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Local Problem Reporting & Community Platform

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Abstract—Civic problems in Indian towns and cities — potholes, failed streetlights, uncollected waste, water leakage, blocked drains, and damaged public property — are reported today through telephone helplines, paper complaint registers, and disconnected municipal portals that offer the citizen no visibility after submission. This paper presents the design, implementation, and evaluation of a Local Problem Reporting and Community Platform: a geotagged, role-based system that lets residents report civic issues with photographic evidence, automatically routes each report to the responsible municipal department, and exposes resolution status publicly. The system adopts a three-tier architecture with a React and Leaflet client, a Node.js and Express REST service layer, and a PostgreSQL store with the PostGIS extension for spatial queries, supported by JSON Web Token authentication, a clustering method that merges duplicate reports of the same physical problem, community confirmation for prioritisation, and a service-level escalation engine. A comparative analysis against helpline-based complaint handling and generic social media reporting is presented. A pilot across three municipal wards over sixteen weeks collected 1,860 reports from 940 residents, yielding a 63% reduction in median acknowledgement time, a 38% relative improvement in resolution within the stated service window, and a 52% duplicate-merge rate. A 10-item deployment checklist is developed and four open challenges are identified: report authenticity, spatial privacy, low-connectivity access, and sustained municipal engagement after pilot conclusion.

Index Terms—Civic Technology, Complaint Management System, Geotagged Reporting, Smart City, Community Platform, PostGIS, Spatial Clustering, Municipal Governance, Citizen Participation, Escalation Workflow, REST API, E-Governance, Crowdsourcing.

I. INTRODUCTION

Urban local bodies in India are responsible for a dense set of public services — road maintenance, street lighting, solid waste collection, drainage, water supply, and sanitation — delivered across wards that frequently contain tens of thousands of residents. The Smart Cities Mission and successive municipal reform programmes have emphasised citizen-facing grievance redressal as a measure of service quality, and several states now publish complaint disposal statistics as a governance indicator [1], [2].

The reporting channels available to a resident, however, remain weak. A telephone helpline captures a verbal description with no location precision and no photographic evidence; a paper register at a ward office requires physical presence during working hours; and where a municipal portal exists, it typically issues a complaint number and then goes silent. None of these channels tells the citizen which department received the report, what the expected resolution window is, or whether anything has happened since.

The consequences are threefold. Reports are lost or misrouted because free-text descriptions cannot be mapped reliably to a department or a location. Duplicate reports of one physical problem are processed as independent complaints, inflating workload and distorting disposal statistics. And

B. Report Submission and Categorisation

A report carries a category drawn from a municipally-aligned taxonomy, a free-text description, one to three photographs, and a location captured from device GPS with manual map correction available where satellite fix is poor. Categories map to departments through an administrator-maintained routing table rather than hard-coded logic, so a municipality can reorganise departmental responsibility without code change. Reports may be submitted anonymously, in which case status is tracked by reference code rather than by account.

C. Duplicate Detection and Clustering

A single pothole may generate a dozen reports. Incoming reports are compared against open reports within a configurable radius sharing the same category; candidates above a combined spatial and textual similarity threshold are merged into a cluster that retains every contributing reporter for notification purposes while presenting the department with one work item. The cluster's confirmation count then serves as a severity signal rather than as noise [11].

D. Workflow, Escalation and Roles

A report transitions through SUBMITTED, ACKNOWLEDGED, ASSIGNED, IN_PROGRESS, RESOLVED, and CLOSED, with REJECTED and

because resolution is invisible, residents disengage — many turn instead to social media, where a post may attract attention but enters no accountable workflow and leaves no auditable record [3].

This paper contributes: (1) a requirements analysis of municipal complaint handling drawn from stakeholder interviews and disposal record review; (2) a geotagged, category-routed architecture for civic issue reporting; (3) a spatial clustering method for merging duplicate reports of one physical problem; (4) a comparative analysis against helpline and social media reporting; (5) empirical results from a sixteen-week multi-ward pilot; and (6) a deployment checklist with four open challenges.

II. BACKGROUND AND RELATED WORK

A. Existing Municipal Complaint Handling

Semi-structured interviews with thirteen stakeholders — five ward-level sanitation and engineering staff, three municipal supervisors, two elected ward representatives, and three resident association members — together with a review of six months of complaint registers, identified a five-stage process: intake, manual categorisation, departmental assignment, field action, and closure. Categorisation and assignment were both manual and both were principal sources of delay; closure was frequently recorded without any notification reaching the originating complainant [4].

B. Civic Technology Platforms

Internationally, platforms such as FixMyStreet and SeeClickFix have demonstrated that geotagged citizen reporting can function at municipal scale, and their published evaluations report gains in acknowledgement speed where an authority commits to integration [5], [6]. Their assumptions do not transfer unmodified to the Indian context: they presume stable connectivity, addressable street geometry, a single accountable authority per area, and a citizen base comfortable with English-language interfaces — none of which can be taken for granted in a tier-two or tier-three Indian municipality.

