



AI-Powered Public Complaint and Governance Intelligence System

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ABSTRACT

The urban environment complaint management is an essential element of urban governance; however, the current systems may have several issues such as delayed reaction, incorrect classification of the complaint, poor allocation of the officer and no supervision of not resolved complaints. This research proposes the artificial intelligence-based civic complaint management and governance intelligence system called CivicPulse. The proposed system allows citizens to submit complaints along with the complaint description, location and images on the web-site. To classify complaints, natural language processing using DistilBERT and the emergency detection rule-based approach are used. Prioritization of complaints is done by applying XGBoost algorithm that includes complaint category, detection of the emergency situation, images relevancy and complaint proximity as features. The system allows to allocate the officers based on departments, monitor Service Level Agreement, perform automatic escalation, provide evidence of the solution and verify the solution by citizens. All information about the complaint, complaint assignment, complaint status history, evidence and audit information are kept in the centralized MongoDB database. The role-based dashboards are provided for Citizens, Officers, Governance, and Administrators.

Keywords: Public Complaint Management, Artificial Intelligence, DistilBERT, XGBoost, Natural Language Processing, Emergency Detection, Automatic Escalation, Governance Intelligence, Citizen Verification.

1. INTRODUCTION

Public complaint management is essential for transparency, accountability, and efficient governance. Citizens regularly report issues such as damaged roads, water leakage, garbage, drainage problems, and electrical hazards. Traditional manual complaint handling can lead to delayed responses, incorrect categorization, and inefficient departmental routing.

To address these challenges, this paper presents CivicPulse, an AI-Powered Public Complaint and Governance Intelligence System. The system allows citizens to submit complaints with descriptions, locations, and images. DistilBERT classifies complaints, rule-based detection identifies emergencies, and XGBoost predicts complaint priority.

The system also integrates image verification, department-based officer assignment, SLA monitoring, automatic escalation, resolution evidence, and citizen verification. Role-based dashboards support Citizens, Officers, Governance users, and Administrators.

Overall, CivicPulse provides an integrated approach to improving complaint processing, prioritization, accountability, transparency, and governance monitoring from complaint submission to verified resolution.

2. LITERATURE SURVEY

2.1 Anurag Saha et al. (2024) – Automated Complaint Classification and Routing Using NLP and Machine Learning

The study proposed an automated system for complaint classification and departmental routing using NLP and Machine Learning. It helps reduce manual processing and improve the assignment of complaints to the appropriate departments. The approach demonstrates how AI can make complaint handling faster and more organized. However, the system does not include image verification, emergency detection, or governance intelligence.

2.2 Shreyas Patil et al. (2025) – CitizenConnect: AI and Blockchain Powered Mobile Grievance Redressal System

This study combines AI and Blockchain to provide secure and transparent grievance management. It focuses on improving trust and accountability in handling citizen complaints. The use of blockchain provides an additional focus on secure and transparent grievance records. However, it does not provide emergency response and governance analytics.

2.3 S. Ysaswini et al. (2026) – Smart City Vision: A Geo-tagged AI System of Automated Road Damage Detection and Civic Workflow Management

The study focuses on using Computer Vision and AI to automatically detect road damage and support civic workflow management. It helps authorities identify infrastructure problems and improve the handling of road-related complaints. The system demonstrates the usefulness of AI-based visual analysis in smart city applications. However, its scope is mainly limited to road-related complaints and does not provide a general-purpose complaint management system.

2.4 A. Rajesh Kumar et al. (2025) – Smart Complaint System Using Generative AI

This study uses Generative AI for complaint categorization and automated routing. It aims to reduce manual effort and improve the processing of citizen complaints. The approach shows how Generative AI can support faster and more intelligent complaint management. However, it does not provide a complete escalation framework or image verification mechanism.

