# REAL-TIME WEATHER FORECASTING

A MINOR PROJECT REPORT

*Submitted by*

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*in partial fulfillment of the requirements for the degree of*

BACHELOR OF TECHNOLOGY
in
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**COLLEGE OF ENGINEERING AND TECHNOLOGY**

**SRM INSTITUTE OF SCIENCE AND TECHNOLOGY**

**KATTANKULATHUR- 603 203**

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# SRM INSTITUTE OF SCIENCE AND TECHNOLOGY
# KATTANKULATHUR – 603 203

## BONAFIDE CERTIFICATE

Certified that this B. Tech project report titled **"REAL TIME WEATHER FORECASTING"** is the bonafide work of **Ms. Y. VENKATA KASHYAPI , Mr. S.SREENIVASULA REDDY and Y.UMA VENKAT REDDY,** who carried out the project work under our supervision. Certified further, that to the best of my knowledge the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion for this or any other candidate.

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# ABSTRACT

Accurate Weather forecasting has been one of the most challenging problems around the world. Modern Weather forecasting involves a combination of computer models, observation (by use of balloons and satellites), and knowledge of trends and patterns (used by Local weather observers and weather stations). Using these methods, reasonably accurate forecasts can be made. Most of the computer models used for forecasting are run by forecast models based on complex formula. However, not all of these predictions prove reliable. Here this system will predict weather based on parameters such as temperature, humidity and wind.

Weather forecasting system gives parameters such as temperature, humidity, and wind, cloudy and will forecast weather based on previous record therefore this prediction will prove reliable. This system can be used for Air Traffic, Marine, Agriculture, Forestry, Military, and Navy etc.

The technical milestones, that have been achieved by various researchers in this field has been reviewed and presented in this survey paper.



**Keywords**- Weather prediction, temperature, API, Meteorological data.

# TABLES OF CONTENTS

# CHAPTER 1

## 1.1 INTRODUCTION

Weather forecasting is the prediction of the state of the atmosphere for a given location using the application of science and technology. This includes temperature, rain, cloudiness, wind speed, and humidity. Weather warnings are a special kind of short-range forecast carried out for the protection of human life.

- Time to time update weather
- Temperature Update
- provide accurate data information about weather.
- any places data can be search and provide information as according to weather.
- help user to travel.

### 1.2 Motivation :

Hazardous weather is the reason the National Weather Service (NWS) was founded. Motivated by previous research on cloud-based real-time weather forecasting using machine learning, this work develops a collaborative machine learning technique for weather forecasting. Essentially, weather conditions from different regions are combined to predict the weather parameters for a given region but in contrast to where only temperature was considered, in this work six different weather parameters are predicted.

Moreover, in addition to using data from different regions as in a complete system with a both local and cloud-based servers as well as web and mobile client applications have been employed by extending the system in. Detailed mathematical formulations of the collaborative models have also been provided for the five different machine learning algorithms that have been used. It was observed that collaborative forecasting particularly enhances the performance of the Multiple Polynomial Regression (MPR) and Multiple Linear Regression (MLR) algorithms. Moreover, a system that incorporates several machine learning algorithms to perform analytics in real-time on the cloud, has been developed. The results of the analytics are then sent to the user from the cloud. A mobile, desktop and web application have also been developed for users to observe the current weather conditions, download weather data and perform analytics.

# CHAPTER 2

## 2.1 EXISTING SYSTEM

The traditional forecast process employed by most NMHSs involves forecasters producing text-based, sensible, weather-element forecast products (e.g. maximum/minimum temperature, cloud cover) using numerical weather prediction (NWP) output as guidance. The process is typically schedule-driven, product-oriented and labour-intensive. Over the last decade, technological advances and scientific breakthroughs have allowed NMHSs' hydro meteorological forecasts and warnings to become much more specific and accurate. As computer technology and high-speed dissemination systems evolved (e.g. Internet), National Weather Service (NWS) customers/partners were demanding detailed forecasts in gridded, digital and graphic formats. Traditional NWS text forecast products limit the amount of additional information that can be conveyed to the user community. The concept of digital database forecasting provides the capability to meet customer/partner demands for more accurate, detailed hydro meteorological forecasts. Digital database forecasting also offers one of the most exciting opportunities to integrate PWS forecast dissemination and service delivery, which most effectively serves the user community

### 2.2 ADVANTAGES:

- Forecasts based on temperature and precipitation are important to agriculture, and therefore to traders within commodity markets.
- Temperature forecasts are used by utility companies to estimate demand over coming days.
- Being able to forecast and plan for the future when it comes to the local climate is a major advantages.

### 2.3 CHALLENGES:

To predict the weather is limited by three factors:

- the amount of available data.
- the time available to analyze it. • the complexity of weather events.

# CHAPTER 3

## 3.1 PROBLEM STATEMENT

The traditional forecast process employed by most NMHSs involves forecasters producing textbased, sensible, weather-element forecast products (e.g. maximum/minimum temperature, cloud cover) using numerical weather prediction (NWP) output as guidance. The process is typically schedule-driven, product-oriented and labour-intensive. Over the last decade, technological advances and scientific breakthroughs have allowed NMHSs' hydrometeorological forecasts and warnings to become much more specific and accurate.

