(REVIEW ARTICLE)

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CitizenConnectBot(CCB): The interactive guide to government schemes

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Abstract

In the ever-evolving landscape of digital governance, the Generative CitizenConnectBot (CCB) emerges as a transformative tool, seamlessly bridging the gap between citizens and government schemes.The absence of real-time updates results in outdated information, undermining the effectiveness of the service. Moreover, the current translation feature limits the accessibility of scheme details for a diverse audience, creating barriers to understanding and participation. Additionally, the lack of a chatbot on schemes dissemination in the available websites complicates the process for citizens to obtain necessary information and determine eligibility, impeding their ability to benefit from available support.The CitizenConnectBot(CCB), integrated into a user-friendly website, acts as a comprehensive information hub, offering citizens tailored insights into various government initiatives.The bot's adaptability ensures that information is generated according to the unique requirements of each user.This paper employs natural language processing (NLP) techniques, including text classification with SVM, TF-IDF vectorization, regular expressions for pattern matching, and session management for maintaining conversation context.

Keywords: Chatbot; Digital Governance; Natural Language Processing; Government schemes; Intent Recognition

1. Introduction

Tamil Nadu, renowned for its progressive policies, has implemented numerous schemes aimed at fostering socio-economic development and welfare among its citizens. These initiatives encompass a diverse range of sectors, including healthcare, education, agriculture, and social welfare, with the overarching goal of improving the quality of life for its residents. Schemes such as the New Entrepreneur cum Enterprise Development Scheme (NEEDS), aimed at supporting first-generation entrepreneurs, and the Revolving Fund Scheme for Women's Self-Help Groups, empowering women through financial inclusion, exemplify the state government's commitment to addressing fundamental needs and ensuring equitable access to essential services.

In tandem with the state's dedication to public welfare, technological advancements have paved the way for innovative solutions to enhance accessibility and efficiency in delivering government services. Among these advancements, Support Vector Machines (SVMs) and Term Frequency-Inverse Document Frequency (TF-IDF) have emerged as powerful tools in the realm of natural language processing (NLP) and information retrieval.

Support Vector Machines (SVMs) are a class of machine learning algorithms utilized for classification and regression tasks. In the context of chatbots, SVMs excel in categorizing user queries into predefined intents or categories, thus enabling accurate and efficient handling of diverse user inputs. By identifying the underlying intent of user queries, SVMs facilitate streamlined interactions and enhance the overall user experience.

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Term Frequency-Inverse Document Frequency (TF-IDF), on the other hand, is a statistical technique used to evaluate the significance of terms within a corpus of documents. In the context of chatbots, TF-IDF serves as a pivotal tool for text processing and feature extraction. By analyzing the frequency of terms in user inputs and assessing their relevance across a corpus of scheme descriptions, TF-IDF enables the chatbot to extract pertinent information and provide tailored responses to user queries.

Combining the state's robust portfolio of government schemes with the power of SVMs and TF-IDF, we present the development and implementation of a novel chatbot tailored for facilitating access to Tamil Nadu's government schemes. This chatbot offers users two distinct query options: firstly, users can input a scheme name to receive a detailed description of the scheme, thus promoting awareness and understanding of government initiatives. Secondly, users can inquire about their eligibility for specific schemes by providing relevant information, receiving immediate feedback on their eligibility status. By employing this dual functionality, the chatbot streamlines information retrieval and eligibility assessment processes, enhancing user accessibility to government initiatives and fostering greater public engagement and empowerment.

This paper focuses on the implementation of advanced natural language processing (NLP) techniques within a conversational system for government scheme information retrieval. Leveraging Support Vector Machine (SVM) for text classification, the system effectively categorizes user queries. TF-IDF vectorization enhances text representation, aiding in accurate scheme identification. Additionally, regular expressions enable precise pattern matching for extracting scheme names from user input. The system also incorporates session management mechanisms to maintain contextual continuity during interactions. Through the integration of these NLP methodologies, the implemented system demonstrates robust capabilities in interpreting and responding to user inquiries regarding government schemes.

