Chatter Box - An Advanced Mangrove Forest Guide

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GitHub Repository: https://github.com/nithishwar17/mangrove-chatbot

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1. Project Overview

The "Chatter Box" project is an advanced, conversational AI designed to serve as an expert guide on Mangrove Forests. The primary goal was to create an intelligent and user-friendly chatbot that can answer a wide range of questions about the flora, fauna, ecological benefits, economic importance, and tourism related to mangroves.

The project evolved from a simple command-line script into a sophisticated web application featuring a Graphical User Interface (GUI), Natural Language Processing (NLP) for understanding user intent, and a custom-themed UI for an enhanced user experience.

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2. Objectives

The key objectives for this project were:

- To develop a chatbot strictly focused on the topic of Mangrove Forests.
- To implement a user-friendly GUI to make the interaction intuitive.
- To use Natural Language Processing to handle flexible, human-like questions instead of relying on rigid commands.
- To ensure the chatbot could politely decline to answer questions outside its knowledge domain.
- To include a "help" command and other guiding features, such as suggested topic buttons, to improve usability.

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3. Technologies Used

- **Programming Language:** Python 3.12
- **GUI Framework:** Streamlit
    - Chosen for its ability to rapidly create beautiful, interactive web-based interfaces with minimal code.
- **Natural Language Processing:** spaCy (en_core_web_sm model)

    - Used for its powerful semantic similarity capabilities, allowing the chatbot to understand the meaning behind a user's question, rather than just matching keywords.
- **Core Logic:** Python dictionaries were used to structure the knowledge base, providing a clean and scalable way to manage the chatbot's information.

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4. Key Features Implemented

The final application includes several advanced features that meet and exceed the initial project requirements:

- **Interactive Web Interface:** A clean, modern chat interface built with Streamlit that works in any web browser.
- **Natural Language Understanding:** By leveraging spaCy, the chatbot can understand diverse questions like "What animals live there?" or "Tell me about the wildlife" and map them to the correct topic.
- **Conversation Memory:** The chatbot has a basic context memory, allowing it to understand simple follow-up questions like "Tell me more" about the last discussed topic.
- **Suggested Topic Buttons:** A sidebar with clickable buttons for each main topic allows users to navigate the chatbot's knowledge base without typing.
- **Custom Theming:** The application's color scheme was customized using a .streamlit/config.toml file to create a unique and visually appealing design.

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5. Project Output (Screenshots)

Below are screenshots of the final application in action.

Figure 1: Main Chat Interface The main screen welcomes the user and displays the suggested topic buttons in the sidebar for easy navigation.

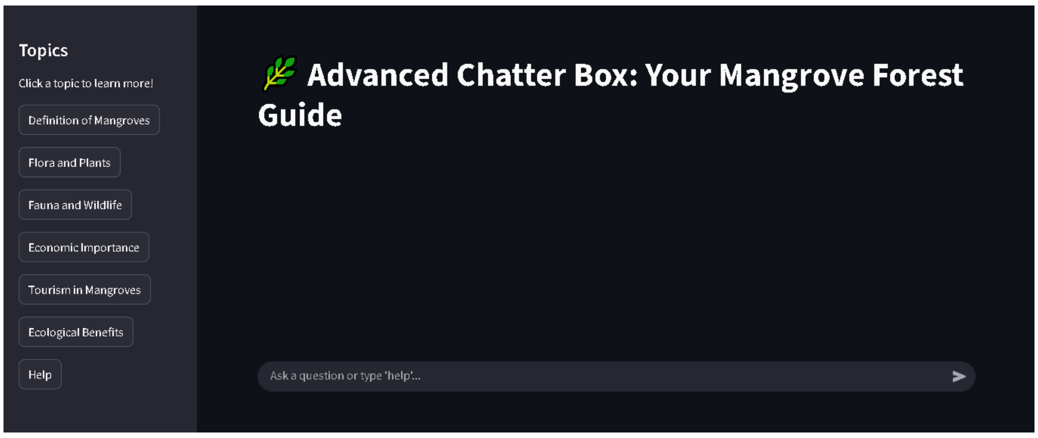
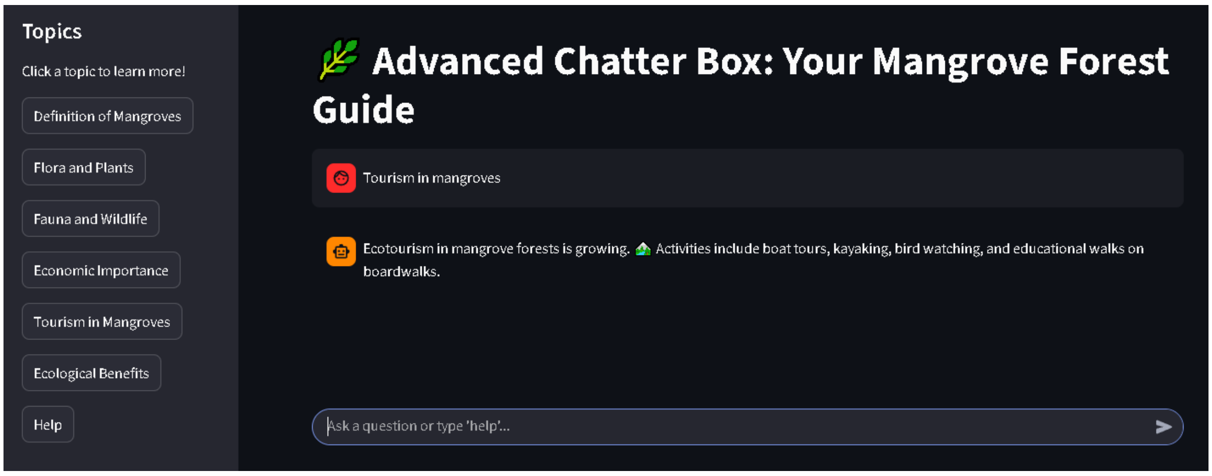