### 3.2PROPOSED METHOD

User will enter current temperature; humidity and wind, System will take this parameter and will predict weather from previous data in database. The role of the admin is to add previous weather data in database, so that system will calculate weather based on these data. Weather forecasting system takes parameters such as temperature, humidity, and wind and will forecast weather based on previous record therefore this prediction will prove reliable.

### 3.3 LIMITATIONS:

- Errors in weather model forecasts arise because we don't know what every molecule of air in the atmosphere is doing.
- We have an imperfect understanding of how these molecules interact with each other at various scales.
- Weather forecasting have limitations because it is only a prediction

# CHAPTER 4

## 4.1 MODULES AND PROJECT DESCRIPTION

In this project we have Two modules

1) Data gathering and pre - processing.

2) Applying Algorithm for prediction .

**Explanation:**

1) In this module we first gather the data(dataset) for our prediction model.

   Data comes in all forms, most of it being very messy and unstructured. They rarely come ready to use. Datasets, large and small, come with a variety of issues- invalid fields, missing and additional values, and values that are in forms different from the one we require. In order to bring it to workable or structured form, we need to "clean" our data, and make it ready to use. Some common cleaning includes parsing, converting to onehot, removing unnecessary data, etc. In our case, our data has some days where some factors weren't recorded. And the rainfall in cm was marked as T if there was trace precipitation. Our algorithm requires numbers, so we can't work with alphabets popping up in our data. so we need to clean the data before applying it on our model.

2) Once the data is cleaned, In this module that cleaned data can be used as an input to our Linear regression model. Linear regression is a linear approach to form a relationship between a dependent variable and many independent explanatory variables. This is done by plotting a line that fits our scatter plot the best, ie, with the least errors. This gives value predictions, ie, how much, by substituting the independent values in the line equation. We will use Scikit-learn's linear regression model to train our dataset. Once the model is trained, we can give our own inputs for the various columns such as temperature, dew point, pressure, etc. to predict the weather based on these attributes.

### 4.2 MODULE

1) By the end of the first module the fully cleaned and useful data is available for the apply the algorithm for the prediction
2) By the end of the second module the actual prediction will be happen the outcome is the amount of rainfall in inches based upon the users input.

**Python API for Data Collection**

A Python API wrapper is an easy way to obtain free weather data from APIs and open data. A wrapper was designed to support multiple weather data suppliers, so it is possible to add more suppliers in the future. The API does not support the use of multiple suppliers at the same time. Currently the Norwegian Meteorological Institute data service frost.met.no and Netatmo are supported. The API will request hourly data for a given date, either at the station nearest to the specified latitude and longitude coordinate or within a specified rectangle as specified in kilometers centered on a given latitude and longitude co ordinate. The wrapper uses HTTP GET requests to obtain the data from the data suppliers and returns a list where each element is a 3 item list with stationID, timestamp, and measured value. The returned data can then be saved to a file or database.

# CHAPTER 5
## 5.1 ALOGORITHM AND ITS TECHNIQUES

Linear Regression is a machine learning algorithm based on supervised learning. It performs a regression task. Regression models a target prediction value based on independent variables. It is mostly used for finding out the relationship between variables and forecasting. Different regression models differ based on – the kind of relationship between dependent and independent variables, they are considering and the number of independent variables being used.

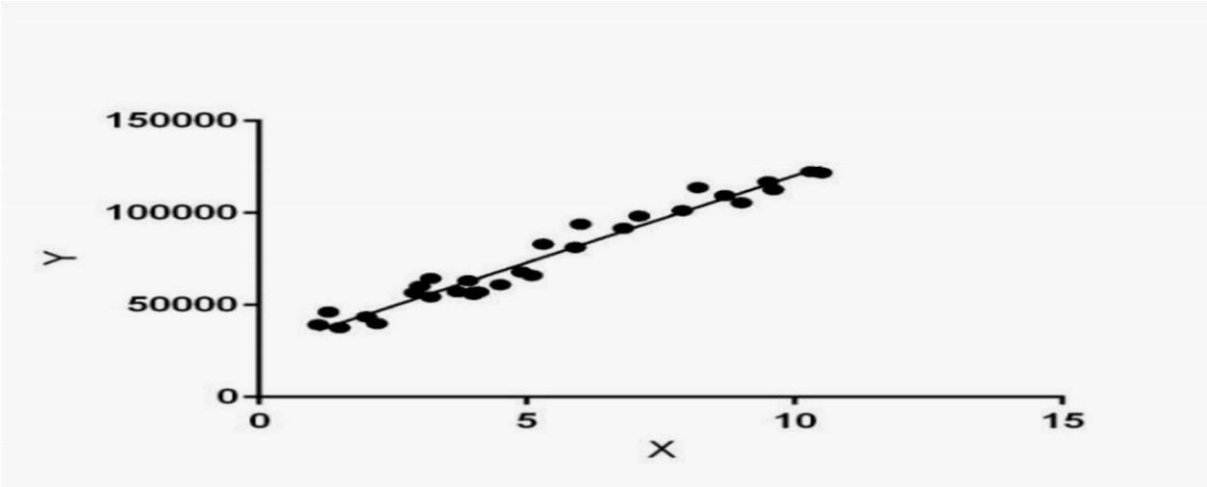



Fig 1: Algorithm Graph

Linear regression performs the task to predict a dependent variable value (y) based on a given independent variable (x). So, this regression technique finds out a linear relationship between x (input) and y(output). Hence, the name is Linear Regression.In the figure above, X (input) is the work experience and Y (output) is the salary of a person. The regression line is the best fit line for our model.

