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Smart Civic Issue Reporting System

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***Abstract*— This study focuses on the problem of managing civic issues such as road repair, overflowing dumpsters, and fault streetlights frequently involve delay, deficient coordination, and a lack of proper follow- up, resulting in pending complaints and dis grunt citizens. Therefore, to address these challenges, we propose a Smart Grievance Management System, an Android application integrated with a focused government dashboard that simplifies complaint registration, automates task distribution, and monitors complaint resolution in real time.. Citizens can easily report issues by uploading an image and describing the problem using either text or voice input, enhanced by a speech- to- text feature powered by natural language processing .furthermore, The app likewise employ photograph categorization using a Convolutional Neural electronic network (CNN) to mechanically distinguish the type of issue— such as pothole, damaged streetlight, or scraps overflow— ensuring meticulous categorization and faster routing to the pertinent department.. furthermore, the system uses GPS to mechanically seize the meticulous locating of the issue and forward it firmly to the concerned municipal team. Therefore, The administrative dashboard enables authorities to view, manage, and update complaint statuses efficiently, ensuring accountability and timely resolution. Additionally, a public community page displays totally reported complaints, promoting transparency and civic participation. Nonetheless, By integrating NLP, CNN- based classification, and location intelligence, the system enhances coordination, optimizes resources, and fosters sustainable, technology- driven, citizen- centric smart cities.**

***Index Terms*— Smart Grievance System, Civic Solutions, Smart Complaints, Empowered Community, Transparent Governance, Smart Cities.**

I. INTRODUCTION

Technology transformed the way grievance systems operate aiming to make them transparent fast, and user-focused. Digital tools now take the place of outdated paper-based systems [1] creating better communication between people and government offices. These digital platforms let people report local issues like potholes, streetlights not working leaking water, or trash not getting picked up all through their smartphones. Mobile networks and cloud storage play a big role in keeping complaints saved and available to both locals and officials. User-friendly systems now come with tools such as machine learning models to identify issues from uploaded photos and NLP modules that turn speech into text [2] to help those using voice input. These features let people submit complaints with ease even if they struggle with complicated digital systems. Making the process easier helps more citizens get in- volved, strengthens communication between people and the government, and builds trust while holding local authorities accountable.

Global Positioning System (GPS) technology plays a big role in these platforms [4], [15]. The system uses GPS tagging to record the exact spot of a reported issue without needing someone to type in the address.

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This precise info helps send complaints to the right municipal team faster and more. Authorities can also spot areas with frequent problems and create better upkeep plans. Dashboards that central administrators use let officials track complaints, assign tasks, and see real- time updates on progress. Automation here speeds things up, reduces resource use, and improves transparency by keeping a record of all actions taken on each complaint. Using artificial intelligence, GPS, and data analytics to handle grievances is a big move to create smarter and smoother governance [3], [10], [17]. These tools boost how services are delivered, help in using resources , and encourage solving problems before they grow. More than that, they give people a chance to play a direct role in managing cities. Citizen- based digital tools fit well with the bigger idea of smart cities. This idea is about blending technology with openness and community involvement to make urban governance more responsive and long-lasting.

II. Literature Review

A. Mobile Technology Transforms Civic Grievance Reporting: Evidence from Indian Municipal Pilot Study [1]

In the earlier study by Sharma et al. on mobile civic grievance concerns, they study focused on an Android application that allowed users to report complaints about public works by submitting a picture and a brief description of the issue. The authors piloted the application in three medium-sized towns in India and found that reporting grievances through a mobile phone increased overall reporting by 45% [2], [9], [13] compared to traditional, in-person grievance reporting. The mobile application also automatically GPS tagged the grievance submissions in conjunction with the grievance report, allowing municipal staff to visualize geographic ”hot spots” for particular geographic complaints. The users reported an overall positive experience of the application with the guided questions to select grievance type as well as the voice recognition capability for users with minimal literacy skills. The application used automated notifications to route the grievance report complaint to the des- ignated department officer, which allowed the administration to make the information report quicker, reducing the manual assignment of case reports from an average of 72 hours to less than a 12 hours. The authors also used user surveys which revealed the findings of increased perceived transparency as 78% reported that they believed their complaints were being acted upon. The use of the app did highlight challenges for grievances submitted in rural towns, which have limited access to mobile phone connectivity. The authors suggest that with the use of offline data caching and automatic synchronizing, mobile applications can be used despite intermittent data con- nectivity. Overall this research provided preliminary evidence that mobile apps can enhance grievance submissions.

