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An Intelligent Smart Civic Issue Reporting and Management System with Automated Routing, Priority Modeling and Transparency Framework for Smart Cities

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Abstract: Growing cities are exerting more pressure on local government offices that are responsible for taking care of public facilities. Although many cities have begun to use online platforms for issue reporting, these platforms are not equipped with smart ways to route complaints, nor do they have clear guidelines for priority setting or issue tracking. This paper proposes a smart system for reporting and managing public complaints that involves location tagging, complaint routing, priority setting using data, and issue tracking and analysis. This system will make it easier to deal with complaints, ensure that government officials are accountable, and encourage more citizens to participate. Results show that this system can decrease the time it takes to handle complaints and increase the speed at which issues are resolved.

Index Terms—Index Terms—Smart City, E-Governance, Civic Complaint System, Intelligent Routing, Priority Modeling.

I. INTRODUCTION

Smart cities provide a new approach to the creation and management of cities through the use of technology to improve lives, optimize resource use, and optimize the functioning of government. Cities are experiencing rapid growth, and as such, they are facing increased challenges in areas such as buildings, clean water, transportation, and basic services. It is for this reason that the management of city challenges in a smart and organized manner has become very important for the development of sustainable cities.

In rapidly developing cities, typical public problems such as potholes, overflowing trash, broken water supply, clogged drains, and malfunctioning streetlights are also common. If such issues are not addressed promptly, they can cause damage to public safety, health, and the efficient functioning of the city. Earlier, complaints were addressed by local authorities through manual registration, phone calls, and home visits. The traditional methods of complaint registration are time-consuming, prone to errors, and lack proper tracking systems. Recently, online complaint registration platforms have been implemented. These platforms enable citizens to register complaints online, but they are generally simple reporting platforms that lack advanced functionality. Most of these platforms operate manually, causing delays and inconsistencies. Moreover, most of these platforms lack proper information dissemination, and as a result, citizens are not aware of the status of their complaints.

To overcome these issues, there is a requirement for a smart system that can assist in reporting and managing civic issues.

This research presents a Smart Civic Issue Reporting and Management System. It uses automation, prioritization, and real-time status tracking to make handling complaints more efficient. The system is expected to provide better visibility into the whole process. It will also help with decision-making based on data. This, in turn, will assist cities in achieving their smart city vision.

TABLE I

GAP ANALYSIS OF EXISTING SYSTEMS AND PROPOSED SYSTEM

Parameter	Existing Systems	Proposed System
Complaint Submission	Basic digital reporting	Structured digital platform with validation and geo-tagging
Complaint Routing	Manual or semi-automatic assignment	Fully automated rule-based routing engine

PriorityHandling	Noformalprioritymodel	Weightedmathematicalpriorityscoringmodel
Transparency	Limitedorunclearstatus tracking	Real-timecomplaintlifecycletracking
Accountability	Weakauditmechanisms	Completeloggingand traceableaudittrail
DataUtilization	Minimaluseofhistorical data	Analyticaldashboardsand data-driveninsights
Scalability	Limitedinfrastructureflexibility	Cloud-basedscalablearchitecture
DecisionSupport	Reactiveissuehandling	Predictiveandperformance basedgovernancesupport

II. MOTIVATION

These days, people want quick, clear, and reliable government services. This is especially true in cities where local issues heavily affect daily life. When problems like broken roads, trash piling up, leaking pipes, or broken streetlights go unfixed for a long time, people begin to lose faith in their local government. Constant delays cause trouble and make people think that the system isn't working well or that officials aren't taking responsibility.

It is difficult for the municipal organizations to handle a large number of complaints that are constantly increasing using the traditional or partially digital methods. If the complaints are handled manually, there are possibilities of losing the data, having duplicate complaints, routing the complaints to the wrong place, and not giving adequate attention based on their importance. As the size of the city grows, the problem becomes worse, making it difficult for the authorities to act promptly and justly.

