Government Schemes Chatbot Using Machine Learning

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Abstract*: A Chatbots have emerged as powerful tools for addressing user queries in an automated, accurate, and efficient manner. Researchers have employed various soft computing techniques to make chatbots user-friendly, catering to a wide array of domains, from ordering food to providing financial assistance. However, there remains a significant gap in exploring the potential of chatbots in public administration-based services. This paper presents an in-depth exploration of artificial intelligence-based chatbots, their applications, challenges, architectures, and models, tracing their evolution from Turing Test and rule-based systems to advanced AI-based chatbots. Focusing on the intersection of AI and public administration, we propose a novel project: a Government Scheme Chatbot using Machine Learning. This project aims to harness the capabilities of AI-assisted chatbots to streamline access to government schemes and services. By leveraging machine learning algorithms, the chatbot will be trained to understand and respond to user inquiries regarding various government schemes, policies, and services. The project seeks to bridge the gap between citizens and government services, offering a user-friendly interface for accessing vital information and assistance. Through this project, we aim to demonstrate the immense potential of AI-assisted chatbot systems in enhancing governance and public administration services. By providing seamless access to information about government schemes and services, the chatbot can empower citizens, improve transparency, and facilitate better interaction between the government and its constituents. Overall, this project underscores the transformative role of machine learning-powered chatbots in advancing public administration and promoting citizen engagement.*

Keywords: Artificial Intelligence, Machine learning, Chatbot, Response, Query, Dataset, Html, CSS, JavaScript

I. INTRODUCTION

The relentless march of technological progress, fuelled by powerful hardware and sophisticated soft-computing techniques, has heralded a new era of AI-based services, reshaping industries worldwide. At the forefront of this revolution are advancements in deep learning and big data analytics, which have seamlessly integrated AI services into everyday applications, captivating the attention of researchers and innovators alike. Among these breakthroughs, chatbots empowered by artificial intelligence have emerged as indispensable tools, providing real-time information, personalized recommendations, and invaluable assistance across diverse domains.

In this document, we introduce a pioneering initiative: the design and implementation of a chatbot powered by machine learning, meticulously tailored to address inquiries and offer assistance regarding government schemes. Recognizing the importance of accessible and efficient access to government services, our project aims to leverage the capabilities of machine learning to develop a sophisticated chatbot interface specifically catered to the needs of citizens seeking information about government schemes, policies, and services.

By harnessing the power of machine learning algorithms, our chatbot will be adept at understanding and responding to user inquiries in natural language, offering personalized recommendations and guidance tailored to individual needs. Through this innovative approach, we seek to bridge the gap between citizens and government services, providing a seamless and user-friendly platform for accessing crucial information and assistance related to government schemes [6].

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DOI: 10.48175/IJARSCT-17664

ISSN
2581-9429
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This document outlines the design and architecture of our government scheme chatbot, detailing the underlying machine learning algorithms, data processing techniques, and user interface considerations. By harnessing the transformative potential of AI-powered chatbots, we aim to revolutionize the delivery of government services, fostering greater transparency, accessibility, and citizen engagement in the process [9].

II. RELATED WORKS

In recent years, there has been a significant surge of interest in the development of conversational agents and chatbots, particularly within the realm of e-governance. Researchers have explored various methodologies and technologies to enhance the performance and capabilities of these systems, aiming to improve citizen-government interactions and democratize access to government services and information [5].

Jayachandran et al. (Jan 2024) highlights the growing importance of chatbot technology in e-governance, emphasizing its role in facilitating access to financial services. They underscore the efficiency gains and user benefits achieved through the deployment of advanced chatbots like L&I MegaBot, showcasing their potential in improving citizen-government interactions [1].

Shreyas et al. (Jan 2024) introduce "Scheme Setu," a chatbot designed to democratize access to government financial assistance programs while promoting financial literacy and inclusivity. They emphasize the use of advanced NLP and machine learning models to ensure the accuracy and credibility of information provided by the chatbot [2].

Zeteng Lin (Nov 2023) explores the potential of Generative-AI, such as ChatGPT, in enhancing government affairs and citizen engagement. Challenges such as algorithm bias and data privacy are noted, suggesting the need for effective governance models and deeper exploration of public trust in chatbots [4].

Carvalho (2023) delves into AI's potential in enhancing citizen relationship management within government, proposing a framework for AI-based solutions in Portuguese local government. Interviews with decision-makers validate opportunities for process optimization, service modernization, and promotion of citizen engagement [5].

Krishna Kumar Nirala et al. (2022) survey the evolution and applications of AI-based chatbots, emphasizing their potential in public administration services. They categorize AI-based chatbots into customer-based and public administration-based services, highlighting their impact on enhancing governance [7].