2.5 A. Karthik et al. (2025) – AI-Powered Petition Tracking and Grievance System

The study focuses on petition tracking, urgency detection, and multilingual support to improve grievance management. It helps citizens and authorities monitor complaints more effectively and supports better communication during the grievance process. The system demonstrates how AI can improve the accessibility and tracking of public petitions. However, it lacks emergency management and governance intelligence.

2.6 R. Sharma et al. (2025) – AI-Based Solution to Enable Ease of Grievance Lodging and Tracking

The study focuses on simplifying complaint registration and tracking through an AI-based grievance management approach. It helps citizens lodge complaints more easily and allows them to follow the progress of their grievances. The approach improves the basic accessibility and tracking of public complaints. However, it does not provide predictive analytics or an automatic escalation mechanism.

2.7 Rahul Sharma et al. (2026) – CivicSense: AI-Based Citizen Complaint Analyzer

The study focuses on complaint trend and sentiment analysis to understand patterns in citizen complaints. It helps authorities analyze complaint data and identify important trends for better decision-making. The approach demonstrates how AI-based analysis can support understanding of citizen feedback. However, it does not provide emergency response or citizen verification.

2.8 Akhil Reddy et al. (2025) – GrievAssist: AI-Powered Public Grievance Redressal System

The study proposes an AI-based system for automated complaint prioritization and departmental routing. It uses complaint information to identify the appropriate department and urgency level, helping improve grievance processing. The system demonstrates how AI can reduce delays and improve the efficiency of public grievance handling. However, it does not include visual verification or governance analytics.

Table 1. Gap Analysis of Existing Studies

Authors & Year	Focus	Methods Used	Limitation
Anurag Saha et al. (2024)	Complaint classification and routing	NLP and Machine Learning	No image verification, emergency detection, or governance intelligence
Shreyas Patil et al. (2025)	Secure grievance management	AI and Blockchain	No emergency response or governance analytics
S. Ysaswini et al. (2026)	Automated road damage detection	Computer Vision and AI	Limited to road-related complaints
A. Rajesh Kumar et al. (2025)	Smart complaint categorization and routing	Generative AI	No escalation framework or image verification
A. Karthik et al. (2025)	Petition tracking and urgency	AI and multilingual support	No emergency management or

Authors & Year	Focus	Methods Used	Limitation
	detection		governance intelligence
R. Sharma et al. (2025)	Grievance lodging and tracking	AI-based complaint management	No predictive analytics or automatic escalation
Rahul Sharma et al. (2026)	Citizen complaint trend analysis	AI and sentiment analysis	No emergency response or citizen verification
Akhil Reddy et al. (2025)	Complaint prioritization and routing	AI, NLP and Machine Learning	No visual verification or governance analytics

3. METHODOLOGY

3.1 Complaint Data Collection and Preprocessing

The data used in this study consists of public complaints submitted by citizens through the CivicPulse web application. Each complaint contains information such as title, description, citizen details, location, category, and optional image evidence. The complaint data is stored in MongoDB Atlas for further processing and management.

The preprocessing process includes:

- Collecting complaint title and description from citizens
- Validating authenticated citizen information
- Processing complaint location and uploaded images
- Combining complaint title and description for AI analysis
- Assigning a unique complaint ID for tracking
- Storing the processed complaint data in the database

The system uses Python-based backend processing to prepare complaint information for classification, emergency detection, priority prediction, and further workflow processing.

Key complaint attributes include:

- Complaint_ID
- Title
- Description
- Category
- Department
- Location
- Image
- Emergency Status
- Priority
- Assigned Officer
- Complaint Status
- SLA Deadline

These attributes provide useful information for intelligent complaint processing and governance monitoring.

3.2 AI-Based Complaint Analysis

After preprocessing, the complaint description is analyzed using AI and rule-based techniques to identify the nature and urgency of the complaint.

