Web Application for Smart Water Supply Management System in Urban City

Keerthika.N[1], Ramya.A[2], Pradeep.A[3], Kowsik.K[4], S. Jenisha[5]
[1,2,3,4]*UG student, Dept.of CSE, Tamilnadu College of Engineering, Coimbatore, Tamil Nadu*
[5]*Assistant professor, Dept.of CSE, Tamilnadu College of Engineering, Coimbatore, Tamil Nadu*

***Abstract*— Access to clean and reliable water supply remains a major challenge due to inefficient distribution, lack of real-time information, and poor communication between authorities and citizens. These issues often lead to water wastage and public dissatisfaction. This study proposes a cross- platform web application to improve water supply management and user interaction. The system provides features such as schedule management, usage tracking, digital grievance redressal, and reporting of disruptions and leakages. It also includes push notifications for maintenance updates and supply interruptions. The proposed solution demonstrates how web technologies can enhance transparency, efficiency, and responsiveness in public utility management.**

***Index Terms*— Water Supply Management, Web Application, Digital Complaint System, Supply Scheduling, Real-Time Notifications, Urban Water Infrastructure, Citizen Engagement.**

I. NTRODUCTION

Access to safe and uninterrupted water supply is a basic necessity for every household. Water distribution authorities are responsible for maintaining supply schedules, managing pipeline infrastructure, and addressing citizen grievances in a timely manner. However, managing these activities manually has become increasingly difficult as urban populations grow and service demands rise.

Traditional water management practices involve maintaining physical records, receiving complaints over telephone, and manually dispatching field teams. These methods are prone to delays, miscommunication, and lack of accountability. Citizens often remain uninformed about supply disruptions or the status of their complaints, leading to frustration and reduced public trust.With the widespread adoption of smartphones, there is a significant opportunity to transform water supply management through web technology. A well-designed web application can serve as a direct communication channel between citizens and water authorities, enabling faster reporting, transparent tracking, and proactive notifications.

II. PROBLEM STATEMENT

Despite the critical importance of water supply services, most municipal systems still depend on outdated or semi-digital methods. These systems suffer from several key issues:

- No centralized platform for citizens to view supply schedules
- Inefficient and untracked telephone- based complaint systems
- Delayed response to leakage and pipeline disruption reports
- No real-time notifications for planned maintenance or supply cuts

Citizens struggle to get timely updates, while department officials lack the tools to efficiently manage and prioritize incoming complaints. These issues highlight the urgent need for a web-based system that automates communication and streamlines service delivery.

III. EXISTING SYSTEM

The existing water supply management process in most municipal corporations is primarily manual or partially digitized, lacking a centralized and citizen-friendly platform. Supply schedule information is typically communicated through printed notices, local announcements, or telephone helplines, which are often inconsistent and inaccessible to a large portion

of the population. Complaints related to water shortages, pipeline leakages, and supply disruptions are generally reported through telephone calls or in-person visits to the department office. There is no structured mechanism to assign, track, or update the status of these complaints. Citizens have no visibility into whether their complaints have been received or acted upon. Field teams receive verbal or paper-based instructions without any centralized assignment system, making coordination difficult and inefficient. Citizens have no single platform to view zone-wise water supply schedules, resulting in frequent uncertainty about supply timings and unplanned water storage. Complaints are received informally via phone or walk-in visits with no digital record, making it impossible to track the status, priority, or the resolution of individual cases.

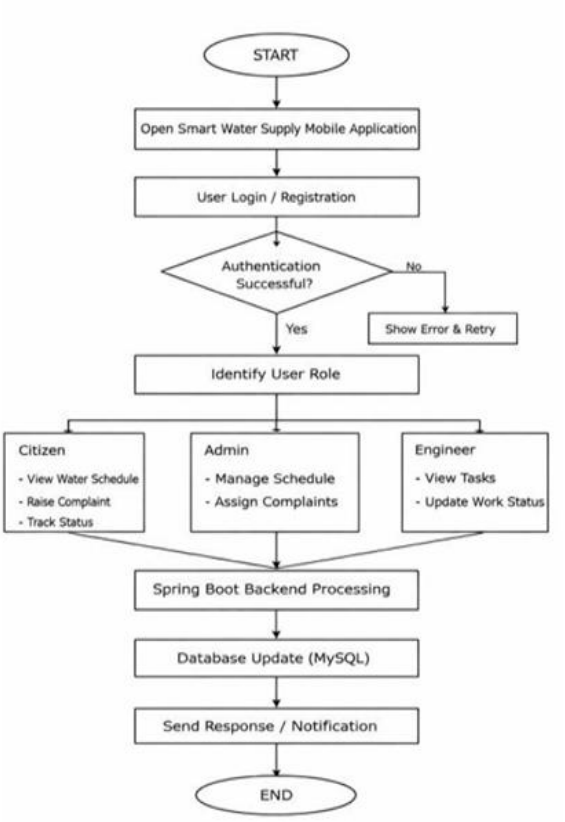

Fig 1: Block diagram of Existing system

IV. WORKFLOW

The complete workflow of the system can be summarized as follow:

1. User Login (Citizen / Admin)
2. Citizen Profile Setup with Zone and Area Selection Drive Creation by Officer
3. Admin Updates Water Supply Schedules by Zone
4. Citizen Views Supply Schedule and Receives Notifications
5. Complaint Submitted to Backend and Stored in Database
6. Admin Reviews Complaints on Dashboard and Assigns Field Team
7. Field Team Resolves Issue and Updates Status

Fig 2: Workflow diagram

V. PROPOSED SYSTEM

The proposed system is a cross-platform web application that connects citizens and water supply administrators through a centralized digital interface. The application addresses all identified gaps by providing structured, trackable, and transparent services to both user groups.

Main Users:

- Citizens
- Administrators Core Functionalities:
- User authentication and role-based access control
- Zone-wise water supply schedule management
- Digital complaint submission and real-time tracking
- Leakage and disruption reporting with location tagging
- Push notification system for supply updates and alerts

VI. SYSTEM ARCHITECTURE

The system follows a client-server architecture with three primary layers:

Components:

i) Frontend (Client)

- Built using React
- Handles user interaction

ii) Backend (Server)

- Built using Node.js
- Manages all business logic, authentication, and

API routing

iii) Database

- MySQL relational database
- Stores user profiles, supply schedules, complaints,

iv) Admin Dashboard

- Web-based interface
- Provides complaint management

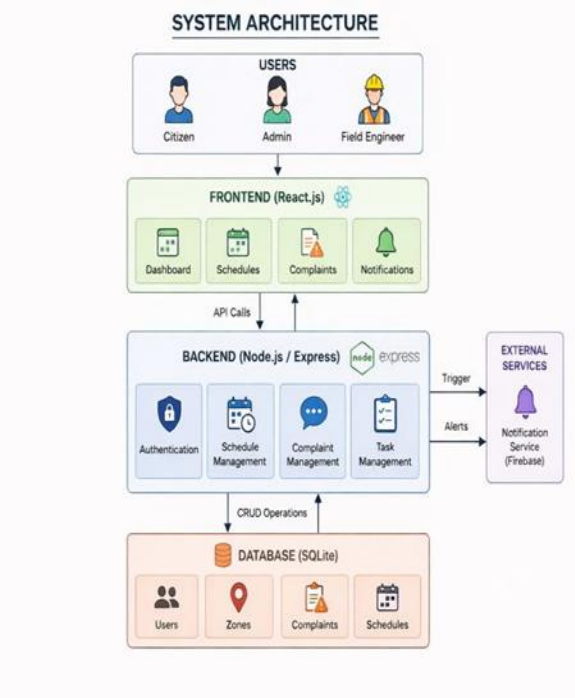

Fig 3: System Architecture

VII. MODULE DESCRIPTION

7.1. Citizen Module

The citizen module provides all features required by end-users to interact with the water supply system.

Features:

- Registration and login
- Zone and area selection
- Zone and area selection
- Report leakage, contamination
- Submit and track complaints
- View complaint history

7.2. Admin Module

The admin module allows water department officials to manage supply operation.

Features:

- Secure admin login
- Create and update zone-wise
- View and manage all complaints
- Assign complaints to field teams
- View analytics including complaint

7.3. Field engineer Module

The Field Engineer Module is responsible for handling on-ground operations related to water supply issues reported by citizens.

Features:

- View assigned complaints and tasks
- Access issue details and location
- Update task status
- Receive notifications from admin

7.4. Notification Module

The notification module handles all push alert and in-app messages sent to citizens.