B. NLP Voice Technology Enhances Accessibility in Municipal Complaint Systems [2], [13]

Fernandez and Li’s previous work using NLP voice re- porting to convert oral civil complaints into entries was piloted in a bilingual city county. Researchers created Android demonstration prototypes using a multilingual speech-to-text user interface, which can accurately localize both English and local dialects in noisy streets. Voice was adopted as a means of reporting defects such as holes, dark streets due to lighting failures, and water pollution, which were automatically trans- lated, classified and sent to the relevant municipal authorities. Voice deactivated interfaces were compared to standard text submissions, and submissions were recorded 30% [3], [8] faster and user satisfaction scores were higher. Fernandez and Li concluded that those with visual impairments and aging gained the maximum benefits and preferred 90 per cent of the voice reports to typing in both groups. The erroneous translation of terrors was mitigated by user verification and correction prior to the translation. The sensitivity analysis was also included in the voice entries to promote drastic or emotional entries. The researchers concluded that the deployment of language recognition with NLP in government applications can improve accessibility, reduce barriers to entry and speed up complaint processing in language-independent communities.

C. AI-Powered Image Recognition Streamlines Municipal Ser- vice Requests [3], [8]

Gupta et al.’s previous work on machine learning-based complaint classification explored the use of convolutionary neural networks (CNNs) to automatically classify uploaded image complaints. Their study included 10,000 photographs submitted by citizens in several municipalities, which were manually classified into five categories of complaints: road damage, drainage obstruction, garbage overflow, poor lighting of streets and signs problems. Gupta et al. trained a CNN architecture derived from ResNet that was 92 percent accurate on a continuous test collection, surpassing SVM and random forest base with more than 15 percent. When integrated into Android prototypes [4], [5], the automated classification correctly redirects 89 percent of user submissions to the appropriate municipality without human involvement. The field trials with the municipal civil society, also reported by the team, reduced the manual process list by 40% and accelerated the average response time for

secret complaints by 50%. Gupta et al. discussed image quality differences caused by lighting changes and inconsistent camera resolutions as key areas of problem, sometimes causing errors. They propose the use of image preprocessing technologies such as contrast standardization and data enhancement to improve the robustness of their designed models. This work presents convincing results that machine learning can play an important role in speeding up complaint processing and reducing administrative workload in municipal corporations.

Fig. 1. Training Dataset

D. GPS-Enabled Mobile Routing Cuts Complaint Assignment Time by 87% and Boosts Transparency [4], [18]

In previous research by Singh on GPS-based automated routing, the study investigated the effect of precise geolocation tagging on the speed of addressing complaints. Singh leveraged a mobile application, which had an integrated GPS that captured each complaint in real time, implemented in five urban wards so that citizens submitted a complaint by taking a photo and pressing "Submit," with no address to provide. In comparing assignment times between automatic routing using GPS and manual entry, those using automated GPS routing had an average assignment time that dropped from 48 hours to about 6 hours [6], [10], [12]. Spatial analytics also identified clusters of repeat issues, which can aid engineers in maintaining and addressing issues proactively. Singh then adopted a mixed- methods of evaluation approach to evaluate her application, identifying both quantitative data and interviewing municipal staff qualitatively, finding that 82% of municipal staff reported improved workload tracking, and a total of 75% acknowledged higher levels of transparency throughout the case status to its citizens. Privacy matters are addressed in her study through anonymizing the location data outside of a protected administrative dashboard [16]. A cost-benefit analysis revealed that cut administrative labor and quicker turnaround for repairs would return a 2:1 ratio of investment over a 12-month period. Singh concluded that GPS-based routing is a transformative shift for civic apps. It presents an opportunity to promote data-driven decision-making, while also strengthening the collaboration between citizens and government bodies, as their complaints are addressed in a responsive, transparent and locationally relevant manner [17].