Figure 2: Answering a User's Question The chatbot provides a detailed, well-formatted answer when a user asks about a specific topic like the local fauna.

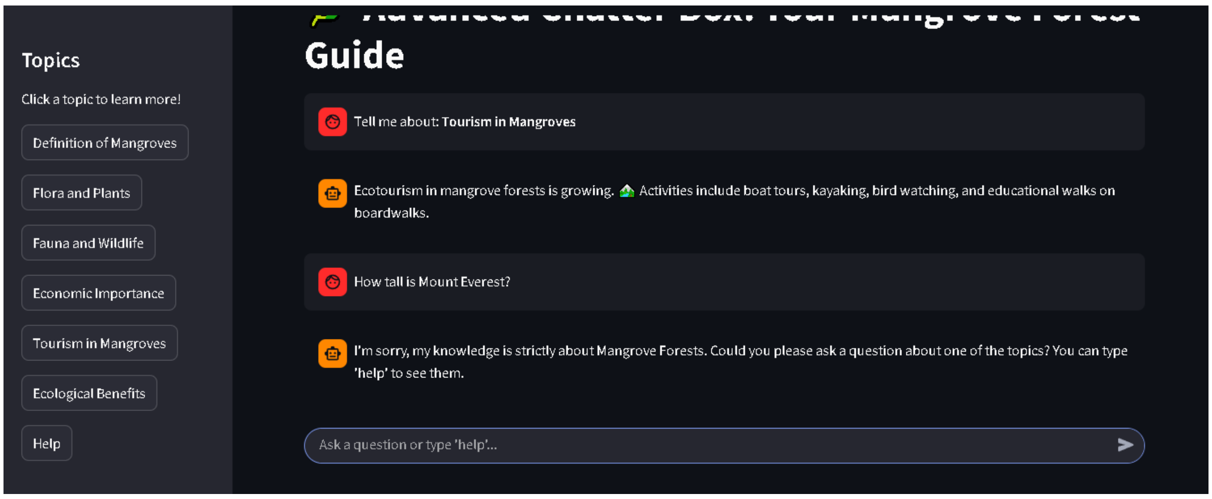


🌿 Advanced Chatter Box: Your Mangrove Forest Guide

Tourism in mangroves

Ecotourism in mangrove forests is growing. 🛖 Activities include boat tours, kayaking, bird watching, and educational walks on boardwalks.

Figure 3: Handling Off-Topic Questions The chatbot correctly identifies when a question is outside its knowledge base and provides a polite, helpful refusal.



