An AI-Enabled Hyperlocal System for Detecting and Reporting Urban Issues

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***Abstract*—Rapid growth in cities often leads to problems such as damaged roads, overflowing waste, blocked drainage, and street-light issues. Reporting these problems through traditional systems can take time and may make it difficult to manage many complaints at once. Artificial Intelligence (AI), computer vision, and Natural Language Processing (NLP) can help make civic reporting easier and faster. This paper studies existing work on civic issue detection and citizen complaint reporting and proposes a simple hyperlocal framework. The framework uses images and text provided by citizens to identify the problem, record its location, and help prioritize complaints. It also considers common challenges such as incorrect detection, data quality, and privacy. The main goal is to support a faster and more organized way of reporting local civic problems.**

***Index Terms*—Artificial Intelligence, Computer Vision, Civic Issue Detection, Hyperlocal Reporting, Smart Cities**

I. INTRODUCTION

Cities face many common local problems, such as potholes, damaged roads, garbage, water leakage, blocked drains, damaged public facilities, and street-light problems. Even though these issues may occur in a small area, they can affect the daily life, safety, cleanliness, and movement of people living nearby. Since these problems are usually related to a specific local area, they can be considered hyperlocal civic issues. In a traditional reporting system, a citizen or inspector has to identify the problem, describe it, add its location, submit a complaint, and wait for it to be checked. When many complaints are received, handling and sorting them manually can take a lot of time. This is where Artificial Intelligence (AI) can be useful. Previous studies have shown that automatic complaint classification and tag suggestions can help organize citizen complaints based on their content and location. Temporal information can also help in understanding when and how often a problem is reported [2]. NLP methods have also been used to group citizen feedback based on different public-service departments [6].

Computer vision is another useful area for civic issue reporting. Researchers have worked on detecting road cracks and potholes from images using different deeplearning models. Some recent studies have used YOLObased models because they can provide faster detection [1], [3], [8], [9], [10]. The RDD2020 dataset contains road images from different countries and includes different types of road damage, making it useful for road-damage detection research [7]. Similar methods have also been used to detect garbage and waste [8], [11].

These studies show that image detection, complaint processing, and location information can be brought together in one reporting system. A citizen could upload an image and a short description of the problem. The system could then identify the issue, use the location, assign a priority, and save the complaint. The information could then be viewed by the concerned municipal staff. This idea is used as the basis for the methodology presented later in this paper.

II. SURVEY APPROACH AND RELATED WORK

This survey mainly covers research published from 2018 onward. The studies are divided into four areas: imagebased detection, complaint-text analysis, location and time information, and civic reporting systems. The selected studies were chosen because they are related to one or more parts of the proposed reporting process. The purpose of this survey is not to provide a formal systematic review or statistical

analysis. Instead, it brings together relevant studies to understand how different methods can be used for civic issue reporting.

A. Visual Detection of Road Damage

Road-damage detection is an important area in civic monitoring. Researchers have used models such as Faster R-CNN to identify cracks and potholes in road images [3]. Cao et al. compared different methods for road-damage detection and discussed factors such as image sources, model selection, and performance on different data [5].

The RDD2020 dataset is useful for this type of research. It contains 26,336 road images and more than 31,000 labelled road-damage examples from India, Japan, and the Czech Republic [7]. It provides a common dataset for testing roaddamage detection methods.

YOLO-based models have also been studied for faster roaddamage detection. YOLOv4 introduced improvements to balance speed and accuracy [4]. Later studies used YOLOv5 and YOLOv7 for road-damage detection, including smaller and lighter models [9], [10]. These studies suggest that a practical system should consider both detection accuracy and the computing resources required.

B. Waste and Garbage Detection

Garbage detection can be difficult because waste items may be small, partly hidden, or affected by lighting and background conditions. Some studies have used improved YOLOv5 models to detect small waste objects and support faster detection [8]. Other studies have focused on smaller YOLOv5 models that can work on devices with limited computing power [11].

Overall, these studies show that waste detection can also be included in a civic issue reporting system.

are relevant to civic reporting because garbage accumulation may need to be detected from mobile images, roadside cameras, or other visual sources with different image quality.

C. NLP for Citizen Complaints

Visual evidence alone does not always describe the full civic problem. A citizen may report that a road is damaged near a school, that a drain is blocked after rainfall, or that garbage has remained at a location for several days. Such details are naturally expressed as text. Gao et al. proposed spatiotemporal and taxonomy-aware tag recommendation for citizen complaints, showing the importance of organizing complaint text together with its location and time [2].

