Clear Brook: A Mobile App that Crowd Sources Water-Related Problems from Around a Community and Display Them on a Man

S. Manikandan[1], M. Rehaana Hafrin[1], V. Bhagyalakshmi[1], Sudaroli[1],
M. Ramakrishnan[2] and M. P. Thiruvenkatasuresh[2]
[1]*Department of Information Technology, E.G.S. Pillay Engineering College, Nagapattinam, Tamil Nadu, India*
[2]*Department of Information Technology, Erode Senguthar Engineering College, Erode, Tamil Nadu, India*

Keywords: Geolocation Services, Community Reporting, Real-Time Monitoring, Water Issue Tracking, Data Visualization, GIS Mapping.

Abstract: Water-Related challenges, including scarcity, contamination, leakage, and flooding, significantly impact communities worldwide. This paper presents a mobile application that leverages crowdsourcing and geolocation technologies to enable users to report and track water issues in real-time. Through an intuitive interface, citizens can submit location-based reports enriched with descriptions, photos, and severity levels. These reports are aggregated, validated, and displayed on an interactive map, providing authorities, NGOs, and policymakers with valuable insights into critical water-related problems. The platform fosters community participation and data-driven decision-making, facilitating proactive interventions and sustainable water resource management. By bridging the gap between citizens and stakeholders, the application enhances response efficiency and contributes to long-term water sustainability efforts.

1 INTRODUCTION

Water-related challenges such as scarcity, contamination, leakage, and flooding pose significant threats to communities worldwide, impacting public health, agriculture, and infrastructure. Addressing these issues requires efficient monitoring, timely reporting, and coordinated intervention. Traditional water management systems often rely on manual reporting and bureaucratic processes, leading to delays in identifying and resolving issues. Additionally, the lack of centralized data and real-time monitoring hinders effective decision-making and resource allocation (J. M. Shepherd, 2022).

This paper introduces a mobile application that leverages crowdsourcing and geolocation technologies to enable community-driven reporting of water-related problems (M. P. Gomez and L. J. Brown, 2022). The platform allows users to submit location-based reports enriched with descriptions, images, and severity levels. These reports are aggregated and visualized on an interactive map, offering real-time insights into problem hotspots. By integrating computer vision and machine learning techniques, the system enhances data validation and categorization, ensuring reliable information for decision-makers (P. Rajalakshmi., 2022).

Unlike traditional water management approaches, this application bridges the gap between citizens and authorities by fostering active participation, accountability, and collaboration (N. Al-Ghamdi and K. S. Al-Hassan., 2021). The system incorporates an alert mechanism to notify relevant stakeholders about critical issues, enabling a faster response to emergencies such as pipeline bursts or flood risks. Furthermore, predictive analytics can be integrated to analyze historical data and anticipate potential water-related issues before they escalate.

The proposed solution is designed to be scalable and adaptable (R. K. Mishra et al., 2021), making it suitable for both urban and rural environments (S. Wang et al., 2021). It can be customized to accommodate region-specific water challenges and integrate with existing governmental or non-governmental databases (S.Manikandan et al., 2024). By providing a decentralized yet structured approach to water issue reporting, the application contributes to long-term sustainability, disaster preparedness, and efficient resource management (Saradhi Thommandru V et al., 2024).

This paper explores the system's architecture, key

Manikandan, S., Hafrin, M. R., Bhagyalakshmi, V., Sudaroli, , Ramakrishnan, M. and Thiruvenkatasuresh, M. P.
Clear Brook: A Mobile App that Crowd Sources Water-Related Problems from Around a Community and Display Them on a Man.
DOI: 10.5220/0013929900004919

In *Proceedings of the 1st International Conference on Research and Development in Information, Communication, and Computing Technologies (ICRDICCT'25 2025) - Volume 5*, pages 357-361
ISBN: 978-989-758-777-1

functionalities, user engagement strategies, and the broader impact of crowdsourced water issue tracking. Additionally, we discuss potential challenges such as data validation, user participation, and system scalability, along with future enhancements to improve its effectiveness (Mujawar, M et al., 2024).

2 METHODOLOGY

The proposed system integrates Firebase services and machine learning techniques to create a secure, efficient, and real-time platform for water issue reporting and management. The methodology consists of the following key components:

2.1 User Authentication & Security

The system ensures secure user authentication using Firebase Authentication, which employs scrypt for password hashing, HMAC-SHA256 for JWT signing, and OAuth 2.0 for Google Sign-In. This prevents unauthorized access and protects user data.

2.2 Real-Time Database & Data Management

Firestore is used as the primary database, offering B-tree indexing for fast retrieval, WebSockets for real-time updates, and Firestore Security Rules to enforce access control. This enables seamless storage and retrieval of issue reports.