Xu Fei Huang explored the design, architecture, and applications of chatbots, specifically focusing on their implementation within the University of Pennsylvania's School of Engineering and Applied Science. While a brief overview of related work isn't explicitly provided, it's common in academic papers to include a section discussing existing literature and research relevant to the topic. This likely involved examining prior studies, frameworks, and applications of chatbots in various domains to inform their own design and approach [8].

A conference paper (July 2020) discusses the integration of chatbots into e-Government systems, aiming to broaden access to government services through digital means. It highlights the success of chatbots in resolving queries efficiently, emphasizing their role as facilitators of efficient and accessible digital interactions within governmental contexts [11].

Sameera A. Abdul-Kader (2015) provides a foundational literature review on chatbot design techniques in speech conversation systems. It emphasizes the importance of NLP and intelligent response generation, as well as the significance of studying successful chatbots to identify effective design strategies for developing robust conversational agents [12].

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DOI: 10.48175/IJARSCT-17664

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2581-9429
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III. LITERATURE REVIEW

Reviews	NLP	Voice	AI	NN Mode	ML	RTS	Adaptive Bitrate	Future
Enhancing E-Governance through Advanced Chatbot Technology: A Case Study of L&I Mega Chatbot	-	✓	-	✓	-	✓	-	✓
Scheme Setu: A Chatbot for Government Schemes	✓	-	-	✓	-	-	✓	✓
How Generative-AI can be Effectively used in Government Chatbots	-	✓	✓	-	✓	✓	-	✓
Government Augmented Intelligence-The Use of AI to improve Citizen Relationship Management	-	-	-	✓	-	✓	-	✓
Citizen preferences and government chatbot social characteristics: Evidence from a discrete choice experiment	✓	-	-	✓	-	-	✓	✓
A survey on providing customer and public administration-based services using AI: chatbot	✓	-	-	✓	-	-	✓	✓
A Chatbot-based e-Services for e-Government	✓	-	-	✓	-	-	✓	✓
Survey on Chatbot Design Techniques in Speech Conversation Systems	✓	✓	-	✓	✓	-	✓	✓
An Intelligent Speech Recognition System for Education System	✓	✓	-	✓	✓	-	✓	✓

IV. HISTORY OF CHATBOT E-GOVERNANCE

The history of chatbot integration in e-governance has seen a notable evolution over the years. In the early 2000s, simple rule-based chatbots were first employed on government websites to address frequently asked questions and provide basic information. The landscape witnessed significant advancements in natural language processing and machine learning during the 2010s, leading to the development of more sophisticated chatbots capable of engaging in conversational interactions. Governments globally began incorporating chatbots into social media platforms, such as Facebook Messenger and Twitter, to offer citizens accessible and user-friendly information and services. Personal assistant chatbots emerged, enabling citizens to perform specific tasks, such as scheduling appointments and checking application statuses. Throughout the 2010s, various countries, including Singapore and the United States, implemented chatbot-driven e-governance projects to enhance citizen engagement. The COVID-19 pandemic further accelerated the adoption of chatbots for disseminating pandemic- related information and guiding citizens on government services. In recent years, the integration of artificial intelligence into chatbots has become more prevalent, allowing for more intelligent and context aware responses. Governments are now focusing on providing multilingual support and ensuring

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DOI: 10.48175/IJARSCT-17664

ISSN
2581-9429
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accessibility, making chatbots an integral part of e-governance strategies As technology continues to advance, chatbots are poised to play an increasingly crucial role in improving citizen services, accessibility, and overall engagement with government entities. Stay informed about the latest developments and case studies to understand the ongoing evolution of chatbot e-governance initiatives [1].

