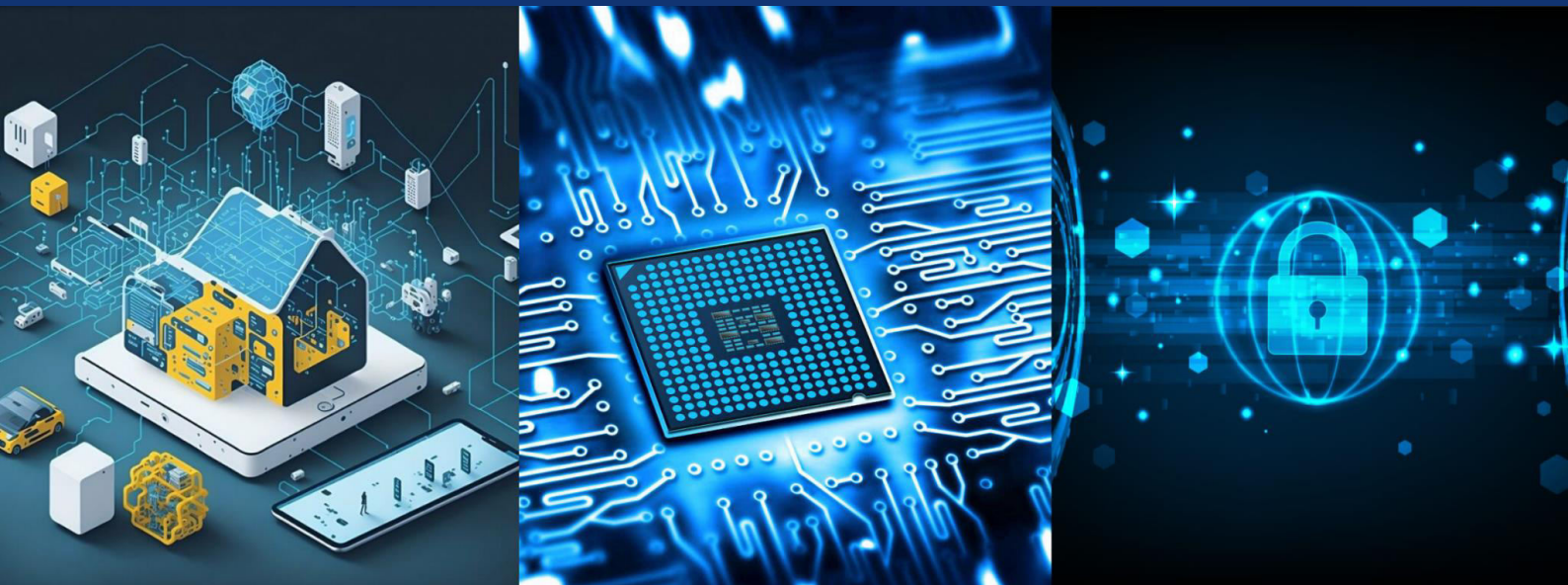
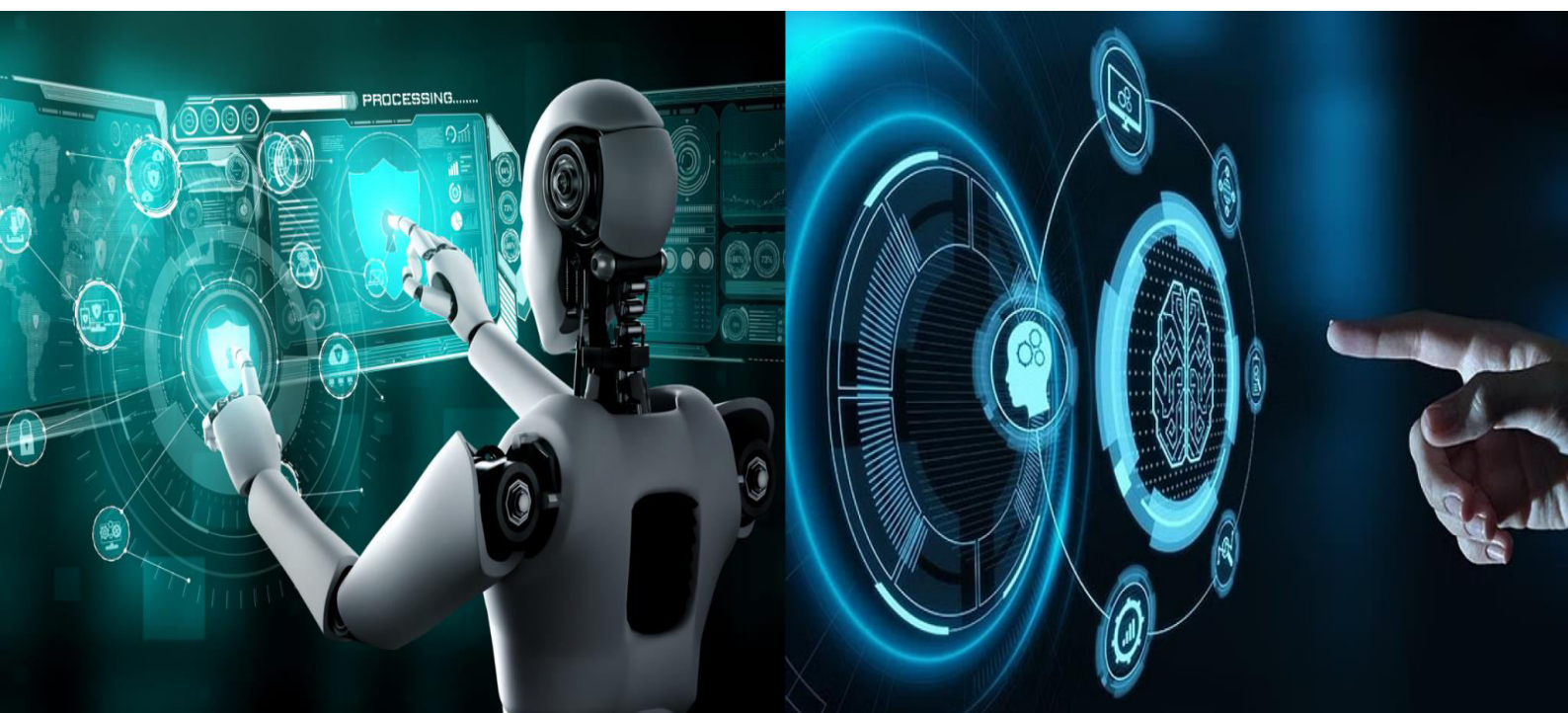




