Revolutionizing Weather Forecasting By Combination Of Internet Of Things (Iot) And Artificial Intelligence (AI) Especially For Tourism In Relevant Cities Of India

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Abstract: The Environmental Weather Comparison Application is an innovative tool that provides users with real-time weather updates, historical weather analysis, and multi-city comparisons based on customizable "ideal" conditions. Designed with an intuitive graphical user interface (GUI) using Tkinter, the application integrates advanced data visualization techniques and machine learning for enhanced insights. Key features include multi-city weather comparisons, trend analysis through historical weather data. IoT sensors sense and receive real-time physical parameters such as temperature, humidity, wind speed, rain and air pressure data, while AI processes this data to generate accurate weather predictions. The machine learning integration using Linear Regression to predict patterns in physical parameters of weather. Users can define their preferred weather conditions, personalize themes, and store data for future reference. The application fetches live weather updates via Weather API and utilizes the Wikipedia API for city descriptions. The technology stack consists of Python and essential libraries such as Tkinter for GUI development, Matplotlib for visual graphs, Requests for API communication, and scikit-learn for machine learning implementations. NumPy and Pandas further support numerical data processing. Weather trends are visually represented through graphs, enabling users to determine the most suitable city to visit based on calculated scores for temperature, wind speed, and humidity. The aim of this proposed real-time experimental research aims to deliver weather insights to tourism enthusiasts, helping them determine the most suitable weather conditions for visiting various destinations across India. By leveraging advanced technologies IoT and AI, this initiative ensures that travellers receive accurate forecasts, allowing them to plan their trips effectively and comfortably as per their suitable weather conditions for a seamless travel experience. In future enhancements include the integration of Polynomial Regression for complex trend predictions, extended language support, and improved GUI aesthetics with animations.

Keywords: Environmental weather, Internet of Things(IoT), Weather API, Machine Learning, Artificial Intelligence

INTRODUCITON

Now a days tourism is one of the attracting by every person to know the historical, culture and environment to visit various places. As per geographical areas having different environmental weather conditions to visiting the places. The diversity of geography weather effects the tourists if not suitable for visiting the places. Before knowing to visit a place or city then the tourist has to get an idea which place is suitable weather conditional parameters like temperature, humidity, rain and wind blow etc. The seasonal changes effect the weather data that effects the tourists significantly reductions the tourist places. In this research paper the objective is tourist can identify which visiting place is suitable for his holiday trip as per the weather conditions suable for a tourist identify by weather predictions generated by this proposed system. The tourist before planning for a visiting any place in India, he can predict suitable weather by using Graphical User Interface(GUI) system by giving suitable weather data, enter date and duration of the tour. The proposed application automatically generate the suitable weather conditions

for a particular city. The transport system in India is a key to enable the safe journey for the tourists around various places throughput the world. The tourist of India will be more affordable, comfortable for sustainable tourism destination[1,2,3,4].

The main motivation of interest for tourists for travel to visit a new place for getting relax from their routine life. Their personnel or family tourism trip get relaxation from stress for happy to get their healthier joyful experience. The forecasting is a method to know the accurate weather predictions as per available data according to that the tourists make a travel for specialized visiting places. The premier approach for data collection is the researchers find to develop a forecasting system for collecting of real data as per weather conditions of certain places in India. The collected weather data is one of the source of a method to be survey, discussions with people of a particular place and obtain to acquire the data[5,6,7,8]. The second approach for data collection is source of the data by knowing forecasting process of data.

The tourism plays a significant role in focusing on economical development of various tourist cities for particular country. The tourism can create employment opportunities, interchange of culture for visitors as well as residents. The tourism is essential to provide for tourists comfortable accommodation, entertainment to visiting places, shopping which things are not available their own local places[9,10]. As per the survey of World Tourism Organization(WTO) the tourists have tremendously increasing year by year and become increase the revenue and help the economy of country and indirectly improve financial status of employment, heather care and transportation[11,12].

For accurate prediction of weather conditions of a particular region and visiting places, the Machine learning algorithms are providing better results when comparison with traditional approaches. Due to rarely available of data there are challenges to provide tourism forecasting system properly[13]. The machine learning algorithm are provide accurate weather forecasting using regression technique like Random Forest Regression(RFR), Support Vector Regression(SVR) etc. have tested with various kinds of feature selection methods and clarity the feature selection models as well as clarity of identify number of attributes for develop a model. This system data prediction to identify particular suitable weather conditions for a particular place to visit[14,15].

LITERATURE SURVEY

The literature survey providing a forecast system of a tourism by direct as well as indirect benefits to the tourists, people, society, business organizations, government and also improve the economy of the country. The tourism services provide the employment, tourism related business, visa services to gain economy. The tourism organization perform the predict the visitors, time, forecast system to provide a novel approach for tourist to comfort visiting of a places for a tourism. The researchers have interacted the development to predict the suitable weather forecasting for particular suitable places by applying various methods and algorithms as follows.

In[16] authors review of impact of weather conditions and climate conditions for a tourism. By applying various sustainable policies for better tourism development in a country for that tourism industry further grow and expand for providing more facilities to the tourist. As per Indias geography the weather conditions are is variable city-to-city. Specially the weather changes seasonal conditions that influence the no. of foreign tourists arrival for India to make tourism to visit historical places of India. At present the current weather impacting the air, rail network, transportation due changing the climate. It is essential to make India is one of the competitive and sustainable tourism has to adapt the policy developments.

In[17] authors proposed a hybrid model by combination of support vector regression(SVR) and nonlinear autoregressive(NAR) neural networks methods. The proposed hybrid model eliminate the convergence problems of time series data. The ML algorithms to predict the model error. This proposed model influence the accurate prediction, sustainable to reduce root mean error as well as absolute mean error when compare with classical algorithms.

In[18] authors proposed to climate change conditions risks in outdoor recreation of the tourism. The authors contributed for this proposed model is provide risks associate with climate conditions change happening in terms of tourism. The impact and role of data analytics in disaster management for tourism climate change for tourism.

In [19] authors proposed an integration of IoT and machine learning algorithms to improve the smart tourism system for implement the intelligent tourism platform services. To evaluate the performance and functionality of this tourism system the simulated datasets are taken to consider. The proposed system based on support vector machine(SVM) method. The proposed system IoT combination of ML algorithms achieves higher prediction accuracy when compare with SVM system.

In[20] author concentrate on classification methods to predict various weather conditions. Authors proposed data pre-processing and SMOTE oversampling technique to balance the data. The ML classifiers apply for weather forecasting prediction. The weather data categorized like rain, temperature, humidity, wind blow, snow, dazzle, fog and sun etc. The xGboost and Random forest classifiers are providing the best results. The researchers compare the accuracy performance of ANN, SVM and Decision tree classifiers by various performance metrics.

Table1: Comprehensive analysis of existing research

As per the above literature of existing research it came to know as study, understand the research views of various eminent authors I motivated by these existing research works. I am as a corresponding author I have with co-authors team worked on Weather forecasting prediction for tourism by Machine learning combination with Artificial intelligence.

