RAJALAKSHMI ENGINEERING COLLEGE
An AUTONOMOUS Institution
Affiliated to ANNA UNIVERSITY, Chennai

25 years OF ACADEMIC EXCELLENCE

Department of Computer Science and Engineering

AI VOICE ASSISTANT FOR CLIMATE CHANGE

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Problem Statement and Motivation

Climate change is one of the most pressing challenges of our time, affecting ecosystems, economies, and human health across the globe. While various governmental and non-governmental bodies collect and disseminate data related to climate change, the information is often scattered, complex, and not easily accessible for the average person. A central challenge is the lack of real-time and predictive insights on crucial factors like carbon emissions, energy consumption, and their long-term effects on the environment.

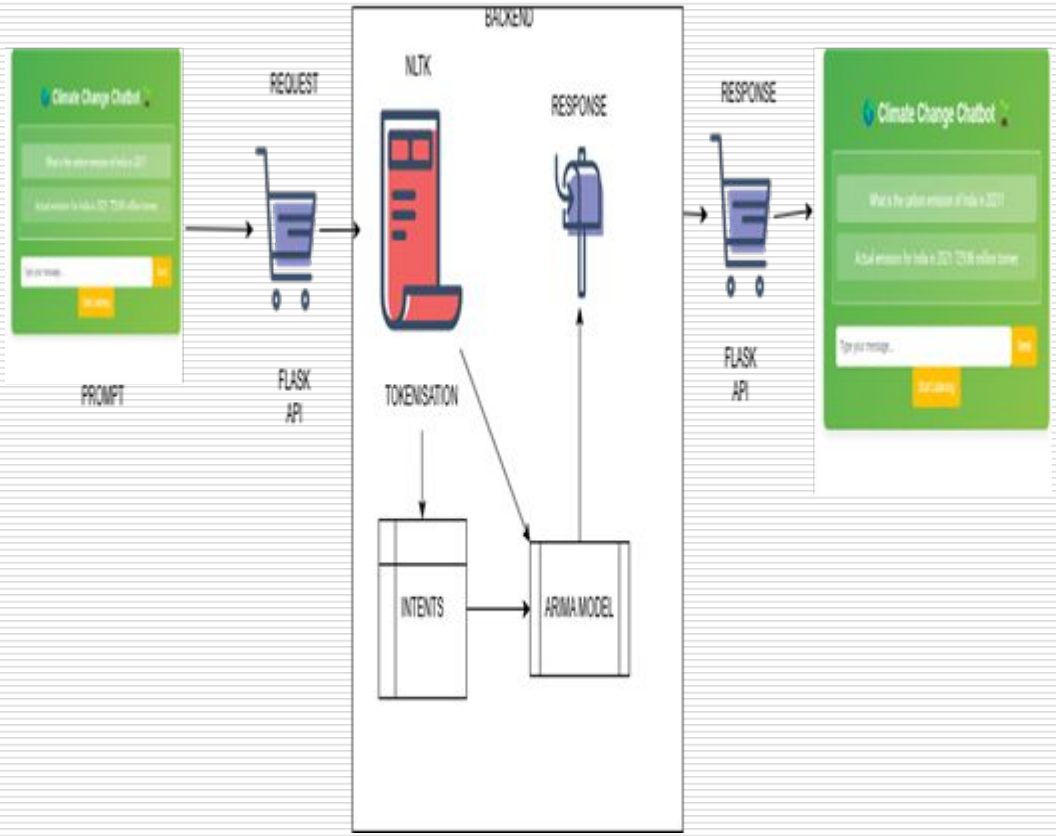
Objectives

The objective of this project is to create an intelligent and interactive climate change chatbot that uses advanced AI models to provide accurate predictions, insights, and recommendations related to climate change. By leveraging real-time data, historical datasets, and retrieval-augmented AI models, the chatbot aims to simplify complex climate data for diverse users. It integrates features such as speech-to-text and text-to-speech for enhanced accessibility, dynamic visualization tools to explain trends, and a feedback loop for continuous improvement. Ultimately, the chatbot seeks to raise awareness, support decision-making, and encourage climate action through an accessible and user-friendly platform.

Abstract

This project presents a conversational AI for climate change. The main factors of climate change are carbon emissions, temperature, precipitation etc. The main model of the project is to use various predictive analysis model to be integrated with the conversational AI. One of the major factor of unsustainable development is climate change. Since many industries have sustainable development as their major concern. So real time data of climate change need to be provided with them properly so that they can overcome the major pollution factors and even the public can make sustainable development as their progress.

System Architecture



List of Modules

1.Accuracy of Historical Data Retrieval:

2.Forecasting Performance Using ARIMA

3. Voice Recognition and Synthesis

4. Data Management and Error Handling

5. Task Management and Model Coordination

6. Grounding in Domain-Specific Knowledge

Functional Description for each modules

1. Accuracy of Historical Data Retrieval:

The chatbot performs well in retrieving and displaying historical data, accurately identifying records for specified countries and years. This capability allows users to obtain verified emission data directly from the dataset without needing external calculations, making the chatbot a reliable reference tool for historical emissions.

Functional Description for each modules

2. Data Preprocessing

After the data is loaded, the next step involves thorough preprocessing, which is essential for preparing the data for accurate model training and prediction. Preprocessing steps include cleaning the dataset by handling missing values, standardizing formats, and structuring the data into easily accessible arrays or DataFrames. Missing values are particularly problematic in time series data, where trends and continuity are critical for predictive accuracy.

