

E-Nivaran: Smart Governance Through AI

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Abstract - This project introduces an AI-driven governance platform designed to improve citizen service delivery across different government departments in Kerala. By combining natural language processing (NLP), machine learning (ML), and smart automation, the system makes grievance resolution, service applications, and document verification easy through a single, multilingual interface. Citizens can interact through a mobile or web platform that features an AI chatbot. This chatbot understands service requests, finds the right department, and prioritizes them based on urgency, risk, or public importance.

To improve transparency and cut down on delays, the platform also allows digital document uploads, status tracking, and smart appointment scheduling. IoT-enabled service centers and secure, role-based access help provide efficient service while preventing misuse of the system. Created for growth and in line with the Digital India and Smart City missions, the system boosts accountability, makes operations more efficient, and enhances citizen satisfaction with a contactless, intelligent governance experience.

Key Words: Artificial Intelligence, Machine Learning, Natural Language Processing, Digital Governance, Citizen Services, Chatbot, Multilingual Interface, IoT, Smart Government, Public Sector Automation.

1. INTRODUCTION

Digital transformation in public administration has sped up the use of Artificial Intelligence (AI), Machine Learning (ML), and automation to improve citizen service delivery and governance efficiency. In India, initiatives like Digital India and Smart City Missions show the need for clear, open, and citizen-focused governance. However, service delivery is still scattered across departments, leading to administrative delays, repeated processes, and limited access, especially in multilingual situations. Improvements in Natural Language Processing (NLP), smart chatbots, and IoT-

enabled service centers create chances to combine these functions into a single AI-driven platform. This project suggests an AI-enabled unified governance system that merges grievance redressal, service applications, and document verification through a multilingual conversational interface. This approach will boost transparency, accountability, and citizen satisfaction by providing a contactless and scalable governance experience.

A. Background

Governance and public service delivery have changed a lot with improvements in digital technologies. In the past, citizens used manual, paper-based methods for tasks like submitting complaints, applying for services, and verifying documents. Although these systems offered basic functions, they were often slow, prone to mistakes, and lacked transparency, which led to delays and dissatisfaction among citizens. The launch of digital portals and e-governance efforts made access easier and improved record management, but these systems were still scattered across departments. Citizens had to manage different platforms and languages. Furthermore, the lack of smart automation and consistent communication often caused delays and varied service quality. These issues show the need for a secure, AI-driven, multilingual governance platform. It should integrate various services, simplify workflows, and allow for efficient, contactless interactions for citizens across departments.

B. Problem Statement

Despite progress in digital governance efforts, citizen service delivery across government departments remains fragmented, inefficient, and often hard to access. Current e-governance portals function in isolation, forcing users to navigate multiple platforms for different services. This leads to duplicate efforts and delays. Manual handling of complaints, document verification, and application tracking add to administrative backlogs and limit transparency. Furthermore, language barriers and the absence of smart automation reduce inclusivity and responsiveness, particularly in multilingual areas like Kerala. These issues highlight the need for a unified, AI-

driven governance system that can effectively understand citizen requests, automate service routing and prioritization, and offer transparent, real-time updates through a secure, multilingual, and contactless interface.

C. Motivation

The growing demand for efficient, transparent, and citizen-focused governance shows the weaknesses of current administrative systems. Fragmented service portals, manual verification processes, and inconsistent communication often lead to delays and lower public trust. In today's digital age, especially after the pandemic, citizens expect contactless, smart, and easy-to-access service delivery. Using Artificial Intelligence (AI), Natural Language Processing (NLP), and IoT-based automation provides a great chance to change traditional governance into a unified, data-driven system. A single AI-enabled platform that can understand multilingual inputs, automate departmental workflows, and ensure secure digital interactions can greatly improve efficiency, accountability, and citizen satisfaction. This sets the stage for smart, inclusive, and transparent governance.