Authors	Year	Advantages	Methods/Algorithms used	Limitations
Padhra, Anil et.al. [16]	2022	• Review of impact of weather conditions and climate conditions • Applying various sustainable policies for better tourism	Review paper	Not a practical implementation
Borrero, Juan D., et.al. [17]	2022	Weather forecasting regression model for tourism	Hybrid model by combination of support vector regression (SVR) and nonlinear autoregressive (NAR)	Not a graphical representation
Hsu, Jane Lu, et.al. [18]	2023	• Climate change conditions risks in outdoor recreation of the tourism. • Risks associate with climate conditions change	Data analytics for disaster management	Algorithms not specified
Ma, Hui et.al. [19]	2024	Smart tourism system	• IoT • Support vector machine (SVM)	Not a graphical representation
Wasim, Shobi et.al. [20]	2025	Predict various weather conditions	Data pre-processing and SMOTE oversampling technique to balance the data	Not a hybrid algorithm

Table 1: Comparison Analysis of Weather forecasting in existing system

METHEGOLOGIES

The Weather Comparison Application is built using Python, integrating real time API calls, machine learning algorithms, and graphical visualizations for enhanced weather analysis. It follows a modular approach to ensure efficiency, scalability, and ease of maintenance.

Module description

Weather Data Retrieval Module for Fetches real-time & historical weather data using WeatherAPI, retrieves details like temperature, humidity, wind speed, and atmospheric conditions, implements error handling for network failures and API request validation. Multi-City Comparison Module allows users to input multiple cities for comparative weather analysis, displays side-by-side comparisons of key meteorological attributes, generates rank-based recommendations based on user-defined climate preferences. Machine Learning Prediction Module uses Scikit-learn's Linear Regression to forecast weather trends, analyzes historical temperature, wind speed, and humidity to predict future patterns, helps in climate trend visualization for research and travel insights.

Graphical Visualization Module implements Matplotlib for generating bar graphs, scatter plots, and linear regression visualizations, displays trend analysis for each city dynamically within the GUI, provides interactive UI

elements for enhanced understanding. User Interface (UI) Module designed using Tkinter, ensuring an intuitive and responsive experience, allows users to select language, theme, and display preferences, enables real-time updates without requiring a manual refresh. Data Storage & Download Module allows users to save and download weather insights in JSON format, supports graph exports for offline reference, implements file-based storage, avoiding complex database dependencies.

The comparison of the techniques used in Existing research with Proposed research

The techniques are used in existing methods are Generalized Statistical Models, basic averaging methods to estimate 16 future weather trends, traditional Weather Reporting APIs, limited historical data with real time weather retrieval, single-City Comparison Models, users had access to data for individual cities rather than comparative analysis, limited Predictive Capabilities – Most existing applications lacked machine learning-driven forecasting methods.

In Proposed Technique Used Or Algorithm Used Your Weather Comparison Application improves upon traditional approaches by integrating modern techniques are applied like API-Based Data Retrieval, uses requests library to fetch real-time & historical weather data. Linear Regression for Weather Prediction, implements Scikit-learn's Linear Regression model to identify trends. Graphical Visualization, uses Matplotlib to generate scatter plots, bar graphs, and trend lines for user interpretation. Multi-City Analysis. allows users to compare weather conditions across multiple locations simultaneously. Defined Ideal Weather Preferences, filters cities based on temperature, humidity, wind speed for recommendations. User Data Storage & Download, saves historical weather data & graphs in JSON format, ensuring offline accessibility.

The primary objective of the proposed research is the Weather Comparison Application is to develop a robust, user-centric tool that allows individuals to analyze, compare, and predict weather conditions across multiple cities with accuracy and ease. The system is designed to go beyond basic weather updates by integrating real-time data retrieval, historical trend analysis, and predictive modeling, providing users with deep meteorological insights. Key objectives of the project includes are enabling users to retrieve and display current weather data for multiple locations simultaneously, allowing users to access and analyze historical weather data to observe trends in temperature, wind speed, and humidity, utilizing machine learning (linear regression) to forecast future weather conditions based on historical patterns, offering customized recommendations by comparing city weather data against user-defined "ideal" weather parameters, delivering clear and interactive visualizations to make complex data easy to interpret through graphs and plots, ensuring an intuitive and responsive GUI using Tkinter, with asynchronous operations to prevent UI freezing, providing options to download results and visual outputs for offline analysis or sharing. The overall goal is to build a lightweight, intelligent, and accessible application that enhances users' ability to make informed, data-driven decisions related to travel, research, or relocation based on comprehensive weather data.

The Problem statement and Read Analysis for the Weather Comparison Application demonstrates low error rates due to accurate feature selection and robust data regression capabilities. Through machine learning-based predictions and real-time API integration, the system provides a competitive accuracy rate for analyzing climate trends. The Hardware Requirements for the following specifications ensure smooth functionality of the application consider the Dual Core or Higher (Optimized for Python & ML operations). RAM – 4GB DDR or above (For efficient API fetching & graph visualization). Storage – 250GB or more (For storing historical weather datasets & images).

Software Requirements for the Weather Comparison Application is built using Python and integrates multiple APIs, machine learning models, and data visualization tools. The software stack ensures efficient execution, minimal latency, and intuitive user interaction. The Operating System Windows 7/8/10 (Compatible across multiple versions). Platform is considered Tkinter-based GUI for seamless user experience. The Programming Language consider Python Chosen for its flexibility and vast ecosystem of libraries. The Front End consider as Tkinter for GUI, Matplotlib for graphical representation.
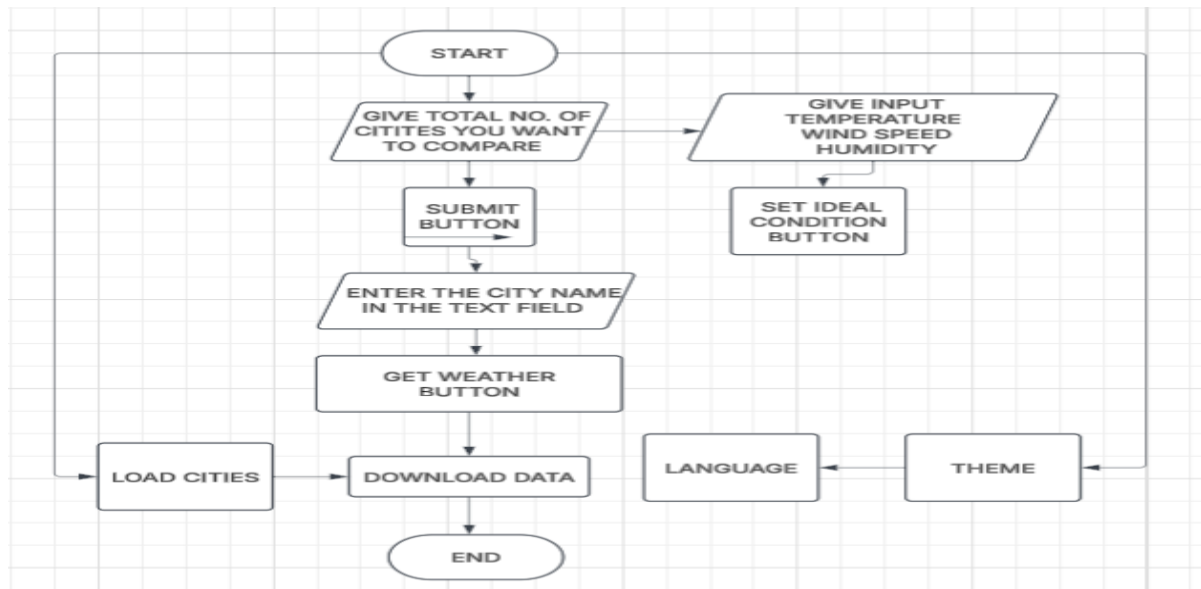
Figure1: Dataflow Diagram

