Development of Weather Forecasting Model Using Rest – API for fetching Current and Future Weather data

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Abstract: "Weather Forecast Application" which is a web based application using Rest API developed to predict the Weather conditions for a particular location by taking user input. As there are very few weather forecasting models and methods for weather prediction and uses different API providers that is where the question of which could be the best Rest API Provider to provide highly accurate results arises. There are few application which are in existence for forecasting Weather conditions which provides the weather data fetching only the user input which is not that accurate in fetching the weather data and visualization of the forecast. This concept of visualization is where few of the application fails to meet the users satisfaction and reach to there understanding and few application are endorsed with many features which makes the user feel complicated in understanding the weather data. This is a web-based application with features which is added for managing and handling errors which is done by the system which makes the system bug free. Option of searching different locations weather condition as per the user's interest. It takes the users input a fetches the weather data and visualizes it to the user. Henceforth, an application is developed Using OpenWeatherMap Rest API works based on user input and visualizes the weather conditions, temperature, humidity, wind speed, sunrise and sunset, date and time of each day. Weather forecasting application is developed to be a user friendly tool which is simple to use and handy to get information on particular geographical location.

Keywords: Weather Forecast, humidity Weather Conditions, OpenWeatherMap, temperature, wind speed, date and time.

1. INTRODUCTION

Weather is day to day changes in the atmosphere which includes humidity wind speed, temperature, cloud cover etc. Weather conditions may differ from one location to another based on the earth's position. Weather Forecasting is an application which is developed for to purpose of technology and science which is used to predict the weather condition of the atmosphere to the specified location. There is different Rest API available over the internet to fetch historical, current and future weather data.

API provider	Forecast	Interval	Format
aemet	Next 7-day	hourly	JSON
metoffice	Next 5-day	hourly	XML
met.no	Next 10-day	3-hourly	XML
openweathermap	Next 5-day	3-hourly	XML/ JSON
weatherbit	Next 5-day	3-hourly	JSON
darksky	Next 7-day	hourly	JSON
wunderground	Next 10-day	hourly	XML/ JSON
apixu	Next 10-day	hourly	XML/ JSON

Table 1: Weather Forecast Rest API providers

There are different Rest API Providers that is shown in Table 1 which is available over the internet used for weather prediction such as aemet which is an API provider that forecasts the weather conditions of next 7 days with hourly interval which is of JSON Format, The metoffice API provider which forecasts the weather data as prediction for the next 5 days with hurly intervals which is developed using XML Format, met.no is the API provider that forecasts the weather data for next 10 days with 3-hourly intervals using XML format, OpenWeatherMap is a Rest API which is used in this model which forecasts the weather data for current and future forecasting of next 5days with 3-hourly intervals which is in both

XML and JSON Format and there are other such API Providers such as weatherbit ,darksky, wunderground, apixu etc,. That provides the weather data.

This Weather Forecasting application is a web based application which predicts the weather condition of the atmosphere for the specified location and time. This application of weather forecasting is not only used by Scientists, researchers but also necessary for ordinary people, It is become a necessary and convenient to every individual person. There are many other advanced weather applications in form of mobile apps or websites which is available in Search Engines, Google Play or App Store to fulfill the user needs. But only few applications are handy and easy to use or interactive to its users, which would not be easy or useful or convenient for ordinary users. This application provides user interface, necessity of all features and functionality to its users and also visually represents the weather conditions by the form of background pictures. This Weather app is a real time system that takes the user's location or the default set location and fetches the exact weather conditions, temperature, humidity, wind speed, date and time of each day and also visualizes the weather for next 7 days.

Weather Forecasting App consists of persistent data which can persistent data which can predict the weather condition of present and Future as the same as currently developed application with some future enhancement. Therefore, as a future improvement can be done by developing the application for IOS, Android, mobile phones and tablets. Secondly the measurement of weather in atmosphere above the ground and as there is no 100 percent accuracy in weather forecasting because future forecasting cannot be exact. As it cannot help the agricultural industry by sensing the rainfall which would help the farmers to cultivate the suitable crop, for predicting the crop health, pest etc based on geographical location all this can be done as the future enhancement.

Weather Forecasting application is developed to be user friendly tool which is simple and convenient to use and get information on particular geographical location from the OpenWeatherMap – API.