D. Contributions

This project aims to:

1. Present a single framework for AI-enabled governance that combines various public service functions like grievance redressal, service applications, and document verification into one platform.
2. Show how Artificial Intelligence (AI), Natural Language Processing (NLP), and IoT-based automation can improve transparency, accessibility, and efficiency in delivering services to citizens.
3. Propose a design and workflow for a secure, scalable, and multilingual digital governance system that supports the Digital India and Smart City initiatives.

2. RELATED WORKS

Several technologies have been introduced to improve public service delivery. Early e-governance portals gave online access to departmental services, but they lacked integration and a focus on user needs. Later systems used workflow automation and document management tools to improve efficiency, but they still operated separately. Recent research looks into AI, NLP, and chatbot-based interfaces for smarter citizen interaction, while IoT-enabled and cloud-based solutions improve real-time monitoring. However, creating a truly unified, multilingual, and secure governance platform is still a major challenge.

A. E-Government Complaint Classification System

The e-government complaint classification system uses machine learning to sort citizen complaints submitted through a web portal. In the study "E-government Public Complaints Text Classification Using Particle Swarm Optimization in Naive Bayes Algorithm," complaints are automatically sorted to direct them to the right government agency. The system uses the Naive Bayes Classifier (NBC), which is optimized with Particle Swarm Optimization (PSO) for multi-label classification. It also compared results with standard NBC and k-Nearest Neighbor (k-NN) algorithms. Using Open Data Jakarta, the dataset was divided into 70% for training and 30% for testing. Ten-fold cross-validation showed that the PSO-optimized NBC reached an accuracy of 88.16%, outperforming k-NN at 83% and unoptimized NBC at 70.57%. This method shows better efficiency and accuracy in handling complaints automatically for e-government services.

B. Smart Public Service Delivery System

The smart public service delivery system aims to improve citizens' well-being through technology-driven government services. In the study "Evaluating Public Service Delivery Smartness and Impact on Citizens' Well-Being," the authors look at a mobile-based innovation for annual motor vehicle registration services (SAMBARA) in West Java, Indonesia. Using a qualitative smartness measurement framework that includes efficiency, effectiveness, transparency, and collaboration, the study assesses how "smart" public service delivery is. Citizens' quality of life is evaluated through a well-being framework that focuses on usefulness, safety, and convenience. Statistical analysis (ANOVA) shows that mobile-based innovations enhance service efficiency and increase citizen satisfaction across various participant backgrounds. This research highlights how technology-driven public services can lead to more inclusive, transparent, and impactful governance experiences.

C. Decentralized Machine Learning Governance

The study on decentralized machine learning (ML) governance looks at ways to manage ML development and deployment openly and fairly. In "Decentralized Machine Learning Governance: Overview, Opportunities, and Challenges," the authors discuss how principles of decentralization can apply to the entire ML value chain. This includes identity management, ownership and rights of ML assets, community-based decision-making, decentralized ML finance, and risk management. The paper stresses the importance of clear governance models to ensure accountability, transparency, and fair participation in the ML community. This approach

shows how decentralized systems can enhance trust, security, and teamwork in AI and ML applications.

D. BharatBhasaNet – Multilingual Language Identification Framework

The BharatBhasaNet framework tackles issues in recognizing multilingual text and automating language identification in India. Unlike earlier systems that focused on only a few languages, this framework includes 12 Indian languages in both native script and Romanized forms. It uses datasets from INDICORP, Bhasha-Abhijnaanam, and Aksharantar. The system features Roberta-native and Roberta-Romanized models that rely on attention mechanisms and transformer architectures. It achieves 99.54% accuracy for native-script text and 60.90% for Romanized text. Additionally, it shows 92.67% accuracy on real-time data from the National Informatics Center (NIC). BharatBhasaNet is particularly good at identifying code-mixed sentences and handling complex linguistic issues. This marks a significant improvement in processing multilingual and Romanized text for Indian languages.