In Figure 1 for the Data Flow Diagram (DFD) represents for visual represent for flow of real-time data via information system. Specially the feature of DFD is provide visualization of processing the data. DFD provides input/output and data storage address. But does not show time process and information about processes will be operate in sequence access or parallel.
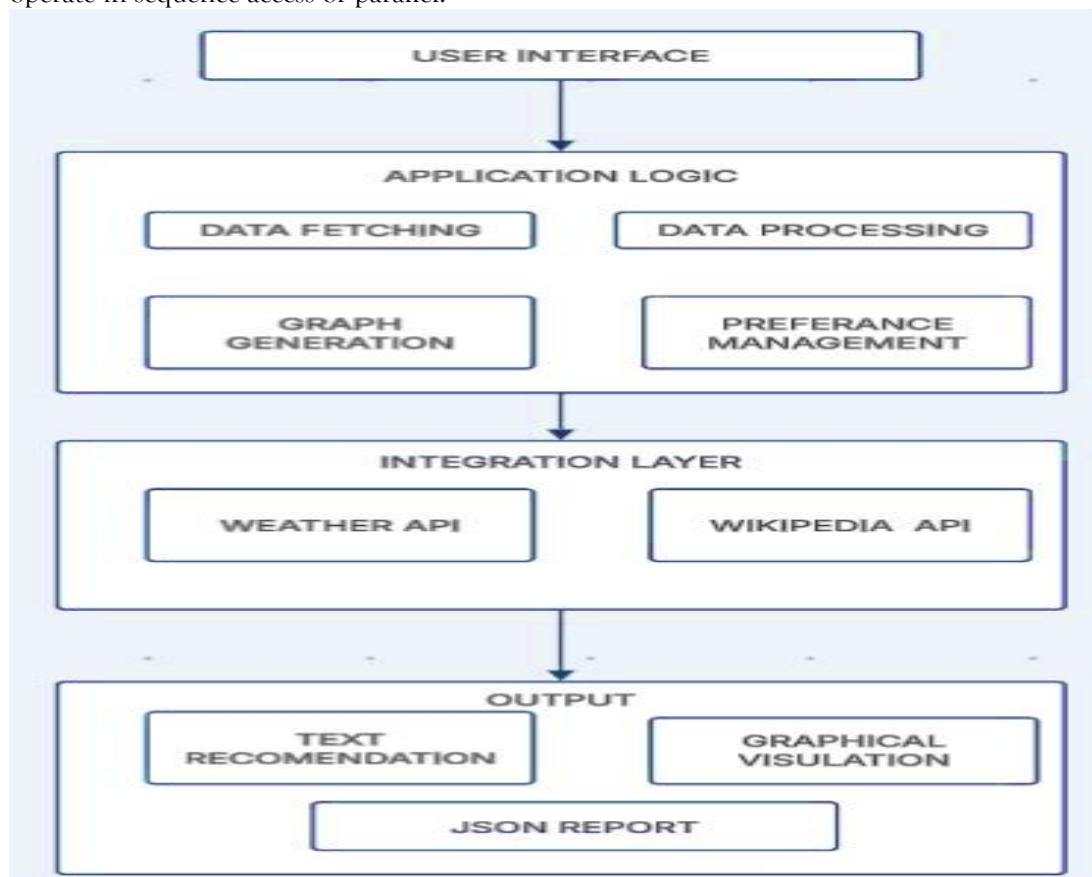

Figure2: System Architecture

PROPOSED

The proposed research paper for the tourism forecasting system to predict season-wise weather conditions in a relevant city arrival of tourists. This method adopted for data collection from various global trusted sources. The data analysis and data processing by machine learning model. The data prediction by Linear regression to evaluate continuous data. The data collection and analysis of this research for providing forecasting of the data and analysis

and develop the predictive model. The data collected by various reliable data sources for the development of to predict the weather data for a visiting of various places for suitable weather conditions for a tourism. The dataset contains tourist arrival for most of the cities of India.

In this proposed research provides an application development for the Weather Comparison Application is an advanced analytical tool developed to deliver precise, real-time, and historical weather data across multiple global locations. Unlike conventional weather apps that focus solely on current conditions, this system is engineered to support comprehensive weather analysis, empowering users with deeper insights through trend visualization and predictive forecasting. Built using Python with a GUI powered by Tkinter, the application integrates robust technologies such as WeatherAPI for real-time and historical data retrieval, Matplotlib for dynamic visualizations, and Scikit-learn's Linear Regression model for predictive analytics. These components work together to provide an interactive platform for comparing weather conditions across cities, identifying historical patterns, and forecasting future trends. Users can enter multiple cities, set their ideal weather parameters (temperature, humidity, and wind speed), and receive data-driven recommendations on the most suitable location. The intuitive interface allows for clear presentation of weather details, including 7-day forecasts, bar graphs, and regression plots, all within a scrollable, user-friendly layout.
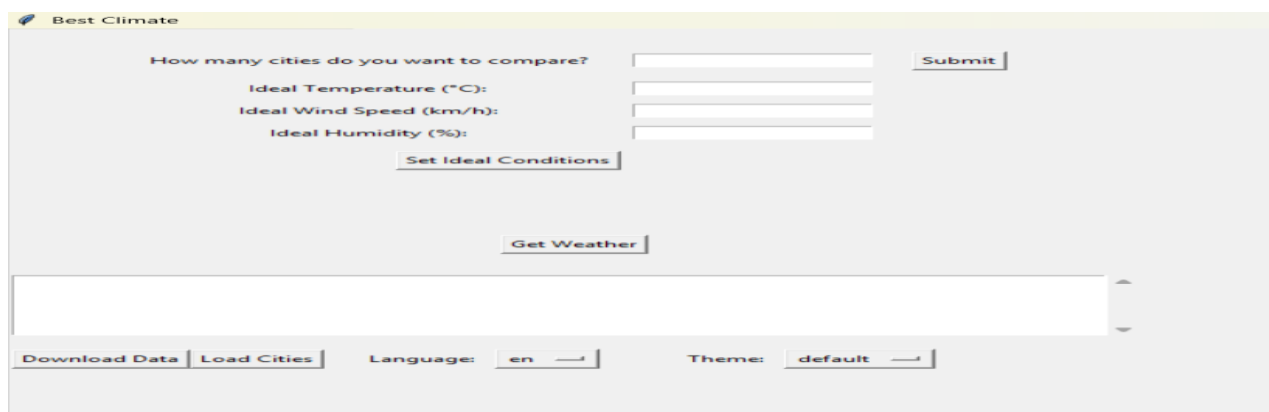
Additionally, the system features are Asynchronous data fetching to maintain responsiveness, Downloadable outputs in JSON and image format, Optional multi-language and theme customization Designed for travellers, researchers, and data enthusiasts, the application prioritizes simplicity, usability, and intelligence, providing a powerful system for climate-aware decision-making model.