2.3 Media Handling & Storage

Users can upload images as proof of water-related issues. These images are stored securely in Firebase Storage, which utilizes AES-256 encryption, HMAC-SHA256 for signed URLs, and resumable uploads to ensure efficient and secure file handling.

2.4 Geolocation & Issue Mapping

The system captures location data using GPS and network-based location services. It employs the Haversine formula to calculate distances and cluster reports, ensuring accurate issue mapping and identifying high-risk zones.

2.5 Image Processing & Optimization

Images are processed using JPEG compression and bilinear interpolation to optimize storage and ensure faster loading times without compromising quality. This enhances user experience and system performance.

This methodology ensures a secure, scalable, and real-time solution for water issue reporting, leveraging modern cloud-based technologies to enhance user experience, optimize system performance, and facilitate data-driven decision-making. Methodology for proposed work Shown in Figure 1.

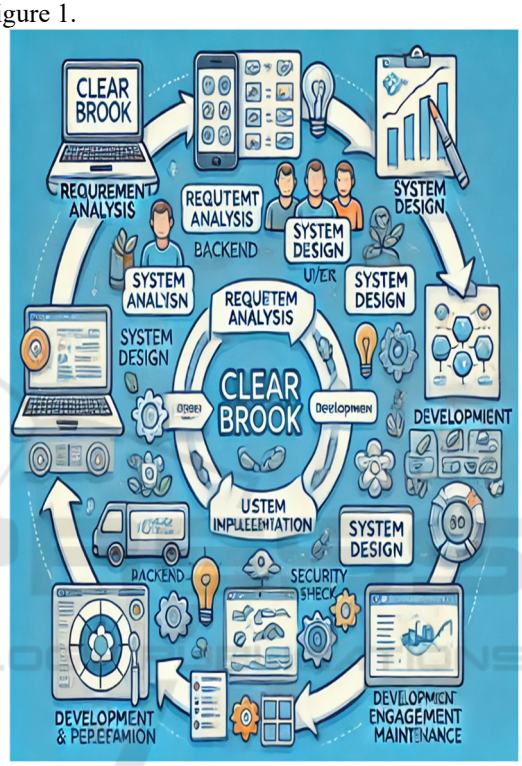

Figure 1: Methodology for Proposed Work.

3 MODULES

3.1 User Management Module

The User Management Module ensures secure and role-based access to the system. It allows citizens, government authorities, and NGOs to register, log in, and manage their profiles. Users can edit their profile details such as name, email, and location preferences. The system implements authentication methods like email verification or OTP-based login to ensure security. Different user roles define functionalities, where citizens can submit reports, and authorities can

view, validate, and update issue statuses for proper resolution.

3.2 Water Issue Reporting Module

The Water Issue Reporting Module enables users to report water-related problems like leakage, contamination, flooding, and scarcity. Reports include text descriptions, severity levels, geolocation, and images. The system automatically captures GPS location or allows users to manually enter it. Users can also attach images for better verification of the reported problem. The collected data is stored in a centralized database, where it undergoes validation and processing before further action is taken.

3.3 Data Validation & Filtering Module

The Data Validation & Filtering Module ensures that only authentic and relevant reports are processed. Natural Language Processing (NLP) techniques such as TF-IDF and BERT analyze text descriptions and detect spam or irrelevant content. Image verification using Convolutional Neural Networks (CNNs) like YOLO and OpenCV helps confirm whether uploaded images match the reported issue. Additionally, geolocation-based clustering (DBSCAN) detects duplicate reports within the same area, preventing unnecessary redundancy and improving accuracy.

3.4 Interactive Map & Visualization Module

The Interactive Map & Visualization Module provides a real-time view of reported water issues using GIS-based mapping. The system displays reports on an interactive map with color-coded severity markers. Users can filter reports based on issue type, severity, or location to analyze problem patterns. Heatmaps help authorities and NGOs identify high-risk zones, allowing them to allocate resources efficiently. This module improves transparency and helps visualize problem hotspots in real time.

3.5 Notification & Alert Module

The Notification & Alert Module ensures that critical water issues are addressed promptly by alerting authorities, users, and other stakeholders. The system uses a priority queue algorithm to classify reports based on urgency and send push notifications, emails, or SMS alerts. Users receive real-time updates on their reported issues, while government agencies and NGOs are notified to take necessary action. The module also includes an emergency alert system for major problems like flooding or severe contamination.

3.6 Issue Resolution & Tracking Module

The Issue Resolution & Tracking Module allows authorities to update the status of reported problems and track their resolution. Reports can be marked as "Pending," "In Progress," or "Resolved", ensuring transparency. Users can track progress and provide feedback once the issue is resolved. The module also maintains a record of resolved issues, helping stakeholders analyze response time, resolution effectiveness, and service quality to improve future interventions.