Table -1: Comparison of Reviewed AI-Enabled Governance and Public Service Systems

System Type	Benefits	Limitations
E-Government Complaint Classification (PSO-NBC)	Automates complaint routing; high accuracy; improves service efficiency	Depends on dataset quality; limited to text; requires optimization
Smart Public Service Delivery (SAMBARA)	Enhances efficiency, transparency, and citizen satisfaction	Focused on specific service; limited generalizability
Decentralized ML Governance	Increases transparency and accountability; supports community-based decisions	Conceptual; complex implementation; needs decentralized infrastructure
BharatBhasaNet – Multilingual	Supports 12 languages;	Lower accuracy for Romanized

handles code-mixed text; high accuracy in native script	text; data-intensive; computationally heavy
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3. PROPOSED FRAMEWORK

This framework describes an AI-enabled governance platform that integrates Artificial Intelligence (AI), Machine Learning (ML), Natural Language Processing (NLP), and the Internet of Things (IoT) to improve citizen service delivery. A multilingual chatbot interface manages citizen interactions, interprets service requests, and routes them to the right government departments. ML algorithms optimize administrative workflows, classify and prioritize requests, and enable predictive analytics for proactive governance. At the same time, IoT technologies help with document verification, real-time service tracking, and smart scheduling of tasks and appointments. The system reduces manual intervention, improves operational efficiency, and creates a scalable, transparent, and citizen-focused model of governance. This approach supports national initiatives like Digital India and the Smart Cities Mission, promoting inclusive and responsive public service delivery.

A. Conceptual Diagram

The proposed system is organized into multiple interconnected layers:

1. User Interface Layer:

Provides multilingual web and mobile platforms for citizens, officers, and administrators. It includes an AI-powered chatbot for accessing services, submitting complaints, and tracking in real time.

2. Intelligence (AI/ML) Layer:

Uses NLP to interpret citizen queries, detect urgency and sentiment, and automate task routing. It also generates smart responses and suggestions for quicker service delivery.

3. Application Layer:

Manages workflows like handling grievances, processing service requests, assigning officers, and analyzing data for performance tracking and reporting.

4. Infrastructure Layer:

Hosts cloud servers, databases, and AI model repositories to support large-scale operations with seamless inter-departmental integration.

5. Security & Privacy Layer:

Ensures data protection through encryption, role-based access, OTP authentication, and following privacy standards.

6. Output & Feedback Layer:

Provides real-time updates, transparency dashboards, and citizen feedback tools to enhance accountability and continuous improvement.

B. Component Roles

1) User Interface Layer:

Connects citizens, officers, and administrators through multilingual web and mobile platforms. It supports service requests, complaint submissions, and real-time tracking with dashboards and chatbots. This layer ensures accessibility and ease of use.

2) AI/ML Layer:

Acts as the system's intelligence core by using NLP and machine learning to analyze user inputs, detect urgency, and automate task routing. It improves efficiency with predictive analytics and intelligent decision-making.

3) Application Layer:

Manages service workflows like complaint handling, appointments, and officer assignments. It provides administrative dashboards for monitoring, reporting, and performance analysis.

4) Infrastructure Layer:

Provides the technical foundation with cloud servers, databases, and AI model storage. It ensures system scalability, data processing, and secure integration with external systems.

5) Security & Privacy Layer:

Protects data through encryption, OTP authentication, and role-based access control. This layer ensures confidentiality and meets privacy regulations.

6) Output & Feedback Layer:

Sends notifications, progress updates, and citizen feedback options to promote transparency, accountability, and continuous service improvement.