Hypothesis function for Linear Regression : $y=mx+c$

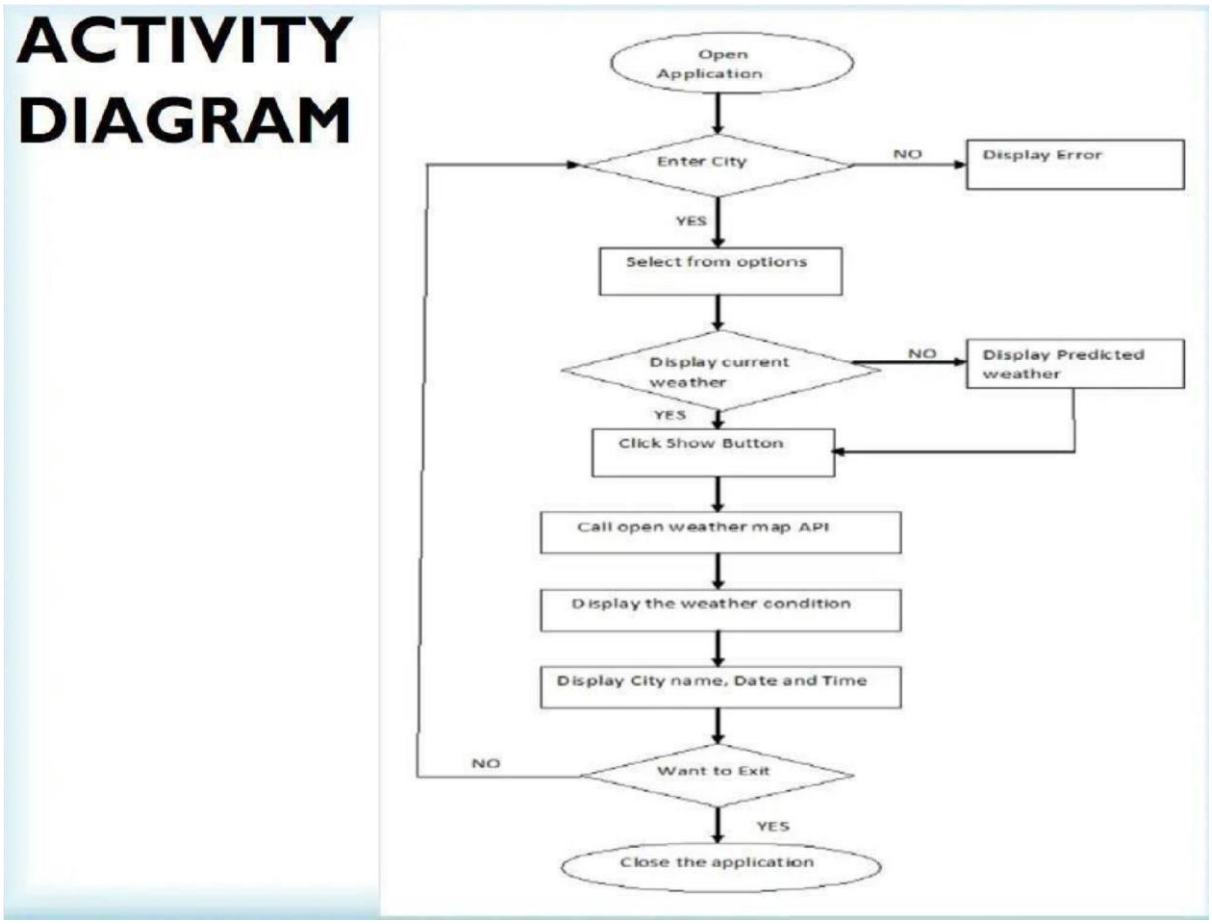
Where y is the response variable.