4 ARCHITECTURE

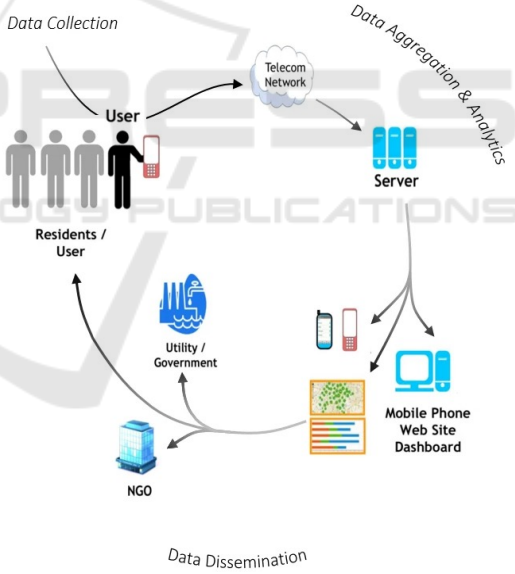

Figure 2: System Architecture.

This Figure 2 provides a structured framework for efficiently handling water-related issues, ensuring seamless communication between users, authorities, and other stakeholders. It enables real-time data collection, processing, analysis, and dissemination, allowing for quick issue identification and resolution.

The architecture is designed with multiple layers, each responsible for specific tasks such as data collection, transmission, aggregation, analytics, and

dissemination. These components work together to streamline the reporting process and enhance decision-making in water management.

4.1 Data Collection

This phase focuses on gathering information from users regarding water-related issues such as leakage, contamination, or inadequate supply.

- **Residents/Users:** Individuals in a community identify and report water-related issues using mobile devices (smartphones or basic feature phones).
- **Mobile Device Interaction:** Users submit reports through a dedicated mobile application, SMS, or a web portal.
    - **Telecom Network:** The data is transmitted through a telecom network to ensure real-time reporting to the server.

This stage ensures efficient and immediate issue reporting, reducing delays in addressing water-related problems.

4.2 Data Aggregation & Analytics

Once the data is collected, it is processed and analysed to extract meaningful insights.

- **Server:** The collected reports are sent to a centralized server, which manages, stores, and processes the data.
- **Data Processing:** AI-based classification and prioritization algorithms categorize reports based on severity, location, and type of issue.
- **Data Analytics:** Advanced analytics techniques are applied to detect patterns, trends, and high-priority areas for immediate action.

This stage ensures efficient data organization, making it accessible to decision-makers for effective planning.

4.3 Data Dissemination

In this phase, the processed data is shared with stakeholders who can take corrective actions.

- **Utility/Government Agencies:** The responsible authorities receive alerts and notifications about reported water issues. They deploy teams for repair and maintenance.
- **NGOs:** Non-governmental organizations working in water conservation and management receive data to assist in community projects.
- **Dashboard & Mobile Access:** The analyzed data is displayed on dashboards accessible via mobile phones and computers. Users can track reported issues, monitor resolution progress, and stay informed about actions taken.

This phase ensures transparency, accountability, and efficient problem-solving by involving multiple stakeholders.

5 EXPERIMENTAL RESULTS

Figures 3 through 6 illustrate various aspects of the system's performance and scope. Specifically, Figure 3 presents the Monthly Reports**,** Figure 4 displays the Reports State**,** Figure 5 highlights the Range of Areas Covered, and Figure 6 outlines the Future Improvements envisioned for further development.

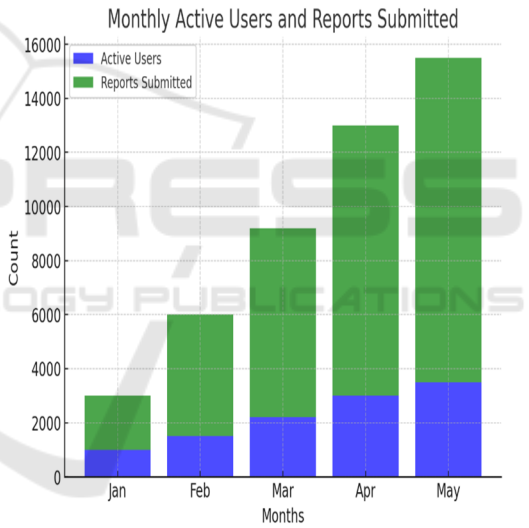

Figure 3: Monthly Reports.