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SmartGovAI: A Multimodal AI Framework for Intelligent Public Complaint Management

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ABSTRACT: The phenomenon of urbanization has led to many civic complaints, which include potholes, garbage dumping, drainage problem, water leaks, and broken street lights, and therefore there is a need for effective mechanisms of complaint management. The current systems of complaint management mostly use manual sorting of complaints. This paper proposes SmartGovAI, a multimodal Artificial Intelligence framework that integrates Natural Language Processing, Computer Vision, OCR, speech processing, and geospatial intelligence to automate complaint classification, verification, department routing, and priority prediction. The proposed framework aims to improve the efficiency, scalability, and transparency of public grievance management while providing a foundation for future smart city governance. A functional prototype comprising web and mobile applications has been developed to validate the proposed architecture and demonstrate the feasibility of the SmartGovAI framework.

KEYWORDS: Public Complaint Management, Smart Cities, Multimodal AI, Natural Language Processing, Computer Vision

I. INTRODUCTION

The fast-growing urbanization process has caused an increase in grievances regarding damaged roads, waste disposal, drainage clogging, water leakage, faulty street lighting, among other public infrastructural problems. To ease the process of lodging such grievances, municipal corporations have come up with digital complaint portals as well as mobile applications. Although such digital tools have made things easy for the citizens, most of them are yet to be automated and rely on manual processing of the complaint type, department, and verification process, which is very inefficient.

Recent developments in the field of Artificial Intelligence (AI), Natural Language Processing (NLP), and Computer Vision (CV) have paved the way for a more efficient system of public grievances handling using intelligent automation. Intelligent Automation [9]-[18] is capable of comprehending the complaints, verifying the images attached to the complaints, assigning the corresponding municipal departments responsible, and prioritizing the complaints depending on their gravity.

Several studies have explored individual applications of AI in complaint classification, image analysis, chatbot-based grievance systems, and multilingual communication. However, most existing solutions focus on specific functionalities and do not provide an integrated framework capable of processing complaints submitted through multiple input modalities such as text, images, and voice while simultaneously supporting intelligent verification and decision-making.