A properly designed and intelligent digital system for complaint management can greatly improve the current situation by ensuring that the complaints are treated equally, monitored in real-time, and transmitted properly between the citizens and the government representatives. Automation can greatly reduce the chances of errors and facilitate faster processing of complaints to be sent to the concerned authorities, while also monitoring the efficiency of the concerned departments. This research work is driven by the need for a responsive government that acts quickly to the needs of the citizens and uses smarter ways to manage the services of the city.

III. RELATED WORK

E-governance solutions have been widely researched to enhance public services. Most cities around the world have designed mobile apps and web portals for citizens to register their complaints. The apps are mainly designed to make services more accessible and keep digital records.

Some of the initial research works have included the ability to geo-tag the complaints to identify their location. This helps the government to identify areas with complaints and allocate their resources accordingly. However, most apps require citizens to physically validate and classify the complaints.

Research on automated complaint registration systems shows that technology can minimize paperwork and improve record management. However, the systems do not have the ability to automatically prioritize complaints or process data for decision-making.

Research also shows that there are some common problems such as a lack of communication between departments, ineffective tracking systems, and the absence of a system to measure the effectiveness of what is being done. Most of the apps fail to use past data to improve their systems.

Although previous research has helped in the digital management of complaints, there is still a need for more intelligent automation and the use of data for evaluation. This research aims to solve these issues by suggesting a more organized way of managing complaints.

IV. GAP ANALYSIS

Despite the development of different digital complaint management systems as part of e-governance initiatives, there still exist certain limitations in the current systems.

The current systems are mainly designed for digital complaint registration and do not have intelligent automation, modeling of prioritization, and analysis capabilities. The absence of transparency and decision support systems impacts the efficiency of the system and citizen satisfaction.

The following table highlights the key gaps identified in existing systems and how the proposed system addresses them. It is clear from the above analysis that despite the existence of digital systems, they do not have intelligent automation, modeling, and analysis capabilities. The proposed system addresses all these limitations by integrating automation, modeling, transparency, and analysis capabilities into a single smart governance system.

V. PROBLEM STATEMENT

The city government receives many complaints from the citizens on a daily basis. Without the intelligent system, it takes time to solve the complaints and is not done in the same way every time. Some complaints are left pending because they are resolved manually and there are no fixed rules on how to prioritize some complaints over others. More important issues may not be attended to immediately, while smaller complaints are solved first.

Another major problem is the lack of transparency. The citizens do not know the status of their complaints, which may cause them to be dissatisfied and complain again and again about the same thing. This also hampers the work of the employees of the city authority.

Also, many city authorities do not have the ability to monitor their performance. Without proper tools to monitor performance, it is difficult to determine whether the departments are working properly or whether there are any roadblocks in the process that are causing delays.

Because of all this, there is a need for a system that can automatically distribute complaints, offer fair priorities, and ensure that everyone is held accountable for the issues in the city.

VI. OBJECTIVES

- 1) The system proposes to facilitate the development of an online central platform that would allow citizens to make civic complaints online or via mobile applications. The system would allow users to input descriptions of the problems encountered, attach relevant images to the complaints, and attach geo-location details to the complaints. The entire process of complaint handling would be automated, and there would be no paperwork or human error in the storage of the complaints lodged.
- 2) The system would be developed to incorporate an automated routing system that would direct the complaints to the relevant department of the local government based on the type of complaint and the geo-location of the complaint. The human effort involved in the entire process of directing the complaints would be eliminated, and this would ensure faster routing of the complaints to the relevant department of the local government.
- 3) A structured priority modeling system is implemented to assess the complaints based on various parameters such as severity, urgency, risk impact, and frequency of occurrence. By using a weighted scoring system, the system prioritizes complaints objectively. This ensures that the most critical issues affecting public safety and infrastructure are addressed first, followed by less urgent complaints.

The system provides real-time status updates for citizens, allowing them to track their complaints. Every action taken by the municipal authority is logged in the system, creating a traceable audit trail. This improves transparency between citizens and the government and ensures that departments are held accountable for resolving complaints promptly.