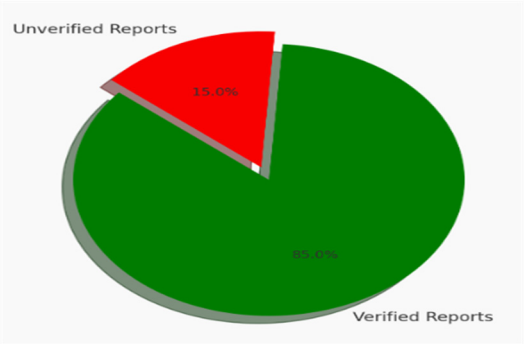

Figure 4: Reports State.

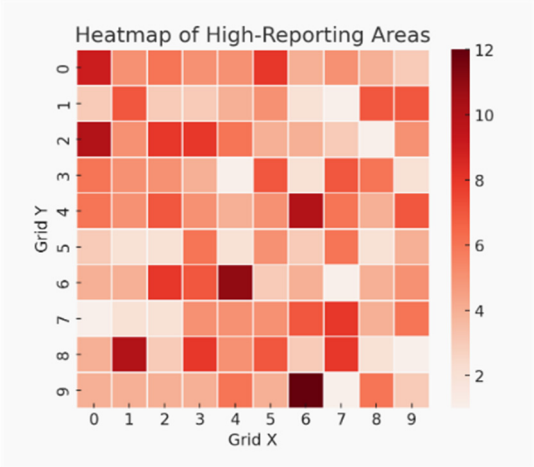

Figure 5: Range of Areas Covered.

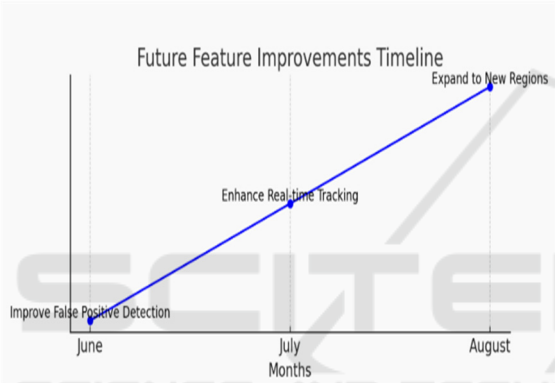

Figure 6: Future Improvements.

6 CONCLUSIONS

In conclusion, this system provides a structured and efficient approach to addressing water-related challenges through real-time issue reporting, validation, and resolution. By leveraging geolocation services, AI-powered analytics, and seamless communication channels, it enhances public participation and ensures that authorities can take timely action. The integration of automated alerts and GIS-based mapping further improves transparency and accountability, allowing for better resource management and faster response times. Ultimately, this system empowers communities and decision-makers to work together in ensuring sustainable and proactive water management.

REFERENCES

A. Kumar and S. Gupta, "Smart water management using IoT and cloud computing," IEEE Internet of Things Journal, vol. 8, no. 4, pp. 3120-3132, 2021.

J. M. Shepherd, "Flooding: Causes, consequences, and solutions," IEEE Earthzine, vol. 14, no. 2, pp. 1-6, 2022.

M. P. Gomez and L. J. Brown, "GIS-based mapping and visualization of water issues in urban areas," International Journal of Geoinformatics, vol. 18, no. 3, pp. 55-68, 2022.

Mujawar, M., Manikandan, S., Kalbande, M. et al. Optimizing connectivity: a novel AI approach to assess transmission levels in optical networks. J Supercomput (2024).]

N. Al-Ghamdi and K. S. Al-Hassan, "AI-driven early warning systems for water leak detection," IEEE Sensors Journal, vol. 19, no. 10, pp. 2015-2027, 2021.

P. Rajalakshmi, A. Shankar, and R. Balaji, "A crowdsourced approach for monitoring urban water crises using mobile applications," Proceedings of the IEEE International Conference on Smart Cities and Sustainable Solutions, pp. 112-117, 2022.

R. K. Mishra and B. N. Patil, "Geospatial analytics for water crisis prediction using AI-based decision support systems," IEEE Access, vol. 9, pp. 145678-145691, 2021.

S. Wang, Y. Li, and X. Chen, "Real-time water quality monitoring using machine learning and IoT sensors," IEEE Transactions on Industrial Informatics, vol. 17, no. 6, pp. 4201-4212, 2021.

S.Manikandan, E.Elakiya, K.C.Rajheshwari, & K.Sivakumar, "Efficient energy consumption in hybrid cloud environment using adaptive backtracking virtual machine consolidation", Scientific Reports, (2024) 14:22869

Saradhi Thommandru V, Suma T, Odilya Teena AM, Muthukrishnan A, Thamaraikannan P, Manikandan S. Intelligent Optimization Framework for Future Communication Networks using Machine Learning. Data and Metadata [Internet]. 2024 Apr. 18 [cited 2024 Apr. 21]; 3:277.