Features:

- Schedules supply update
- Emergency disruption alerts
- Complaint status update
- Maintenance schedule remainder

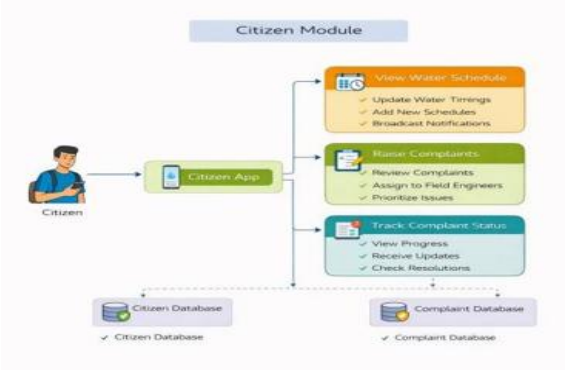

Fig 4: Citizen modules

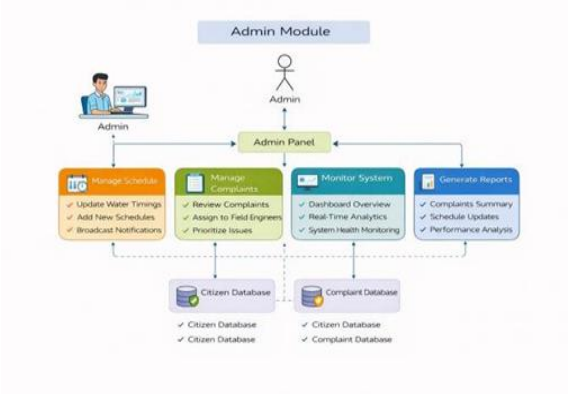

Fig 5: Admin module

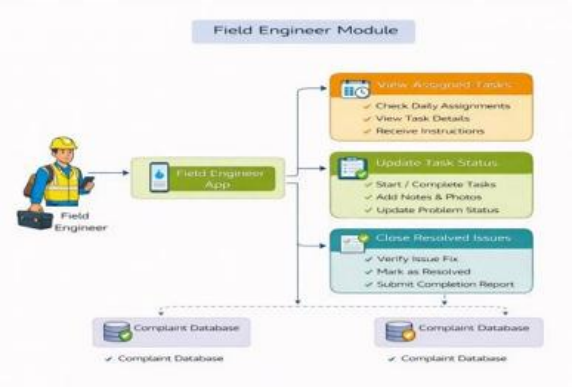

Fig 6: Field engineer module

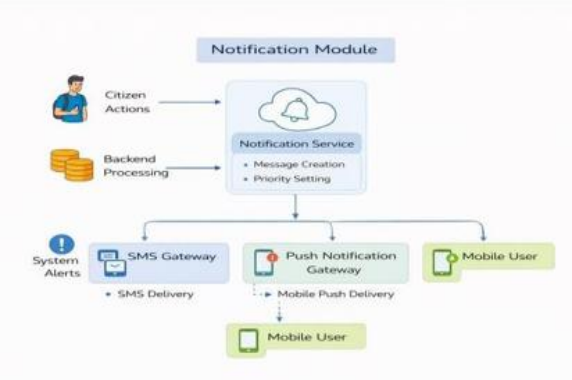

Fig 7: Notification module

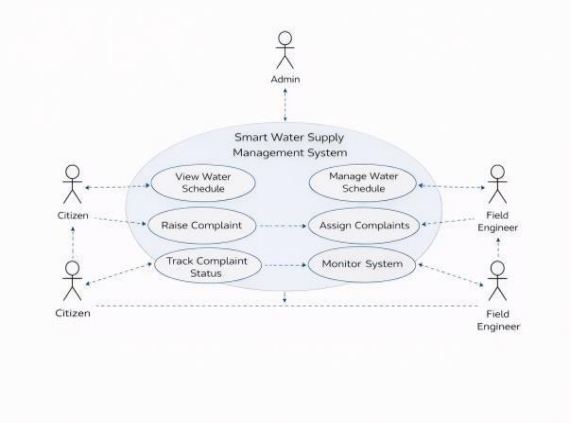

Fig 8: Use case diagrams

VIII. IMPLEMENTATION

8.1. Frontend Development

The frontend is developed using React.js with Native Wind for styling. Features:

- Cross-platform deployment
- Component-based architecture
- API integration using Axios

8.2. Backend Development

The backend is developed using Node.js with the Express framework, providing a robust and scalable REST API layer.

Features:

- RESTful APIs
- JWT-based authentication
- Firebase Cloud Messaging

8.3. Database Design

The system uses MySQL, a structured relational database

Tables:

- Users
- Zone
- Schedules
- Complaint
- Notification

IX. SYSTEM TESTING

System testing was conducted to ensure the reliability, performance, and correctness of the web application. Multiple testing methodologies were applied to validate different components of the system across both citizen-facing and administrative interfaces.