The system analyzes complaint data to uncover patterns, identify high-risk areas, and assess department performance. It employs analytical tools to evaluate response times, resolution effectiveness, and complaint density in various regions. This information helps administrators make informed choices about resource allocation, infrastructure growth, and service delivery.

VII. PROPOSED SYSTEM ARCHITECTURE

The system has been developed in a way that allows for scalability and reliability through the addition of various layers. The presentation layer offers services to both citizens and administrators. The citizens can lodge their complaints, upload images, and view the progress of their complaints. The application layer handles all the processes and procedures involved in complaint processing. This layer connects all the parts of the system. The routing engine routes all the complaints to the relevant teams based on the nature and location of the complaint. The data layer contains all information regarding complaints, user information, and performance data. The cloud infrastructure offers support to the system by ensuring that it is always available, scalable, and secure.

VIII. METHODOLOGY

The proposed Smart Civic Issue Reporting and Management System employs a structured approach based on data-driven methodology for the efficient handling of complaints, routing, and prioritization. This data-driven methodology has different stages, like acquisition, validation, classification, routing, prioritization, etc.

A. Complaint Acquisition

The process begins when a citizen files a complaint through a web interface or a mobile application. The complaint data includes:

- Description of the issue
- Category selection (e.g., sanitation, water supply, roads) location (manual entry or GPS-based tagging) This ensures that there is adequate information for the complaint to be processed.
- Supporting images (optional)

This organized input helps ensure that adequate information is present for further processing.

B. Data Validation and Preprocessing

After submitting the information, the system carries out validation automatically to ensure data quality and completeness:

- Mandatory field verification
- Image format validation
- Geo-location accuracy check of duplicate complaints based on location and similarity of description

Invalid or incomplete information is marked and returned for correction.

C. Complaint Classification

The validated complaint is classified into predefined categories using rule-based logic. The classification is based on:

- Keywords in the complaint description
- Selected complaint category
- Historical complaint patterns

This step ensures that the complaint is properly identified before routing.

D. Automated Routing Mechanism

The system employs a rule-based routing engine to assign complaints to the appropriate municipal department. The routing decision is based on:

- Complaint category
- Geo-location mapping (zone/ward-based allocation)
- Department responsibility rules

This eliminates manual intervention and significantly reduces routing delays.

E. Priority Modeling Using Weighted Scoring

To ensure fair and efficient handling of complaints, a priority score is computed using a weighted mathematical model:

$$P = w_1 \times \text{Severity} + w_2 \times \text{Urgency} + w_3 \times \text{Frequency} + w_4 \times \text{Risk} \quad (1) \quad k$$

Where:

- Severity → Impact level of the issue
- Urgency → Time sensitivity of resolution
- Frequency → Number of repeated complaints
- Risk → Potential safety or public impact
- w_1, w_2, w_3, w_4 → Weight factors assigned to each parameter

Complaints with higher priority scores are processed first. This ensures objective and consistent prioritization across all cases.

F. Processing and Status Tracking

Once routed, the assigned department processes the complaint. The system maintains real-time status updates such as:

- Submitted
- InProgress
- UnderReview
- Resolved
- Closed

Eachupdateisloggedwithtimestampstomaintaintrans- parency and accountability.

G. FeedbackandVerification

Afterresolution,thecomplaintundergoesverification:

- Administrativeverification(internalreview)
- Optionalcitizenfeedback

Thisensuresthequalityofresolutionandhelpsimprove service delivery.

H. DataAnalyticsandPerformanceMonitoring

The system continuously analyzes complaint data to gener- ate insights such as:

- Averageresolutiontime
- Complaintdensitybyregion
- Departmentperformancemetrics
- High-riskorfrequentlyreportedissues

These analytics support data-driven decision-making and pol- icy planning.

I. SystemEfficiencyandConsistency

Byintegratingautomation,prioritization,andtracking mechanisms, the system ensures:

- Reducedmanualerrors
- Fastercomplaintprocessing
- Consistentdecision-making
- Improvedtransparencyandaccountability

IX. SYSTEM WORKFLOW

Theworkflowkicks offwhenacitizenfilesacomplaint viatheonlineinterface.Theuserisrequiredtofillincritical informationsuchasa complaint description, categoryselection (whichcouldbesanitation,water,orroads,amongothers),and geo-location (either manuallyorautomaticallythroughgeo- tagging).