The analysis includes:

- Complaint classification using DistilBERT
- Emergency detection using predefined rules and keywords
- Priority prediction using XGBoost
- Image relevance verification
- Identification of the appropriate

department

DistilBERT processes the complaint text and predicts the relevant complaint category. The emergency detection module identifies critical terms and assigns emergency levels such as Critical, High, Medium, and Low. XGBoost predicts complaint priority using features such as category, emergency status, image relevance, and nearby complaint information.

3.3 Complaint Assignment and SLA

Management

After AI-based analysis, the complaint is assigned to the appropriate government department and an eligible officer. Officer selection considers department matching and officer availability to ensure that complaints are routed to the correct service area.

The system also maintains an SLA deadline for assigned complaints. The SLA monitoring process continuously checks whether a complaint has exceeded its assigned deadline.

The SLA management includes:

- Department-based officer assignment
- Officer availability checking
- Assignment timestamp recording
- SLA deadline calculation
- Monitoring overdue complaints
- Automatic escalation of overdue complaints
- Maintaining escalation history

When an assigned complaint exceeds its SLA, the system automatically escalates it to an eligible officer within the same department, supporting faster resolution and accountability.

3.4 Resolution Verification and Governance Monitoring

After receiving a complaint, the assigned officer updates its status and uploads **resolution evidence**. The complaint then moves to the verification stage, where the citizen can confirm whether the reported issue has been properly resolved.

The resolution workflow includes:

- Officer status updates
- Uploading resolution evidence
- Image verification of submitted evidence
- Citizen verification of the resolution
- Complaint history and audit records
- Notifications for important status changes
- Governance and administration monitoring

The system provides separate dashboards for Citizens, Officers, Governance users, and Administrators. These dashboards help track complaints, assignments, escalations, resolutions, and governance activities.

Overall, the methodology integrates React and TypeScript, Flask REST API, MongoDB Atlas, DistilBERT, XGBoost, rule-based emergency detection, image verification, SLA monitoring, automatic escalation, and Google Maps into a unified public complaint and governance management system.

4. ARCHITECTURE AND DESIGN

The AI-Powered Public Complaint and Governance Intelligence System (CivicPulse) follows a modular architecture designed to manage public complaints efficiently from submission to verified resolution. The system integrates a React-based frontend, Flask backend, AI/ML modules, MongoDB Atlas database, complaint assignment, SLA monitoring, automatic escalation, and governance dashboards.

4.1 Frontend (React Dashboard)

- Interactive user interface developed using React, TypeScript, and Tailwind CSS.
- Provides separate dashboards for Citizens, Officers, Governance users, and Administrators.
- Allows citizens to submit complaints with description, location, and images.
- Displays complaint status, assigned officer, notifications, and resolution updates.
- Provides monitoring and management interfaces for officers, governance users, and administrators.

4.2 Backend (Flask REST API)

- Python Flask is used as the main backend framework.
- REST APIs handle authentication, complaint submission, status updates, officer assignment, evidence submission, and notifications.
- AI modules process complaint descriptions for classification, emergency detection, and priority prediction.
- The backend manages SLA monitoring and automatic escalation of overdue complaints.
- PyMongo connects the application with MongoDB Atlas for persistent data storage.

4.3 AI-Based Complaint Processing

- DistilBERT is used to classify complaints based on their title and description.
- A rule-based emergency detection module identifies critical and urgent complaints.
- XGBoost predicts complaint priority using complaint-related features.
- Image verification checks whether the uploaded image is relevant to the complaint category.
- The analysis results are used for department identification and further complaint processing.

4.4 Data Flow and Complaint Management

- The citizen submits a complaint through the React interface.
- Complaint details are sent to the Flask backend for processing.
- The complaint is analyzed for category, emergency level, priority, and image relevance.
- The complaint is assigned to an eligible officer within the appropriate department.
- The system monitors the stored SLA deadline.
- If the complaint becomes overdue, it is automatically escalated to another eligible officer within the same department.
- The officer updates the complaint and uploads resolution evidence.
- The citizen verifies the resolution before the complaint is finally closed.