C. Social Media as an Ad-Hoc Channel

Residents increasingly report civic problems by tagging municipal accounts on public social platforms. This channel is accessible and occasionally effective, but it is structurally unsuited to service delivery: there is no category, no verified location, no duplicate detection, no service-level clock, and no closure record. Visibility rather than severity determines what receives attention, which systematically advantages neighbourhoods with larger online presence [7].

D. Identified Research Gap

Prior academic work on Indian civic reporting systems is largely confined to functional prototypes demonstrating DUPLICATE as terminal branches, each transition writing an immutable audit entry. Four actor classes are defined: Resident, Field Officer, Department Supervisor, and Municipal Administrator, with authorisation enforced in API middleware rather than in the client. Each category carries a configurable service window; when the window lapses without transition, the escalation engine raises the report to the supervisory tier and records the lapse, making delay visible rather than absorbing it silently [12].

E. Community Features and Transparency

Residents may confirm an existing report rather than filing a new one, add photographic updates, and view a public ward map of open and resolved issues. Resolution requires a closing photograph from the field officer, which is shown to the original reporters for confirmation; a disputed closure reopens the report. A public dashboard publishes per-ward counts, median acknowledgement and resolution times, and service-window compliance, making the same statistics available to residents and administrators simultaneously.

IV. COMPARATIVE ANALYSIS

Table I situates the platform against the two incumbent channels: helpline and register based complaint handling, and ad-hoc social media reporting. Social media exceeds both alternatives on accessibility and visibility, but supplies no category, no verified location, no duplicate handling, and no service clock. The helpline retains a formal record and a nominal accountability chain, but captures location imprecisely, cannot attach evidence, and returns nothing to the complainant after intake. Three differentiators are absent from both: automatic spatial merging of duplicate reports into one work item; a lapse-triggered escalation path with a recorded audit trail; and photograph-confirmed closure that the original reporter can dispute [13].

V. IMPLEMENTATION AND SECURITY

The client uses React 18 with Leaflet and a service worker that queues submissions made without connectivity, uploading them with their original capture timestamp on reconnection — a necessary provision given that the locations most in need of reporting frequently have the weakest coverage. Photographs are compressed client-side to remain usable on metered connections. The service layer uses Node.js, Express, and a job queue for notification and escalation processing; six primary tables are maintained — Users, Reports, Clusters, Transitions, Attachments, and Departments — with a GiST index on report geometry supporting radius and polygon queries.

Authentication uses short-lived JSON Web Tokens with refresh rotation, and mobile number verification guards submission against automated abuse while rate limiting constrains volume per account and per device. Photograph

submission and listing [8], [9]. Few address the three problems that determine whether such a system survives contact with a municipality: reliable routing of a report to an accountable department, merging of duplicate reports into one work item, and escalation when a service window lapses. Fewer still report outcomes measured against a pre-deployment baseline.

III. PROPOSED SYSTEM ARCHITECTURE

A. Architectural Overview

The platform follows a three-tier separation. The presentation tier is a React progressive web application with a Leaflet map view, delivered as a PWA rather than a native application to avoid the install friction that suppresses first-time civic participation. The application tier is a stateless Node.js and Express REST service. The data tier is PostgreSQL with the PostGIS extension, chosen over a document store because the dominant query in this domain is spatial — reports within a radius, reports within a ward polygon, nearest open report to a given point — and these are expressed directly and indexed efficiently in PostGIS [10].

metadata is stripped of camera and owner identifiers on upload, retaining only the coordinates the reporter explicitly submitted. Personal data handling follows minimisation and purpose limitation consistent with the Digital Personal Data Protection Act 2023; reporter identity is never exposed on the public map, and anonymous submission remains available throughout [14], [15].

VI. RESULTS AND EVALUATION

The platform was piloted for sixteen weeks across three municipal wards, collecting 1,860 reports from 940 distinct residents. Baseline figures were derived from the preceding sixteen weeks of helpline and register records for the same wards and categories.

Median acknowledgement time — from submission to a recorded departmental acknowledgement — fell from 71 hours to 26 hours, a reduction of 63%. The proportion of reports resolved within the stated category service window rose from 44% to 61%, a relative improvement of 38%. Automatic clustering merged 52% of incoming reports into existing clusters, which both reduced departmental work items and revealed that raw complaint counts had previously overstated distinct problem volume by roughly a factor of two.

Escalation fired on 18% of reports, and escalated reports subsequently resolved at a higher rate than comparable lapsed reports without escalation, suggesting the mechanism functioned as intended rather than merely recording failure. Closure disputes were raised on 6% of resolutions. System Usability Scale scores from 214 resident respondents and 11 municipal staff returned means of 80.6 and 74.3 respectively; the lower staff figure corresponded to consistent feedback requesting tighter integration with existing departmental record-keeping [16]. Table II presents the deployment checklist derived from the pilot.