2. Literature Review

In the realm of government service consulting, there is a growing focus on leveraging big language models merged with knowledge bases [1] and fine-tuning models to enhance efficiency. Complementing this approach, research [2] offers valuable advice for government chatbot designers, delving into the consequences for policy while providing a theoretical framework for understanding interaction model design. Drawing from experiences with Evatalk [3], a chatbot for the Brazilian Virtual School of Government, a cyclic, human-supervised process is introduced in the suggested Chatbot Management Process. Meanwhile, [4] aims to assess the efficacy of rural Maharashtra programs designed to empower women in entrepreneurship. Additionally, efforts are underway in [5] to develop Arabic task-oriented dialogue systems utilizing Wit.ai to implement a hybrid approach for text-based flight booking.

Integrating chatbot adoption in public institutions with prior research [6] on chatbots across sectors and service delivery channels advances our understanding. Moreover, there's a focus on leveraging digital technology to enhance global government services [7], emphasizing trust-building through accessible smart services. Notably, a paper [8] introduces a chatbot facilitating user access to government data through natural language inquiries. Investigating citizen acceptance of e-government services [9], a study constructs an e-government adoption recommendation model. Furthermore, the significance of perceived usefulness and trust in e-government effectiveness is explored [10].

Highlighting the role of natural language in improving communication with information systems [11], KBot demonstrates enhanced usability and performance. Similarly, there's a focus on integrating machine learning and natural language understanding in interactive question answering [12]. Exploring citizen perceptions of open innovation in government services [13], a quantitative study finds positive opinions regarding innovation accessibility and policy effectiveness. Efforts are made to bridge traditional and digital channels [14] catering to citizen preferences for service complexity.

Examining the interactive internet services provided by the MOFA mGovernment to Saudi citizens and residents [15], and deploying chatbots for citizen services in a Japanese city office [16], demonstrates practical implementations. Combining data mining, machine learning, and natural language processing, new digital channels for citizen-government contact are established [17]. Leveraging openly accessible e-commerce data, SuperAgent offers customer support [18], while GovInfoBot integrates artificial intelligence with public information support [19]. Finally, SchemeSetu provides access to government-sponsored insurance and loans through a pioneering chatbot [20].

3. System Architecture

In this architecture, the user interacts with a chat interface, sending their query. This query is processed by the chatbot which utilizes natural language processing to understand the intent. The chatbot then retrieves information from a knowledge base or database, and finally delivers a response back to the user through the chat interface.
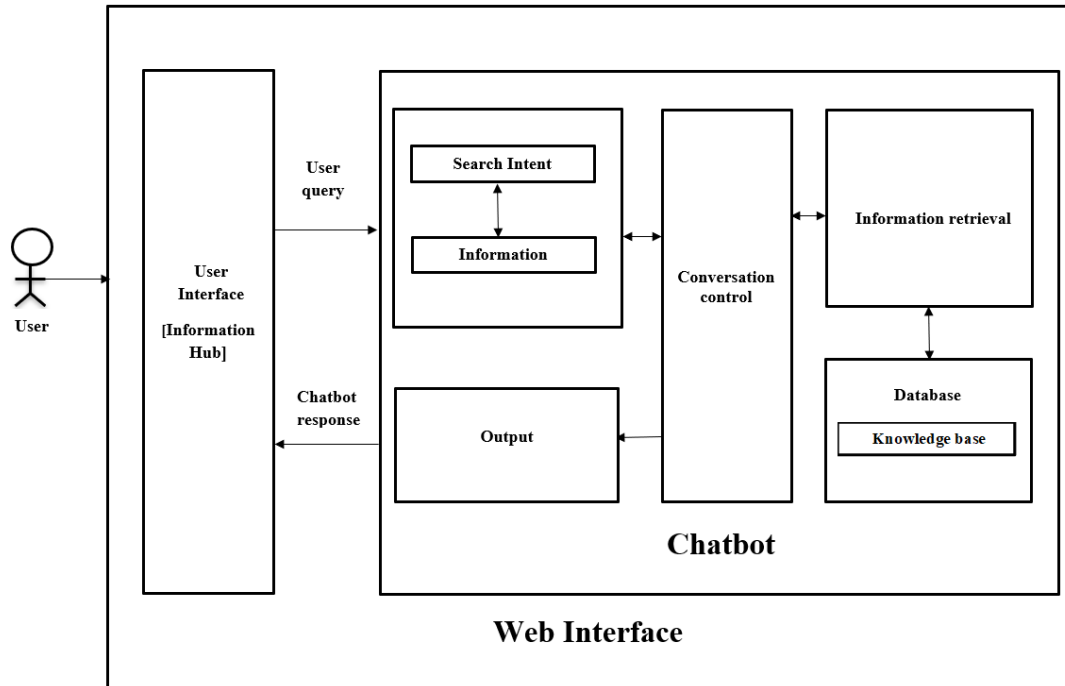

