

● Generate reports and analytics for decision-making and performance evaluation.
● Receive alerts for high-priority or escalated complaints.
● Track departmental or team-level resolution efficiency.

Functional Requirements for Field Maintenance Crews

1. Work Reporting

● Upload photos of completed work for verification and record-keeping.
● Update work status linked to assigned complaints (**Assigned ➜ In Progress ➜ Completed**).
● Add remarks or notes regarding work done, challenges faced, or special observations.

2. Task Management

● View assigned complaints/tasks with details such as location, priority, and deadline.
● Mark tasks as completed or request assistance if additional support is needed.

3. Communication and Coordination

● Communicate with government authorities or system administrators regarding progress or obstacles.
● Receive alerts or notifications for newly assigned or escalated tasks.

4. Additional Features

● Access history of completed tasks with photos and remarks.

- Provide feedback on workflow or system usability to improve operational efficiency.
- Integration of GPS/location tracking for field verification and monitoring (optional but useful).

Non-Functional Requirements

1. Usability

- Intuitive and easy-to-use interface suitable for users of all ages and backgrounds.
- Consistent navigation and layout across web and mobile platforms.
- Accessible design adhering to accessibility standards (e.g., WCAG) for visually or physically challenged users.

2. Performance

- AI-powered complaint categorization and prioritization should complete within 10 seconds.
- System should maintain low response times for all user interactions, even under high load.

3. Scalability

- Capable of handling thousands of concurrent complaints and user sessions.
- Flexible architecture to accommodate future growth in users, complaints, and modules.

4. Reliability

- Ensure 24/7 uptime with minimal downtime.
- Implement automatic failover and recovery mechanisms to handle system failures.

● Maintain data integrity and consistency across all modules.

5. Security and Privacy

● Data encryption for storage and transmission of sensitive information.
● Implement federated learning or other privacy-preserving techniques for AI training on sensitive data.
● Role-based access control to prevent unauthorized access.
● Compliance with local privacy regulations (e.g., GDPR, India's IT Act).

6. Multi-Language Support

● System should support multiple languages for wider citizen accessibility.

7. Maintainability and Extensibility

● Modular design to allow easy updates and addition of new features.
● Well-documented codebase for efficient maintenance and troubleshooting.

8. Auditability and Logging

● Maintain detailed logs of user actions and system events for auditing and accountability.
● Provide reporting tools for system usage and performance monitoring.

User Stories:

User Story 1 – Complaint Submission

Front:
As a citizen, I want to submit a complaint with a photo and description so that authorities can understand and resolve it.

Back (Acceptance Criteria):

- Complaint ID auto-generated.
- Photo upload and description required.
- Category selection available.

Failure:

- Complaint not saved if mandatory fields are missing.
- Upload fails due to unsupported format/size.

User Story 2 – Anonymous Complaint

Front:
As a citizen, I want the option to submit complaints anonymously so that I can report issues without fear.

Back (Acceptance Criteria):

- Checkbox/toggle for anonymity.
- The system hides identity from government officials.

Failure:

- Identity accidentally revealed in dashboard.
- Anonymous complaints not tracked properly.

User Story 3 – Complaint Tracking

Front:
As a citizen, I want to track my complaint status so that I know when it is being resolved.

Back (Acceptance Criteria):

- Complaint moves through stages: **Received → In Progress → Resolved**.
- Citizens can see status updates in real time.

Failure:

- Status not updated even after official action.
- Notifications not received.

User Story 4 – Upvote Complaint

Front:
As a citizen, I want to upvote complaints so that high-impact issues get priority.

Back (Acceptance Criteria):

- Citizens can upvote once per complaint.
- Upvote count visible to officials.

Failure:

- Multiple upvotes from same user.
- Votes not reflected in dashboard.

User Story 5 – Search Complaints

Front:
As a citizen, I want to search complaints by keywords, category, or location so that I can quickly find relevant issues.

Back (Acceptance Criteria):

- Search bar accepts keywords.
- Users can search by category (road, garbage, etc.).

- Users can search by location (city/area).

Failure:

- No results shown even if complaint exists.
- Wrong complaints returned.

User Story 6 – Filter Complaints

Front:
As a citizen, I want to filter complaints based on status, category, or timeframe so that I can narrow down results.

Back (Acceptance Criteria):

- Filter options include status (**Received, In Progress, Resolved**).
- Complaints filter correctly by category & date range.

Failure:

- Filters not applied correctly.
- Combining multiple filters gives wrong results.

User Story 7 – Feedback & Ratings

Front:
As a citizen, I want to provide feedback or ratings for resolved complaints so that I can evaluate service quality.

Back (Acceptance Criteria):

- Rating scale (e.g., 1–5 stars).
- Optional text feedback allowed.
- Feedback stored with complaint record.