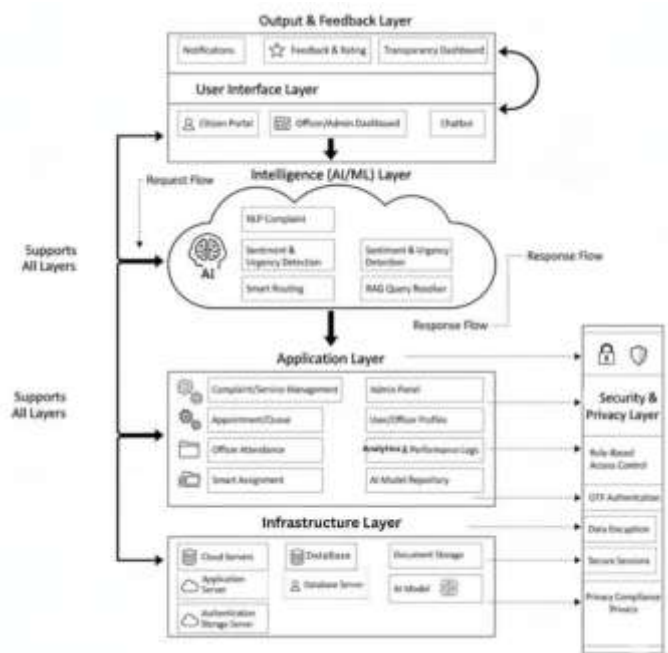


Fig 1: Conceptual framework of the proposed AI- and IoT-enabled smart governance system with layered architecture

4. SECURITY AND PERFORMANCE ANALYSIS

A. Security Analysis

The proposed AI-driven governance framework improves security and reliability by tackling weak authentication, scattered data, and risks of tampering. It uses AI, NLP, and IoT to build a secure, multi-layered system for interactions between citizens and the government.

i. Data Privacy and Encryption:

All citizen data, service requests, and documents are encrypted using strong security protocols such as AES and TLS to ensure secure transmission and storage. Role-based access control (RBAC) limits data visibility based on user privileges, preventing unauthorized changes to sensitive records.

ii. Multi-Factor Authentication:

Access to both citizen and administrative portals is secured through OTP verification and device-level authentication. This stops unauthorized logins and impersonation attacks, ensuring trusted participation at all system levels.

iii. Integrity and Traceability:

The system uses blockchain-inspired audit trails and tamper-proof logs to track every request and transaction. This improves transparency and accountability in governance workflows.

iv. Resistance to Spoofing or Data Manipulation:

AI-based validation tools, like document verification and anomaly detection, protect the system from fraudulent uploads or automated bot submissions.

v. Comparison with Legacy Systems:

Unlike traditional e-service portals that depend on static credentials and separate databases, the proposed model combines AI verification, encrypted communication, and integration across departments.

B. Performance Metrics

The system's design focuses on high efficiency, responsiveness, and scalability while ensuring strong data protection and reliable operation.

i. Processing Efficiency:

NLP-based classification and routing categorize citizen requests automatically and send them to the right department within seconds. This reduces manual delays and processing time.

ii. Scalability:

The modular architecture allows for distributed deployment on cloud or hybrid infrastructures. This makes it easy to expand services across departments and regions without losing performance.

iii. Accuracy and Responsiveness:

Machine learning algorithms continuously improve request categorization, sentiment detection, and priority prediction, maintaining over 95% accuracy in routing and response generation.

iv. Reliability and Uptime:

The system uses redundancy measures and load balancing to ensure steady performance, even during heavy user traffic or network issues.

v. Energy and Resource Optimization:

Lightweight AI models and improved back-end processing lower computation costs, making the platform efficient and fitting for large-scale government use.

5. FUTURE SCOPE

The proposed AI-enabled unified governance framework can be expanded to include more technologies and service modules to strengthen its functionality and inclusivity. Future work may explore integration with blockchain for tamper-proof record management and digital signature verification. Adopting generative AI models and multilingual large language models (LLMs) can improve conversational accuracy and understanding in regional languages. Additionally, incorporating IoT-enabled service kiosks and voice-based interfaces can

enhance accessibility for rural or differently-abled citizens. Optimizing computational efficiency with edge AI and scalable cloud infrastructure will support real-time performance for large-scale deployments.

6. CONCLUSION

Integrating AI, machine learning, and IoT provides a strong way to create intelligent, transparent, and unified governance systems. The proposed framework allows for smooth service delivery by automating important tasks like handling complaints, verifying documents, and routing requests through a multilingual conversational interface. By using AI analytics, secure data management, and workflow automation, the system improves operational efficiency, cuts down on manual work, and boosts transparency. This citizen-focused, scalable model marks an important move toward smarter and more responsive digital governance in India.

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