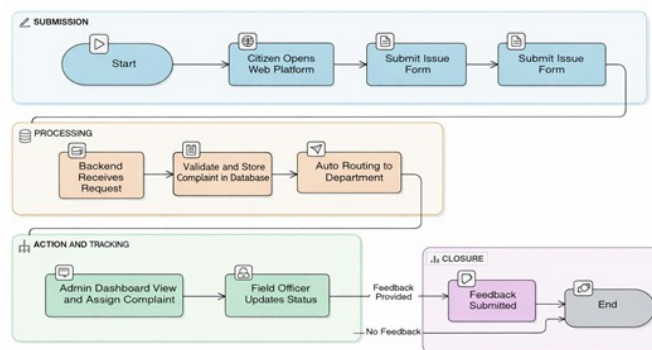


Fig. 1. System Workflow of the Smart Civic Issue Reporting and Management System

The complaint can also be accompanied by photos. The complaint is then validated automatically by the system to ensure that it is complete and accurate. The system checks if all mandatory fields have been filled, if the image format is correct, and if the location information is accurate. This step helps to ensure that the data is complete and does not contain any errors that could affect the processing of the complaint.

The complaint is then subjected to processing by the routing engine. Using pre-defined complaint classification rules, category selection, and geo-location mapping, the complaint is automatically routed to the relevant authority within the municipality.

Once assigned, the concerned department receives an automated notification of the complaint via the system dashboard, email, or alert systems. The notification contains information about the complaint, priority score, and location, allowing the concerned authorities to take immediate action.

The concerned department examines the complaint and takes corrective actions. The system logs status changes such as "In Progress," "Under Review," or "Work Completed." These changes are viewable by administrators and citizens, ensuring that the process of resolving the complaint remains transparent.

After resolving the complaint, the department submits resolution information, which may include completion comments, photographic evidence, and timestamping. This process ensures that a record of the complaint resolution is maintained. After the complaint resolution is logged, the complaint receives final verification. This may depend on the system implementation and may include supervisory approval or citizen verification. After verification, the complaint status is updated to "Closed," and the complaint is archived for record-keeping purposes. This ensures that everything is tracked and everyone is responsible.

X. IMPLEMENTATION

The proposed Smart Civic Issue Reporting and Management System has been implemented using the full-stack approach. The front-end of the proposed system has been implemented using React.js. React.js is considered to be an interactive front-end technology. The component-based approach of React.js ensures the scalability of the front-end system. The front-end system has been designed to allow citizens to register complaints and upload images in support of the complaints. The front-end system has been designed to display the status of the complaints in real-time.

For the administrators and civic body officials, the system has been designed to display the status of the complaints. The proposed system has been implemented using the Spring Boot technology for the back-end services. Spring Boot is considered to be a powerful Java-based technology platform for developing RESTful APIs. The proposed system has been implemented using the Spring Boot technology. The business logic of the system has been implemented using the Spring Boot technology. The business logic involves the rules for routing the complaints and calculating the priority score.

The proposed system has been implemented using the Spring Boot technology. The system has been designed to provide APIs for the front-end and database.

The system also utilizes the MySQL relational database management system. The structured tables in the system are used to store complaint information, user information, department information, priority information, timestamps, and status information. The system has been optimized to allow for efficient querying and fast data retrieval.

The Google Maps API has been integrated in the system to enable routing. For the routing to take place, geo-tagging has been enabled. This involves the precise determination of the location's coordinates. This information will be used to route the complaint to the concerned department in the municipal government.

The application will be hosted on the Amazon Web Services (AWS) cloud infrastructure. Cloud hosting has been chosen to ensure the application's high availability and robustness. AWS offers a range of benefits in the form of load balancing, storage, backup, and scalability of the application's computation based on user requirements. Cloud hosting will ensure the application's high availability, meaning the application will always be accessible to the user regardless of the time.