Leelavathy and Nithya studied public feedback for smartcity services and showed how complaints can be grouped and managed using a ticketing system [6]. Text-based methods can also be used to understand and organize citizen complaints [12].

D. Location and Spatial Temporal Information

Location is important in civic complaints because it helps authorities know where the problem has occurred. Details such as the area, location, and reporting time can help organize complaints and identify places where the same problem occurs repeatedly [2].

III. TECHNOLOGIES AND CHALLENGES

A. Image Processing

Images submitted by citizens can help identify common problems such as potholes, road cracks, garbage, and damaged public facilities. This can help in understanding the problem before taking further action.

B. Complaint Text

The description provided by citizens can help identify the type of problem and the concerned department. Simple text processing can be used to organize complaints and handle different types of descriptions.

C. Location and Maps

Location information can connect a complaint to a street, area, or ward. Maps can be used to show where complaints have been reported and to find areas where similar problems occur repeatedly.

D. Web Application and Database

A simple web or mobile application can allow citizens to submit complaints and check their status. A database can store the complaint details, image, location, and reporting time. Municipal staff can use a dashboard to view and manage these complaints.

E. Challenges

The quality of submitted images can affect how easily problems can be identified. Blur, poor lighting, rain, shadows, and distance may make an issue difficult to

recognize [5], [7]. Other challenges include wrong identification, duplicate complaints, different languages, privacy, and limited data [8].

IV. RESEARCH GAP

Previous studies have mainly focused on separate areas such as road problems, waste detection, and complaint classification [2], [5], [7], [8], [9], [10], [11]. These different parts can be brought together into one simple civic reporting system.

The main gap is the need for a system that combines complaint details, images, location, time, and municipal management in one place. Handling different types of civic problems, repeated complaints, and privacy are also areas that need more attention.

V. PROPOSED METHODOLOGY

The proposed system follows a simple process. A citizen can submit a photo, short description, location, and time of a civic problem. The submitted information is then organized, the problem is identified, and the complaint is given a suitable priority. The complaint is then stored for future reference and tracking. This process can help make local complaint handling faster and easier for both citizens and authorities

A. Issue Submission

Citizens can submit a complaint through a web or mobile application. Each complaint contains the basic details needed to understand and track the problem.

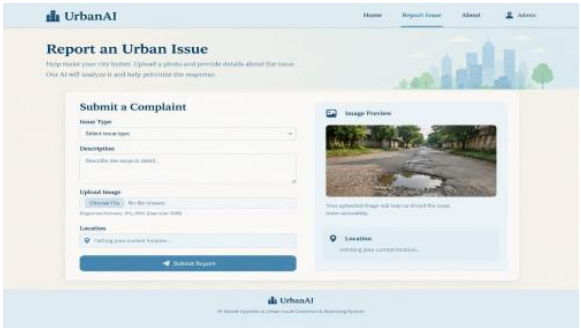

Fig. 5.1. Prototype interface for submitting a civic issue report with image, description, and location.

B. Image Checking

The submitted image is checked for basic quality and prepared for further processing.

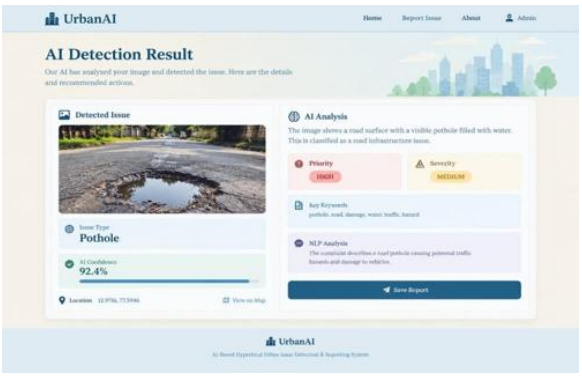

Fig. 5.3. Prototype interface showing the identified civic issue, priority, severity, and location details.

C. Problem Identification

The image and description are used to identify the type of civic problem. If the information is unclear, it can be checked by a person before the complaint is confirmed.

D. Complaint Processing

The complaint description is used to understand the problem and send it to the appropriate category or department.

E. Location and Time

The location and reporting time are stored with the complaint. This information can help identify repeated problems and areas where civic issues occur frequently. Only the required location information should be collected to maintain privacy.

The location information should be protected because it may reveal details about citizens and their movements.

