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Geospatial Civic Issue Reporting Platform using Interactive Web Maps

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Abstract: ***Rapid urbanization has led to a significant increase in civic issues such as potholes, waste accumulation, and infrastructure failures, while traditional complaint systems remain inefficient and lack transparency. This paper presents NagarSeva, a real-time geospatial civic issue reporting platform that enables citizens to report urban problems using an interactive map interface. The system allows users to submit geo-tagged complaints with multimedia evidence and track their status in real time. By integrating modern web technologies such as React, Leaflet, and Supabase, the platform ensures scalability, real-time synchronization, and secure data management. The proposed system enhances transparency, improves response time, and strengthens citizen participation. The results demonstrate that digital civic platforms can significantly improve communication between citizens and authorities, contributing to smarter and more efficient urban governance.***
Keywords: Civic Issue Reporting, Smart City, GIS, Crowdsourcing, Real-Time Systems, Web Application

I. INTRODUCTION

Urban areas today face increasing challenges in managing civic infrastructure efficiently. Issues such as damaged roads, garbage overflow, and malfunctioning streetlights directly affect citizens' daily lives. However, traditional complaint mechanisms are often manual, time-consuming, and lack transparency, resulting in delayed resolution and reduced trust in authorities [1].

With the advancement of internet technologies and smartphones, digital platforms have emerged as effective solutions for civic issue reporting. These platforms enable users to submit complaints online, attach multimedia evidence, and track progress in real time. Research shows that such systems significantly improve accountability and efficiency in governance [3].

Crowdsourcing plays a vital role in modern civic systems, allowing citizens to actively participate in reporting issues using GPS-enabled devices. This approach ensures accurate data collection and faster problem identification [6].Additionally, web-based platforms have significantly improved citizen participation by providing accessible and user-friendly complaint reporting interfaces [9].

The proposed system, NagarSeva, is a web-based platform designed to bridge the gap between citizens and municipal authorities. It provides a real-time, map-based interface for reporting, tracking, and managing civic issues efficiently.

II. THEORETICAL BACKGROUND

In recent years, the advancement of digital technologies has significantly transformed the way civic issues are reported and managed. Traditional grievance systems relied on manual processes such as physical visits or phone-based complaints, which often resulted in delays, lack of transparency, and inefficient tracking mechanisms [1]. These limitations created a need for more efficient, technology-driven solutions.

Modern civic platforms also incorporate multimedia reporting, where users can upload images along with complaint details. This enhances the credibility of reports and provides better context for authorities to take appropriate action [2]. Additionally, automated complaint routing and structured workflows have been introduced to streamline the complaint lifecycle, reducing manual intervention and improving resolution time [3]

Recent platforms such as Jan Suvidha and CivicWatch demonstrate the effectiveness of combining real-time tracking, admin dashboards, and user participation to create transparent and efficient systems [4], [5]. These systems allow users to monitor the status of their complaints, increasing trust and accountability in governance.

With the widespread adoption of smartphones and internet connectivity, modern civic reporting systems now leverage crowdsourcing and geospatial technologies to improve urban governance. Crowdsourcing enables citizens to actively participate in reporting issues, while GPS-based geo-tagging ensures accurate location identification of problems [6]. This combination allows authorities to receive real-time, location-specific data, improving response efficiency.

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Furthermore, cloud-based architectures and real-time databases have enabled instant data synchronization across users and administrators. Systems like Jan-Samasya Portal highlight the importance of real-time updates, secure data storage, and scalable infrastructure in modern civic applications [7].

Recent advancements in civic issue reporting systems emphasize the importance of multimedia-based reporting, where images and text are used together to provide better context and accuracy[11].

Furthermore, intelligent systems are being developed to automatically analyze images and extract meaningful insights, reducing the dependency on manual processing [12].

Despite these advancements, challenges such as duplicate complaints, scalability, and data security still persist. Therefore, there is a need for integrated platforms that combine geospatial technologies, real-time processing, and user-friendly interfaces.

