

Development of AI-Powered Chatbots for Enhancing E-Governance Services: SARTHI

Chhaganlal^{1,*} and Madhur Shrivastava²

¹⁻²Dr. Preeti Global University, Shivpuri - 473665, M.P. India

*Corresponding Author: Chhaganlal, Email: chhaganlal.pgu@gmail.com

Received: 17/07/2026; Revised: 25/08/2026; Accepted: 19/09/2026; Published: 30/09/2026.

DOI: <https://doi.org/10.69996/fmep.2026023>.

Abstract: Artificial Intelligence (AI)-powered chatbots are transforming the delivery of e-governance services by improving citizen engagement, accessibility, and administrative efficiency. This research paper presents the design, development, and evaluation of an AI-powered e-governance chatbot named “SARTHI.” The proposed chatbot integrates Natural Language Processing (NLP), Machine Learning (ML), and cloud-based digital governance infrastructure to provide real-time responses to citizen queries related to public services, certificates, taxation, welfare schemes, grievance redressal, and municipal administration. The study investigates how AI-driven conversational agents can reduce response time, improve transparency, and increase citizen satisfaction within digital governance ecosystems. A mixed-method research methodology involving system architecture development, user interaction analysis, and performance evaluation was adopted. Experimental findings demonstrate that the SARTHI chatbot achieved an average response accuracy of 93.2%, reduced administrative workload by 61%, and significantly improved service accessibility for rural and urban users. The study also highlights challenges related to multilingual communication, cybersecurity, ethical AI, and data privacy in e-governance systems. The results indicate that AI-powered chatbots can become an effective digital governance tool for smart cities and public administration. The proposed framework contributes toward scalable, intelligent, and citizen-centric governance systems aligned with Digital India initiatives.

Keywords: Artificial Intelligence, E-Governance, Chatbot, Natural Language Processing, Smart Governance, Digital India, Machine Learning, SARTHI.

1. Introduction

The rapid evolution of Information and Communication Technology (ICT) has transformed the operational framework of governance systems across the world. Governments are increasingly adopting digital technologies to enhance transparency, accountability, responsiveness, and accessibility of public services. E-governance refers to the application of ICT tools in governmental operations for improving interactions between government agencies, citizens, businesses, and employees [1-5].

Despite the advancements in digital governance, several challenges remain unresolved, including delayed responses, complex service procedures, excessive paperwork, inadequate citizen support systems, and limited accessibility for rural populations. Artificial Intelligence (AI) offers promising solutions to address these limitations through intelligent automation and conversational systems [6-15].

AI-powered chatbots are software applications capable of interacting with users using natural language. These systems simulate human conversation through Natural Language Processing (NLP), Machine Learning (ML), and deep learning algorithms. Chatbots have become increasingly important in customer service, healthcare, banking, education, and public administration [16-27].



The proposed chatbot “SARTHI” is designed as an AI-enabled virtual assistant for e-governance services. SARTHI aims to simplify interactions between citizens and government departments by offering real-time information, multilingual support, automated grievance handling, and 24×7 service availability.

The major objectives of this research are:

1. To design an AI-powered chatbot framework for e-governance.
2. To integrate NLP and ML techniques for intelligent citizen interaction.
3. To evaluate chatbot performance in terms of response accuracy and user satisfaction.
4. To analyze the impact of AI chatbots on governance efficiency and transparency.
5. To identify challenges and future opportunities in AI-enabled governance systems.

2. Literature Review

The concept of digital governance emerged during the early development of internet technologies. Initially, government portals provided static information, but recent advancements have enabled dynamic and intelligent citizen interaction systems.

Early chatbot systems such as ELIZA demonstrated the feasibility of automated conversation systems. With the advancement of AI and NLP, chatbots evolved into intelligent conversational agents capable of contextual understanding.

Research by Weizenbaum (1966) introduced the first rule-based chatbot model. During the 1990s, Artificial Intelligence applications in public administration gained momentum. The emergence of machine learning techniques improved the ability of chatbots to process user queries efficiently.

Luo et al. (2019) discussed the role of AI in smart governance and emphasized the integration of conversational systems for digital public services. Adamopoulou and Moussiades (2020) classified chatbots into rule-based, AI-based, and hybrid systems and highlighted their growing significance in public service delivery.

Several countries including Estonia, Singapore, India, and the United Kingdom have adopted AI-based governance tools. India’s Digital India mission accelerated the development of citizen-centric e-governance platforms such as UMANG, DigiLocker, and AI-enabled grievance systems.

Recent studies demonstrate that chatbot systems significantly reduce waiting time and improve service accessibility. However, challenges related to multilingual processing, ethical AI implementation, and cybersecurity remain significant concerns.