Functional Description for each modules

3. Input Handling via Rasa Actions

The chatbot's interaction with users is managed through Rasa actions, specifically `ActionGetEmission`. This Rasa action listens for user inputs, captures the year and country name through slots, and then determines if both inputs are provided. If either is missing, the chatbot prompts the user to complete their request, ensuring that it has sufficient information to proceed. This functionality ensures the chatbot maintains a seamless and user-friendly experience, prompting users only when necessary and guiding them towards completing a valid query.

Functional Description for each modules

4. Year and Data Validation

Upon receiving the year and country inputs, the `EmissionPredictor` checks if the requested year exists within the dataset. This validation is essential for determining the system's next steps: if the year is within the dataset, the chatbot can directly retrieve the emission data; if not, it proceeds to forecasting.

Functional Description for each modules

5. ARIMA Model Fitting for Forecasting

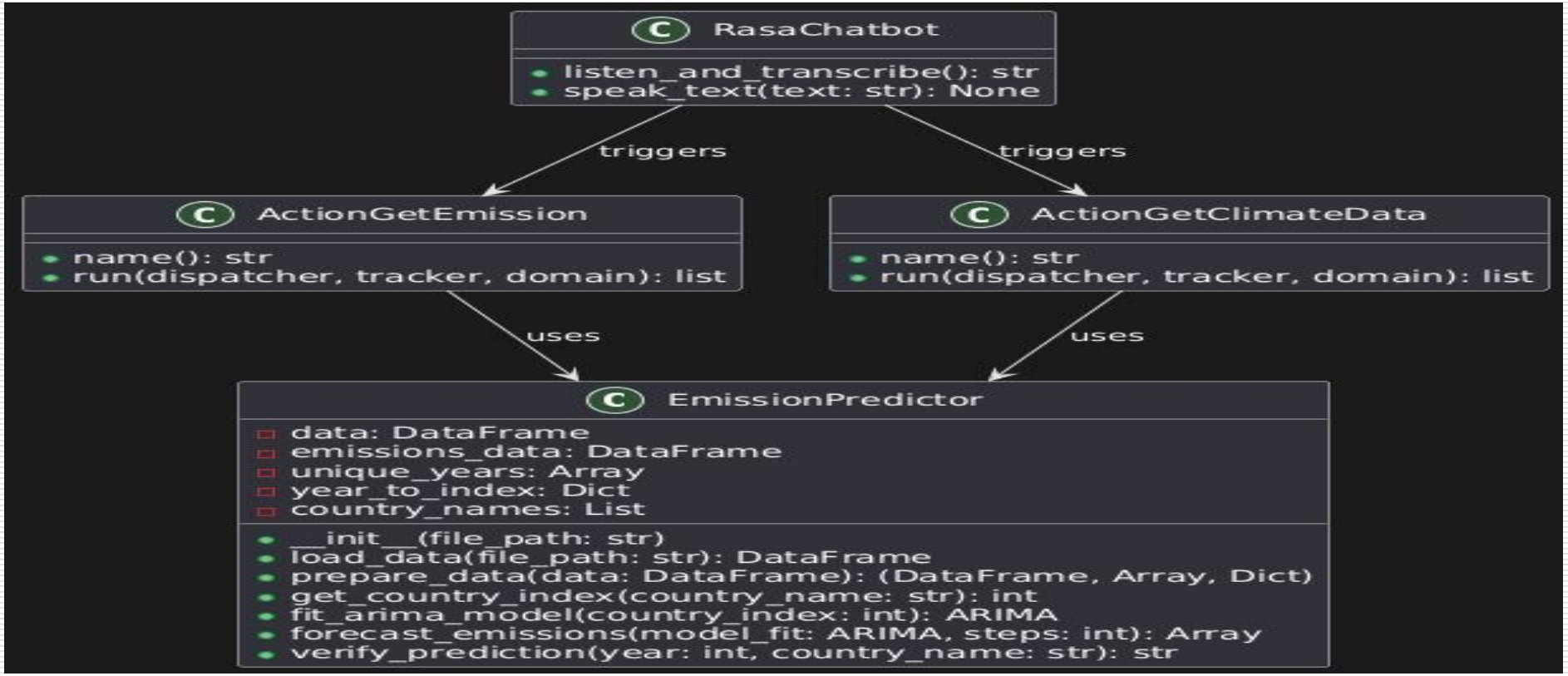
When a forecast is needed, the system trains an ARIMA model on the historical data for the specified country. The ARIMA (AutoRegressive Integrated Moving Average) model is chosen for its effectiveness in time series forecasting, where it can capture and predict trends based on prior emissions data

Functional Description for each modules

6. Emission Forecasting

After fitting the ARIMA model, the chatbot proceeds to forecast emissions for the requested number of years into the future. This process involves specifying the number of steps (years) from the last available data point and using the ARIMA model's predictive capabilities to generate an estimated emissions value.

CLASS DIAGRAM



Implementation & Results of First Module

Conclusion & Work for Phase II

The emission prediction chatbot developed here demonstrates an effective approach to integrating conversational AI with time-series forecasting, creating a tool that is both user-friendly and valuable for emissions-related inquiries. By combining data retrieval, ARIMA-based prediction, and real-time voice interaction, this chatbot provides a streamlined method for users to access historical and predicted emissions data based on country and year inputs.

References

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[2] HuggingGPT: Solving AI Tasks with ChatGPT and its Friends in Hugging Face Yongliang Shen1,2,*, Kaitao Song2,*,†, Xu Tan2, Dongsheng Li2, Weiming Lu1,†, Yueting Zhuang1,† Zhejiang University1, Microsoft Research Asia

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Thank You