Figure 1 System Architecture

- User: This refers to the person interacting with the chatbot.
- Search Intent/Query: This is what the user types into the chat interface.
- Web Interface: This is the chat window where the user interacts with the chatbot. It can be embedded on a website or a separate application.
- User Interface (UI): This is where the conversation between the user and the chatbot is displayed.
- Information Retrieval: The Information Retrieval component accesses the knowledge base or database. It retrieves relevant information based on user queries. This process involves searching and accessing stored data. The retrieved information is then presented to the user. This component ensures efficient access to accurate and timely information.
- Information Control: This component manages the flow of information between the user interface, chatbot, and knowledge base.
- Chatbot: This is the core software program that powers the conversation between the user and the system. It interprets the user's query, retrieves information from the knowledge base or database, and generates a response.
- Knowledge Base: This is a repository of information that the chatbot can access to answer user queries. It can include text, code, or other data.
- Database: This is a storage location for the chatbot's data, such as user information, conversation history, and other relevant data.
- Output: This is the chatbot's response to the user's query, which is displayed in the chat interface.

The integration of voice input elements into the chatbot system enhances user engagement by facilitating seamless communication via spoken commands. This feature expands the area of accessibility by supporting users who have limited mobility or prefer voice-based interactions. Voice input makes the chatbot system more approachable and simple to use, opening up a range of interaction opportunities. This development aligns with current developments in natural language processing and human-computer interaction, thereby promoting a more engaging and inclusive user experience. The addition of text-to-speech capability to our chatbot system has greatly improved its accessibility and

usability. These innovative features harness the power of modern browser capabilities to transform text into clear, audible messages, ensuring that the information conveyed by the bot is easily comprehensible to all users.
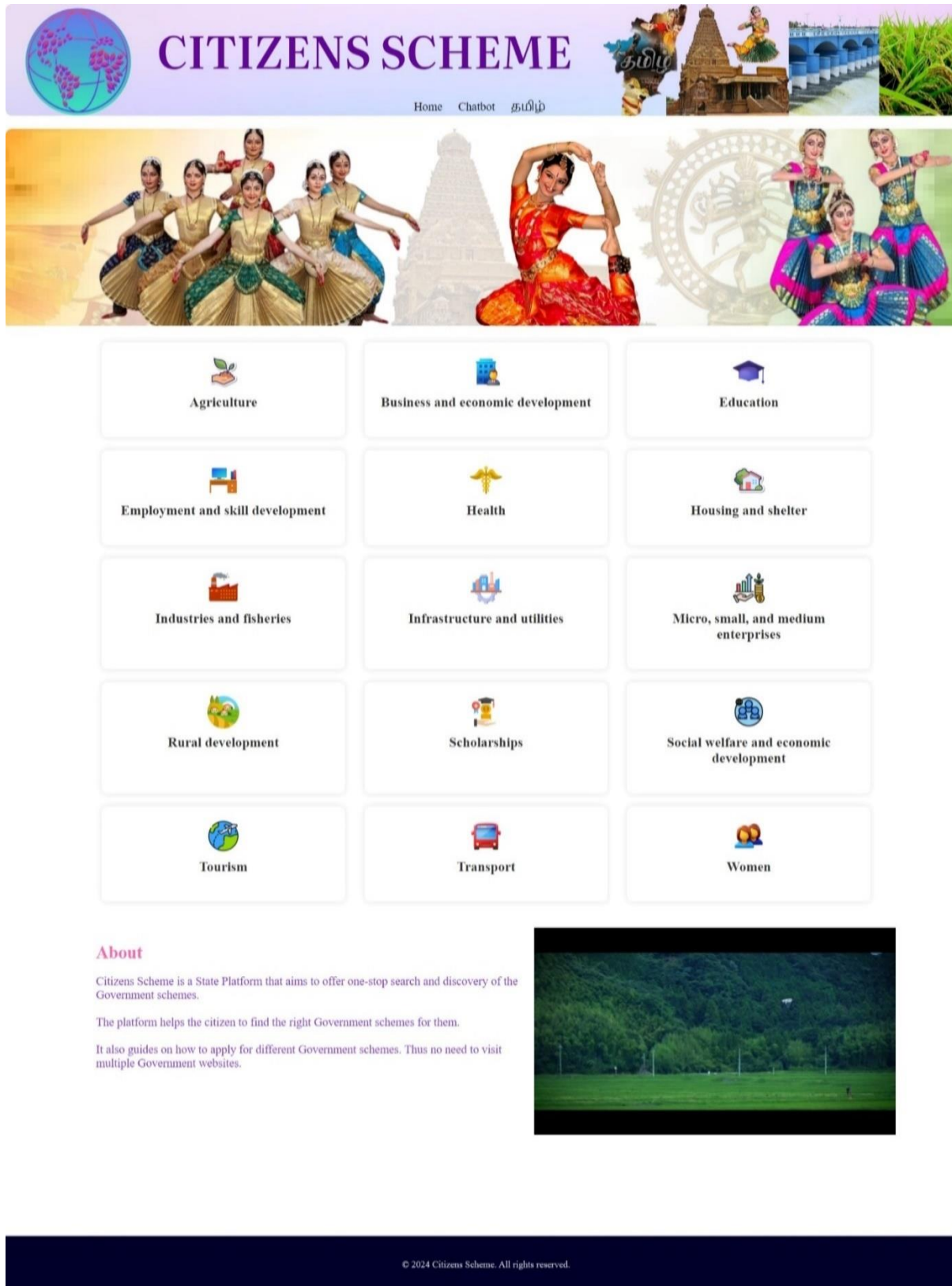
4. Results and Discussion