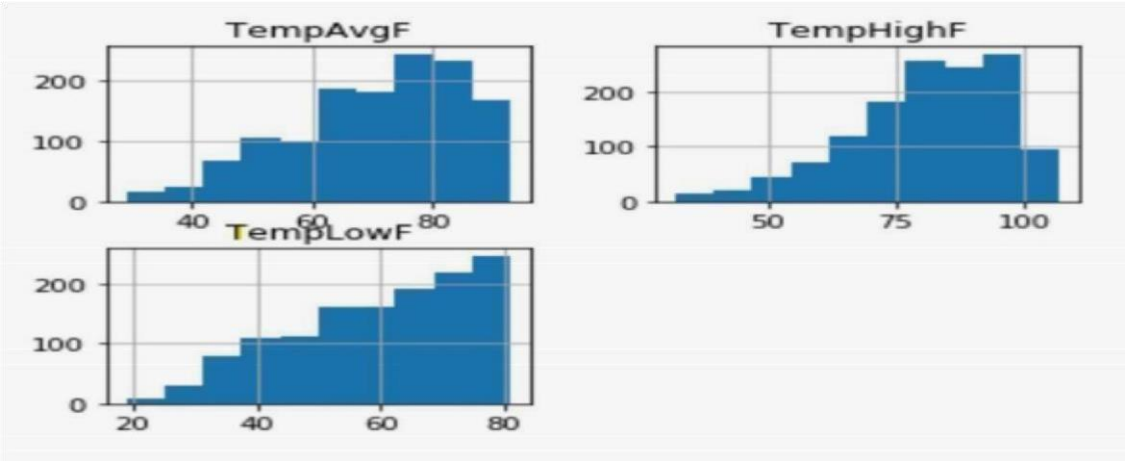
x is the predictor variable.

m and c are constants which are called the coefficients.

# CHAPTER 6

## 6.1




**IMPLEMENTATION**

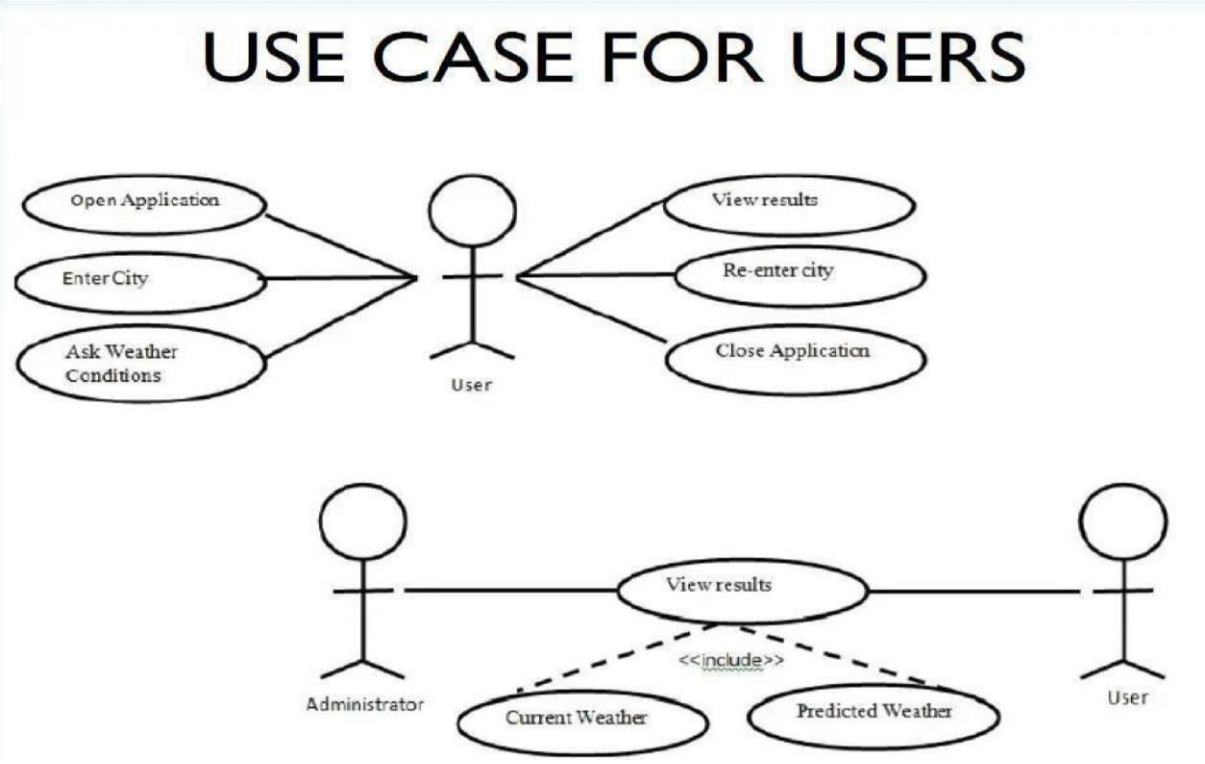
Implementation process : The precipitation in inches for the input is as follows