In conclusion, the system design and implementation have incorporated the latest web technologies, secure backend processing, data management, and cloud hosting to ensure a robust and scalable civic complaint management system.

XI. SECURITY CONSIDERATIONS

Security A secure Smart Civic Issue Reporting and Management System is required for the management of issues reported by citizens. It is associated with personal information, the location of citizens, and city information. Confidentiality, integrity, and good service require security.

- 1) Data Privacy and Confidentiality Personal information such as the names of citizens, their contact information, and the location of the complaint should be kept confidential and should not be visible to anyone who is not authorized to view it.
- 2) Only authorized users can view the information. It is not used in any unauthorized way.

- 3) Authentication and Authorization The citizens and city officials should have an authenticated system of login. It is the process of determining who you are. It is the process of ensuring you can only see the parts of the system that you are authorized to use.
- 4) Role-based access control is used to determine the rights of citizens, operators, and administrators.
- 5) Secure Data Transmission All the communication between the users and the system must be encrypted. This ensures that the data cannot be intercepted or altered in any way. This is especially necessary in the case of complaints that may contain images or locations.
- 6) Data Integrity In order to maintain accurate records without any alterations, the system has to use certain mechanisms. The system uses integrity mechanisms to protect the data once it has been recorded.
- 7) System Availability The system should be accessible to the general public at all times. It resists attacks such as denial of service, server overload, and system breakdowns. Cloud technology is used to ensure that the system is always available and to ensure quick recovery in case of any problems.
- 8) Audit and Monitoring The system records all activities. These activities can be used to identify any unusual behavior, unauthorized access, or unusual patterns in complaints.
- 9) Protection Against Malicious Inputs The system checks for inputs that may pose threats such as SQL injection, cross-site scripting, and spam. This ensures that the system is safe and reliable.
- 10) Backup and Recovery The system backs up data to prevent loss due to accidents, attacks, or system failures. Recovery procedures are also in place to ensure that the system can be quickly restored in case of any problems.

XII. PERFORMANCE EVALUATION

To evaluate the effectiveness of the proposed system, a dataset of 250 civic complaints was used, covering categories such as sanitation, road maintenance, water supply, and street lighting. Variations were included in terms of urgency, location, and time of submission to mimic a real-world scenario. The proposed system was compared to other complaint management systems based on performance indicators such as resolution time, efficiency in processing, accuracy in prioritization, user satisfaction, and rate of duplicate complaints. The proposed systems show significant improvements in terms of:

- Resolution time reduced by approximately 40
- Processing efficiency increased due to automation
- Priority assignment accuracy improved using weighted scoring
- Duplicate complaints reduced due to transparency