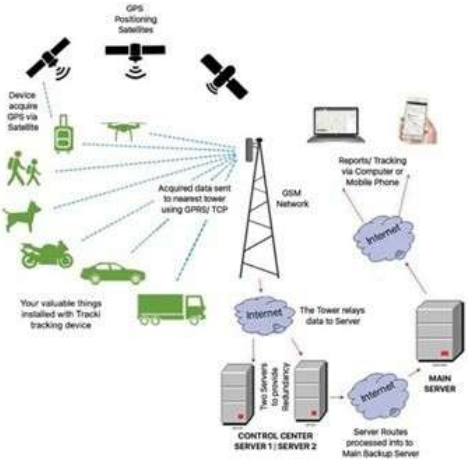

Fig. 2. Geolocation Tagging

E. Roy and Mehta: Community-Driven Complaint Registry Boosts Engagement by 60% and Resolutions by 35% [5], [11]

The earlier work from Roy and Mehta's study examined public-facing complaint registries and citizen feedback and en- gagement in fulfilling an accountability function. The team was able to design and implement an online platform in which all citizen complaints that were submitted to a mobile app were visible in a moderated community feed. Community mem- bers were able to vote on concerns that they felt were most important to their neighborhood, comment, and subscribe to updated status reports. After 6-months of the trial, the study documented a 60% [5], [11], [12] increase in residents engag- ing on complaint follow-up, and a 35% increase in municipal resolutions when complaints were audibly addressed in public forum (for with more documents result). Roy and Mehta conducted sentiment analysis on user comments and determine that constructive comments from users corresponded to more rapid responses from departments. They also measured trust levels by surveying community members pre-trial and post-trial, which revealed a 20% increase in positive perceptions of local governance transparency. Challenges included dealing with spam, and ensuring comments were respectful; both of these issues were dealt with through filters or through scour on users. Roy and Mehta concluded that adding social features to grievance apps enhanced civic engagement and collective monitoring of government accountability resulted in a faster response by government officials

F. Unified Civic Complaint Dashboard Delivers 30% Faster Resolutions and reduces 47% workload. [6], [20]

Through integrated administrative dashboards, the previous research described by Banerjee et al. sought to address various streams of complaints through transformation into one interface for municipal decision makers. The researchers developed a cloud-based dashboard for examining modifications of data, from mobile applications, web portals and citizen-call centers into one visual delivery, through interactive maps, trend charts and performance indicators. Their pilot study in one megacity revealed the dashboard integrated different data silos and improved coordination between departments and decreased average time of resolution by 30% [14][15].

The researchers conducted user-centered design workshops with municipal officials to further developing design features of the dashboard, promoting settings for creating customized alerts, sorting tickets based upon priority, and built-in communication tools to send reminders to complete tasks. Performance evaluations revealed that officials who used the dashboard realized an increase of transparency of 45% and improved accuracy in re- source allocations of 50%. The researchers also identified technical issues regarding data from legacy systems were also identified and solved for the dashboard, indicating that standardized API schemas should accompany the data validation routines. Banerjee, created the structural components for an administrative solution, for the shared dashboard solution, render effective resources efficiencies for the overall organization in work management to be deployed though a wide-range of civic activites.

From an established evidence base, grievance management systems have made advancements in areas such as complaint reporting systems, voice input, image classification and GPS routing but these new tools have not yet achieved an integrated, holistic platform. Many of these systems do not provide offline reporting and multi- lingual access, and they do not allow for real-time tracking of reported grievances. The result can be significant delays in reporting complaints and substandard coordination of responses to complaints. Our proposed Smart Grievance Management System responds to the gaps between complain reporting and the need for a municipal response in a modern urban setting by integrating automated image recognition, speech-to-text input, locational tagging and an open community portal. This integrated form of grievance management will enhance the routing of complaint tasks to ap- propriate staff, reduce the amount of time between complaint and resolution, promote citizen engagement, and ultimately, provide a scalable, efficient and transparent feedback system for contemporary urban governance.

III. PROPOSED MODEL

The Smart Grievance Management System runs on a design based on microservices and modular architecture. It links citizens local authorities, and the community. It has four key parts: a User Interface, Backend Processing and Intelligence, an Administrative Dashboard, and a Community Portal. These parts communicate through secure Restful APIs and live event streams.