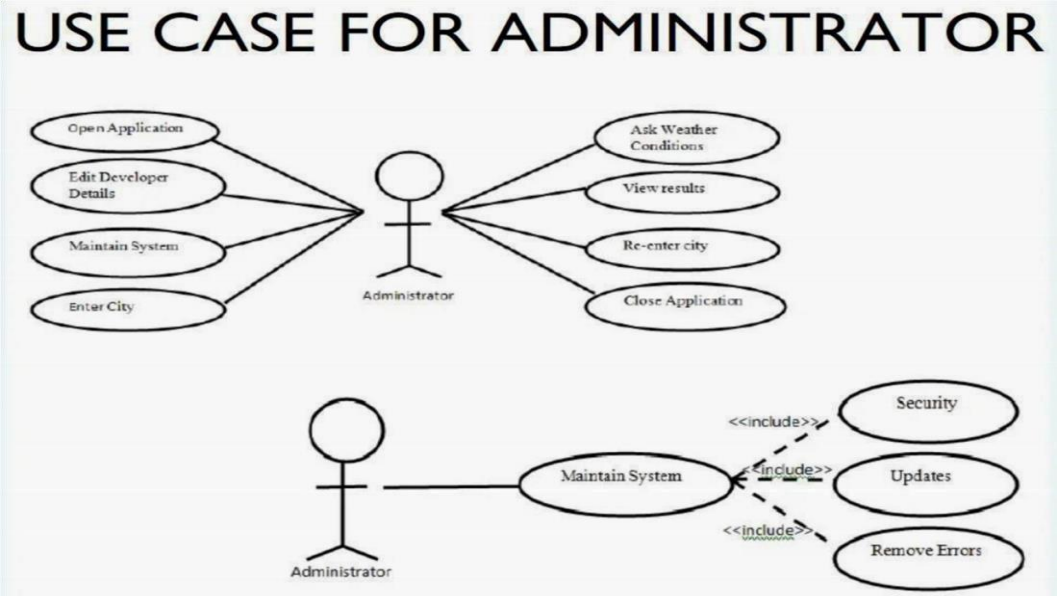
Fig : Histogram for Temp

## 6.2 LITERATURE SURVEY

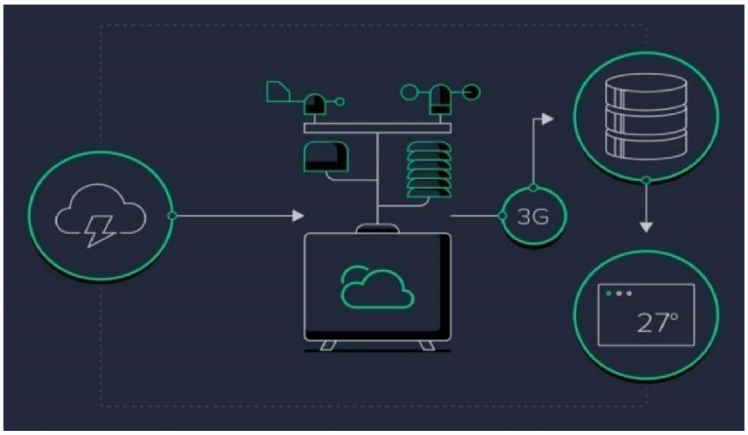
| Author | Year | Approach |
|---|---|---|
| M. M. Ali,<br>P. S. V. Jagadeesh | 2005 | Neural Network Approach to Estimate Tropical Cyclone Heat Potential in the Indian Ocean" IEEE Geosciences and Remote Sensing |
| Diganta Kumar Sarma,<br>Mahen Konwar,<br>Jyotirmoy Das | 2007 | A Soft Computing Approach for Rainfall Retrieval From the TRMM Microwave Imager |
| Sutapa Chaudhuri,<br>Surajit Chattopadhyay | 2009 | Neurocomputing based short range prediction of some meteorological parameters during the pre-monsoon season |
| F. Mekanik<br>M. A. Imteaz | 2012 | "A Multivariate Artificial Neural Network Approach for Rainfall Forecasting: Case Study of Victori |
| Kin C. Luk,<br>J. E. Ball and A. Sharma | 2013 | An Application of Artificial Neural Networks for Rainfall Forecasting |
| Mohsen Hayati<br>Zahra Mohebi, | 2017 | Temperature Forecasting Based on Neural Network Approach |

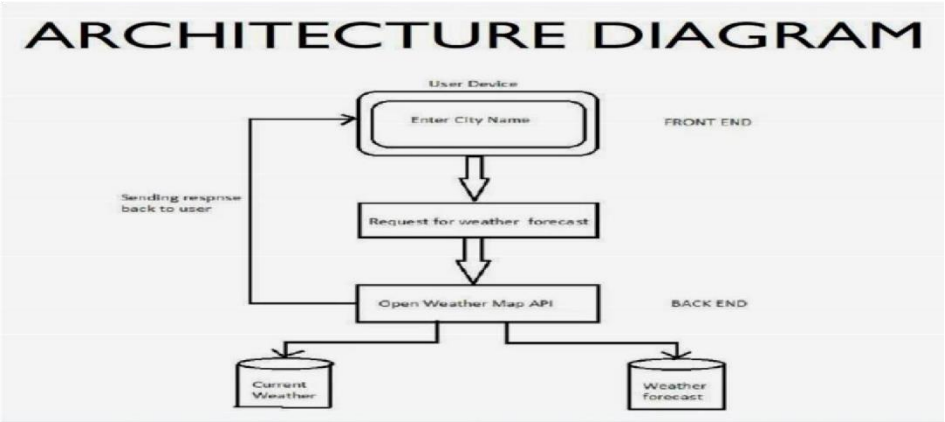
**6.3**






**6.4 Block Diagram.**




**6.5ARCHITECTURE DIAGRAM**

# CHAPTER 7

## 7.1 CONCLUSION

We successfully predicted the rainfall using the linear regression but here this is not very accurate only sometimes any way it depends upon the climate changes to season to season. Here we are taking only summer season weather data set it only useful to predict rainfall in summer season. Finally, it is agreed that we made an attempt on the following points:

- The description of the purpose the scope and applicability of this project.
- We specify the system's necessary specs as well as the actions that can be performed on these objects.
- We define the system's required specifications and the actions that can be taken on these objects.
- We comprehend the problem domain and create a system model that represents the operations that can be performed on the system.
- We went into great lengths about the features and processes, providing a lot of important information.
- We created the user interface as well as system security issues.
- Finally, the system is built and tested in accordance with the test cases.