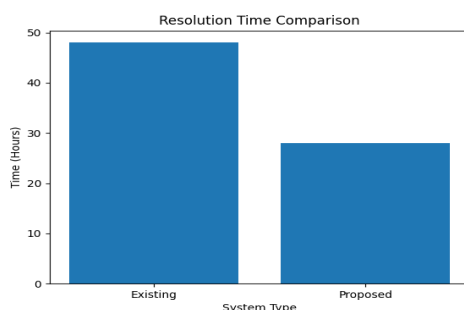


Fig.2. Resolution Time Comparison

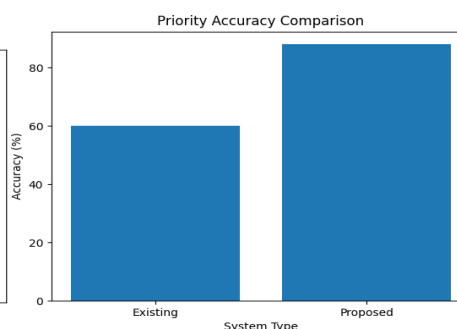


Fig.4. Priority Accuracy Comparison

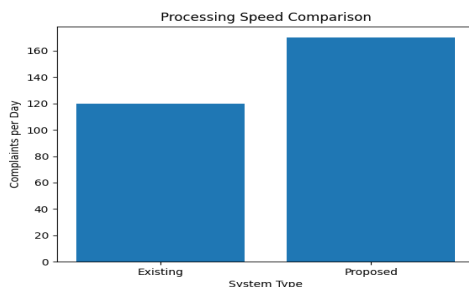


Fig.3. Processing Speed Comparison

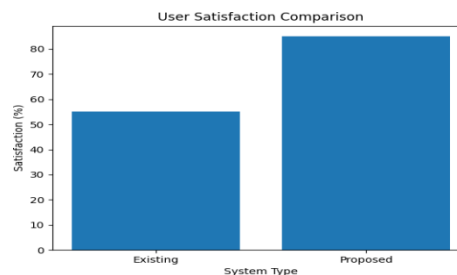


Fig.5. User Satisfaction Comparison

- Usersatisfactionincreasedduetoreal-timetracking

PerformanceComparison

Metric	Existing	Proposed
ResolutionTime	48hr	28hr
ProcessingSpeed	128/day	170/day
PriorityAccuracy	60%	88%
UserSatisfaction	55%	85%

XIII. ADVANTAGES

- 1) The automated routing process reduces the time taken to deliver complaints to the concerned department. In this way, the process eliminates the need for manual verification and reduces the time taken to resolve civic complaints.
- 2) Citizens can track the status of their complaints in real- time,fromthetimeofsubmissiontothetimeofclosure. This helps to eliminate confusion and improves the flow of communication between citizens and city authorities.
- 3) Each step of the process is traceable, and a transparent trail of accountability is established for every complaint. This accountability system ensures that concerned departments and authorities adhere to resolution timelines and service stan- dards.
- 4) Fasterresolution,effectivecommunication,andunbiased prioritization of complaints all work together to improve the user experience. As a result, citizens develop more trust and confidence in the way the city is being governed.

XIV. LIMITATIONS

- 1) The system is very dependent on a stable internet connection for the submission of complaints, the status of the complaints, and the administrative work. In places where the internet is not readily available, it will be hard for people to use the system effectively.
- 2) The workers and administrators inthemunicipalitywillalsohavetobetrainedonhowto use the system effectively. Without the right technical know- how, the advantages of the system will not be achieved.
- 3) Forthesystemtobeimplemented,therewillbetheneed for investment costs in developing the infrastructure, cloud services, system integration, and staff training. This will be a challenge even for smaller municipalities, which have fewer budgets, although it will have its long-term advantages.

XV. FUTURE WORK

Future enhancements to the proposed system would be heavily integrated with the latest advancements in the field of AI. Image recognition would be integrated into the system. Thiswouldallowthesystemtoautomaticallyinspectthe images uploaded. The system would be able to automatically recognize problems such as potholes, accumulation of trash, and damage to infrastructure without waiting for the feedback from citizens. The system would be able to automatically analyze the text of the complaints with the help of Natural Language Processing. This would allow the system to auto- matically classify the complaints and determine the urgencyof the complaints by identifying language patterns. Moreover, thesystemwouldbeabletousepredictiveanalyticstoforecast possible problems. The system would be able to use past data to predict possible problems. The system would be able to use IoT devices such as smart trash cans, water leak detectors,and environmental sensors to automatically detect problems without waiting for the feedback from citizens. All these enhancements would allow the system to transform from a reactive system to a proactive system.

XVI. CONCLUSION

The Smart Civic Issue Reporting and Management System is a game-changer in the way cities are managed, and it introduces theelementofautomation,prioritization,andabso- lute transparency while handling complaints. This is different from the traditional system, which was based on a more manual approach. This new system will make the handling of complaints much more organized. This system will automa- tically route the complaints to the relevant departments and prioritize them based on their urgency and importance, thus avoiding delays in the working of the city.

This system will also introduce transparency, and the citizen will be able to track their complaints in real-time, thus keeping the relevant departments accountable. This will thus create a sense of trust among the citizens regarding the working of the city.

Theuseofquantitativeevaluationandgraphicalcomparison has strengthened the validation of the proposed system.



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