Table 1: Summary of Previous Research Studies

Author	Year	Research Focus	Key Findings
Weizenbaum	1966	ELIZA chatbot	Introduced rule-based conversational systems
Luger & Sellen	2016	Human-chatbot interaction	Improved user engagement with conversational AI
Luo et al.	2019	AI in governance	AI improves governance efficiency
Adamopoulou & Moussiades	2020	Chatbot classification	AI-based chatbots outperform rule-based systems
Gupta & Sharma	2021	E-governance chatbot	Reduced public service delays
Singh et al.	2022	NLP in governance	Enhanced multilingual communication
Khan et al.	2023	Smart governance systems	Improved citizen satisfaction and transparency

3. Methodology

3.1 Research Design

The research follows a mixed-method approach combining quantitative system performance analysis and qualitative user satisfaction evaluation.

The study includes:

- Requirement analysis
- Chatbot architecture design
- Dataset preparation
- NLP model training
- System integration
- Performance evaluation

3.2 System Architecture

The SARTHI chatbot architecture consists of five major layers:

1. User Interaction Layer
2. NLP Processing Layer
3. AI Decision Engine
4. Government Database Integration Layer
5. Response Delivery Layer

3.3 Dataset Preparation

The dataset includes citizen queries collected from:

- Government service portals
- Public grievance systems
- Citizen support centers
- Municipal service requests

Table 2: Dataset Distribution

Category	Number of Queries
Certificates	4,200
Tax Services	3,100
Welfare Schemes	2,850
Complaints & Grievances	3,950
Health Services	2,100
Education Services	1,850
Others	2,450

Total dataset size: 20,500 queries.

3.4 Machine Learning Algorithms

The following algorithms were implemented:

- Naive Bayes
- Support Vector Machine (SVM)
- Long Short-Term Memory (LSTM)
- Bidirectional Encoder Representations from Transformers (BERT)

4. Implementation of SARTHI Chatbot

The SARTHI chatbot was developed using Python programming language with TensorFlow and NLP libraries.

Technologies Used

Table 3: Workflow of SARTHI Chatbot

Technology	Purpose
Python	Backend Development
TensorFlow	Deep Learning

Technology	Purpose
NLTK	NLP Processing
Flask	API Framework
MySQL	Database Management
Dialogflow	Conversational Interface
Cloud Computing	Deployment

5. Results and Discussion

5.1 Performance Analysis

The chatbot was tested with 5,000 real-time user queries.

Table 4: Performance Comparison of ML Algorithms

Algorithm	Accuracy (%)	Precision (%)	Recall (%)	F1-Score (%)
Naive Bayes	82.4	80.2	78.9	79.5
SVM	87.6	85.4	84.1	84.7
LSTM	91.8	90.6	89.8	90.2
BERT	93.2	92.4	91.9	92.1

The BERT-based model achieved the highest performance due to contextual understanding and semantic processing capabilities.

5.2 User Satisfaction Analysis

A survey involving 300 citizens was conducted.

Table 5: Citizen Satisfaction Survey

Parameter	Satisfaction (%)
Ease of Use	92
Response Speed	95
Information Accuracy	91
Accessibility	89
Overall Satisfaction	93

5.3 Reduction in Administrative Workload

Government officers reported a substantial reduction in repetitive query handling.

Table 6: Administrative Efficiency Improvement

Parameter	Before SARTHI	After SARTHI
Average Response Time	18 minutes	2.5 minutes
Daily Manual Queries	1,200	470
Citizen Waiting Time	High	Low
Operational Efficiency	Moderate	High

The deployment of SARTHI reduced administrative workload by approximately 61%.

5.4 Discussion

The findings reveal that AI-powered chatbots significantly improve governance efficiency and citizen engagement. The integration of NLP and machine learning enables accurate interpretation of user queries and real-time service delivery.

The multilingual capability of SARTHI enhances accessibility for diverse populations. Rural citizens benefited from voice-assisted communication and simplified information retrieval.

However, several challenges remain:

- Data privacy concerns
- AI bias and ethical governance
- Cybersecurity threats
- Limited internet accessibility in remote regions
- Requirement for continuous model training

Despite these limitations, AI-powered governance systems show strong potential for smart administration and digital transformation.

6. Advantages of AI-Powered Governance Chatbots

The major advantages of SARTHI include:

1. 24×7 citizen support services.
2. Reduced workload on government staff.
3. Faster grievance resolution.
4. Improved governance transparency.
5. Multilingual interaction capability.
6. Increased accessibility for differently-abled users.
7. Real-time information dissemination.
8. Enhanced citizen engagement.
9. Cost-effective public administration.
10. Improved data-driven governance.

7. Conclusion

This research presented the development and evaluation of an AI-powered chatbot named SARTHI for enhancing e-governance services. The proposed chatbot integrates Artificial Intelligence, Natural Language Processing, and machine learning techniques to provide intelligent citizen support services.

The experimental results demonstrated that the chatbot significantly improved service efficiency, reduced response time, enhanced citizen satisfaction, and minimized administrative workload. The BERT-based NLP model achieved the highest response accuracy of 93.2%.

The study confirms that AI-powered chatbots can play a transformative role in digital governance systems by enabling responsive, transparent, and accessible public administration. However, successful implementation requires robust cybersecurity measures, ethical AI frameworks, and continuous technological advancements.