The proposed system, NagarSeva, builds upon these theoretical concepts by integrating crowdsourcing, GIS-based mapping, and real-time cloud technologies to provide an efficient and scalable solution for civic issue reporting and management.

III. BLOCK DIAGRAM AND DESCRIPTION

A. Block Diagram

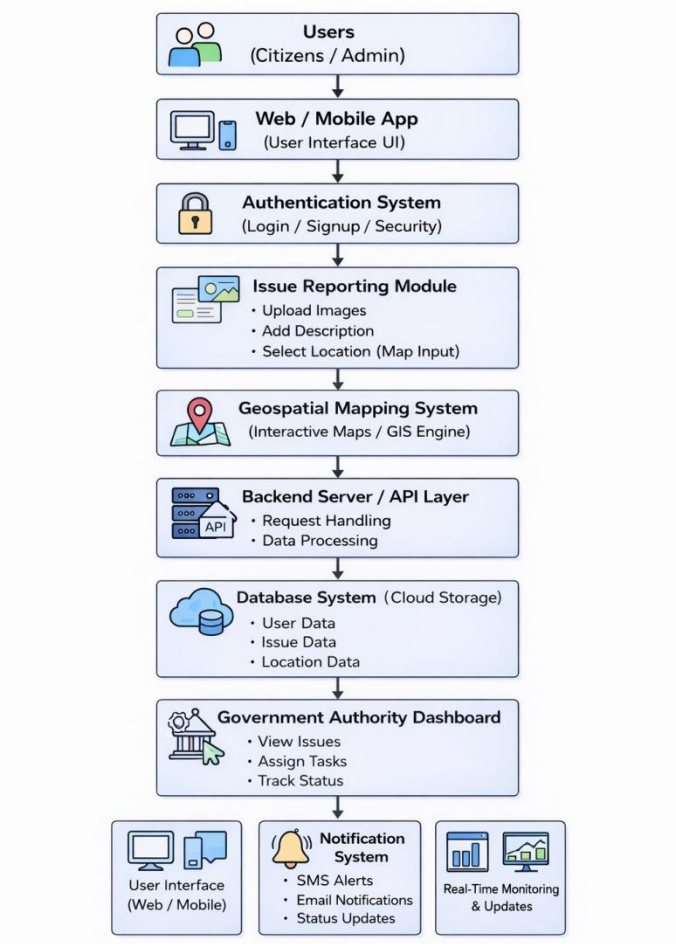


Fig 1. Block Diagram of NagarSeva System Architecture

B. Description of block diagram

The block diagram illustrates the overall working architecture of the NagarSeva system, which is designed to provide a real-time and efficient platform for reporting and managing civic issues. The system begins with users (citizens and administrators) who interact with the platform through a web/mobile application interface, ensuring accessibility across different devices.

The next component is the authentication system, which manages user registration, login, and security. This ensures that only authorized users can access the system and submit or manage complaints, thereby maintaining data integrity and privacy.

Once authenticated, users can access the issue reporting module, where they can submit complaints by providing details such as issue type, description, and uploading images. The inclusion of multimedia data improves the reliability and authenticity of the reported issues, as supported by modern civic reporting systems [2].

The geospatial mapping system enables users to select the exact location of the issue using an interactive map interface. This GIS-based approach ensures accurate geo-tagging of complaints, which helps authorities in identifying problem areas and allocating resources efficiently [6].

The submitted data is then handled by the backend server/API layer, which is responsible for processing requests, validating data, and managing communication between the frontend and the database. This layer ensures smooth system operation and supports real-time functionalities.

All the information is stored in a cloud-based database system, which maintains user details, issue reports, and location data. The use of cloud storage provides scalability, reliability, and fast data retrieval, which are essential for modern web applications [7].

The government authority dashboard allows administrators to view reported issues, assign tasks, and update the status of complaints. This centralized management system improves coordination and ensures efficient handling of civic problems .

Finally, the system includes a notification system, which provides updates to users through alerts and status notifications. This enhances transparency and keeps users informed about the progress of their complaints . Additionally, the system supports real-time monitoring and updates, ensuring that all changes are reflected instantly across the platform.