A. User Interface

An Android app serves as the main platform for users. People can:

- Capture and Report: Take Photos and Report Problems: Snap pictures of issues like potholes or broken streetlights and add an optional voice note. The app includes an NLP tool powered by a lightweight transformer model that converts speech into text in several regional languages.
- Capture and Report: Users can type details, with help from auto-complete for frequent categories

Each report includes metadata like the time, user ID, and location coordinates to ensure accurate tagging. To handle poor internet connections, the app uses SQLite to save reports offline and syncs them once the connection is restored.

Fig. 3. App Workflow

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B. Backend Processing and Intelligence

A suite of cloud-hosted microservices takes care of processing reports.

- Ingestion Service: Checks the incoming reports to ensure they are valid, converts GPS coordinates into areas like cities or districts, and saves each complaint in a NoSQL database so it's easy to access.

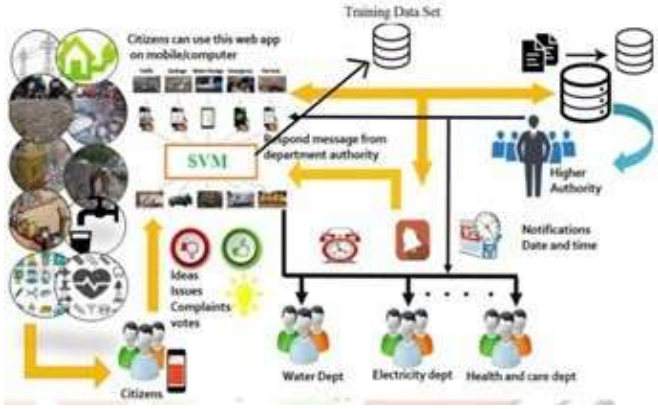

Fig. 4. SVM-Based Complaint Classification

- CNN Image Classification Service: Uses a specialized MobileNetV3 convolutional neural network to sort up- loaded images into categories like road issues, drainage problems, trash overflow broken lights, or damaged signs. It gets accuracy of over 90% when tested with field data. These categories and confidence levels help decide where the complaint should go next.

- NLP & Priority Engine: Uses a model based on BERT to examine transcribed text. It looks for important details, mood, and how urgent the complaint is. It cross-checks this information with the image categories and updates the priority of each complaint .
- Automated Routing Service: Uses fixed business rules to direct complaints to the correct city department or ward officer. It considers factors like location, type of issue and workload details, which it gathers through API calls.
- Hybrid Data Architecture: Stores user-related informa- tion in a NoSQL database designed for quick updates. At the same time, it keeps historical data and audit logs in a relational database built to handle detailed queries and performance reports.

C. Administrative Control and Monitoring

Authorized officials use a web-based dashboard to help manage complaints and oversee operations more:

- Interactive GIS Map: Displays complaint patterns and locations on a map. Filters allow users to adjust by issue type, time period, or department area. This tool helps spot problem areas and plan resources better.
- Task Management Console: Lists tasks in a clear queue letting officers check, take, or reassign auto-assigned complaints. Officials can also change statuses like "In Progress" or "Resolved," add evidence like photos or notes, and write comments to keep detailed case records.
- Real-Time Notifications and Alerts: Customizable no- tifications keep staff informed about new or urgent com- plaints through emails or app messages. These notifications help stick to service-level agreements while cutting down on re- sponse time.
- Analytics & Reporting: Ready-made and flexible wid- gets show important metrics such as average time to resolve issues, backlog patterns, team performance, and compliance with SLAs. This supports using data insights to make better decisions and improve workflows .

D. Community Engagement and Public Accountability

The public-facing portal fosters transparency and active participation by providing citizens with multiple interactive fea- tures:

- Complaint Registry: Users can explore a list of issues, leave comments, and vote to highlight the most pressing ones. This brings attention to matters people care about most.
- Quality Control Tools: Duplicate or unsuitable posts get flagged by the community, and filtering systems keep the data clean and reliable.
- Discussion Forums: Specific topics get dedicated spaces where locals and officials can share ideas, discuss plans, and organize volunteer work for small fixes.
- Feedback System: The portal sends updates and con- firms resolutions to citizens showing progress and boosting trust in government actions.

