

CIVOX: An AI-Assisted Civic Complaint Management and Verification System

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Abstract:

Rapid urbanization has placed growing pressure on city administrations to manage civic infrastructure effectively. Common urban problems such as garbage accumulation, deteriorating roads, water pipe leakages, and illegal dumping continue to affect the quality of life in many cities. Existing complaint platforms largely depend on manual verification and conventional administrative processes, which results in slow resolutions, limited accountability, and declining public trust. To address these shortcomings, this paper proposes CIVOX, an AI-assisted civic complaint management and verification system aimed at making the reporting and resolution process faster and more reliable. Citizens can submit geo-tagged images of civic issues through a web interface, where the system applies image processing techniques to automatically validate complaints, filter duplicates, and forward verified reports to the relevant municipal authorities. A post-resolution verification step compares before-and-after images to confirm that issues have been genuinely addressed. Prototype testing yielded a validation accuracy of approximately 80%, a duplicate detection accuracy of around 85%, and an average processing time of 3–5 seconds per complaint. CIVOX adopts a modular and scalable architecture that integrates AI-based validation, cloud storage, automated notifications, and an administrative dashboard, with the broader goal of improving transparency and efficiency in public service delivery.

Keywords — Civic Complaint Management, Artificial Intelligence, Image Processing, Smart City, Complaint Verification, E-Governance.

I. INTRODUCTION

Cities across the world are expanding at a rapid pace, and this growth brings with it a range of civic infrastructure challenges that are difficult to manage through traditional means. Problems such as uncollected garbage, damaged roads, leaking water pipelines, illegal dumping, and blocked drainage are a common sight in many urban areas. While online portals and mobile applications have been introduced to allow citizens to report such issues, most of these platforms still rely on manual processes for verification and follow-up. This leads to considerable delays in resolution, a lack of accountability, and growing frustration among residents.

The core issue with existing systems is that every complaint typically has to be reviewed by an officer before it is forwarded to the right department. This manual step is not only slow but also prone to human error. Incomplete submissions, duplicate reports, and fraudulent complaints add to the burden, consuming time and resources that could be better utilized. Given the progress made in artificial intelligence, cloud computing, and image processing, there is a real opportunity to automate much

of this process and make civic services more responsive and transparent.

This paper introduces CIVOX, a web-based civic complaint management and verification system that uses AI to handle complaint submission, validation, routing, and resolution tracking. Citizens submit photographs of civic problems along with location data through a straightforward interface. An AI validation module then assesses the quality and relevance of the submitted images, removes duplicates, and routes verified complaints directly to the appropriate authorities. Once a complaint is resolved, updated images are compared with the original submission to confirm that the issue has actually been fixed. The overall aim is to build something practical that lightens the workload on administrators, speeds up the resolution process, and keeps citizens informed at every stage.

II. LITERATURE REVIEW

A number of digital platforms have been developed over the years to support civic issue reporting and urban infrastructure management. With the rise of smart city initiatives, mobile and web-based applications have become a common way for

citizens to flag problems in their surroundings. Kumar and Singh developed a complaint monitoring system for smart cities that showed noticeable improvement in routing speed compared to manual approaches, though human verification was still required at every step [1].

Sharma and Gupta built an e-governance platform focused on urban issue reporting, which helped improve communication between citizens and local authorities. However, the system had no mechanism for automatically verifying the images submitted with complaints [2]. Vijayalakshmi explored the use of image processing for detecting potholes, showing that machine learning could be applied effectively to visual inspection of road infrastructure. That said, scaling such models into full complaint workflows remains difficult, primarily due to limited and varied training data [3].

Patel and Shah proposed a web-based complaint reporting system that allowed users to submit issues and track their status. While functional, the platform offered no intelligent filtering, duplicate checking, or image validation [4]. More recently, Reddy and Naik presented an AI-driven infrastructure monitoring system that combined sensor data with image analysis for real-time issue detection [5].

Looking across these works, it is clear that most existing systems either handle complaint submission or perform image analysis as separate tasks. There is a noticeable gap when it comes to platforms that bring these capabilities together into one cohesive workflow — one that covers automated validation, smart routing, and transparent resolution tracking. CIVOX is designed to fill exactly that gap by embedding AI-based image verification into the complaint management process from start to finish.