2. LITERATURE REVIEW

Weather Forecasting Application has become very important for day to day life, as it is the concept of science and technology that is creating a major impact on lives of many individuals. The Weather Forecasting is proposed by NMHSs which includes forecasters providing text-based, sensible and weather elements which are predicted using one of the approaches used for weather forecasting i.e. by using numerical weather prediction method.

This application is where the user will enter a location for which current temperature, humidity, wind speed, sunrise, sunset, date and time. The weather conditions are fetched from the OpenWeatherMap – API which provides a key along with the path which is used to fetch the weather data. This application helps us, scientists and researchers to predict the weather condition if its going to rain or be cloudy. Weather forecasting App's main objective for development of this project is to fetch data in the need of taking information about weather conditions world-wide. The user fetches the device position using OpenWeatherMap and if in case the weather condition of specified location is unavailable then the location by default is set to Delhi. Along with fetching the data and providing information on weather condition, this project is designed to make it user friendly and helpful to assume what could be the weather condition as soon as the user input is given the background of the desktop application changes according to the weather condition. Along with daily weather forecast this application also developed for displaying the future forecast of next & days which is not 100 percent accurate as it is not possible to predict the accurate weather condition.

The main concept of differentiating the differences between the proposed system and existing system is to analyze the betterment and improvisation in the features that is being embedded. Before proceeding further in development of application the developer makes the analysis on the past, present and future weather forecasting applications feature so that uniqueness and novelty can be infused into the application which would also add value to the proposed system.

The existing system consists of the features with present improvisation. There are few application which are in existence for forecasting Weather conditions which provides the weather data fetching only the user input which is not that accurate in fetching the weather data and visualization of the forecast. This concept of visualization is where few of the application fails to meet the users satisfaction and reach to there understanding and few application are endorsed with many features which makes the user feel complicated in understanding the weather data.

This is a web-based application with features which is added for managing and handling errors which is done by the system which makes the system bug free. Option of searching different locations weather condition as per the user's interest. It takes the users input a fetches the weather data and visualizes it to the user.The main Functions or Features of this application are:

[1] This application provides time to time update of weather condition.
[2] Provides predicted weather forecast for the next 7 days.
[3] Provides 98 percent accurate weather data and information.
[4] Provides current temperature, wind speed, humidity, the timings of sunrise and sunset which is updated based on the weather condition.

[5] It provides user interface, the user can search of weather condition at anytime or anywhere from the current location to the desired location's weather forecast.

[6] Based on the future forecast the users can plan there day to day activities and plan for traveling.

[7] The change in weather in every hour as according to weather changes.

WORKFLOW / PLAN:

[1] Literature search and review: We will work on HTML, CSS, JavaScript, and JSON, use the OpenWeatherMap-API and JSON formatting to the fetched data.

[2] Analysis and modeling: Based on the Literature review, the project analysis is done and a prototype is developed for the following application.

[3]Navigation and UI design: This stage of development is where the project design is developed by application layout and application flow so the it provides User Interface for its users.

[4]Implementation: Beginning with the prototype is developed to start the integrate modules together and completion with all the features endorsed with the application which should be developed in a way it that there is no errors and functioning properly

[5] Testing and Debugging: Testing and Debugging will be a challenging and always need to emphasize on the comprehensiveness of the data and magnificence of UI.
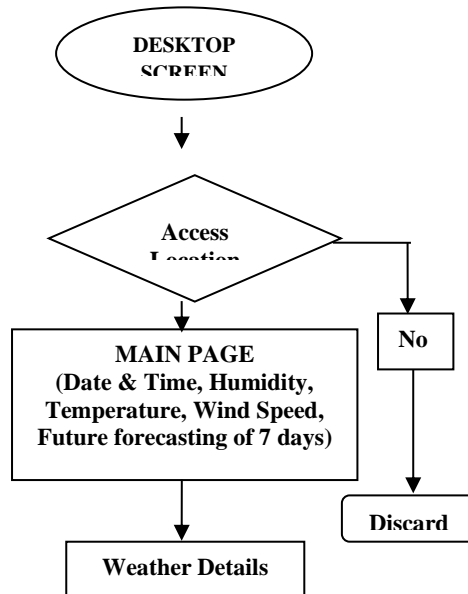