The SARTHI framework contributes toward the realization of smart governance and Digital India objectives through intelligent citizen engagement platforms

Acknowledgment: Not Applicable.

Funding Statement: The author(s) received no specific funding for this study.

Conflicts of Interest: The authors declare no conflicts of interest to report regarding the present study

References

- [1] J. Weizenbaum, "ELIZA—A computer program for the study of natural language communication between man and machine," *Commun. ACM*, vol. 9, no. 1, pp. 36–45, 1966.
- [2] A. M. Turing, "Computing machinery and intelligence," *Mind*, vol. 59, no. 236, pp. 433–460, 1980.
- [3] T. Berners-Lee, "Information management: A proposal," *CERN*, Geneva, Switzerland, 1989.
- [4] T. Gruber, "A translation approach to portable ontology specifications," *Knowledge Acquisition*, vol. 5, no. 2, pp. 199–220, 1993.
- [5] P. Maes, "Agents that reduce work and information overload," *Commun. ACM*, vol. 37, no. 7, pp. 31–40, 1994.
- [6] T. H. Davenport, "Putting the enterprise into the enterprise system," *Harvard Bus. Rev.*, vol. 76, no. 4, pp. 121–131, 1998.
- [7] K. Layne and J. Lee, "Developing fully functional e-government," *Government Information Quarterly*, vol. 18, no. 2, pp. 122–136, 2001.

-
- [8] E. Hovy, "Natural language processing," *AI Mag.*, vol. 23, no. 4, pp. 15–21, 2002.
 - [9] P. T. Jaeger, "Deliberative democracy and the conceptual foundations of electronic government," *Government Information Quarterly*, vol. 22, no. 4, pp. 702–719, 2005.
 - [10] M. Al-Shboul, "Challenges and factors affecting e-government implementation," *J. Software Eng. Appl.*, vol. 1, no. 1, pp. 1–7, 2007.
 - [11] S. K. Sharma and J. N. D. Gupta, "Building blocks of an e-government framework," *Transforming Government: People, Process and Policy*, vol. 3, no. 1, pp. 20–35, 2009.
 - [12] WenFen Liu, Yijun Guo, and Jian Li, "5G Resource Allocation between Channels with Non-Linear Analysis to Construct Urban Smart Information Communication Technology (ICT)," *JCAI*, vol. 1, no. 1, pp. 54–65, 2023.
 - [13] M. Janssen, "Benefits, adoption barriers and myths of open data and open government," *Information Systems Management*, vol. 29, no. 4, pp. 258–268, 2011.
 - [14] B. Klievink and M. Janssen, "Developing multi-layer information infrastructures: The case of the Dutch public sector," *Government Information Quarterly*, vol. 31, no. 2, pp. 240–252, 2014.
 - [15] E. Luger and A. Sellen, "Like having a really bad PA: The gulf between user expectation and experience of conversational agents," in *Proc. CHI Conf. Human Factors Comput. Syst.*, pp. 5286–5297, 2016.
 - [16] Y. K. Dwivedi, "Artificial intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy," *Government Information Quarterly*, vol. 35, no. 4, pp. 503–509, 2018.
 - [17] Swara Snehit Patil, "Artificial Intelligence: A Way to Promote Innovation," *JSIHS*, vol. 2, no. 1, pp. 1–5, 2024.
 - [18] J. Devlin, "BERT: Pre-training of deep bidirectional transformers for language understanding," in *Proc. NAACL-HLT*, pp. 4171–4186, 2019.
 - [19] T. Q. Sun and R. Medaglia, "Mapping the challenges of artificial intelligence in the public sector: Evidence from public healthcare," *Government Information Quarterly*, vol. 36, no. 2, pp. 368–383, 2019.
 - [20] C. Luo, "Artificial intelligence in smart governance," *International Journal of Public Administration*, vol. 42, no. 7, pp. 557–567, 2019.
 - [21] E. Adamopoulou and L. Moussiades, "Chatbots: History, technology, and applications," *Machine Learning with Applications*, vol. 2, 2020.
 - [22] B. W. Wirtz, "Artificial intelligence and the public sector—Applications and challenges," *International Journal of Public Administration*, vol. 43, no. 7, pp. 596–615, 2020.
 - [23] A. Gupta and R. Sharma, "AI chatbot systems in e-governance," *Journal of Digital Governance*, vol. 14, no. 2, pp. 75–88, 2021.
 - [24] A. Haleem, "Artificial intelligence applications in industry and governance," *Materials Today: Proceedings*, vol. 46, pp. 10994–10999, 2021.
 - [25] P. Singh, "NLP-based multilingual governance systems," *International Journal of Information Management*, vol. 63, 2022.
 - [26] V. Kumar and R. Sinha, "Citizen-centric AI governance models," *Journal of E-Government Studies*, vol. 11, no. 3, pp. 188–201, 2022.
 - [27] M. Khan, "Smart governance using AI-powered conversational systems," *Smart Cities Journal*, vol. 5, no. 1, pp. 34–49, 2023.
-