The primary objective of the Weather Comparison Application is to develop a robust, user-centric tool that allows individuals to analyze, compare, and predict weather conditions across multiple cities with accuracy and ease. The system is designed to go beyond basic weather updates by integrating real-time data retrieval, historical trend analysis, and predictive modelling, providing users with deep meteorological insights. Key objectives of the project includes objectives like Enabling users to retrieve and display current weather data for multiple locations simultaneously, allowing users to access and analyze historical weather data to observe trends in temperature, wind speed, and humidity, utilizing machine learning (linear regression) to forecast future weather conditions based on historical patterns, offering customized recommendations by comparing city weather data against user-defined "ideal" weather parameters, delivering clear and interactive visualizations to make complex data easy to interpret through graphs and plots, ensuring an intuitive and responsive GUI using Tkinter, with asynchronous operations to prevent UI freezing, providing options to download results and visual outputs for offline analysis or sharing. The overall goal is to build a lightweight, intelligent, and accessible application that enhances users' ability to make informed, data-driven decisions related to travel, research, or relocation based on comprehensive weather data.

RESULTS AND DESCRIPTION

The Weather Comparison Application is implemented using Python, integrating real-time weather APIs, machine learning-based forecasting, and graphical visualizations. The server process is handled using API calls instead of SOCKET & SERVERSOCKET, ensuring efficient data retrieval.

Snapshot And Their Description: The following snapshot shows the parameters selection for a desire city for the tourism.

Figure 3: Snapshot for parameters selection for a desire city for the tourism

This is the first image while user execute the code . Here it is need to enter " Number of Places want to compare for eg: user enter 5 i.e. the desired ideal Temperature , Wind Speed and Ideal Humidity for the place want to visit . here enter as a 25 , 10 and 50 respectively" and then need to click on set ideal Condition to set data and then click on submit button or Simply click on Load cities So that user can directly load the cities Name that user already saved in Json format. This is shown in the below diagram.
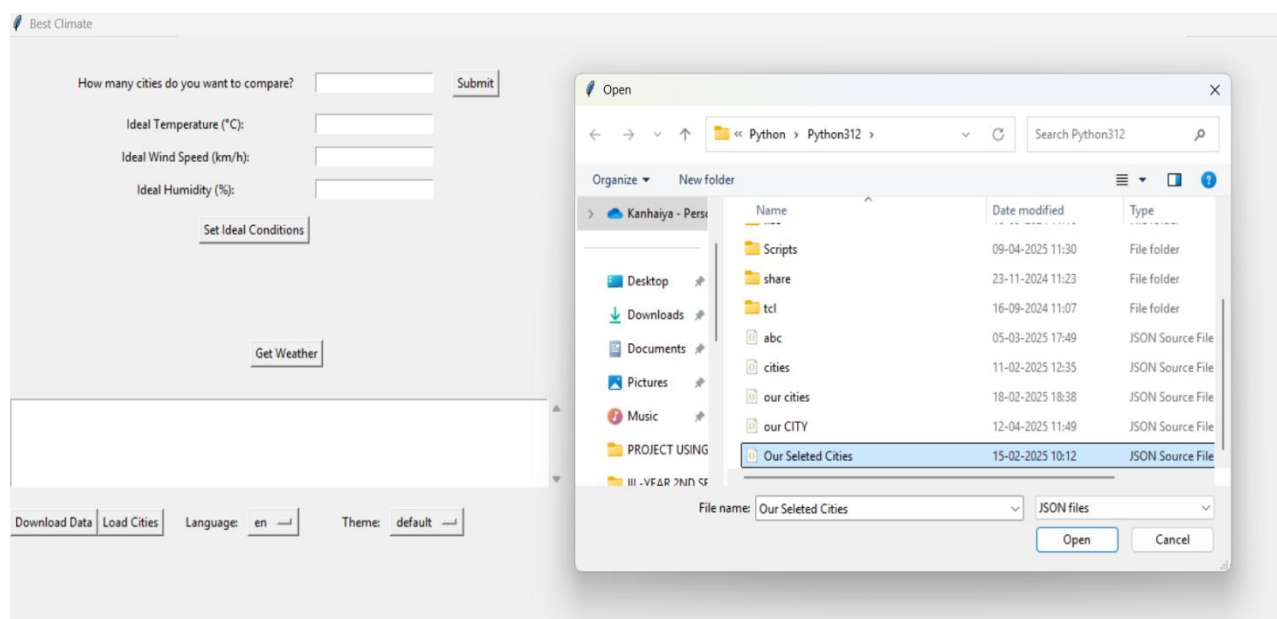
Figure 4: Select the particular city as per choice of user for visiting for tourism

After entering the above data you will get this type of diagram

Figure 5: Python IDLE application snapshot to select the user n. number city option for suitable climate to visit
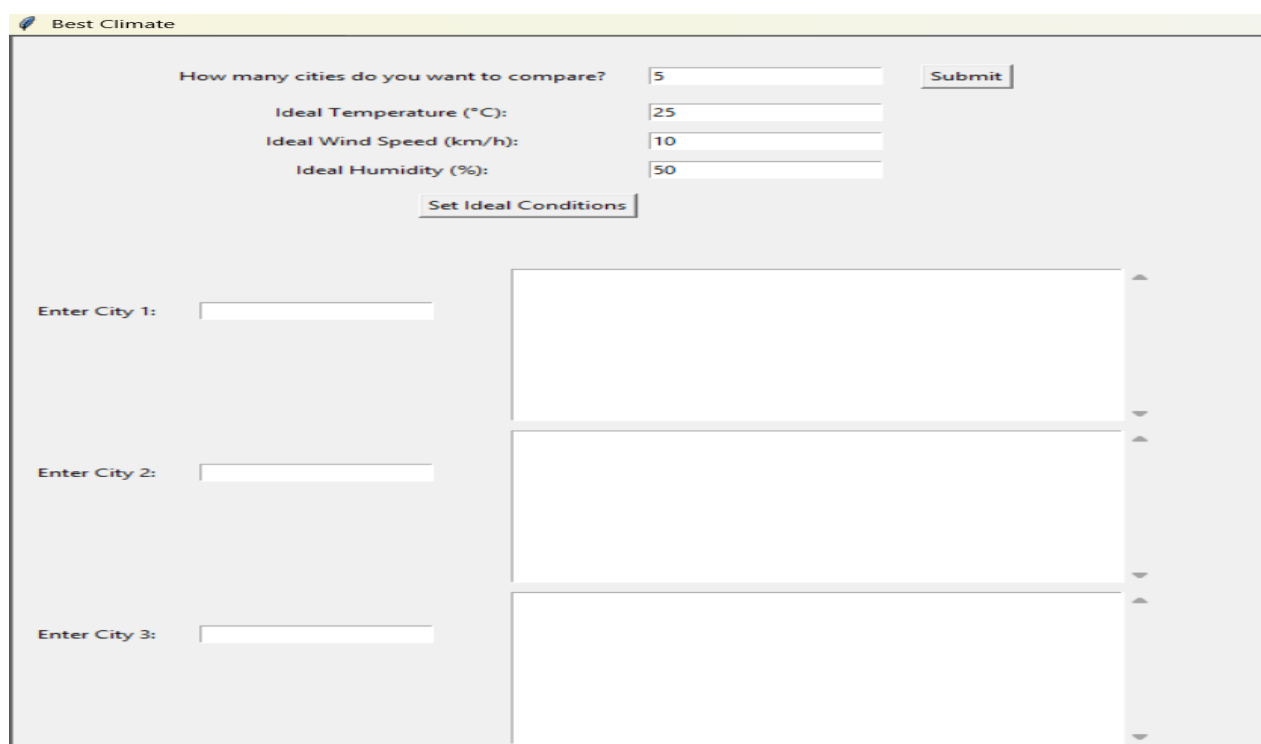
tourism

