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Research Article

Chatbot For Government Employees in Education Department

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ABSTRACT

Government employees in the education sector often encounter delays and inefficiencies due to inadequate systems for task scheduling and query resolution. This paper proposes a chatbot-based helpdesk to address these issues by providing instant answers to frequently asked questions and integrating task management features like desktop reminders. Leveraging advanced NLP techniques and the Hugging Face Zephyr-7B model via API, the system delivers accurate, AI-powered responses even for complex queries not covered in the FAQ dataset. Built using Gradio and Python, the chatbot offers a user-friendly interface, aiming to streamline workflows and enhance communication within the sector.

Keywords: Chatbot, Natural Language Processing, Zephyr-7B, Event Scheduling, Desktop Notifications

1. INTRODUCTION

There are often many challenges faced by government employees in the education sector because of inefficient systems for resolving queries and scheduling tasks. From these challenges, delays, misunderstandings, and communication gaps can result, ultimately affecting the quality and timeliness of their work. Employees may find it difficult to access accurate and relevant information quickly, because of which the decision-making process may slow down. Additionally, managing multiple deadlines and tasks without an efficient system can result in unnecessary confusion and stress. The proposed project aims to solve these issues by creating a chatbot-based helpdesk system that improves communication and increases productivity. Using this system, employees will receive instant answers to frequently asked questions (FAQs), reducing the need for time-consuming manual searches or waiting for supervisors or colleagues to respond. Through the chatbot's quick and accurate responses, employees will have access to information they need when they need it. In addition to event scheduling and reminders, this system will help employees manage their time efficiently. Employees can ensure to meet deadlines and stay organized without having to worry about forgetting meetings,

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appointments, and important tasks. This feature reduces the likelihood of missed deadlines, which can have significant consequences in the education sector, where timely decision-making is very important.

2. LITERATURE SURVEY

S.no	Title	Author	Year	Methodology	Achievement	Limitations
1	Intelligent Chatbot[1]	Munira Ansari, Mohammed Saad Parbulkar, Saalim Shaikh, Talha Kha	2021	To facilitate natural language interaction between humans and machines, it has used AI based chatbot technology	It enables improved chatbot conversations dynamically and context aware responses	Understanding complex queries beyond predefined contexts is difficult.
2	College Enquiry Chatbot System using AI[2]	Gayathri.V, Saranya.V, Vijetha.A, Vijey.A, SriRagavi.M, Mrs.K. Malarvizhi	2021	To analyze and respond to the queries asked by the students regarding college details, fees and location, it has implemented Machine Learning algorithms.	By automating college-related queries, it has improved the student support.	May not handle complex queries and the predefined college related queries are limited.
3	Chatbot Using Natural Language Processing (NLP)[3]	V. Adarsh, B. Koushik, D. Mahesh	2023	To develop an online chatbot system for website users, seamless query handling and allowing file access, it has used NLP and Machine Learning.	By enabling natural interactions and Machine learning based responses, user experience on websites are enhanced.	It struggles with understanding user intent and it has limited multilingual suppor.t
4	Chatbot Developmen t Using Python[4]	Shreyashkar Sharma	2020	A Python based chatbot was built by integrating audio and video communication to provide interactive conversations.	Improved accessibility for users and enabled voice based interactions.	The responses are restricted to predefined commands and limited AI capabilities.
5	Cloud-Based Student Information Chatbot[5]	Radhika Patel, Nancy Bhagora, Pushpraj Singh, Ms. Kavita Namdev	2020	A cloud based AI chatbot was developed which analyzes student queries and provides answers through messaging. For invalid queries, it includes admin notification system	Improved real time query handling and also maintains admin oversight for incorrect responses.	Vulnerable to downtime and network failures as it is dependent on cloud infrastructure.

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3. METHODOLOGY

The proposed system is a chatbot system developed for the government employees in the education department to handle administrative queries, event scheduling and task management. This system is built using Python,Gradio, and Hugging Face NLP models, providing an efficient and interactive tool for employees. The core functionalities of this system are:

3.1. ALGORITHM/TECHNIQUES

1. Self-Attention: It is a mechanism used in Transformer Models like Zephyr-7B to generate responses and to understand context. Based on the relevance of words in a given context, it assigns different importance to words.

Algorithm 1 Self-Attention Algorithm

Input: Matrices Q (Query), K (Key), V (Value)

Output: Matrix Z

(Updated Representations)

1: Compute dot products of queries with keys: $D \leftarrow Q K^T$

2: Scale dot products: $D \leftarrow D / \sqrt{d}$□

3: Apply SoftMax normalization: $A \leftarrow \text{SoftMax}(D)$

4: Compute the weighted sum of values: $Z \leftarrow A V$

5: **Return** Z

Where, d_k is the dimension of the Key vector.