## 7.2 SOURCE CODE

To get the live weather conditions of any city using Python, you first have to install the BeautifulSoup library in Python. You can easily install this Python library in your system by using the pip command:

**Weather.py**

```
import tkinter as tk
import requests
HEIGHT = 500
WIDTH = 600
def test_function(entry):
    print("This is the entry:", entry;
#
api.openweathermap.org/data/2.5/fore
cast?q={city name},{country code}
#
a4aa5e3d83ffefaba8c00284de6ef7c3
def format_response(weather):
    try:
            name = weather['name']
            desc =
weather['weather'][0]['description']
            temp =
weather['main']['temp']
            final_str = 'City: %s
\nConditions: %s \nTemperature (°F):
%s' % (name, desc, temp)
    except:
            final_str = 'There was a
problem retrieving that information'
    return final_str
def get_weather(city):
```

```
    weather_key =
'a4aa5e3d83ffefaba8c00284de6ef7c3'
    url =
'https://api.openweathermap.org/data/
2.5/weather'
    params = {'APPID': weather_key,
'q': city, 'units': 'imperial'}
    response = requests.get(url,
params=params)
    weather = response.json()
    label['text'] =
format_response(weather)
root = tk.Tk()
canvas = tk.Canvas(root,
height=HEIGHT, width=WIDTH)
canvas.pack()
background_image =
tk.PhotoImage(file='landscape.png')
background_label = tk.Label(root,
image=background_image)
background_label.place(relwidth=1,
relheight=1)
frame = tk.Frame(root, bg='#80c1ff',
bd=5)
frame.place(relx=0.5, rely=0.1,
relwidth=0.75, relheight=0.1,
anchor='n')
entry = tk.Entry(frame, font=40)
entry.place(relwidth=0.65,
relheight=1)
button = tk.Button(frame, text="Get
Weather", font=40,
command=lambda:
get_weather(entry.get()))
button.place(relx=0.7, relheight=1,
relwidth=0.3)
```

```
lower_frame = tk.Frame(root,
bg='#80c1ff', bd=10)

lower_frame.place(relx=0.5,
rely=0.25, relwidth=0.75,
relheight=0.6, anchor='n')

label = tk.Label(lower_frame)

label.place(relwidth=1, relheight=1)

root.mainloop()
```

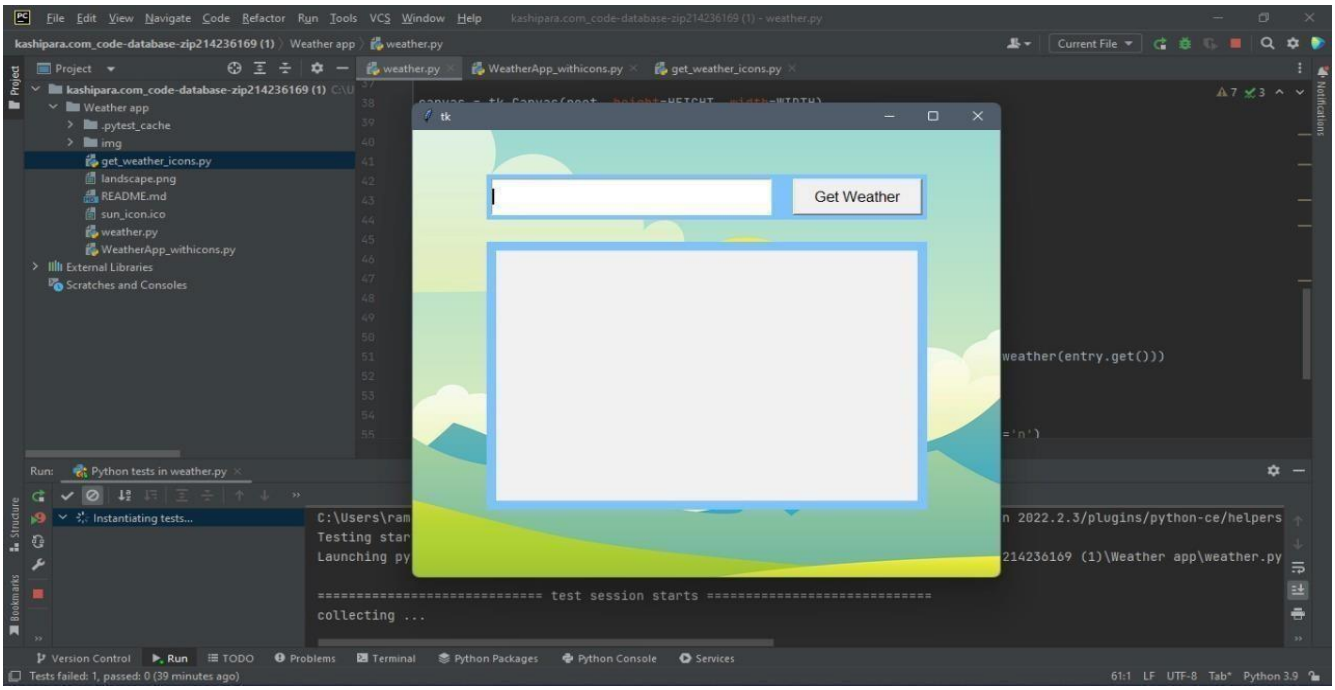
WEATHER APP.