As per the need to enter all the city name that you want to compare. After Entering all the cities name, Just click on Get Weather button. Then you will get all the image shown in the below diagram
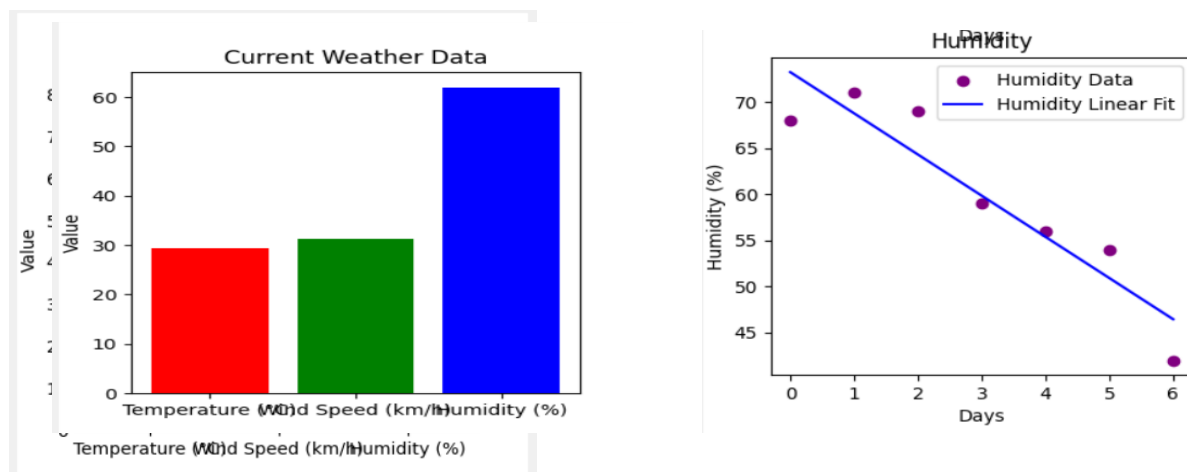
This diagram shows the bar graph indicating that current temperature , wind speed and humidity in terms of values .

Figure 6: Bar graph to visit Goa check the weather parameters temperature, wind speed, humidity.
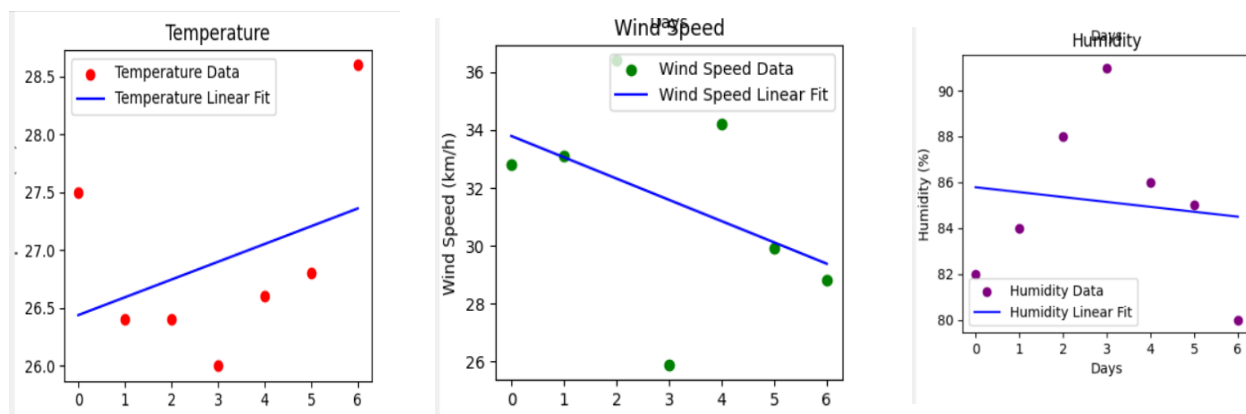
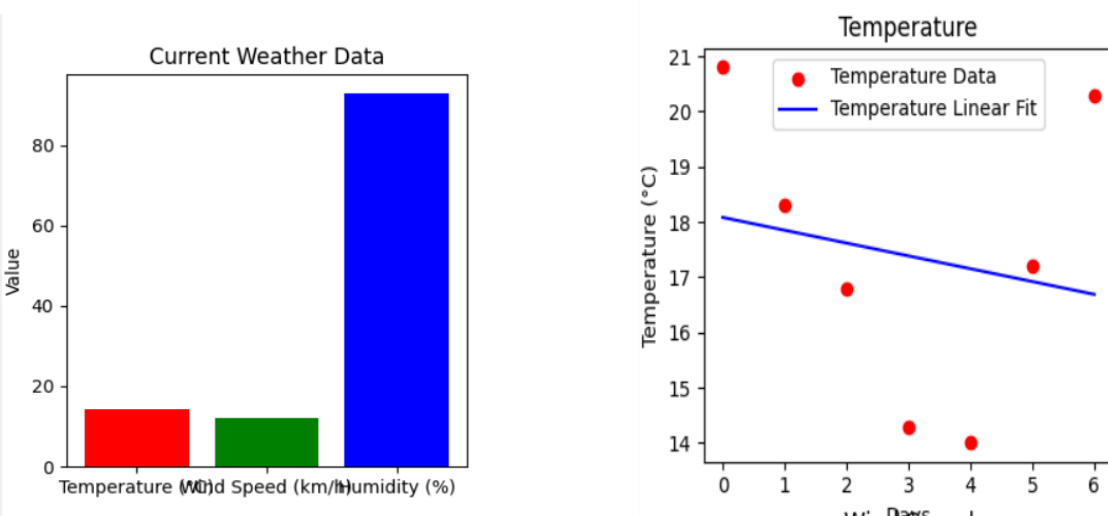Figure 7: Simple Linear regression model for weather parameters

Similarly the above diagram shows that simple linear regression of Temperature , wind speed and humidity respectively where points indicates past 7 days data. So that you can predict the future one's .
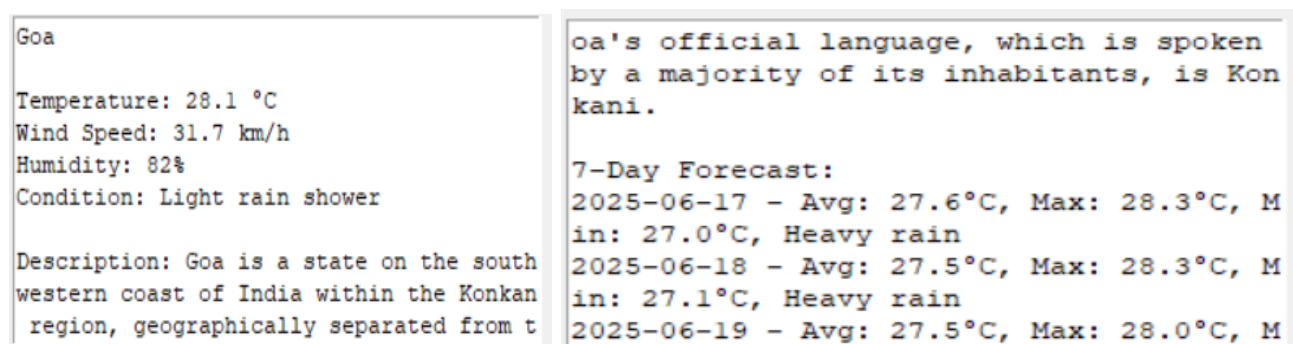
Figure 8: Weather prediction Description Box for Goa