III. PROBLEM STATEMENT

There are several challenges in the current civic complaint ecosystem:

1. Manual verification is time-consuming and error-prone, causing delayed responses and resource misallocation.
2. No automated mechanism exists to validate complaint authenticity, enabling submission of fraudulent or irrelevant reports.
3. Duplicate complaints for the same issue from different users result in redundant administrative effort.
4. Poor communication channels between citizens and municipal authorities reduce transparency and accountability.
5. Absence of post-resolution verification means complaints may be closed without actual remediation.

These challenges collectively reduce civic participation, create administrative overhead, and diminish citizen confidence in government responsiveness. CIVOX is designed to address each of these issues through automation and intelligent verification.

IV. PROPOSED SYSTEM

CIVOX is a modular, web-based platform designed to automate and streamline the full complaint lifecycle—from submission to resolution. The system architecture follows a client-server model and comprises four primary functional modules.

System Architecture

The CIVOX architecture integrates four major components: the User Interface Module, the AI Validation Module, the Cloud Storage Module, and the Authority Management Module. These components communicate through secure RESTful APIs and backend services to deliver an automated, transparent complaint management workflow.

1) *User Interface Module*: Citizens and administrators interact through a responsive web interface. Users can register, log in, submit complaints with supporting images and GPS-tagged location data, track complaint status in real time, and receive automated notifications. The interface is designed for simplicity and accessibility across diverse user groups.

2) *AI Validation Module*: This module analyzes uploaded images to determine complaint authenticity and relevance. It performs preprocessing including resizing, grayscale conversion, noise reduction, and contrast adjustment. Validation logic evaluates image clarity, detects irregular visual patterns indicative of civic issues, and compares submissions against existing records to identify duplicates. Machine learning classification marks complaints as valid or invalid, significantly reducing manual screening effort.

3) *Cloud Storage Module*: All multimedia data from complaint submissions are stored on cloud platforms. Secure access URLs are maintained in the relational database for efficient retrieval. The module supports data backup, high availability, and scalability to accommodate growing complaint volumes.

4) *Authority Management Module*: This module connects CIVOX with municipal departments. Upon validation, complaint details are automatically forwarded to the relevant authority, tasks are assigned, progress is monitored, post-resolution proof images are collected, and status is updated. This closed-loop mechanism promotes accountability and timely issue resolution.

B. System Features

The proposed system incorporates: geo-tagged complaint submission with image upload; AI-based image validation and duplicate detection; automated routing to relevant municipal departments; real-time status tracking through a citizen dashboard; an administrative dashboard for complaint management; and post-resolution image comparison for verified closure.

V. METHODOLOGY

The development of CIVOX followed a structured yet practical approach. Since this work was implemented as a prototype system, the primary objective was to create a working workflow that connects complaint submission, validation, storage, and resolution tracking. The focus was on functional integration rather than large-scale deployment. The methodology consists of five main stages: complaint registration, image validation, data storage, authority notification, and resolution verification.

A. Complaint Registration Process

The complaint registration module was developed and tested on a Windows 11 environment using a local server configuration. Users are required to create an account and log in before submitting complaints. Each complaint submission includes:

- User identification details
- A short description of the issue
- One or more uploaded images
- Automatically generated timestamp
- Location details (if available)

Input validation checks were implemented to prevent empty submissions and unsupported file formats. This ensured consistency in stored records and reduced incomplete entries during testing.

B. Image Validation Approach

Since the current system is a prototype, a fully trained deep learning model was not deployed. Instead, image validation was implemented using basic image processing techniques combined with structured logical conditions.

1) *Preprocessing*: Before analysis, images are standardized using the following preprocessing steps:

- Resizing images to a fixed resolution
- Converting images to grayscale when required
- Applying basic noise reduction filters
- Adjusting contrast levels for clarity

During testing, it was observed that images captured under low-light conditions significantly affected validation reliability, leading to lower detection accuracy.

2) *Validation Logic*: The validation process evaluates uploaded images based on:

- Image clarity
- Presence of irregular visual patterns
- Similarity with previously submitted complaints

Image similarity comparison was used to identify duplicate complaints. If a new submission closely matched an existing complaint from the same location, it was flagged to prevent redundant processing. Although the validation mechanism is not based on a trained convolutional neural network, it demonstrated moderate effectiveness in filtering clearly irrelevant or repeated submissions.

C. Database and Storage Management

Complaint data is stored in a relational database running on a local server environment. The database maintains:

- User details
- Complaint descriptions
- Image file paths
- Submission timestamps
- Complaint status information

Images are stored separately, and only their references are maintained in the database to improve retrieval efficiency. Database indexing was applied to frequently queried fields to enhance performance.