V. SYSTEM ARCHITECTURE

The system architecture is designed to facilitate user interaction with government schemes through a user-friendly interface, leveraging Natural Language Processing (NLP) techniques for query understanding. When a user submits a query, the system initiates a series of processes to comprehend the user's intent and retrieve relevant information. Initially, the text input undergoes tokenization, where it is broken down into individual words or phrases to extract meaningful tokens. This tokenization step enables the system to identify key elements in the user's query. Once the text is tokenized, the system employs a machine learning model trained on a comprehensive dataset encompassing various government schemes and related information. This model is trained to recognize patterns in the data and classify user queries into relevant categories or topics. To achieve this, the system may utilize advanced machine learning techniques, including deep learning algorithms, to enhance classification accuracy. After categorizing the user's query, the system accesses a JSON database containing pre-defined responses corresponding to each category or topic. These responses are meticulously curated to provide accurate and informative assistance to users regarding government schemes. The system retrieves the appropriate response from the database based on the classification of the user's query. Finally, the generated response is presented to the user through the user interface in a clear and understandable manner [1].
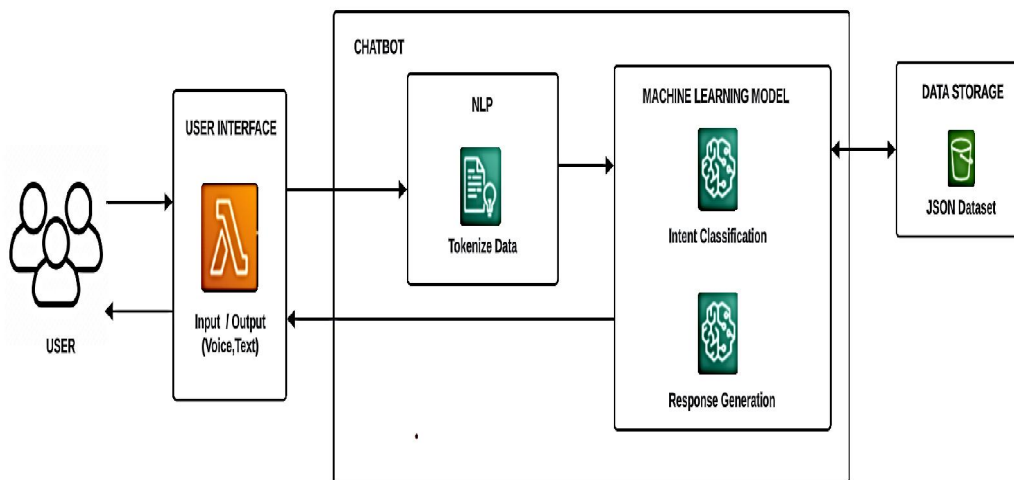

Fig. 1. System Architecture

VI. IMPLEMENTATION AND PERFORMANCE EVALUATION

Step 1: User Query Input and Tokenization. When a user submits a query to the chatbot, the input is received and processed. This involves breaking down the query into individual tokens and extracting relevant information from it. Tokenization aids in structuring the query data in a format that can be easily analyzed and interpreted by subsequent stages of the chatbot system.

Step 2: Query Classification using Machine Learning Model. Once the user query has been tokenized, it undergoes classification using a machine learning model. This model is trained to categorize queries into predefined categories or

topics, such as eligibility criteria, application procedures, or benefits of government schemes. Classification helps in organizing the queries efficiently and enables targeted response retrieval in the subsequent stage.

Step 3: Response Retrieval from JSON Database. Based on the categorized queries, the chatbot retrieves relevant responses from a JSON database containing comprehensive information about various government schemes. The database is structured to store scheme details, including eligibility criteria, application procedures, benefits, and frequently asked questions. By matching the categorized queries with the corresponding information in the database, the chatbot ensures that the responses provided are accurate and pertinent to the user's inquiry.

Step 4: Response Generation and Presentation completes the process. Using the retrieved information from the database, the chatbot generates tailored responses to the user's queries. These responses are formulated to address the specific query category and are presented to the user in a user-friendly format.

```
You :What is Hostel Scheme Eligibility
what is hostel scheme eligibility
1/1 [==============================] - 0s 24ms/step
TamilAI (Hostels_Special_Guides_Eligibility) : Eligibility criteria:
Income: --
Age: --
Community: --
Other Details: --
You :Hostels Sponsored by
hostels sponsored by
1/1 [==============================] - 0s 23ms/step
TamilAI (Hostels_Special_Guides_Sponsored) : Sponsored By: State
```
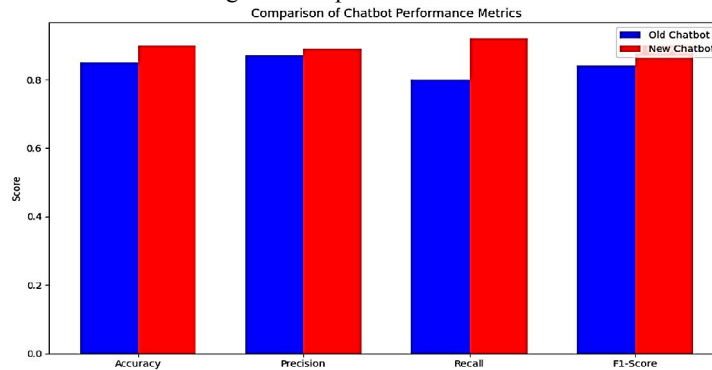
Fig. 2. Example of Conversation