4.5 Governance Monitoring and Insight Generation

- Governance users can monitor complaints, departments, officers, priorities, emergencies, SLA breaches, and escalations.
- Complaint history and audit records support transparency and accountability.

- Notifications provide important complaint and resolution updates.
- Administrative dashboards provide an overall view of system activities and officer performance.
- The integrated architecture helps improve complaint processing, response time, accountability, transparency, and governance decision-making.

5. RESULTS AND DISCUSSION

The proposed **CivicPulse system** was implemented as a web-based public complaint and governance management platform using **React, Flask, MongoDB Atlas, and AI/ML modules**. The system processes citizen complaints containing descriptions, locations, and images. After submission, the complaint is analyzed for category, emergency level, priority, and image relevance. The processed complaint is then assigned to an appropriate officer and monitored through its SLA until verified resolution.

5.1 Results

The developed system provides different dashboards and modules for managing complaints throughout the complete resolution process. The system supports complaint submission, AI-based analysis, officer assignment, SLA monitoring, automatic escalation, resolution evidence, and citizen verification.

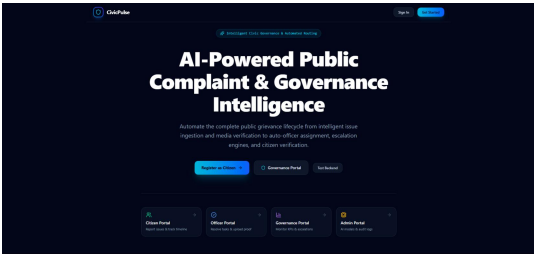


Figure 5.1.1: CivicPulse Landing Page

The Landing Page is the main entry point of the CivicPulse application. It introduces the AI-Powered Public Complaint & Governance Intelligence system and provides options to register as a citizen, sign in, and access different system portals. The page also presents separate portals for Citizen, Officer, Governance, and Admin users.

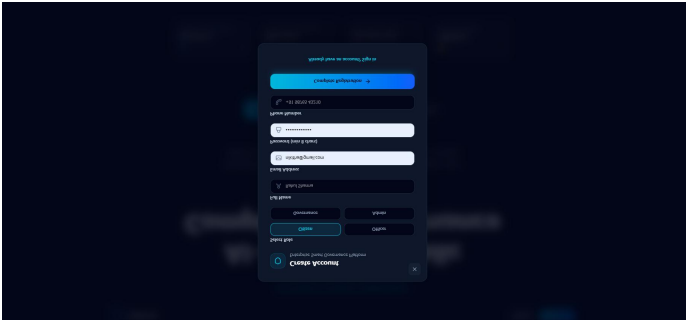


Figure 5.1.2: Citizen Registration Screen

The Citizen Registration screen allows a new user to create an account in the system. The registration form collects the user's full name, email address, password, and phone number. The user can select the appropriate role before completing the registration process.

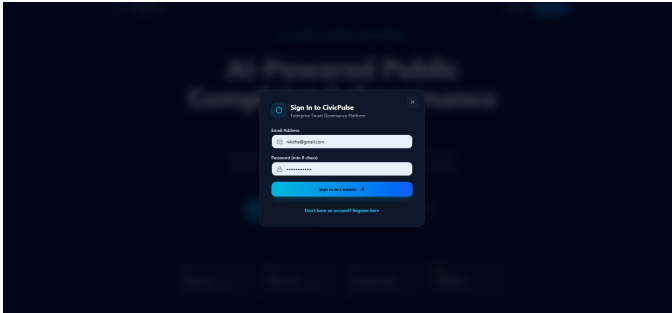


Figure 5.1.3: CivicPulse Login Screen

The Login screen provides authenticated access to the CivicPulse system. Users enter their email address and password to sign in. After successful authentication, the system provides access to the appropriate console based on the user's role.