Overall, the block diagram represents a scalable, secure, and real-time architecture that integrates geospatial technology, cloud computing, and user-friendly interfaces to improve civic issue reporting and management.

IV. SOFTWARE REQUIREMENTS

The system is developed using modern web technologies to ensure scalability, performance, and real-time functionality.

1) **React.js with TypeScript** – Used for frontend development, providing a component-based architecture and improved code reliability through type safety.
2) **Tailwind CSS** – Used for designing a responsive and mobile-first user interface with fast and consistent styling.
3) **Leaflet.js with React-Leaflet** – Enables interactive map functionalities such as marker placement, geolocation tracking, and visualization of reported issues.
4) **OpenStreetMap** – Provides open-source map data for accurate and cost-effective geospatial rendering.
5) **Supabase** – Used as a backend platform offering authentication, PostgreSQL database, real-time updates, and storage for images and user data.
6) **REST APIs / Supabase Client** – Handles communication between frontend and backend for data submission, retrieval, and updates.
7) **Vercel** – Used for deployment, providing fast hosting, automatic builds, and high availability of the web application.

V. METHODOLOGY

The NagarSeva system follows a real-time full-stack architecture that integrates geospatial mapping, cloud-based backend services, and user interaction modules to enable efficient civic issue reporting and management.

The process begins when a user accesses the platform through a web or mobile interface and authenticates using the login/signup system. Once authenticated, the system identifies the user's location using geolocation services and displays an interactive map interface. This allows users to easily navigate and identify their surroundings.

To report an issue, the user selects a location on the map and provides necessary details such as issue type, description, and optional image uploads. The use of geo-tagging ensures accurate location mapping of the issue, which is a key feature in modern civic reporting systems . The inclusion of images further improves the credibility and clarity of the complaint [2].

The submitted data is then transmitted to the backend system through APIs, where it is validated and stored in a cloud-based database. Each issue is assigned a unique identifier and an initial status (e.g., pending). The system supports real-time synchronization, ensuring that newly reported issues are instantly visible to both users and administrators.

Administrators access the system through a dedicated dashboard, where they can view reported issues, filter them based on category or status, and assign tasks to relevant departments. They can update the issue status (pending, in-progress, resolved), and these updates are reflected immediately on the user interface through real-time updates [3].

The system incorporates automated processing techniques such as issue classification and prioritization, which help in routing complaints to the appropriate authorities.

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Machine learning models can analyze submitted data and categorize issues efficiently, reducing manual workload and improving response time [8]. Additionally, cloud-based architectures enable continuous data synchronization and real-time tracking of complaints across all users [10].

The system also includes a notification mechanism that informs users about status changes via alerts or messages, improving transparency and engagement. This continuous feedback loop between users and authorities enhances trust and efficiency in the grievance redressal process.

Overall, the methodology ensures a structured workflow that integrates user input, real-time data processing, and administrative actions, resulting in an efficient and scalable civic issue management system.