Fig.1 Process and workflow of application

3. METHODOLOGY:

Weather Forecast Application which is a web based application developed to predict the Weather conditions for a particular location by taking user input. This application works based on user input and visualizes the weather conditions, temperature, humidity, wind speed, date and time of each day. It also predicts and visualizes the weather forecast for next 7 days.
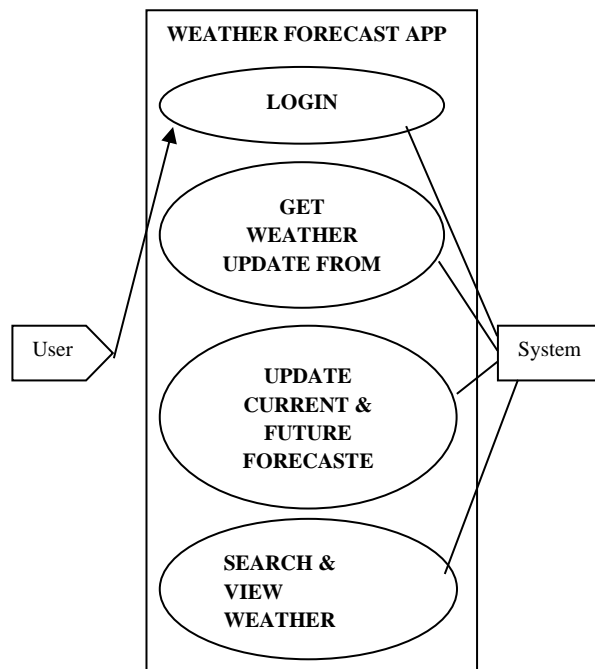
[1] User: The user logins into the developed application which requests to grant permission to access the location, which connects to the system to use fast and easy-to-work, weather APIs.

[2] OpenWeatherMap-API: It is a free open source platform which takes the user location or user input location which helps in making one API call and receive all essential weather data in one response such as Minute forecast, Hourly forecast, Daily forecast for next 7 days and also get the weather updates through the API Key. It responses back to the system and updated the current and future forecasting. It is also developed in such a way that user can fetch the weather condition of the desired location by giving a user input to the weather API.
For developing this application the technologies used are HTML, CSS, and JavaScript. It helps in getting the data using API (Application Programming Interface). In this case of development we are using two API's one to fetch the current location weather conditions and another is to fetch the weather condition as per the users interest.
To fetch the current weather using the user input by the format:

api.openweathermap.org/data/2.5/weather?q={cityname},{state},{country code}&appid={your api key}

WEATHER DATA GATHERING
For retrieving weather data for Visualization and Analysis, we use various Weather APIs which helps to collect data with expected parameters and integration.
There are few API for fetching the weather data: Google Weather API, AccuWeather API, Open Weather API, and Dark Sky API which are open source platforms that is helpful in reducing the need to store data and latency delay which consumes a lot of storage. The data retrieved from the APIs would be in JSON format which is streamed into JavaScript that extracts the data from the storage.
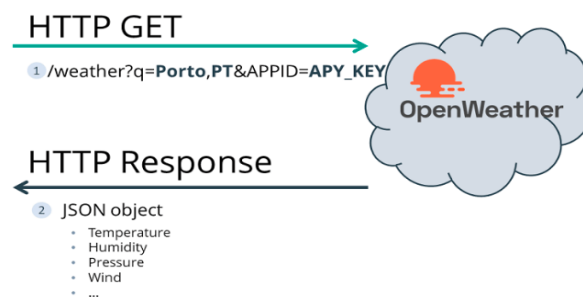

Fig.3 Weather Forecast Gathering Flow

Some currently used approaches for predicting weather conditions:
(1) Numerical Weather Prediction.
(2) Persistence and Trend Method.
(3) Climatology Method
(4) Analog Method.

(1) **Climatology Method:** It is a simple method which is used for weather forecasting. Earlier, it was used by the scientists for reviewing the weather statistics which is being collected over multiple years and also to predict the current weather condition.

(2) Analog Method: It is one of the difficult methods of weather forecasting as it requires the historical weather forecast for the past forecast with similar forecast of the current forecast which is not easy to gather. Even slight difference between the past forecast and current forecast would create a huge impact on the prediction or forecasting. This is why analog method is not that recommended to be used.