Figure 2 Citizens Scheme Website

Figure 3 Citizens Scheme Website in Tamil
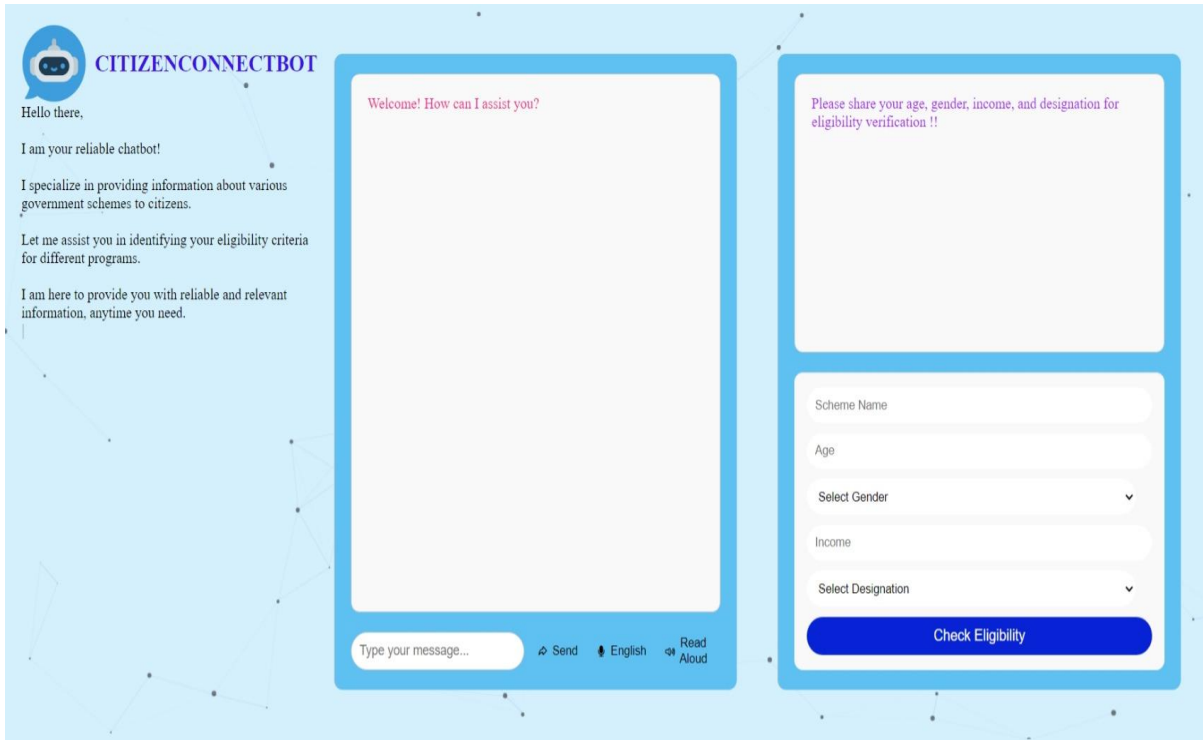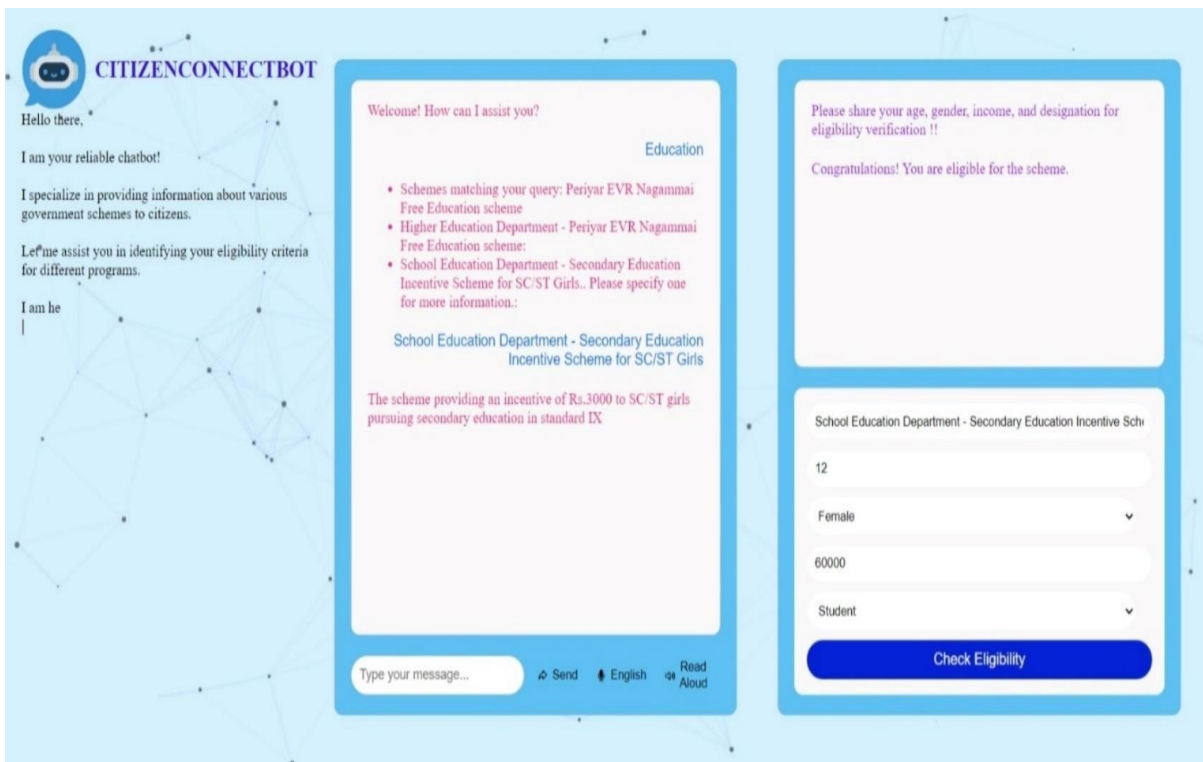
Figure 4 CitizenConnectBot