Here is the one small description box for the purpose of explaining above cities1(Goa) and upcoming forecast that is shown in the above diagram. Similarly the below diagram is same as the above automation of images for all cities..
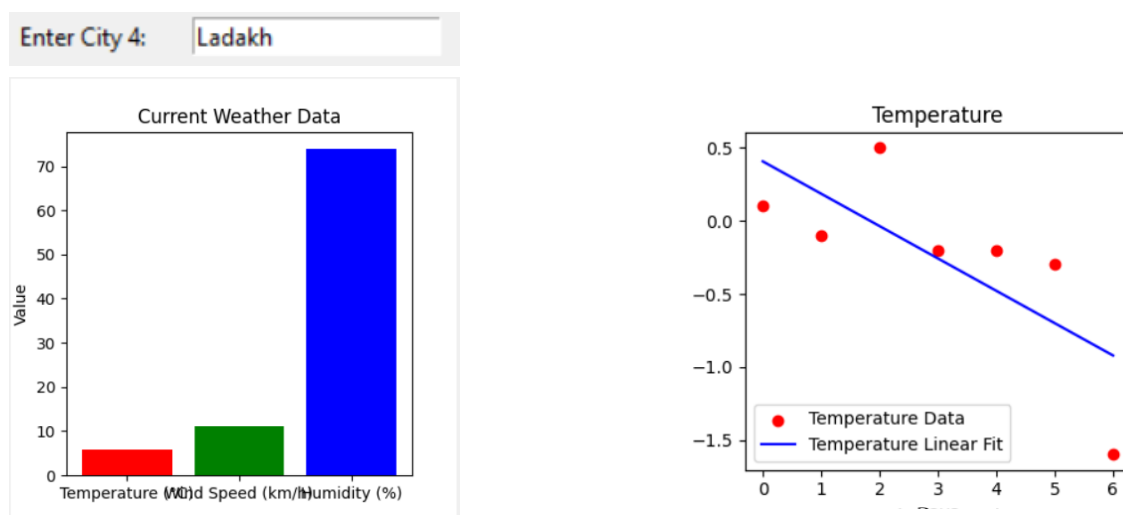
Figure 9: Bar graph to visit Hyderabad check the weather parameters temperature, wind speed, humidity.
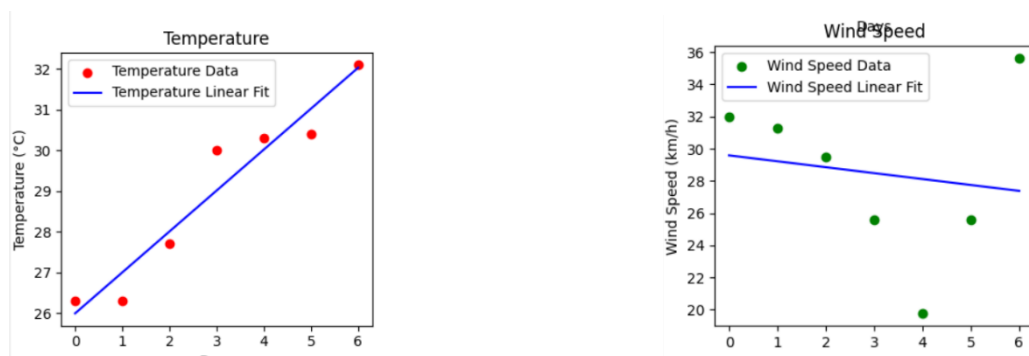
Figure 10: Simple Linear regression model for weather parameters

Figure 11: Weather prediction Description Box for Hyderabad

Figure 12: Bar graph to visit Delhi check the weather parameters temperature, wind speed, humidity.
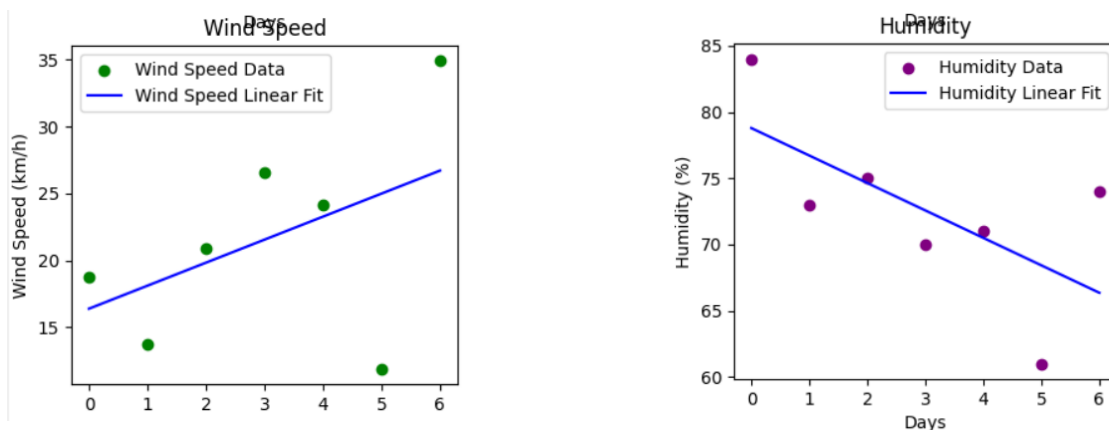
Figure 13: Simple Linear regression model for weather parameters