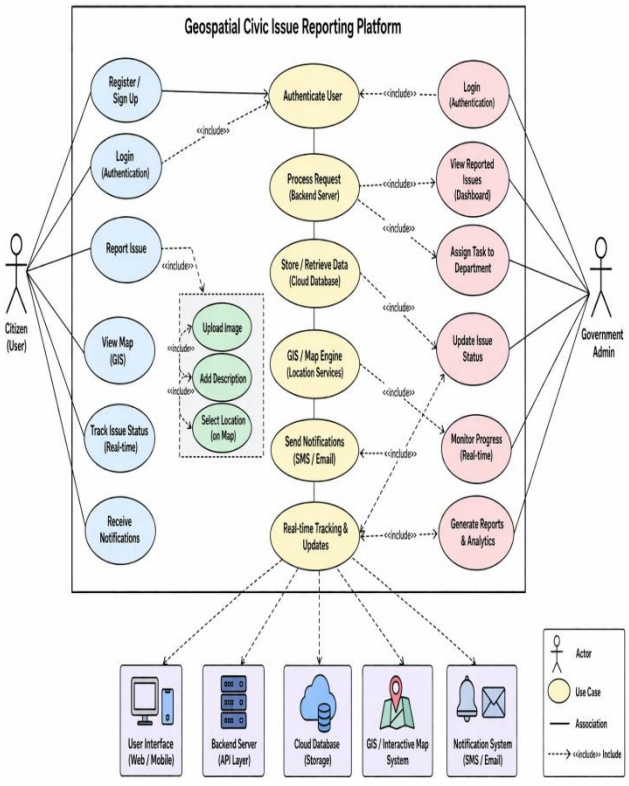


Fig 2. UML Diagram of NagarSeva System

The UML diagram represents the interaction between different actors and the system functionalities in NagarSeva. The system primarily involves two actors: Citizen (User) and Government Administrator.

The Citizen can perform actions such as registering or logging into the system, viewing the map, reporting issues, tracking issue status in real time, and receiving notifications. The issue reporting process includes sub-functions such as selecting location on the map, adding a description, and uploading images, which together form a complete reporting workflow.

The Government Administrator interacts with the system through functionalities such as viewing reported issues, assigning tasks to departments, updating issue status, monitoring progress, and generating reports. These actions help in efficient management and resolution of civic issues. between actions, such as authentication The central system processes include user authentication, request processing, data storage, GIS-based mapping, and notification services, which support both actors. The inclusion relationships in the diagram indicate dependencies being required before accessing system features.

Overall, the UML diagram highlights the flow of interactions between users, administrators, and system components, demonstrating a structured and efficient workflow for civic issue reporting and management.

VI. EXPECTED OUTPUT

The proposed NagarSeva system is expected to provide a fully functional and user-friendly platform for reporting and managing civic issues in real time. The system will enable citizens to easily report problems such as potholes, garbage accumulation, and infrastructure damage by marking locations on an interactive map and submitting relevant details.

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The platform is expected to display all reported issues dynamically using map-based visualization, where each issue is represented by a marker indicating its current status. This visual representation will help users and administrators quickly understand the distribution and severity of problems across different areas.

From the administrative perspective, the system will provide a centralized dashboard that allows authorities to monitor reported issues, assign tasks, and update their status efficiently. The use of real-time updates ensures that any changes made by administrators are instantly reflected to users, improving transparency and communication [3].

The system is also expected to support image uploads, geolocation accuracy, and secure authentication, enhancing the reliability and usability of the platform. Additionally, users will receive notifications regarding the progress of their reported issues, keeping them informed throughout the resolution process.

Overall, the expected output of the system is a scalable, real-time, and efficient civic issue reporting platform that improves citizen participation, reduces response time, and enhances the effectiveness of urban governance.

VII. CONCLUSION

This paper presented NagarSeva, a real-time geospatial civic issue reporting platform that integrates modern web technologies, GIS mapping, and cloud-based services to address urban civic challenges. The system enables citizens to report issues easily using an interactive map, while providing administrators with a centralized dashboard for efficient management and resolution.

The use of geo-tagging, image-based reporting, and real-time updates improves the accuracy, transparency, and responsiveness of the system. Crowdsourced reporting allows citizens to actively participate in identifying problems, thereby enhancing the overall efficiency of civic governance [6].

Additionally, the system ensures seamless communication between users and authorities through real-time data synchronization, reducing delays in issue resolution. The scalable architecture makes the platform suitable for smart city applications and large urban environments.

Overall, NagarSeva demonstrates an effective approach to improving civic engagement and urban management through technology.

VIII. FUTURE SCOPE

The proposed NagarSeva system can be further enhanced by incorporating advanced features to improve functionality and scalability. Integration of Artificial Intelligence (AI) can enable automatic classification and prioritization of reported issues based on severity and type. The system can also be extended to include duplicate complaint detection to avoid redundant reports.

Future improvements may include the development of a dedicated mobile application for better accessibility and user experience. Additionally, implementing push notifications and alerts can provide instant updates to users regarding issue status.

The platform can also incorporate data analytics and visualization tools to identify problem hotspots and support better decision-making by authorities. Furthermore, integration with government APIs and smart city infrastructure can enable automated task assignment and faster resolution.