In an effort to overcome these shortcomings, this paper presents the design of a multimodal Artificial Intelligence (AI) system called SmartGovAI which is meant to provide intelligent handling of citizen complaints in addition to facilitating the smart governance of cities. In SmartGovAI, multilingual NLP, Computer Vision, Optical Character Recognition (OCR), speech processing, geospatial intelligence, and decision support through AI have been combined in one platform. With its capability of automated complaint classification, verification, departmental allocation, and priority prediction, the proposed framework seeks to increase efficiency, transparency, and citizen involvement in addition to providing a scalable base for future smart city implementations. Unlike the existing complaint management systems, SmartGovAI combines multilingual NLP, Computer Vision, OCR, speech processing, geospatial intelligence, and decision support through AI in one modular framework.



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II. LITERATURE SURVEY

The integration of Artificial Intelligence (AI) into public grievance management has gained considerable attention in recent years, with researchers proposing various techniques to automate complaint processing, classification, and resolution. Most existing studies focus on improving administrative efficiency through Natural Language Processing (NLP), Computer Vision (CV), and web-based complaint management systems. [1]-[5]

Number of researchers have applied NLP for complaint categorization and departmentation automatically. They save manual work by classifying complaints according to the description provided by them in the text form. But most of these systems use only one language and work with text data only, hence they perform poorly in multilingual and multimodal environment. [1], [3], [5]

Computer Vision techniques have also been explored for identifying civic infrastructure issues such as potholes, garbage accumulation, damaged roads, and water leakage from images. Deep learning models such as **YOLO**, **CNN**, and object detection frameworks have demonstrated promising results in recognizing infrastructure defects. Nevertheless, these models are generally developed as standalone applications and are not integrated with complete complaint management workflows. [14]-[17]

Recent research suggests the development of intelligent grievance systems that involve mobile applications, cloud computing, and complaint tracking in real time. Although such systems increase transparency and accessibility, they fail to provide intelligent verification of complaints, detection of duplicate complaints, intelligent priority assessment, and multimodal processing features. [2], [4], [6]

Table I. Comparative Analysis of Existing Studies

Ref	Method	Contribution	Limitation
SmartChat [1]	NLP	Complaint Classification	Text only
CUI [2]	Conversational AI	Better User Interaction	No Vision Support
Gupta et al. [3]	AI Grievance Portal	Multi-department Routing	Limited AI Verification
Citizen Centric Platform [4]	Complaint Portal	Citizen Engagement	Manual Decision Support
Smart Civic Complaint System [5]	AI + Image Analysis	Complaint Automation	No Multimodal Integration
SmartGovAI	Multimodal AI	Unified Intelligent Framework	Prototype under evaluation

The literature indicates that current solutions primarily address individual aspects of complaint management rather than providing an integrated platform that combines multilingual NLP, Computer Vision, speech processing, OCR, geospatial intelligence, and AI-assisted decision-making. This limitation motivates the development of **SmartGovAI**, a unified multimodal framework designed to automate complaint registration, verification, department routing, and priority prediction while supporting scalable smart city governance.

III. PROPOSED METHODOLOGY

The suggested SmartGovAI system is aimed at automating the entire process of public complaint management, where artificial intelligence is combined with the principles of smart city government. It provides the ability of citizens to submit complaints via text, picture, or voice messages through a web/mobile application. The artificial intelligence modules will then perform an analysis of the complaint and assign the complaint to the appropriate agency for handling. The proposed methodology consists of five major stages, as illustrated in **Figure 1**.

A. System Overview

SmartGovAI refers to a multichannel solution for complaints that integrates the use of Natural Language Processing (NLP), Computer Vision (CV), Optical Character Recognition (OCR), Speech Processing, and Geospatial Intelligence.



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The framework supports multilingual complaint registration and provides intelligent decision support to municipal authorities by reducing manual intervention in complaint processing.

B. SmartGovAI System Architecture

The proposed architecture consists of four major components:

1. Citizen Interface:

Complaining facility available either through a mobile app or web portal by making use of text, photos, or audio. Location is identified using GPS and users are able to track status of complaints in real time.

2. AI Processing Engine:

Uses Processes for complaint information through NLP for text understanding, Computer Vision for image processing, Speech-to-Text for speech complaints, and OCR to extract text information from uploaded images.