Figure 14: Weather prediction Description Box for Delhi

Figure 15: Bar graph to visit Ladakh check the weather parameters temperature, wind speed, humidity.
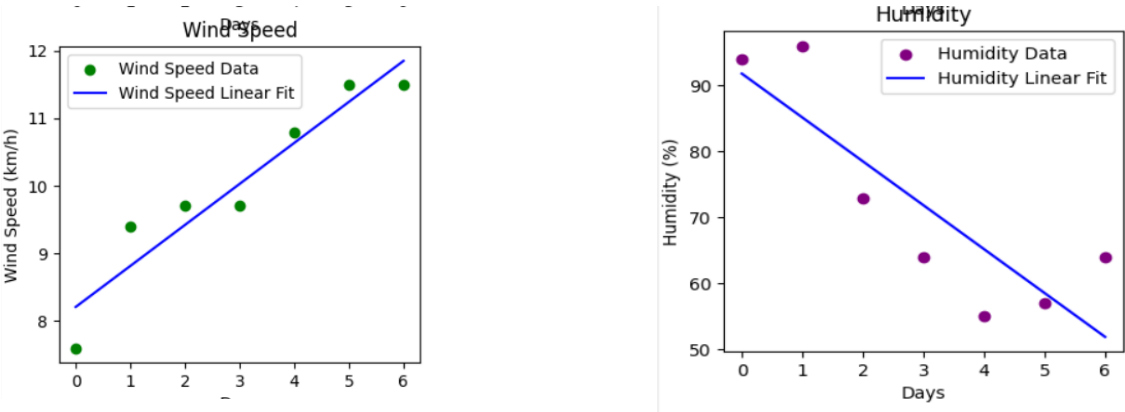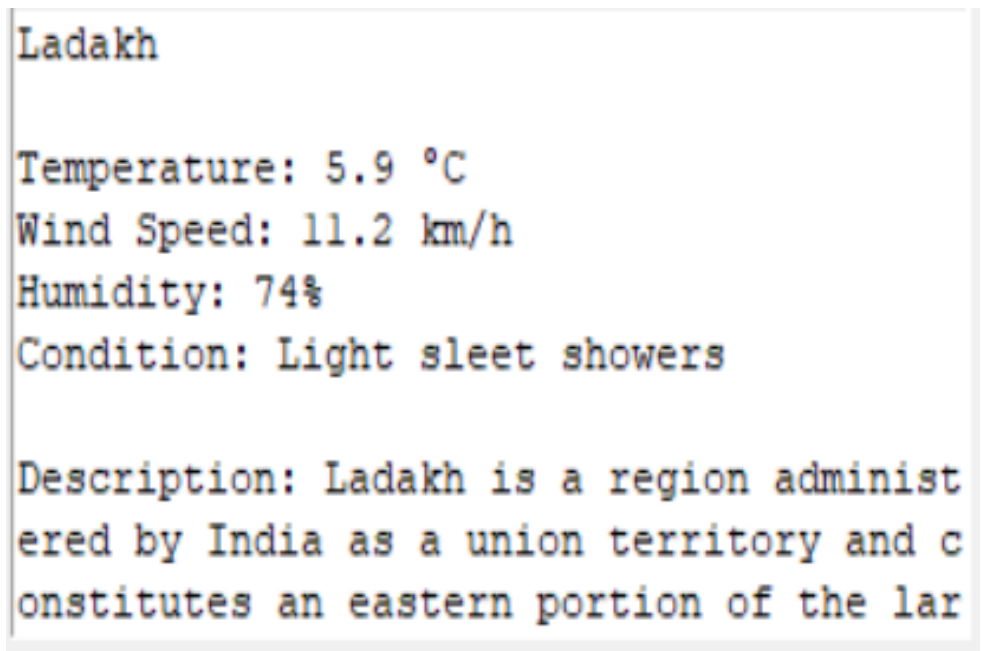
Figure 16: Simple Linear regression model for weather parameters

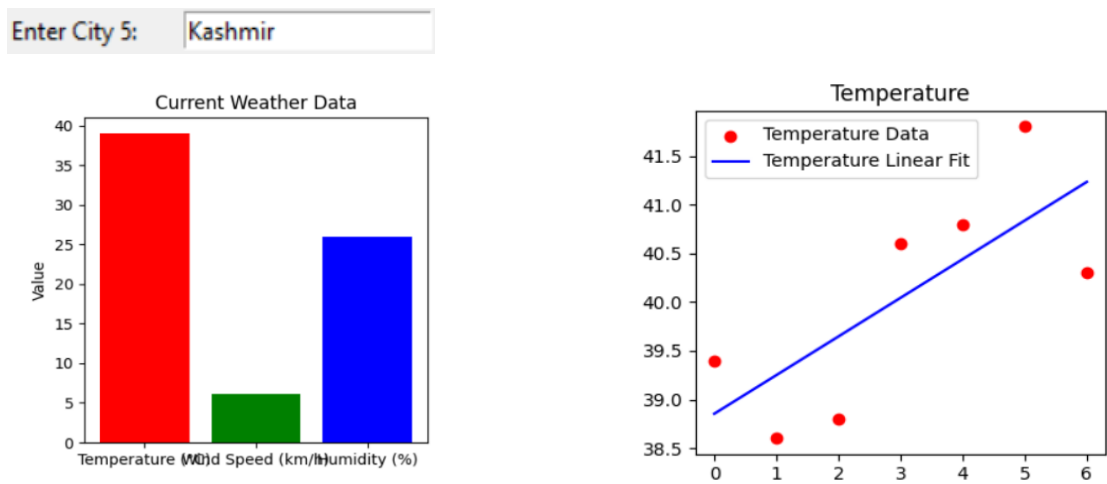Figure 17: Weather prediction Description Box for Ladakh

Figure 18: Bar graph to visit Kashmir check the weather parameters temperature, wind speed, humidity
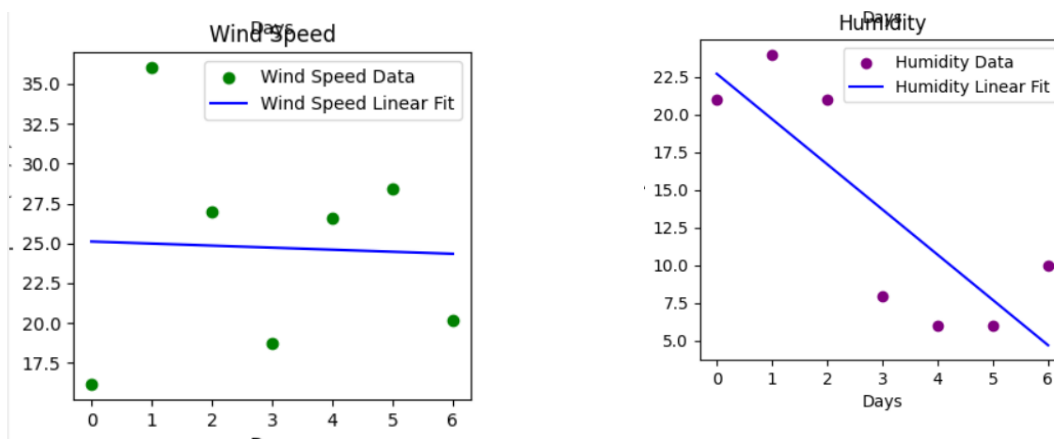
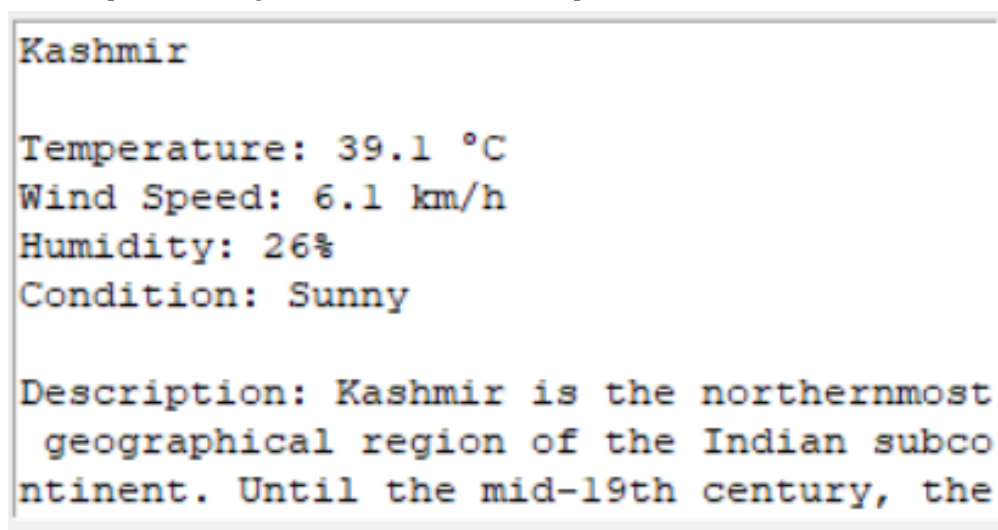Figure 19: Simple Linear regression model for weather parameters