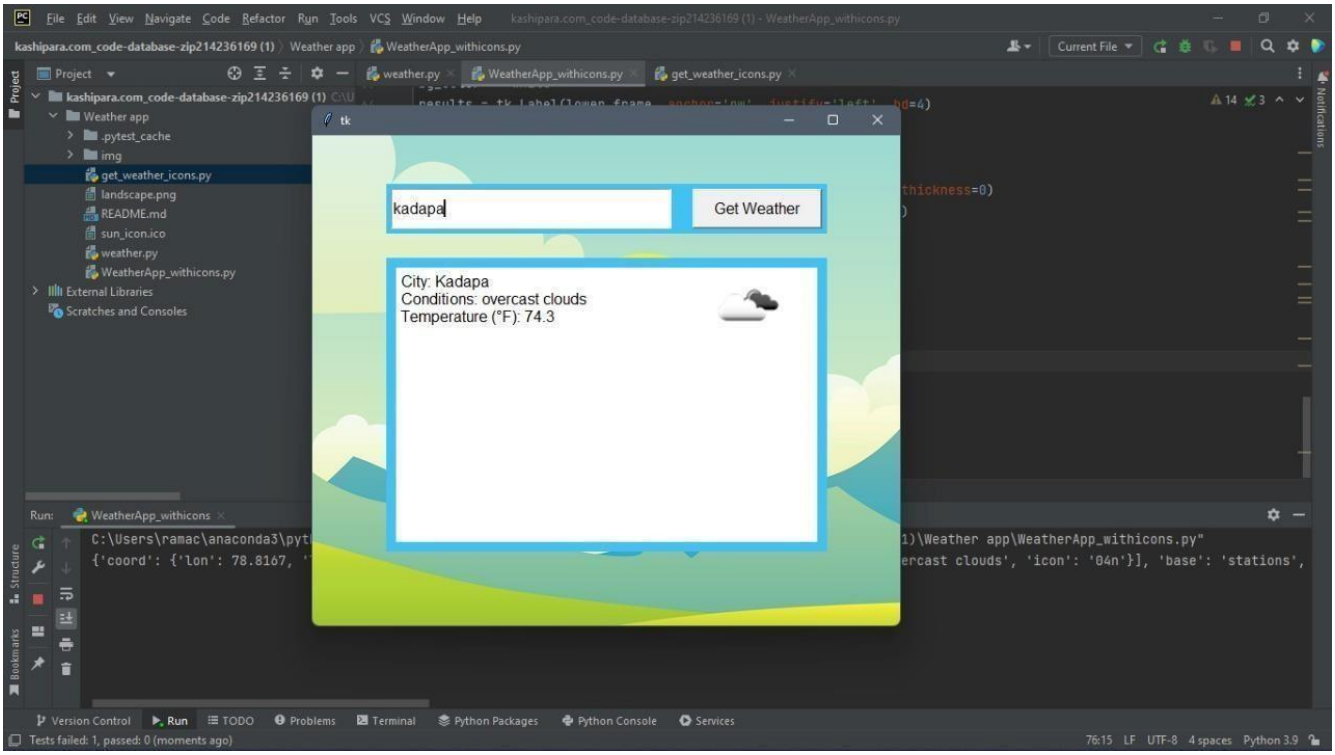
```
import tkinter as tk

import requests

from PIL import Image, ImageTk

app = tk.Tk()

HEIGHT = 500

WIDTH = 600

def format_rsponse(weather_json):

    try:

        city = weather_json['name']

        conditions =
weather_json['weather'][0]['descriptio
n']

        temp =
weather_json['main']['temp']

        final_str = 'City: %s
\nConditions: %s \nTemperature (°F):
%s' % (city, conditions, temp)

    except:

        final_str = 'There was a problem
retrieving that information' #final_str
= 'hello'

    return final_str

def get_weather(city):

    weather_key =
'edffd1bf975a74d5d10e58c5ac8be2'
```