Failure:

- Ratings allowed for unresolved complaints.
- Feedback not saved or linked properly.

User Story 8 – Dashboard for Officials

Front:
As a government official, I want a centralized dashboard so that I can monitor and resolve complaints efficiently.

Back (Acceptance Criteria):

- Dashboard lists all complaints.
- Complaints sortable by urgency, date, or location.

Failure:

- Dashboard fails to load large numbers of complaints.
- Sorting/filters not working properly.

User Story 9 – AI Prioritization

Front:
As a government official, I want AI to auto-categorize and prioritize complaints so that urgent cases are addressed first.

Back (Acceptance Criteria):

- High-priority cases appear at the top of the queue.

Failure:

● Wrong categorization leading to misrouted complaints.

User Story 10 – Review Feedback

Front:
As a government official, I want to review citizen feedback and ratings on resolved complaints so that I can assess satisfaction and service quality.

Back (Acceptance Criteria):

● Officials can view ratings and comments linked to resolved complaints.
● Feedback visible in complaint details/dashboard.

Failure:

● Feedback not displayed or mismatched with complaint.
● Unresolved complaints show feedback.

User Story 11 – Search Complaints (Officials)

Front:
As a government official, I want to search complaints by ID, category, location, or status so that I can find specific cases quickly.

Back (Acceptance Criteria):

● Search works by ID, category, location, and status.

Failure:

● Wrong or incomplete results.

User Story 12 – Field Crew Assignment

Front:
As a field crew member, I want to receive assigned tasks with photos and maps so that I can resolve issues quickly.

Back (Acceptance Criteria):

- Task includes description, photo, location map.
- Push notification sent for new assignment.

Failure:

- Missing location/map details.
- Crew does not receive assignment in real time.

User Story 13 – Proof of Resolution

Front:
As a field crew member, I want to upload photos after work so that I can provide proof of completion.

Back (Acceptance Criteria):

- At least one completion photo required before closing.
- Status updated to "Resolved" after upload.

Failure:

- Upload fails due to poor connectivity.
- Complaint marked resolved without proof.

User Story 14 – System Security

Front:

As a system admin, I want to enforce role-based access so that unauthorized users cannot misuse the system.

Back (Acceptance Criteria):

- Roles (Citizen, Official, Admin, Crew) clearly defined.
- Unauthorized access attempts logged.

Failure:

- Citizens gain access to the admin dashboard.
- Role permissions not applied consistently.

User Story 15 – Multi-language Support

Front:

As a citizen, I want the app in my local language so that I can use it comfortably.

Back (Acceptance Criteria):

- Minimum 2 languages supported.
- Users can switch languages easily.

Failure:

- Incomplete translations.

EPICs (Set of Sprints)

Epic 1:

As any user, I can sign up, log in, and log out so that I can access the system according to my role.

Child Stories:

- As a citizen, I can create an account and log in securely.
- As a field worker, I can log in to access assigned tasks.
- As an authority, I can log in to monitor and assign complaints.
- As an admin, I can log in and manage the whole system.
- As tech support, I can log in to assist users.

Epic 2:

As a citizen, I can raise complaints (public or private) so that issues are recorded transparently but sensitive complaints remain private.

Child Stories:

- As a citizen, I can submit a complaint with description, category, and location.
- As a citizen, I can attach media (photo/video).
- As a citizen, I can mark a complaint as private (visible only to authority, not public dashboards).
- As a citizen, I can track and withdraw a complaint before assignment.

Epic 3:

As the system, I can classify complaints into categories using AI and FL so that sensitive data remains private while helping authorities prioritize issues.

Child Stories:

- As a system, I can auto-classify complaints into categories (roads, water, electricity, etc.).
- As an authority, I can correct the AI's classification when it is wrong.
- As a system, I can prioritize urgent complaints using AI scoring.
- As a system, I can use federated learning to improve classification without exposing private complaint data.

Epic 4:

As a field worker, I can view, update, and complete assigned tasks so that authorities know the progress.

Child Stories:

- As a field worker, I can view my assigned complaints.
- As a field worker, I can accept or reject a task (with reason).
- As a field worker, I can update task status (in-progress, completed).
- As a field worker, I can upload proof of completion (photo, notes).

Epic 5:

As a government authority, I can verify the resolution of complaints so that the system prevents false completions.

Child Stories:

- As an authority, I can verify field worker–completed complaints with evidence.
- As an authority, I can reopen complaints if work is unsatisfactory.
- As a citizen, I can confirm whether my issue is resolved.
- As an authority, I can close complaints after both worker and citizen verification.

Epic 6:

As a government authority, I can track complaints and resolution metrics so that governance becomes data-driven.