(3)Persistence and Trend Method: This method does not require any particular skill as it relies on the past weather forecast trends. The state of weather condition changes slowly, which will be same to a forecast tomorrow that remains the same as current day, with a hat tip to the climate's norm for the specific time of year.

(4) Numerical Weather Prediction (NWP): This prediction method depends on the computer for weather forecasting. Massive Super computers, complete with the forecasting models which helps the scientists to make predictions based on the weather condition, like Temperature, pressure, time, date, wind speed etc.,

This project is entitled as "Weather Forecast Application" which is a web based application developed to predict the Weather conditions for a particular location by taking user input. This application works based on user input and visualizes the weather conditions, temperature, humidity, wind speed, date and time of each day. It also predicts and visualizes the weather forecast for next 7 days.

ANALYSIS:
System Analysis is a concept of analysis or to find the nature and functionalities of the proposed system. The process of collection the facts and it is making done to solve problems or for making improvements in the project. It is one of the important phases of development. System Analysis is a detailed study of this application for proper understanding of the system applications flow.The design of the complete application is defines the flow of from beginning and how it should move forward and make sure it reaches the desired goal to be the result.
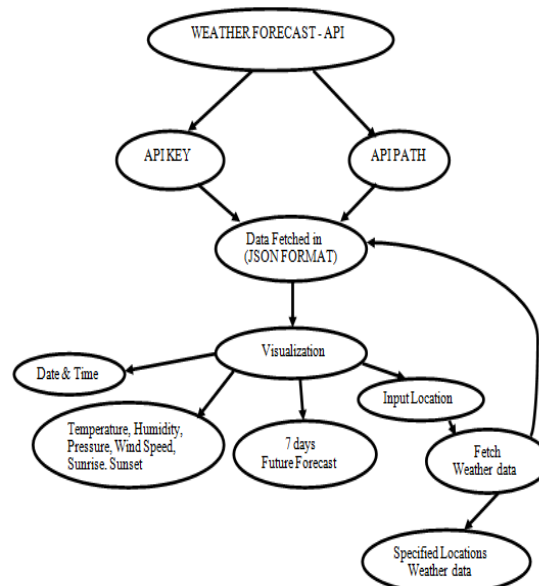

Fig.4 Flow of Weather data fetched and visualised

[1] Environment Analysis: This is a desktop application which is using the Open Weather API to fetch the weather data. It sends the request to the API through the API Key and then gets responses from the API. This application also uses the Google API for fetching geolocation.
[2] Screen and Interaction Analysis: The user should access this application from desktop or laptops where all the information is displayed on the resolution of desktop. Interaction with the system is done by scrolling, clicking. For

example, the user can view the 7 days weather forecast by scrolling the screen and also by giving a text input by clicking on the search box.

[3] Usage Analysis: Users can access this application through a desktop or laptop whenever the user wants according to user's interest. User must be connected to the internet.

SCOPE:

The scope of this project is a desktop application, which works for the weather forecasting sector which is developed with the intention to fetch the weather data through the weather API for the purpose of gathering information about weather worldwide.

FORECASTING ISSUES

An aim of developing this application is to visualize accurate weather predictions. In fact, this is where the main forecasting problem arises in the prediction of weather condition as it is not 100 percent accurate. But there weather many other scientist who worked on providing 100 percent accurate forecasting which was a very challenging task which is yet to be accomplished as predicting the weather condition exactly is not possible because earth's surface is of both land and water which produces various natural sources of energy such as solar energy, liquid, and solid form of energy and also the gases that are available in the atmosphere. Which in result creates problems in prediction by providing Imperfect data, Faulty vision and fudges, Chaos and we do not know the atmospheric conditions accurately because the weather can naturally change any time.

Accuracy

This application is 98 percent accurate and efficient model and aggregate.

Accuracy = (TP + TN)/ (TP + TN + FP + FN).

Precision = TP/ (TP + FP).