2. Tokenization: It breaks the user input into meaningful components. It uses as a tokenizer from the Hugging Face model API to perform tokenization before passing them to the transformer.

3. String Matching: The input from the user is converted to lowercase and the bot searches for the matching question in a dictionary (faq_dict).

Algorithm 2 String Matching

Input:

User input: A string entered by the user.

faq_list: A list of predefined FAQ questions and their corresponding answers.

Output: An appropriate answer from the FAQ list or a generated response from Zephyr-7B.

1: Convert user input to lowercase.
2: Convert all FAQ questions in faq_list to lowercase.

3: For each question in faq_list:
a. if the question exactly matches user_input, return the corresponding answer.
4: For each question in faq_list:
a. if user input partially matches the question (i.e., substring match), return the corresponding answer.
5: If no match is found, send user input to the Zephyr-7B model and **return** the generated response.

4. Named Entity Recognition: it identifies the entities like dates, names and organizations in queries. The named entities are recognized by the Zephyr-7B model internally when processing the input.

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Algorithm 3 Named Entity Recognition

Input: User query Q

Output: Recognized named entities E

1: Tokenize the input Q.

2: Assign entity labels (e.g., Date, Organization, Name) using a pre-trained NER model.

3: Extract recognized entities and their corresponding labels.

4: Return E (list of detected entities).

5. Sentiment Analysis: It helps in determining the sentiment in the user messages. The Zephyr-7B uses this to generate contextually appropriate responses.

Algorithm 4 Sentiment Analysis

Input: User query Q

Output: Sentiment label S (Positive, Neutral, Negative)

1: Tokenize the input Q.

2: Pass the tokens through a sentiment classification model.

3: Compute probability scores for Positive, Neutral, and Negative sentiments.

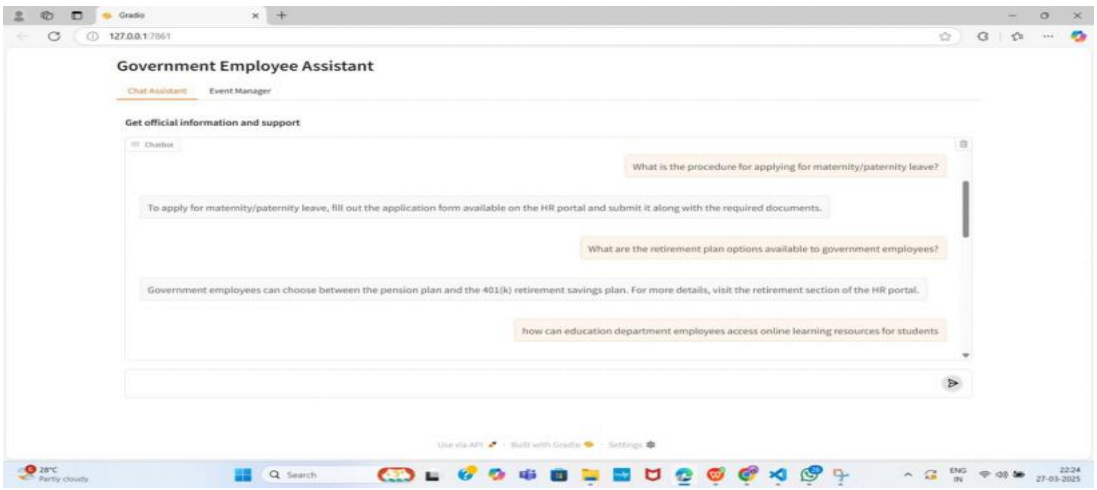
4: Assign the highest probability class as the sentiment label S.

5: Return S.

4. RESULTS

With a FAQ accuracy of 90-95% and an average response time of <1 second for predefined questions, the Government Employee Assistant Chatbot efficiently expedited task management and query resolution. The Zephyr-7B model produced context-aware responses with an accuracy of 75-85% for queries not included in the FAQ dataset, guaranteeing pertinent answers.