9.1. Unit Testing

Unit testing was performed on individual modules to verify their functionality in isolation. Each component including user authentication, complaint submission, schedule management, and notification dispatch was tested independently.

Examples:

- Login and registration modules were tested with valid and invalid inputs
- API endpoints verified using Postman
- Database operations checked for accurate
- This ensured that each module performed as expected without errors.

9.2. Integration Testing

Integration testing was conducted to verify the interaction between the mobile frontend. the Node.js backend, and the MySQL database.

Key checks included data flow across API calls, notification triggers upon status updates, and correct rendering of schedule data in the citizen interface.

9.3. User Acceptance Testing (UAT)

User Acceptance Testing was performed with a group of citizens and mock administrators to evaluate the system from an end-user perspective. Test cases included:

Test cases included:

- Citizen registration and zone selection
- Viewing and verifying supply schedule
- Submitting a leakage complaint
- Admin assigning a complaint

Feedback from users helped improve usability and performance.

9.4. Performance Testing

- Performance testing was conducted to evaluate system under multiple simultaneous user requests.
- The application was tested for API response time, database query speed, and concurrent user handling.

9.5. Security Testing

Security testing was performed to ensure data protection and safe access control throughout the application.

Key measures tested:

- JWT-based authentication
- Password hashing using decrypt
- Role-based access control
- Input validation and sanitization

X. SYSTEM FEATURES

The system provides a comprehensive set of features to modernize the water supply management experience for both citizens and administrators.

Features:

- Citizens can view daily and weekly water supply timings by zone
- Structured digital form for reporting leakages and disruptions.
- Automated alerts for schedule changes and complaint updates
- Admin can assign reported issues to field teams with priority
- Zone-wise complaint trends and resolution performance charts
- Citizens can attach location to reported issues

XI. RESULTS AND DISCUSSION

The system was evaluated under real-world usage scenarios involving citizen registration, complaint submission, schedule viewing, push notification delivery, and administrative complaint management. The results demonstrate that the system significantly reduces the manual workload of water department staff by automating the intake, assignment, and tracking of citizen complaints. Citizens reported higher satisfaction with the transparency of the complaint tracking feature, which provided real-time visibility into the status of their reported issues.

Overall, the system demonstrates that a well-designed web application can meaningfully improve the quality and reliability of public water supply services.

XII. CONCLUSION

The proposed web application presents an efficient, scalable, and citizen-centric solution for modernizing water supply management at the municipal level.

By digitizing the key interactions between citizens and water authorities, the system eliminates the inefficiencies of manual complaint handling, improves schedule transparency, and enables faster response to on-ground issues.

The application successfully automates the end-to-end complaint lifecycle, from citizen submission to field resolution, while providing administrators with the tools and data needed to make informed operational decisions.

The push notification system ensures proactive communication, reducing citizen frustration during supply disruptions. Evaluation results confirm that the system delivers measurable improvements in resolution time, complaint visibility, and overall service quality.

The system serves as a practical and replicable model for municipalities seeking to modernize water governance through accessible and affordable digital solution.

REFERENCES

[1] United Nations, *The Sustainable Development Goals Report 2023*, United Nations Department of Economic and Social Affairs, 2023.

[2] S. Kumar and R. Patel, “Web-based grievance

redressal system for municipal services," *International Journal of Computer Applications*, vol. 182, no. 4, pp. 12–17, 2022.

[3] Sharma and P. Singh, "Digital transformation in urban water management: A review," *Journal of Water and Climate Change*, vol. 14, no. 2, pp. 45–58, 2023.

[4] React Native Documentation, [online]. Available: https://reactnative.dev/

[5] Node.js Documentation, [online]. Available: https://nodejs.org/en/docs/

[6] MySQL Documentation, [online]. Available: https://dev.mysql.com/doc/

[7] Firebase Cloud Messaging Documentation, [online]. Available: https://firebase.google.com/docs/cloud-messaging

[8] M. Ali *et al.*, "Citizen-centric public service delivery using web applications: A case study," *Government Information Quarterly*, vol. 38, no. 3, 2021.

[9] World Health Organization, *Progress on household drinking water, sanitation and hygiene 2000–2022*, WHO/UNICEF Joint Monitoring Programme, 2023.

[10] R. Goyal and N. Mehta, "Smart water management systems: Challenges and opportunities," *International Journal of Environmental Science and Technology*, vol. 19, pp. 3421–3436, 2023.