Overall, these enhancements can make the system more intelligent, scalable, and effective for real-world urban governance.

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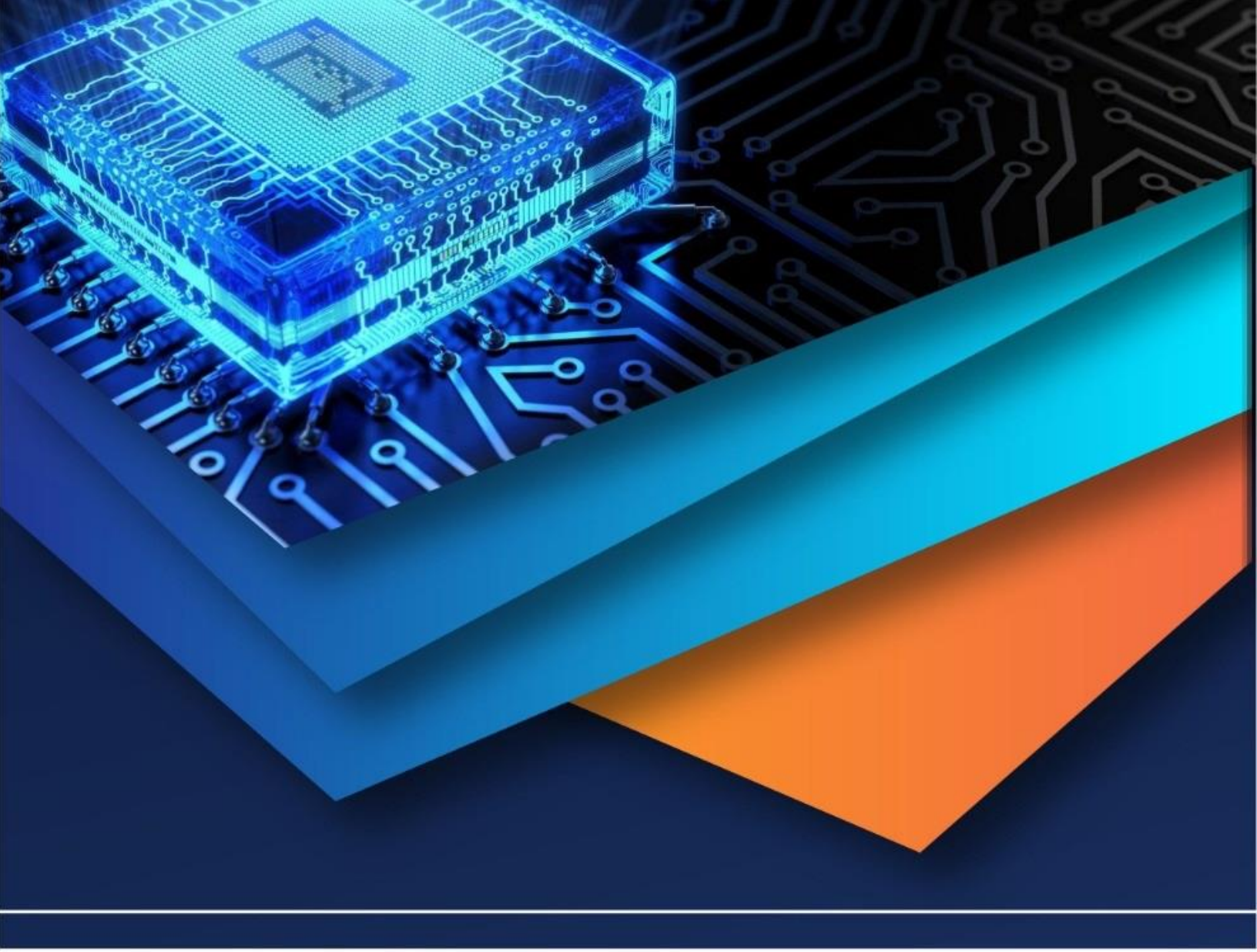
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