Guide

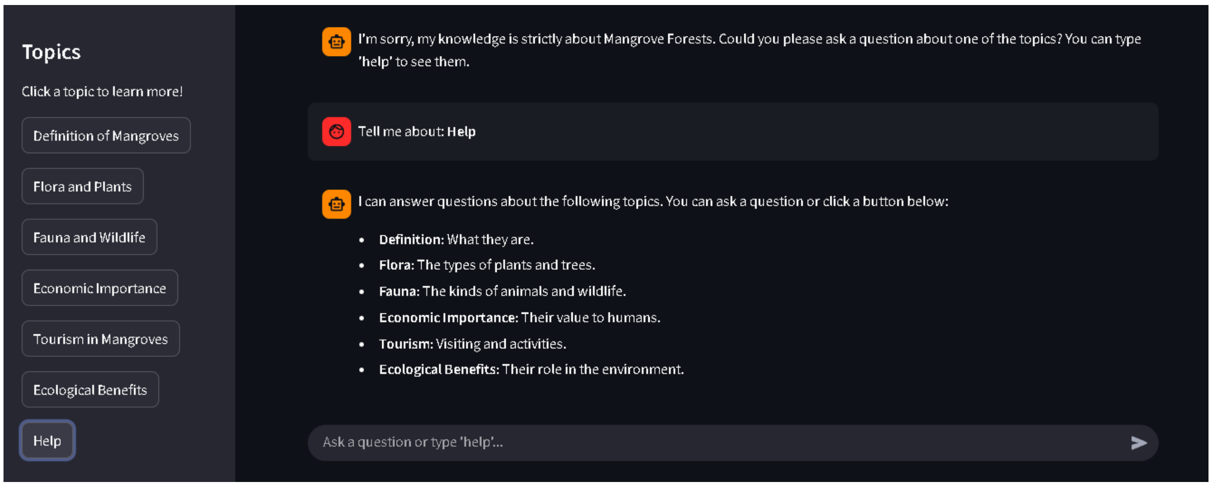
Tell me about: **Tourism in Mangroves**

Ecotourism in mangrove forests is growing. 🛖 Activities include boat tours, kayaking, bird watching, and educational walks on boardwalks.

How tall is Mount Everest?

I'm sorry, my knowledge is strictly about Mangrove Forests. Could you please ask a question about one of the topics? You can type 'help' to see them.

Figure 4: Using the "Help" Command The help feature clearly lists all the topics the chatbot is an expert on, guiding the user's interaction.



I'm sorry, my knowledge is strictly about Mangrove Forests. Could you please ask a question about one of the topics? You can type 'help' to see them.

Tell me about: **Help**

I can answer questions about the following topics. You can ask a question or click a button below:

- **Definition:** What they are.
- **Flora:** The types of plants and trees.
- **Fauna:** The kinds of animals and wildlife.
- **Economic Importance:** Their value to humans.
- **Tourism:** Visiting and activities.
- **Ecological Benefits:** Their role in the environment.

6. Challenges and Learning

Throughout the development process, several challenges were encountered and overcome:

- **Environment and Path Issues:** A significant challenge was resolving the 'command not recognized' error for streamlit and pyinstaller. This led to a deeper understanding of system PATH variables, Python environments, and the importance of running commands with appropriate administrative permissions.
- **Evolving NLP Logic:** The project initially started with simple keyword matching, then evolved to use fuzzywuzzy for fuzzy string matching, and finally upgraded to spaCy for superior semantic similarity. This progression provided valuable insight into the different levels of NLP complexity and their respective benefits.
- **GUI State Management:** Implementing a chat history that persists required learning about Streamlit's session state (st.session_state), a crucial concept for creating interactive, multi-step applications.

7. Conclusion and Future Scope

The project successfully achieved all its objectives. The final result is an intelligent, responsive, and user-friendly chatbot that serves as an effective educational tool about Mangrove Forests. The use of modern tools like Streamlit and spaCy enabled the creation of a professional-grade application.

Future Scope:

- **Knowledge Base Expansion:** The chatbot's knowledge could be expanded to include more detailed sub-topics or different ecosystems.
- **Cloud Deployment:** The application could be deployed to a service like Streamlit Community Cloud to make it publicly accessible via a URL.
- **Multi-turn Conversations:** The context memory could be enhanced to handle more complex, multi-turn dialogues.
- **Multimedia Responses:** The chatbot could be upgraded to include images and videos in its answers for a more engaging experience.