Fig. 3. Performance Evaluation of Government Scheme Chatbot

VII. FLOWCHART

The flowchart diagram illustrates the process flow of the government scheme chatbot system. It begins with the user interacting with the chatbot interface, where they input their query regarding government schemes. The system then utilizes Natural Language Processing (NLP) techniques to understand and parse the user's query. The parsed text is tokenized to extract relevant keywords and phrases, which are then used to query a machine learning model. This model is trained on a dataset containing information about various government schemes and is capable of classifying user queries into specific categories or intents. Once the query is classified, the system retrieves pre-defined responses corresponding to the identified category from a JSON database. These responses are generated and presented to the user through the chatbot interface, providing assistance and information about the relevant government scheme. The flowchart ensures a structured and efficient interaction between the user and the chatbot, facilitating seamless access to government scheme details.
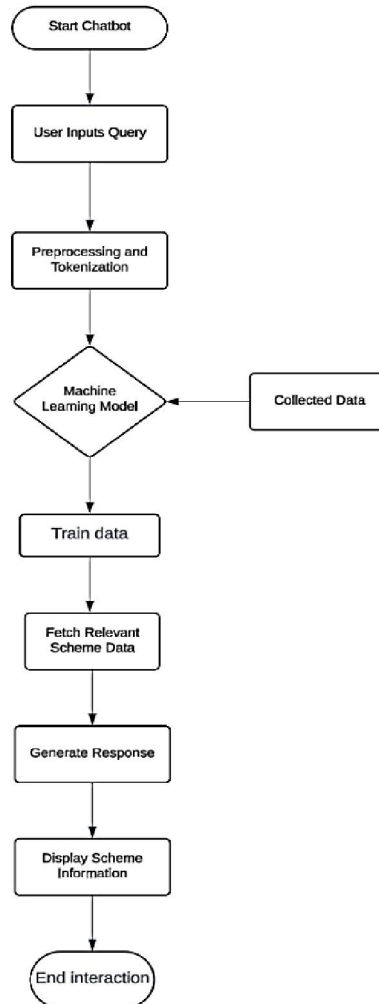
Fig. 4. Flowchart

VII. AUTHOR CONTRIBUTIONS

All Authors equally contributed in this work.

IX. FUTURE WORK

In future endeavors, we envision augmenting the chatbot's functionality with sophisticated features to enrich user interactions. To enhance understanding and responsiveness, we aim to integrate sentiment analysis, enabling the chatbot to discern user emotions and tailor responses accordingly, thereby fostering more empathetic interactions. Moreover, we seek to implement multi-turn dialogue handling capabilities, allowing the chatbot to engage in more dynamic and contextually relevant conversations, leading to smoother user experiences. Additionally, we aspire to introduce personalized recommendations, leveraging user data to offer tailored advice and suggestions, thus enhancing user satisfaction and engagement. Expanding the chatbot's reach, we plan to explore machine translation to support multiple languages, making government scheme information accessible to a broader audience. Furthermore, by incorporating external knowledge bases, we aim to enrich response generation with comprehensive and up-to-date information, further empowering users with valuable insights. To ensure resilience and adaptability, continual training on updated datasets and the adoption of reinforcement learning techniques will be pursued, enabling the chatbot to evolve and adapt to changing user needs and preferences over time. Chatbots are built on the latest and most efficient technologies available. As the landscape of e-governance continues to evolve, these forward-looking considerations hold the

potential to contribute significantly to the ongoing improvement and optimization of E-Governance Chatbots, ensuring their effectiveness, user-friendliness, and alignment with the dynamic needs of citizens [1].

X. CONCLUSION

In conclusion, the implementation of a government scheme chatbot stands as a pivotal advancement in enhancing citizen engagement, accessibility, and the efficiency of public service delivery. By harnessing the capabilities of artificial intelligence (AI), natural language processing (NLP), and voice recognition and synthesis technologies, these chatbots offer a transformative solution to address the evolving needs of citizens seeking information about government schemes.

Through AI-driven algorithms and NLP techniques, these chatbots adeptly interpret user queries, providing timely and personalized responses tailored to individual needs. This not only streamlines the process of accessing government services but also ensures that citizens receive accurate and relevant information promptly. Furthermore, by integrating voice recognition and synthesis, these chatbots offer an additional layer of accessibility, allowing users to interact with the system through speech input and receive spoken responses.

By serving as virtual assistants, these chatbots can guide users through the intricacies of various government schemes, simplifying complex procedures and fostering greater understanding among citizens. Ultimately, the integration of AI, NLP, voice recognition, and synthesis technologies into government scheme chatbots represents a significant step towards promoting transparency, efficiency, and inclusivity in public service delivery, ultimately empowering citizens to make informed decisions and actively participate in government initiatives.

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