4.1 Result Using FAQ Dataset



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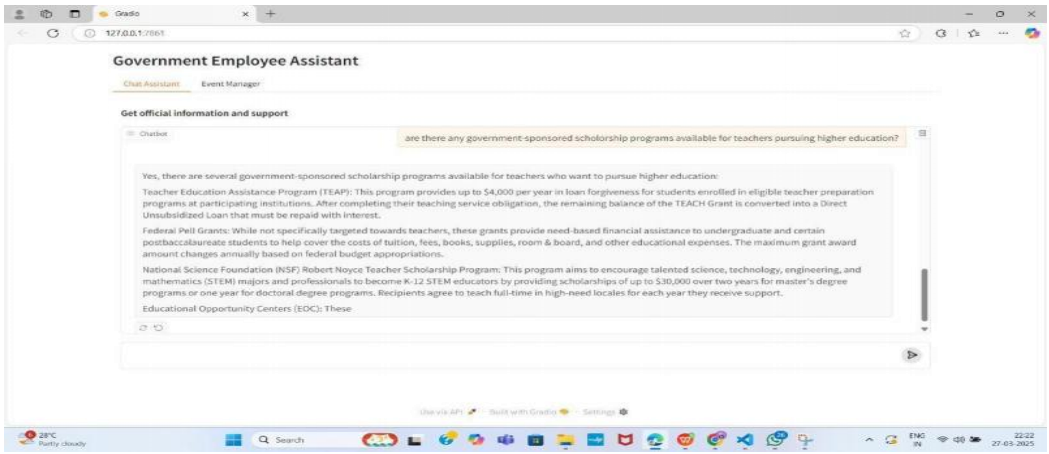
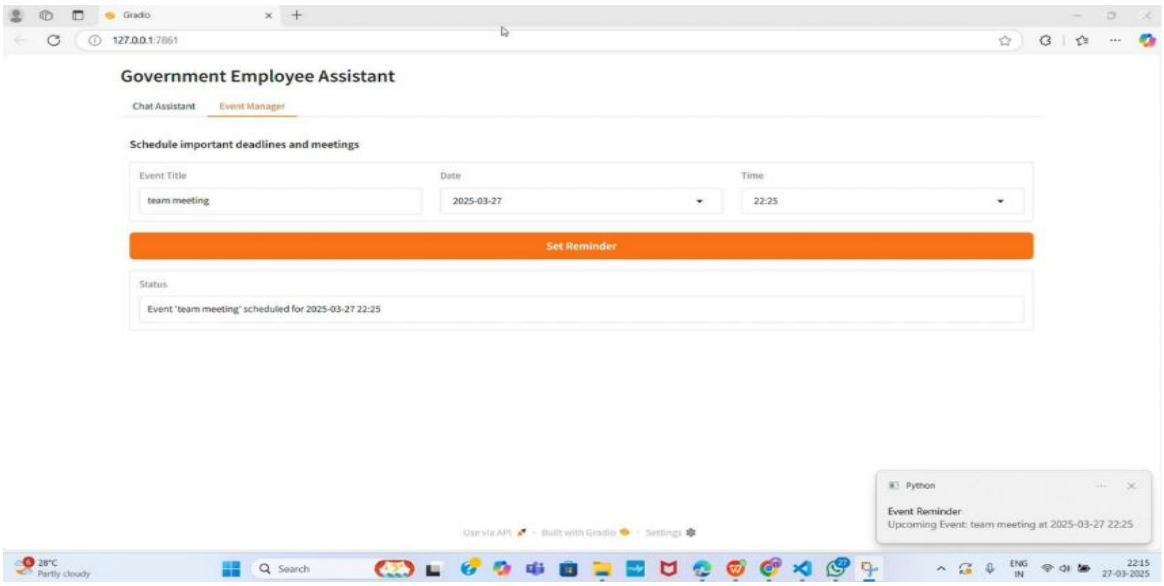
4.2 Result Using Zephyr-7BAPI



4.3 Event Scheduling



5. COMPARATIVE ANALYSIS

SNO	MODEL	VALUES
1	College Enquiry Chatbot System using AI[2]	85-90% accuracy, 88% Recall and 86% F1-Score.
2	Chatbot Development Using Python[4]	80% accuracy
3	Chatbot for Government Employees in Education Department	85-90% accuracy,88% Precision

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6. CONCLUSION

In conclusion, the proposed chatbot system provides an effective solution for managing queries and scheduling tasks within the government education sector. By leveraging a dataset of FAQs, it offers instant and accurate responses, reducing the time spent on routine inquiries. The integration of event scheduling and reminders enables efficient task management. For queries beyond the dataset, the system uses an AI-powered NLP model to deliver reliable answers, ensuring versatility and prompt response. Its user-friendly interface and advanced NLP features make interaction seamless, improving overall efficiency and communication.

7. FUTURE SCOPE

To enhance the overall functionality and user experience, several key improvements can be integrated into the system. Multilingual support can significantly improve accessibility for employees from diverse linguistic backgrounds by expanding the chatbot's language capabilities. Implementing voice recognition and response features enables a more intuitive, hands-free interaction, further simplifying user engagement. The addition of real-time analytics dashboards allows administrators to monitor usage patterns, identify frequently asked queries, and fine-tune responses for greater efficiency. Furthermore, incorporating advanced encryption, authentication protocols, and compliance measures ensures robust data privacy and system security.

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