Recall = Sensitivity = TP / (TP + FN)

4. INTERPRETATION OF RESULT

Weather Forecast Application" which is a web based application developed to predict the Weather conditions for a particular location by taking user input. This application works based on user input and visualizes the weather conditions, temperature, humidity, wind speed, date and time of each day. It also predicts and visualizes the weather forecast for next 7 days. In case user requires other location's weather condition; user can change the location or city by giving other input. The user input fetches the device position using OpenWeatherMap. If in case the device position is unavailable, by default the location is set to Delhi and weather data i.e. the forecast data and current weather of a location is fetched from OpenWeatherMap with Asyn, Await and server less functions which makes API call and receives all essential weather data.
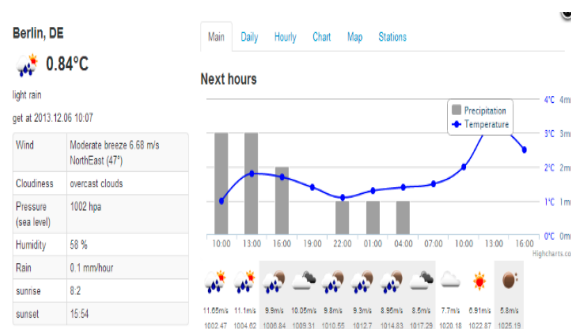

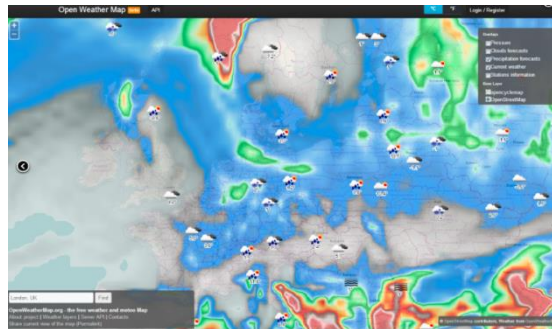Fig.5 Current Weather state of desired location

Fig.6 Overview of weather data in thematic map

This Application also visualizes the weather conditions which are also reflecting the weather conditions in form background pictures which changes as the weather condition of the user interest location. Weather forecasting application is developed to be a user friendly tool which is simple to use and handy to get information on particular geographical location.

5. SUMMARY

Weather Forecasting Application is developed to provide future and current weather condition of a particular region, which visualizes the state of atmosphere of users location and also for the location across the world as per users interest. This application's main goal is to create a web application using JavaScript framework with OpenWeatherMap API which is in JSON Format.

This Application uses the OpenWeatherMap-API which records the pattern of weather data of the current and future forecast where the JavaScript code is embedded with a API key where it makes one call to the OpenWeatherMap-API to fetch the current and future weather condition. The API is used to access the location which the user specifies to retrieve the weather condition through this restful API which has a web interface.

This application is a desktop web based application; it provides better accuracy in fetching the data and more efficient. Weather forecasting is one of the major concept of life which very essential these days and handy to use. It helps every individual to plan there day to day living and also helpful for the agricultural aspects for cultivation of crops. This application visualizes the humidity, pressure, temperature, and predicts the timings of sunrise and sunset and displays the weather condition of the next 7 days.

6. FUTURE ENHANCEMENTS

Weather Forecasting Application consists of persistent data which can predict the weather condition of present and future as the same as currently developed application with some future enhancement of measuring weather in the atmosphere above ground and as there is no 100 percent accuracy in weather forecasting because future forecasting cannot be exact. As it cannot help the agricultural industry by sensing or predicting the crop health, pest etc based on geographical location. It can be done in future enhancement and the weather forecast cannot be always be accurate, especially in predicting the future weather conditions and remain unpredicted. Weather forecasting application is developed to be user friendly tool which is simple to use and handy to get information on particular geographical location and as the future enhancement as it is a desktop or laptop based project the application can be improvised to use mobile phones, tablets, and in both android and IOS.

Though, it was not possible to develop the application with 100 percent accuracy in predicting the future weather condition. Although successfully completed creating an application with 98 percent of accuracy. But in case of future enhancement there is some possibility of improvement in this case. Once visualization of the weather forecasting it would be easy to modify the application by adding the advanced modules. This provides efficiency and versatility to the project, which would have high scope of improvement. Hence, adding more improvement will increase the accuracy and make the application more efficient.

7. CONCLUSION

Weather is day to day changes in the atmosphere which includes humidity wind speed, temperature, cloud cover etc. Weather conditions may differ from one location to another based on the earth's position. Weather Forecasting is an application which is developed for to purpose of technology is used to predict the weather condition of the atmosphere for the specified location.