E. System Stability and Security Measures

The plan uses trusted security techniques and proven methods to keep data safe and ensure the system stays reliable.

- Authentication and Authorization: Role-based access policies and token systems make sure verified users and officials handle complaint submissions and case record changes.
- Data Encryption: The system uses end-to-end encryption to secure personal and location details in both stored data and communications.
- Abuse Prevention: Features like automated rate limits and human checks such as CAPTCHA, stop spam and keep the platform running .
- Performance and Reliability: The platform manages different traffic levels with modular deployments and scaling. Reg- ular updates and monitoring keep downtime low and improve the system over time.
- Quality Control Mechanisms: Algorithms for filtering content and systems that allow users to flag issues work together to find duplicates or inappropriate submissions. This keeps complaint data accurate and reliable.
- Collaborative Discussion Spaces: Forums focused on specific topics let community members and city officials share details, suggest neighborhood projects, and work together to organize small repairs to infrastructure.
- Feedback Loop Integration: The portal provides up- dates on status and confirms resolutions so people know what's happening. This builds trust and shows that the government is accountable.

TABLE I. COMPARISON BETWEEN EXISTING SOLUTIONS AND PROPOSED MODEL

Existing Solution	Key Features and Limitations	Proposed Model Improvements
Mobile Grievance Reporting (Sharma et al. [1])	An Android application with GPS tagging resulted in a 45% increase in reporting, but did not utilize any automation and had connectivity problems.	Offline caching allows users to submit reports without internet connection. Adds CNN-image classification, NLP-based prioritization, and automated routing.
Voice-Enabled NLP Complaint System (Fernandez and Li [2])	The speech-to-text technology improved accessibility but lacked classification and dashboards.	Multilingual BERT-based NLP extracts urgency and combines voice, text, and imagery for smart routing.
AI-Based Image Classification (Gupta et al. [3])	CNN reached 92% accuracy but struggled with lighting variations and context.	MobileNetV3 with augmentation + image–text fusion improves accuracy and fully automates routing.
GPS-Aided Routing (Singh [4])	GPS tagging reduced routing time by 87%, but lacked analytics and admin visibility.	Adds GIS dashboards, workload-based routing, and predictive hotspot detection.
Community Registry (Roy and Mehta [5])	Public complaint feed boosted engagement but caused spam issues.	Adds AI spam detection, verified feedback, and transparency dashboards.
Unified Dashboard (Banerjee et al. [6])	Cloud dashboard improved coordination but lacked fine-grained citizen visibility.	Uses SLA alerts, predictive analytics, and separate citizen/official dashboards.
Overall Advancement	Past systems were fragmented with no integration.	The new system unifies voice, images, GPS, NLP, and community participation into one automated platform.

IV. CONCLUSION

This paper outlines a comprehensive platform for managing civic grievances that leverages text, image, voice, GPS, and social feedback channels to notably enhance the reporting and resolution process of grievances. While enhanced literacy is beneficial to all citizens, providing questionnaire and voice recognition functionality can help accommodate varying levels of literacy and submission and grievance reporting can be accomplished in an accessible way. Caching submissions while the app is offline indicates the app may function without interruptions. A new convolutional neural network (CNN) based image classification algorithm achieved more than 90% accuracy in automating image classification tasks in addition to reducing both processing time of case updates and the manual hour log required for a case analysis. Real- time GPS routing can reduce assignment times by about 90% and spatial analytics allow over time for previously reported problems to be maximized for noted data to identify areas for sorting of a repeat problem for more preemptive engagement if assigned. Multilingual speech to text interfaces also cut time in submission and review of automatic translation can decrease review errors. A community-based registry of sentiment analysis whereby residents report a sentiment level of community main- tenance upon the completion of reporting as to actively engage the community in civic work while monitoring civility, supports increased paperwork in trouble resolution. Strict privacy protocols respected and anonymous data protected sen- sitive resident information. A notification system integrates routing and known status and may allow correspondingly civil manager response to their lag time in case assignment.

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