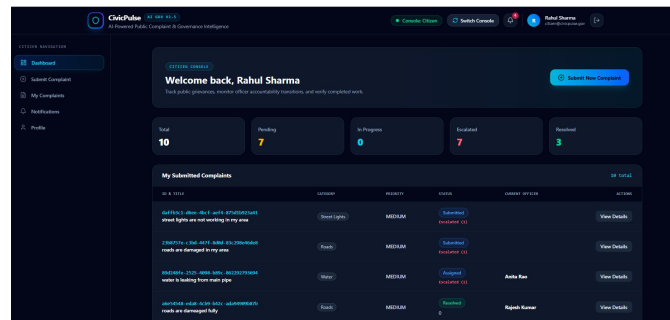


Figure 5.1.4: Citizen Dashboard

The Citizen Dashboard allows citizens to manage and track their submitted complaints. It displays complaint statistics such as total, pending, in-progress, escalated, and resolved complaints. Citizens can also view complaint details and submit a new complaint from the dashboard.



Figure 5.1.5: Officer Operations Dashboard

The Officer Dashboard provides officers with an overview of their assigned municipal tasks. It displays the number of assigned complaints, complaints currently in progress, critical emergencies, and resolved complaints. Officers can open assigned complaints and upload resolution evidence.

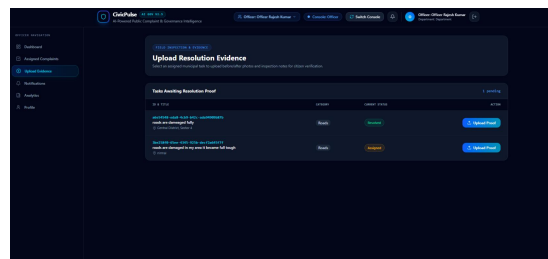


Figure 5.1.6: Upload Resolution Evidence Screen

The Upload Resolution Evidence screen allows officers to provide proof after completing work on an assigned complaint. Officers can select a complaint and upload resolution proof along with inspection information. The submitted evidence is used for the subsequent citizen verification process.

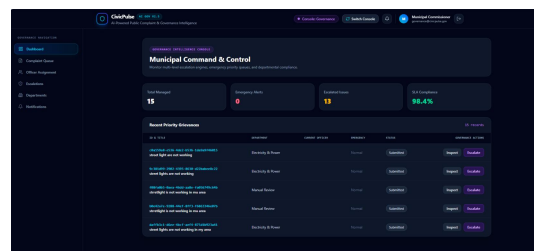


Figure 5.1.7: Municipal Governance Dashboard

The Governance Dashboard provides municipal authorities with an overall view of public complaints. It displays total managed complaints, emergency alerts, escalated issues, and SLA compliance. Governance users can inspect complaints and take appropriate governance actions such as escalation.

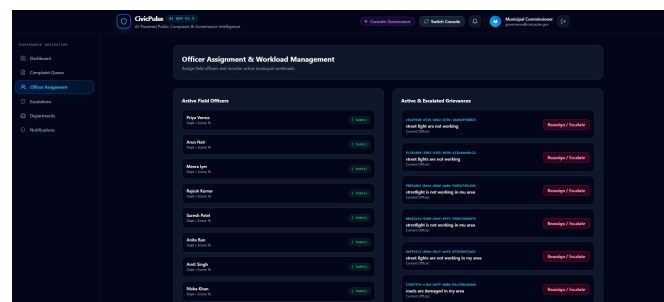


Figure 5.1.8: Officer Assignment and Workload Management

This screen allows governance users to monitor active field officers and their workloads. It displays the available officers and the active or escalated grievances associated with them. Governance users can review complaints and perform reassignment or escalation when required.