TABLE I — Proposed Platform vs. Helpline Complaints vs. Social Media Reporting

Dimension	Proposed Platform	Helpline / Register	Social Media	Civic Impact
Location capture	GPS coordinates with map correction	Verbal description of landmark	Optional, rarely precise	Eliminates misrouting from vague addresses
Evidence	Photographs, metadata stripped on upload	None attached	Photographs, unverified location	Field officer arrives informed
Departmental routing	Automatic via configurable category table	Manual categorisation by operator	Not applicable	Removes the principal source of intake delay
Duplicate handling	Spatial and textual clustering into one work item	Processed as separate complaints	None; volume mistaken for severity	Corrects inflated complaint statistics
Status visibility	Public tracking with transition history	Complaint number only	Public but unstructured	Sustains resident engagement over time
Escalation	Automatic on service-window lapse, audited	Informal, dependent on follow-up	Depends on viral attention	Delay becomes visible rather than absorbed

Closure	Photograph-confirmed, disputable by reporter	Recorded without notification	No closure concept	Prevents unverified disposal
Equity of attention	Severity from confirmations and service window	Order of receipt	Online reach of the poster	Reduces advantage of better-connected areas

TABLE II — Deployment Checklist — 10 Action Items and Pilot Outcomes

#	Deployment Action Item	Primary Owner	Priority	Pilot Outcome
1	Map the existing complaint workflow with stakeholder interviews	Project team	Critical	13 stakeholders, 5 stages identified
2	Agree category taxonomy and departmental routing table	Municipal administration	Critical	9 categories mapped to 4 departments
3	Define service windows per category with supervisory sign-off	Municipal administration	Critical	Windows agreed for all categories
4	Implement geotagged submission with offline queueing	Development team	Critical	14% of reports submitted offline
5	Deploy spatial and textual duplicate clustering	Development team	High	52% merge rate achieved
6	Build escalation engine with immutable audit trail	Development team	Critical	Escalation fired on 18% of reports
7	Require photograph-confirmed closure with dispute path	Development team	High	6% of closures disputed
8	Strip photograph metadata and enable anonymous reporting	Development team	Critical	DPDP-aligned handling verified
9	Publish ward-level performance dashboard	Municipal administration	Medium	Median acknowledgement down 63%
10	Train field officers and stage the ward-by-ward rollout	Municipal administration	Medium	3 wards, 1,860 reports, SUS 80.6

VII. FUTURE RESEARCH DIRECTIONS

A. Report Authenticity and Abuse Resistance

A public reporting channel attracts misuse: staged photographs, reports filed for private advantage, and coordinated submission to distort ward-level statistics. During the pilot, moderation was manual and consumed supervisory time disproportionate to the volume involved. Future work should evaluate automated image-location consistency checking, reporter reputation weighting, and anomaly detection over submission patterns, assessing each against its false positive cost — a wrongly suppressed genuine report is a more serious failure than an admitted spurious one [17].

B. Spatial Privacy

Precise coordinates are what make a report actionable, but a public map of reports filed from residential locations is also a map of who was where and when. Reports concerning domestic water supply or waste collection are effectively household-linked. Research into spatial generalisation, differential privacy applied to published aggregates, and category-dependent precision policies is required to reconcile operational utility with the privacy expectations of residents [18].

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C. Low-Connectivity and Low-Literacy Access

Offline queueing addressed connectivity only partially, and the interface remained text-dependent despite regional language support. Voice-led submission, icon-driven category selection, and lightweight channels such as missed-call or SMS-initiated reporting warrant structured evaluation, since the residents facing the most acute civic service deficits are frequently those least served by a conventional smartphone interface [19].

D. Institutional Sustainability

The pilot benefited from active municipal attention that a permanent deployment cannot assume. Understanding what sustains engagement after novelty subsides — the effect of published ward performance data, integration with staff performance review, and budgetary ownership of hosting and maintenance — is arguably more consequential to long-term impact than any remaining technical refinement [20].

VIII. CONCLUSION

This paper presented the design, implementation, and evaluation of a Local Problem Reporting and Community Platform that connects residents to municipal service delivery through geotagged reporting, automatic departmental routing, spatial duplicate clustering, lapse-triggered escalation, and photograph-confirmed closure. The argument advanced here is that the distinguishing capability of a civic reporting system is not submission convenience, which social media already supplies, but the conversion of a report into an accountable, deduplicated, time-bounded work item with a visible outcome.

A sixteen-week pilot across three wards, covering 1,860 reports from 940 residents, produced a 63% reduction in median acknowledgement time, a 38% relative improvement in service-window compliance, and a 52% duplicate-merge rate that materially corrected the municipality's understanding of distinct problem volume. Usability scores were acceptable among residents and adequate among staff, with the gap attributable to integration with existing departmental records.

Four open challenges remain: report authenticity under adversarial use; spatial privacy for household-linked reports; access for low-connectivity and low-literacy residents; and institutional sustainability after a pilot's attention subsides. The last is the least technical and the most decisive: the platform makes municipal responsiveness measurable, but measurement changes outcomes only where an institution chooses to act on what it now sees.

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