Figure 20: Weather prediction Description Box for Ladakh

Now here Under the Get Weather box , The result is mentioned . I mean to say that this application will analyse the all the data and tell you the best place to visit is : Hyderabad . this application also mention the reason why the Hyderabad is chosen as the best place.
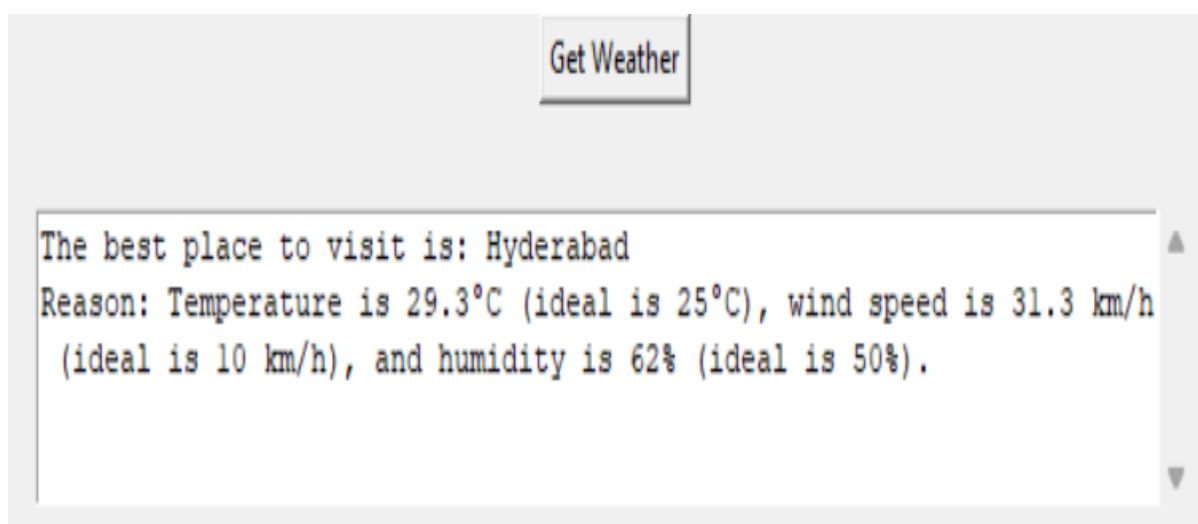

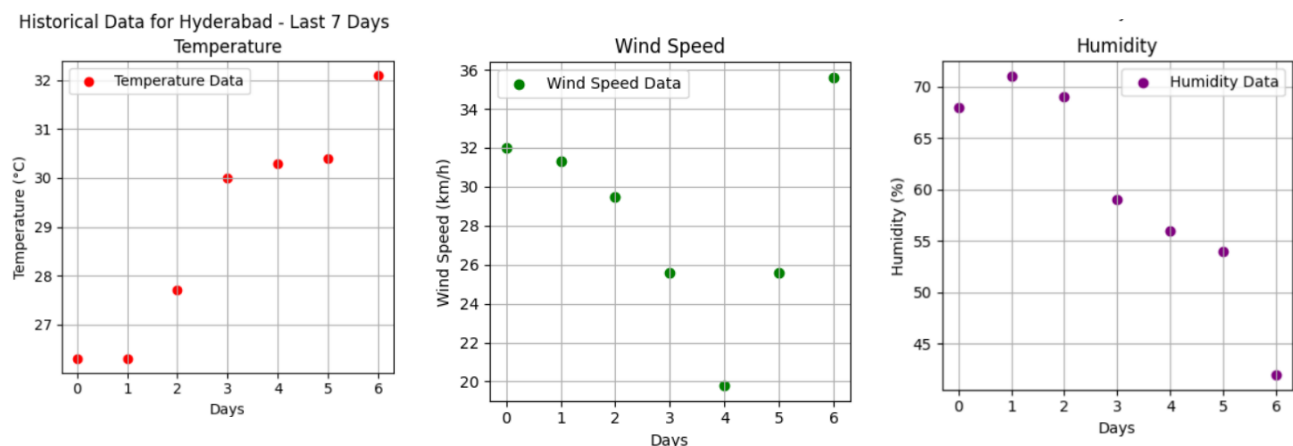Figure 21: Weather suitable prediction image to visit the suitable City

Figure 22: The below diagram represents the graph where point is mention indicating as temperature , wind speed and humidity in separate diagram for the place Hyderabad for further analysis.
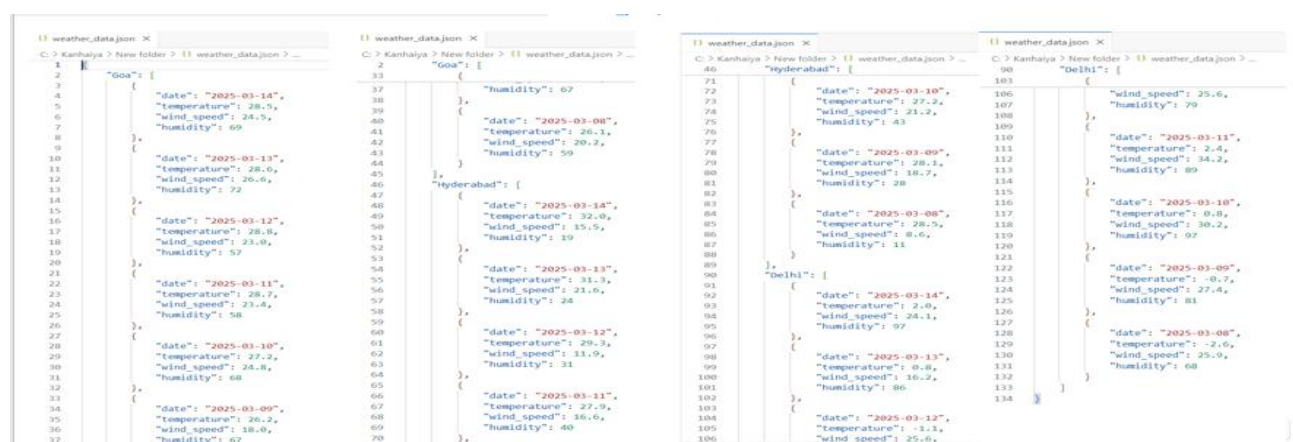

Figure 23 : Python programming (in JSON format) for application development Climate for tourism

CONCLUSION

The Weather Comparison Application is an efficient, scalable, and user friendly tool for analysing real-time and historical weather trends across multiple cities. It integrates advanced APIs, machine learning models, and graphical visualizations to provide accurate climate insights and predictive analysis. With features such as multi-city comparison, ideal weather recommendations, and data visualization, the system offers an interactive and informative approach to climate study. Though highly effective in its current implementation, future enhancements— including advanced forecasting models, interactive maps, push notifications for extreme weather conditions, and cloud-based storage—will further refine its capabilities. These improvements will transform the application into a comprehensive climate analysis tool, catering to a wider audience from travellers, researchers, and environmental analysts.

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AUTHOR CONTRIBUTIONS

Dr. V. Subrahmanyam is corresponding author of the research paper. His contribution of this paper includes implementation and optimization of algorithm. Other co-authors are Dr. K. Praveen Kumar contribution to verify the results, Indraneel K contribution to data gather, Nagurla Mahender and U. Balashivudu verify the available resources.

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