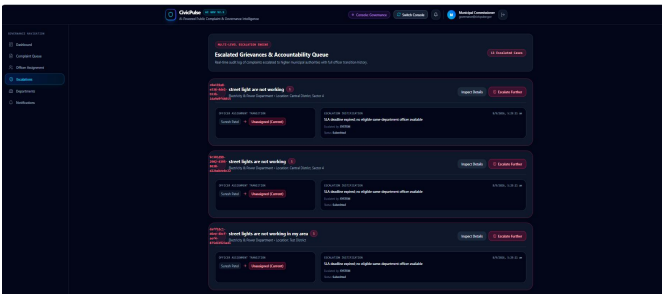


Figure 5.1.9: Escalated Grievances and Accountability Queue

The Escalated Grievances screen displays complaints that have been escalated through the system. It provides information about officer assignment transitions, escalation justification, SLA deadline status, and the system actor responsible for the escalation. This screen supports accountability and monitoring of delayed complaints.

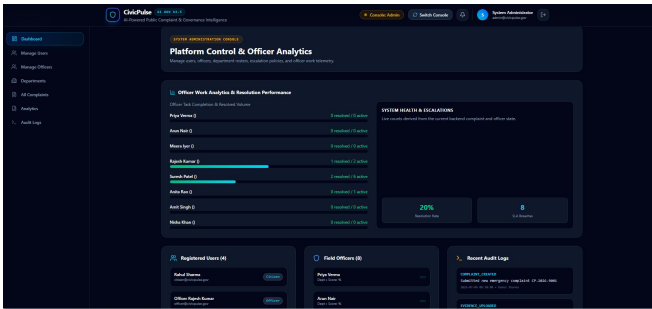


Figure 5.1.10: System Administration Dashboard

The Admin Dashboard provides system-level monitoring and administration functionality. It displays officer work analytics, resolution performance, system health, SLA breaches, registered users, field officers, and recent audit logs. This screen helps the administrator monitor the overall operation of the platform.

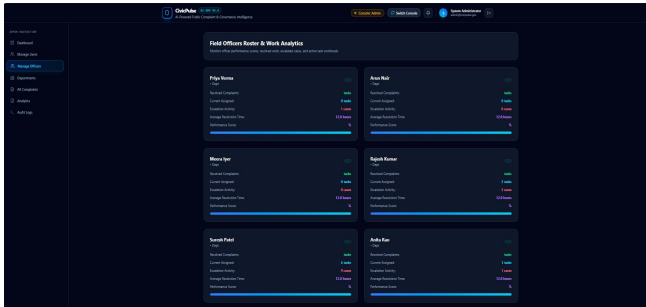


Figure 5.1.11: Field Officers Roster and Work Analytics

This screen provides detailed information about field officers and their work performance. It displays information such as resolved complaints, currently assigned tasks, escalation activity, average resolution time, and performance score for individual officers.

6. CONCLUSION

This study presented CivicPulse, an AI-Powered Public Complaint and Governance Intelligence System for improving public complaint management and governance. The system integrates complaint submission, AI-based classification, emergency detection, priority prediction, image verification, department-based officer assignment, SLA monitoring, and automatic escalation. The results demonstrate that combining AI, Machine Learning, and automated governance workflows can improve complaint processing, transparency, and accountability. The inclusion of resolution evidence and citizen verification provides a structured approach to completing the complaint lifecycle from submission to verified resolution. Overall, CivicPulse provides an integrated and effective solution for intelligent public complaint management.

7. FUTURE SCOPE

The proposed system can be further improved by integrating more advanced Computer Vision models for accurate image and video-based complaint verification. Future versions can incorporate larger and more diverse complaint datasets to improve the performance of AI-based classification and priority prediction. Emergency detection can be enhanced using advanced NLP models to identify critical situations more accurately. The system can also be extended with predictive governance analytics to identify complaint trends, high-risk areas, and recurring civic issues. Further improvements may include multilingual complaint processing, mobile application support, real-time public safety alerts, and advanced governance decision-support features.

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