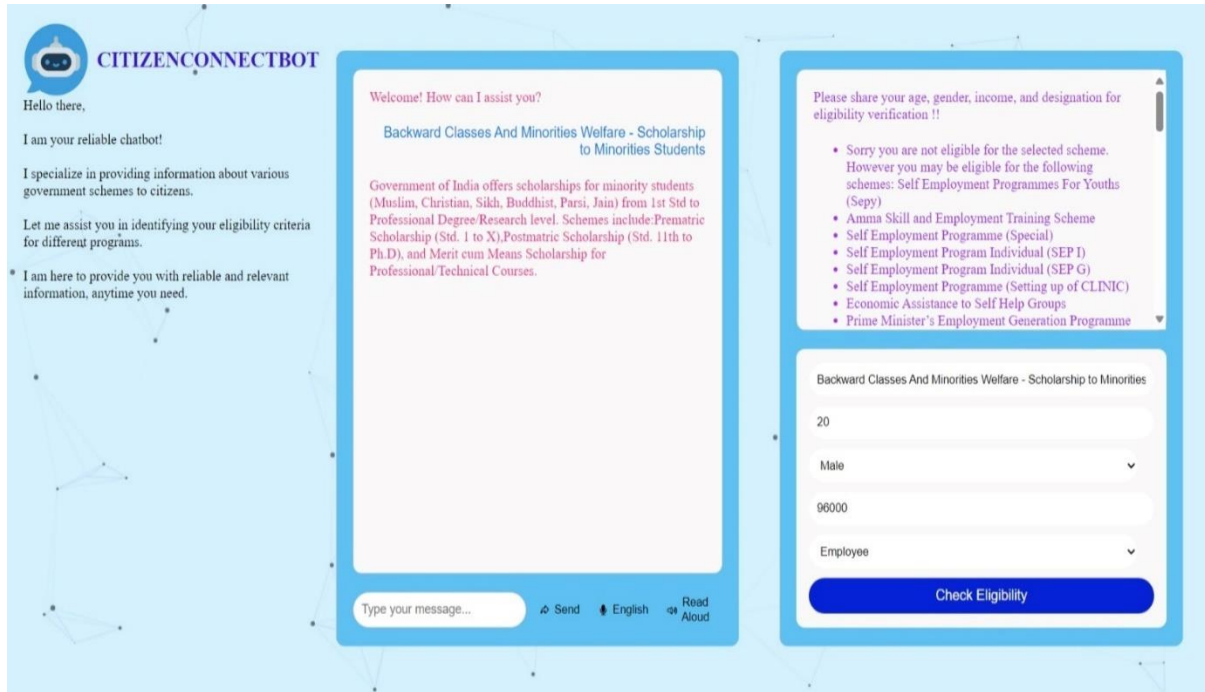**Figure 5** Retrieval of Scheme Description

Figure 6 Eligibility Check for Schemes

The developed website for government schemes successfully integrates dual-language support in English and Tamil, catering to a wider audience and enhancing accessibility for users who prefer either language. This bilingual capability ensures that users can access information about government schemes in their preferred language, thereby improving user engagement and satisfaction. Furthermore, the website provides comprehensive and detailed information about schemes across various government departments. By offering in-depth descriptions, eligibility criteria, application procedures, and benefits of each scheme, the website serves as a valuable resource for citizens seeking information about available programs and services. The detailed information enables users to make informed decisions and take advantage of relevant government initiatives effectively.

The implemented chatbot system successfully integrates various functionalities aimed at enhancing user experience and accessibility. The system incorporates text-to-speech (TTS) and speech recognition capabilities, allowing users to interact with the bot using voice commands. Additionally, it features a responsive and visually appealing user interface designed with HTML and CSS, ensuring optimal display across different devices. The information retrieval functionality enables the chatbot to provide accurate and relevant responses to user queries by accessing a knowledge base or database. This feature ensures that users receive timely and informative assistance, enhancing their overall satisfaction with the system. Additionally, the chatbot's ability to process eligibility criteria for government schemes adds a practical utility aspect to the system, making it a valuable tool for citizens seeking information about available programs and services.

5. Conclusion

A Generative CitizenConnectBot(CCB) serves as a comprehensive information resource on government schemes tailored to individual users based on their specific requirements by providing an intuitive interface. Leveraging advanced natural language processing capabilities, it engages users in dynamic conversations to understand their specific needs and demographics. By employing a combination of intent classification, entity extraction, and dialog management, the system can understand user intent, extract scheme names, and guide users through eligibility checks when necessary. Also by analyzing user input, the CCB generates relevant and up-to-date information about schemes, including eligibility criteria, application processes, and benefits according to the specific user requirements. However, there is room for improvement in terms of enhancing the system's understanding of complex queries, refining the dialog management for smoother interactions, integrating external data sources to ensure comprehensive and up-to-date information, and implementing multi-language support to cater to a broader user base with diverse language preferences.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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