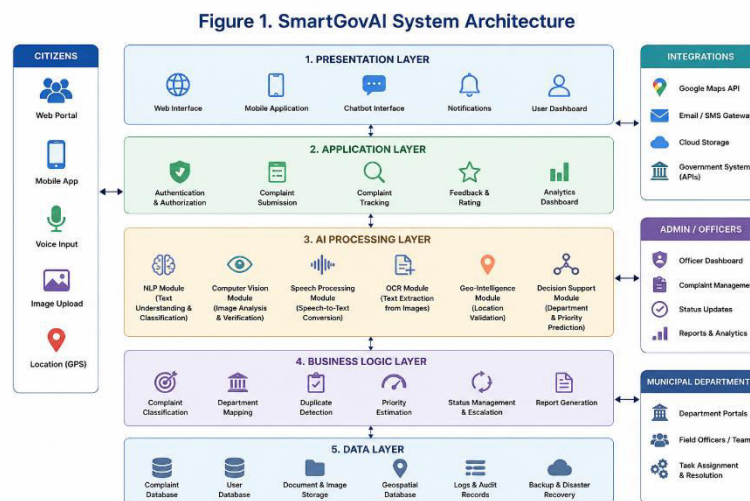
3. Decision Engine:

Complaints are automatically classified, the responsible municipal department is automatically determined, prediction of complaint priority is made, authentication of the complaints is done, and duplicate complaints are identified.

4. Administration Module:

Enables the creation of the dashboards that would enable monitoring of the complaints, updating of the complaint status, generating reports, and analysing complaint trends to enhance efficient governance.

Figure 1. Proposed SmartGovAI System Architecture



C. Complaint Processing Workflow

The workflow of SmartGovAI consists of the following sequential steps:

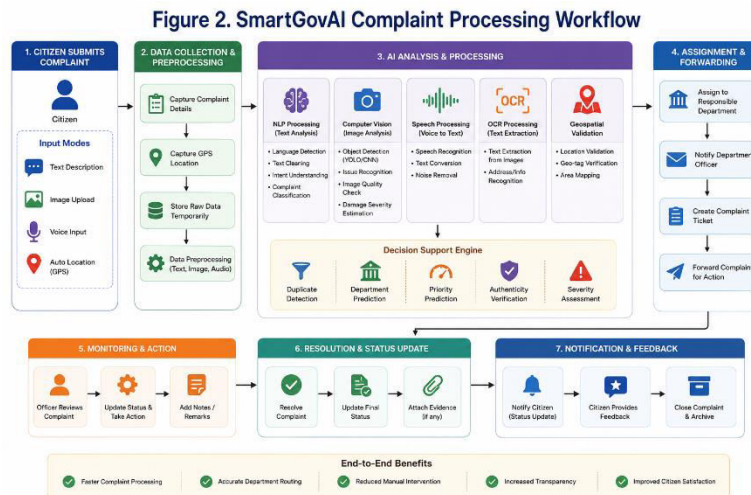
1. Citizen submits a complaint through the web or mobile application.
2. Complaint details, images, voice input, and GPS location are collected.
3. AI modules preprocess and analyze the complaint.
4. The complaint category and responsible department are identified.
5. Image verification, duplicate detection, and priority estimation are performed.
6. The verified complaint is assigned to the concerned municipal department.
7. Officers update the complaint status until resolution.
8. Citizens receive notifications and can provide feedback after completion.



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Figure 2. SmartGovAI Complaint Processing Workflow



D. AI Modules

The SmartGovAI framework incorporates multiple AI modules to automate complaint analysis and verification.

• Complaint Classification Module

Analyzes multilingual complaint descriptions and predicts the appropriate complaint category using a fine-tuned NLP model.

• Image Verification Module

Validates uploaded images and identifies civic infrastructure issues using Computer Vision techniques.

• Voice Processing Module

Converts spoken complaints into text using speech recognition for further analysis.

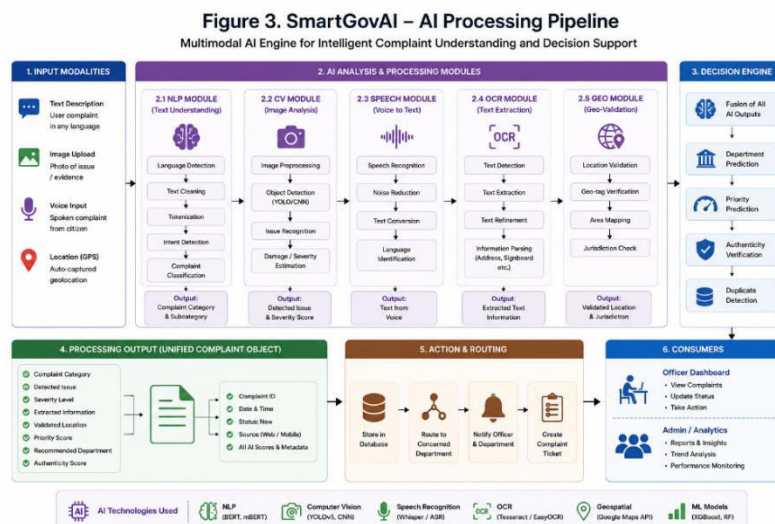
• OCR Module

Extracts textual information such as addresses, signboards, or landmarks from uploaded images.