Child Stories:

- As an authority, I can filter complaints by urgency, location, and category.
- As an authority, I can view unresolved complaint hotspots.
- As an authority, I can generate periodic reports (weekly/monthly).
- As an authority, I can monitor average resolution time and worker efficiency.

Epic 7:

As an admin/tech support, I can maintain the system and assist users so that it runs smoothly.

Child Stories:

- As an admin, I can create, deactivate, or assign roles to users.
- As an admin, I can monitor system health (errors, performance).
- As tech support, I can respond to user issues (e.g., login problems).
- As tech support, I can escalate system-level bugs to admins.

Conflicts Between Epics

Epic 2 (Complaint Submission & Privacy) vs Epic 3 (AI/FL Classification)

- **Conflict:** AI may misclassify private complaints since training data must remain secure.
- **Resolution:** Use federated learning so sensitive data stays local, and allow manual correction by authorities.

Epic 4 (Field Worker Tasks) vs Epic 5 (Verification & Oversight)

- **Conflict:** Field workers might mark tasks as completed prematurely.
- **Resolution:** Authority + citizen verification required before final closure.

Epic 5 (Verification & Oversight) vs Epic 6 (Authority Dashboard)

- **Conflict:** Authorities may close complaints without citizen confirmation to improve dashboard metrics.
- **Resolution:** Enforce citizen confirmation step before final resolution unless citizen is unreachable.

Epic 6 (Dashboard & Analytics) vs Epic 7 (System Admin & Tech Support)

- **Conflict:** Authorities may demand sensitive aggregated data that admins restrict for privacy.
- **Resolution:** Provide only anonymized, aggregate analytics to authorities.

Proof of Concept (POC) – Sprint 1

Objective

The goal of Sprint 1 is to establish the core user authentication system using Django's built-in User Model for the Crowd-Powered Smart Complaint Management System. This sprint will validate the integration of our frontend, backend, and database within a containerized environment, ensuring a solid foundation for subsequent sprints.

The main objective of this sprint is to validate the complete authentication cycle (**register, login, logout, password reset, OTP login, and email notifications**) and provide a foundation for secure citizen access to the system.

Scope of Sprint 1

Frontend (React + Figma)

UI/UX

- Design a minimal and clean UI for login, registration, forgot password, and OTP input screens.
- Wireframes and mockups created in Figma before implementation.
- Responsive layout (desktop).

Pages

- Registration Page (Name, Email, Password, Confirm Password, Phone Number). *(subject to change)*
- Login Page (Email + Password **OR** OTP) ➜ with multiple login options:
    - Login as User
    - Login as Government Authority
    - Login as Field Worker

- ○ Login as System Admin
- ○ Login as Tech Support
● Forgot Password Page (Email input ↦ reset link).
● OTP Verification Page (6-digit OTP input, expiry timer).

Features

● Form validations (email format, password strength, phone number format).
● Success/error notifications (e.g., *"OTP sent to your email"*).
● Integration with backend authentication logic.

Backend (Django + PostgreSQL)

Authentication

● Use Django's built-in auth models.
● Registration flow with email confirmation notification.
● Login/Logout with Django session authentication.
● Forgot Password flow using `PasswordResetView` (email reset link).

OTP-based Login

● Generate & send OTP via email.
● Store OTP in DB/cache with expiry (5 minutes).
● Verify OTP for login.

Multiple Login Roles

● Standard User login
● Government Authority login with elevated permissions (for future role-based access).

Email Notifications

● Email on successful registration.
● Email for password reset.

● Email/SMS for OTP delivery (*email-only in POC*).

Database (PostgreSQL)

● Persist users with:
    ○ username
    ○ email
    ○ phone_number
    ○ password (hashed)
    ○ date_joined *(subject to change)*
● Store OTP codes with:
    ○ otp_code
    ○ user_id
    ○ expiry_timestamp
● Extend User model with a **role field** (e.g., USER, GOV_AUTHORITY).

Testing (tests.py)

Unit tests for:

● User registration (duplicate email validation).
● Login (valid + invalid credentials).
● Forgot password flow.
● OTP generation & expiry.
● Role-based login (User vs Government Authority).

Automation:

● Automated test execution before deployment.

Containerization (Docker + Docker Compose)

● Dockerfile for Django backend, React frontend, and PostgreSQL DB.
● Docker Compose setup to run full stack with one command.

● Validate service communication (React ↔ Django ↔ PostgreSQL).

Why This Sprint is Valuable

● Establishes core entry point for all users and government authority.
● Covers both password-based and Aadhaar-inspired OTP login.
● Demonstrates end-to-end integration of frontend, backend, database, email, and Docker.
● Sets up testing pipeline early (**good DevOps practice**).
● Establishes a foundation for all future sprints, as authentication is a prerequisite for most other modules.