F. Priority and Report Generation

The complaint details such as the problem type, description, location, and reporting time are combined to create a complete report. Complaints can be given a priority based on their seriousness. For example, a major road problem in a busy area may need quicker attention than a minor cleanliness issue. The reason for the priority should also be recorded so that municipal staff can review it when needed.

G. Centralized Storage and Dashboard

All complaint details can be stored in a central database. The record may include the report ID, problem type, description, image, location, priority,

status, and date of reporting. A municipal dashboard can help staff view new complaints, search them by area or type, update their status, and see problem areas on a map. This can make complaint management easier and more organized.



Fig. 5.9. Prototype administrative dashboard for viewing and managing reported civic issues.

H. Human Verification and Feedback

Before taking action, municipal staff can review the submitted complaints. They can confirm the complaint, make changes, reject incorrect reports, or combine duplicate complaints. This checking helps make sure that the information is correct and that the reported issue is handled properly.

The system may face difficulties when conditions change over time. For example, a problem may look different because of weather, lighting, traffic, or the surrounding area, which can make it harder to identify correctly. Therefore, the system should be tested under different local conditions.

VI. INTEGRATED SYSTEM ARCHITECTURE

The proposed system can be divided into five simple parts. The user layer allows citizens to register, submit complaints, and track their reports. The processing layer manages the submitted images and complaint details. The location and decision layer handles the location, reporting time, priority, and verification of complaints. The data layer stores the complaint information. Finally, the authority layer provides a dashboard where municipal staff can view and manage complaints. For a prototype, a Flask backend can be connected to a MySQL database, while HTML, CSS, and JavaScript can be used to create the user interface. The system can be designed in a simple and flexible way, allowing changes to be made without affecting the entire application. The final setup should depend on factors such as cost, response time, privacy, and the expected number of complaints.

VII. DISCUSSION

The reviewed studies show that technology can reduce some of the manual work involved in identifying and organizing civic complaints. However, human checking is still important, especially when the submitted information is unclear or incorrect. The performance of an issuereporting system can also vary depending on image quality, weather, lighting, traffic, and local surroundings [5], [7], [8].

For cities in India, the system should therefore be tested using local images and different real-life conditions. This can include different types of roads, weather conditions, lighting, construction areas, traffic, and common waste problems.

The complete reporting process should also be considered when evaluating the system. Identifying a pothole correctly is not enough if the location is missing, duplicate complaints are not handled, or the report does not reach the correct department. Similarly, a complaint may be correctly categorized but still require clear rules for deciding its priority.

Therefore, future testing should consider issue identification, complaint classification, location accuracy, duplicate reports, processing time, staff corrections, and user experience. This will provide a better understanding of how useful the complete system is in real situations.

VIII. PROTOTYPE INTERFACE SNAPSHOTS

The prototype interface shows how the proposed system can be used by citizens and municipal staff. The screenshots include the complaint submission page, issue result page, and administrative dashboard. These interfaces show how a complaint can be submitted, checked, stored, and monitored.

The screenshots are included as prototype evidence of the proposed system design.

IX. FUTURE SCOPE

In the future, the system can be improved by using information from other sources such as authorized CCTV cameras, vehicle cameras, or drone images.

This can help authorities identify problems that may not be directly reported by citizens. The system can also support different Indian languages and voice-based reporting. This would make it easier for people who are not comfortable typing their complaints. A simple chatbot or guided reporting form could also help users provide the required information.

Another possible improvement is map-based analysis. Repeated complaints can be shown on a map to help authorities identify areas where the same type of problem occurs frequently. In the long term, stored complaint records can be used to understand repeated problems and seasonal patterns. This information may help authorities plan maintenance work and identify areas that need more attention. However, this should only be done after collecting enough reliable data and following proper privacy measures.

X. CONCLUSION

The proposed hyperlocal reporting system provides a simple way for citizens to report local problems such as road damage, waste, drainage issues, and damaged public facilities. The system brings together complaint details, images, location, time, database storage, and a municipal dashboard to make complaint handling more organized. The proposed process includes submitting a complaint, checking the information, identifying the problem, recording its location and time, assigning a priority, storing the report, and allowing municipal staff to review it. Human verification is also included so that incorrect or unclear reports can be checked before any action is taken.

The success of such a system depends not only on technology but also on good-quality information, proper testing, privacy protection, and regular feedback from users and authorities. A simple and reliable reporting system can make it easier for citizens to report local problems and for authorities to manage them effectively. process can help citizens communicate local problems more easily and help municipal staff manage complaints in a more organized manner.

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