• Decision Support Module

Automatically determines the responsible department, predicts complaint priority, and assists municipal authorities in efficient complaint routing.

Figure 3. SmartGovAI - AI Processing Pipeline





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E. Proposed Algorithm

Algorithm 1: SmartGovAI Complaint Processing

Input: Complaint (Text/Image/Voice), GPS Location

Output: Verified Complaint assigned to the concerned department

1. Receive complaint from citizen.
2. Validate user authentication.
3. Collect complaint text, image, voice, and location.
4. Preprocess complaint data.
5. Perform multilingual complaint classification.
6. Verify uploaded image and detect infrastructure issue.
7. Extract text using OCR (if applicable).
8. Detect duplicate and fake complaints.
9. Predict complaint priority.
10. Identify the responsible municipal department.
11. Store complaint in the database.
12. Forward complaint to the officer dashboard.
13. Update complaint status until resolution.
14. Notify the citizen.

IV. RESULTS AND DISCUSSION

The proposed **SmartGovAI** prototype demonstrates the practical implementation of an intelligent public complaint management system through a web application and mobile application. The developed interfaces enable citizens to register complaints, upload supporting images, capture GPS location, and monitor complaint status. The prototype validates the feasibility of integrating multimodal Artificial Intelligence into a unified public grievance platform.

A. Prototype Implementation

The SmartGovAI prototype has been developed as a web and mobile-based application to demonstrate the feasibility of the proposed framework. The current implementation supports user authentication, complaint registration, multimedia uploads, GPS-based location capture, and complaint tracking. Backend integration and AI module deployment are currently in progress and will be incorporated in subsequent development phases.

B. System Validation

The design of the prototype implementation is based on the SmartGovAI architecture as described above in Figure 1. The complaint management process depicted in Figure 2 represents the entire process lifecycle from the submission of complaints up to their settlement. The AI Process Pipeline, depicted in Figure 3, is an example of how various AI modules cooperate for complaint analysis and decision-making processes.

C. Comparative Analysis

Table II. Comparison of Existing Systems and SmartGovAI

Feature	Existing Systems	SmartGovAI
Multilingual Support	Limited	✓
Image-based Complaint	Partial	✓
Voice Complaint	✗	✓
AI Complaint Classification	Partial	✓
Automatic Department Allocation	Limited	✓
Duplicate Detection	✗	✓



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Feature	Existing Systems	SmartGovAI
GPS Integration	Partial	✓
Complaint Priority Prediction	X	✓

As can be seen from the comparison, SmartGovAI incorporates various AI features in one platform, thus solving the problem of shortcomings in traditional complaint management systems. The system consists of several components: multilingual capability, multimodal complaints handling, verification process, and decision-making process.

D. Discussion

This prototype proves the potential of incorporating web-based technology, mobile apps, and artificial intelligence in a single complaint management system. With its modular structure, it is possible to incorporate more advanced AI algorithms and analytical tools in the future. The current implementation establishes a strong foundation for the experimental evaluation and performance analysis planned in future work.

V. CONCLUSION

This paper presented SmartGovAI, a multimodal Artificial Intelligence framework for intelligent public complaint management and smart city governance. The suggested model employs Natural Language Processing, Computer Vision, Optical Character Recognition, speech recognition, and geospatial intelligence technologies for automating the processes of complaint classification, verification, assigning complaints to concerned departments, and prediction of priorities. The usage of multiple input means including text, pictures, and speech makes the framework more accessible to users.

A prototype implementation consisting of web and mobile applications demonstrates the feasibility of the proposed architecture and validates the overall complaint management workflow. The modular design enables seamless integration of AI services and provides a scalable foundation for future smart city applications.

Future work will focus on completing backend integration, deploying fine-tuned AI models for complaint analysis and image verification, implementing officer and analytics dashboards, and evaluating the framework using real-world municipal complaint datasets. The proposed SmartGovAI framework aims to improve the efficiency, transparency, and reliability of public grievance management while contributing towards intelligent and citizen-centric smart city governance.

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