D. Authority Notification Workflow

Once a complaint passes validation checks, it is marked as “*Verified*” in the system. The complaint information is then forwarded to the authority module. In this prototype, notifications are simulated through automated email triggers and administrative dashboard updates. The goal was to demonstrate automated routing logic rather than implement a full-scale municipal communication system.

E. Resolution Verification

After an authority marks a complaint as resolved, post-resolution images are uploaded. These images are compared with the original submission using basic similarity analysis. If sufficient visual differences are detected, the complaint status is updated to “*Closed*.” If similarity remains high, the complaint is flagged for further review, preventing premature closure and ensuring genuine issue resolution.

F. Development Challenges

Several practical limitations were observed during system development and testing:

- Reduced accuracy for low-light images
- Sensitivity to extreme camera angles
- Limited dataset diversity
- Performance constraints under simulated heavy load

As the system is currently a prototype, these observations provide direction for future improvement and optimization of the CIVOX platform.

VI. RESULT AND DISCUSSION

The CIVOX prototype was evaluated in a controlled local environment using a mixed image dataset that included publicly available civic issue photographs alongside manually collected samples. The dataset covered three main categories: garbage accumulation, road surface damage, and water pipeline leakage. Several complaint submissions were simulated under normal operating conditions to observe how well the system performed in terms of validation accuracy, response time, and database handling.

In terms of validation, the system achieved an accuracy of approximately 80% during testing. It performed consistently well for images taken under standard lighting conditions. Accuracy did drop noticeably for images captured at night or in poorly lit environments, which is an expected limitation of the current rule-based approach. The duplicate detection component performed better, reaching around 85% accuracy by successfully identifying repeated submissions of the same issue and preventing them from being logged more than once.

The average time taken to process a complaint from end to end — including image upload, validation, database entry, and status update — was between 3 and 5 seconds per submission in the local testing setup. The relational database handled queries and insertions smoothly throughout testing, and applying indexing to frequently accessed fields led to a clear improvement in response times compared to the initial configuration.

Overall, the results suggest that even a relatively straightfor-

ward validation approach can reduce the manual effort involved in complaint screening. The system does not rely on a fully trained neural network, yet it manages to filter out irrelevant submissions and catch duplicates with reasonable consistency. The main factor affecting reliability was image quality — poor lighting, unusual angles, and low resolution all had a visible impact on detection performance. Deploying and evaluating the system at a larger scale in a real municipal environment remains an important next step.

VII. CONCLUSION

This paper presented CIVOX, an AI-assisted civic complaint management and verification system built to address the well-known inefficiencies of manual grievance platforms. By bringing together image-based validation, automated complaint routing, cloud storage, and post-resolution verification under a single web-based platform, CIVOX offers a more streamlined and transparent approach to handling civic issues.

The prototype results were encouraging. The system achieved 80% validation accuracy, 85% duplicate detection accuracy, and processed complaints in an average of 3–5 seconds in a controlled setting. Its modular design makes it straightforward to maintain and extend. More broadly, CIVOX shows that AI and automation have genuine practical value in civic governance — they can speed up complaint resolution, reduce the burden of manual screening, cut down on fraudulent submissions, and help rebuild public confidence in how city services are managed. The work presented here is a step in that direction, with meaningful scope for further development and real-world deployment.

VIII. FUTURE SCOPE

Future enhancements may include:

1. Mass deployment with distributed databases and load balancing for handling thousands of simultaneous users.
2. Use of advanced AI models with deep learning architectures like ResNet, EfficientNet, or Vision Transformers with transfer learning.
3. Separate Android and iOS apps with offline complaint registration and automatic synchronization.
4. Multilingual interfaces and accessibility options like voice-based complaint registration and screen reader support.
5. IoT sensor integration for automatic problem detection in areas like garbage overflow, water leaks, and deterioration in air quality.
6. Predictive analytics for analyzing past complaint data to detect hotspots of recurring problems and predict infrastructure failures.
7. Blockchain-based complaint management for immutable records and improved data security and transparency.
8. GIS-based integration for visual representation of complaint data through heat maps and location-based dashboards.

ACKNOWLEDGMENT

The authors would like to express their sincere gratitude to Prof. Vijay Sonawane for his guidance, support, and invaluable suggestions throughout the development of this project. The

authors also thank the Department of Computer Engineering and Sandip Institute of Engineering and Management for providing the necessary resources and infrastructure to carry out this research successfully.

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