This weather Forecasting application is a web based application which predicts the weather condition of the atmosphere for the specified location and time.

Weather Forecasting Application consists of persistent data which can predict the weather condition of present and future as the same as currently developed application with some future enhancement of measuring weather in the atmosphere above ground and as there is no 100 percent accuracy in weather forecasting because future forecasting cannot be exact. As it cannot help the agricultural industry by sensing or predicting the crop health, pest etc based on geographical location. It can be done in future enhancement and the weather forecast cannot be always be accurate, especially in predicting the future weather conditions and remain unpredicted. Weather forecasting application is developed to be user friendly tool which is simple to use and handy to get information on particular geographical location.

REFERENCES

[1]https://www.w3schools.com/html/default.asp.

[2]https://www.w3schools.com/html/html_scripts.asp

[3] https://stackoverflow.com/

[4]https://developer.mozilla.org/en-US/docs/Web/JavaScript

[5] https://openweathermap.org/api/one-call-3

[6] Mr. Sunil Nevada, Mr. Jobin Thomas, Mr. Pintukumar Yadav, Ms. Shakila Shaikh, "Weather Prediction: A novel approach for measuring and analyzing weather data", International.

[7] Dhanashree S. Medhekar, Mayur P. Bote, Shruti D. Deshmukh, "Heart Disease Prediction System using Naive Bayes", INTERNATIONAL JOURNAL OF ENHANCED RESEARCH IN SCIENCE TECHNOLOGY & ENGINEERING

[8]Wang, ZhanJie & Mujib, A B M. (2017). "The Weather Forecast Using Data Mining Research Based on Cloud Computing". Journal of Physics, pp 1-6

[9] Munmun Biswas BGC Trust University Bangladesh, Sayantanu Barua BGC Trust University Bangladesh, Tanni Dhoom Premier University "Weather Forecast Prediction: An Integrated Approach for Analyzing and Measuring Weather Data" in International Journal of Computer Applications · December 2018.

[10] Anant Sharma1 , Ankit Yadav2 , Bhanu Kumar3 , Dr. Sunil Gupta4 1,2,3 Department of Computer Science Engineering, Global Institute of Technology, Jaipur 4Professor, Department of Computer Science Engineering, Global Institute of Technology, Jaipur "Weather Forecast Application".

[11] THE WEATHER RESEARCH AND FORECASTING MODEL Overview, System Efforts, and Future Directions Jordan G. Powers, Joseph B. Klemp, William C. Skamarock, Christopher A. Davis, Jimy Dudhia, David O. Gill, Janice L. Coen, David J. Gochis, Ravan Ahmadov, Steven E. Peckham, Georg A. Grell, John Michalakes, Samuel Trahan, Stanley G. Benjamin, Curtis R. Alexander, Geoffrey J. Dimego, Wei Wang, Craig S. Schwartz, Glen S. Romine.

[12] Weather Forecasting Application Using Web-Based Model-View-Whatever Framework, Kathiravan Srinivasan; Anant Nema; Chao-Hsi Huang; Tung Yang Ho.

[13] A Review on Weather Forecasting Techniques Garima Jain1 , Bhawna Mallick2 Student, Department of Computer Science and Engineering, Galgotias Educational Institutions, Greater Noida, Uttar Pradesh, India1 Head of Department (Computer Science), Galgotias Educational Institutions, Greater Noida, Uttar Pradesh, India.

[14] A Review Study of Weather Forecasting Using Artificial Neural Network Approach 1Abhishek Saxena, 2Neeta Verma & 3Dr K. C. Tripathi 1M.Tech(CSE) persuing,Department of Computer Science & Engineering, Inderprastha Engineering College, Ghaziabad, Uttar Pradesh,INDIA 2 Associate Professor, Department of Computer Science & Engineering, Inderprastha Engineering College, Ghaziabad, Uttar Pradesh, INDIA 3Assistant Professor, Department of Computer Science & Engineering, Inderprastha Engineering College, Ghaziabad, Uttar Pradesh, INDIA

[15] Deep Uncertainty Quantification: A Machine Learning Approach for Weather Forecasting, Bin Wang, Jie Lu, Zheng Yan, Huaishao Luo, Tianrui Li, Yu Zheng, Guangquan Zhang, 22 Dec 2018.