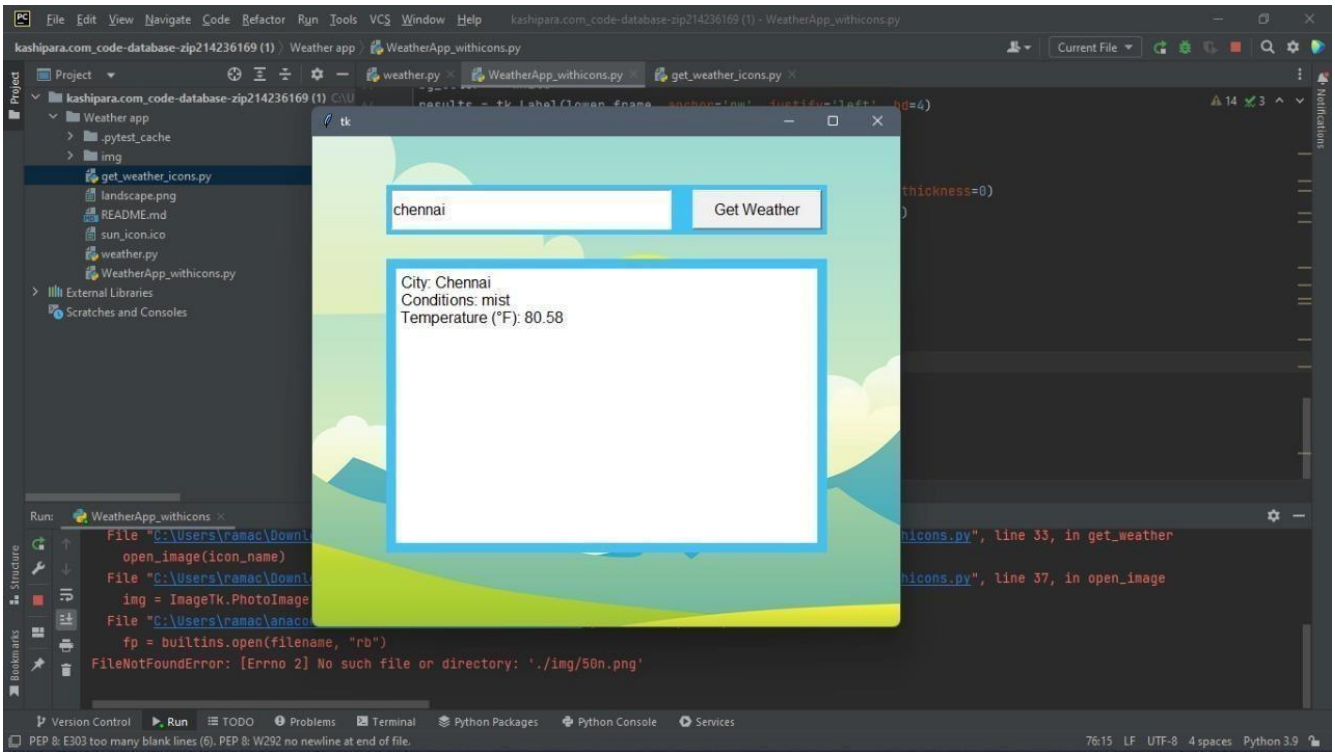
```
url='https://api.openweathermap.org/data/2.5/weather'
    params = {'APPID': 'edffd1bf975a74d5d10e58c5ac8be2d3', 'q': city, 'units':'imperial'}
    response = requests.get(url, params=params)
    print(response.json())
    weather_json = response.json()
    results['text'] = format_response(response.json())
    icon_name = weather_json['weather'][0]['icon']
    open_image(icon_name)
def open_image(icon):
    size = int(lower_frame.winfo_height()*0.25)
    img = ImageTk.PhotoImage(Image.open('./img/'+icon+'.png').resize((size, size)))
    weather_icon.delete("all")
    weather_icon.create_image(0,0, anchor='nw', image=img)
    weather_icon.image = img


C = tk.Canvas(app, height=HEIGHT, width=WIDTH)
background_image= tk.PhotoImage(file='./landscape.png')
background_label = tk.Label(app, image=background_image)
background_label.place(x=0, y=0, relwidth=1, relheight=1)


C.pack()
```

```
frame = tk.Frame(app,  bg='#42c2f4',
bd=5)

frame.place(relx=0.5, rely=0.1,
relwidth=0.75, relheight=0.1,
anchor='n')

#frame_window =
C.create_window(100, 40,
window=frame)

textbox = tk.Entry(frame, font=40)

textbox.place(relwidth=0.65,
relheight=1)

submit = tk.Button(frame, text='Get
Weather', font=40,
command=lambda:
get_weather(textbox.get()))

#submit.config(font=)

submit.place(relx=0.7, relheight=1,
relwidth=0.3)

lower_frame = tk.Frame(app,
bg='#42c2f4', bd=10)

lower_frame.place(relx=0.5,
rely=0.25, relwidth=0.75,
relheight=0.6, anchor='n')

bg_color = 'white'

results = tk.Label(lower_frame,
anchor='nw', justify='left', bd=4)

results.config(font=40, bg=bg_color)

results.place(relwidth=1, relheight=1)

weather_icon = tk.Canvas(results,
bg=bg_color, bd=0,
highlightthickness=0)

weather_icon.place(relx=.75, rely=0,
relwidth=1, relheight=0.5)

app.mainloop()
```

## 7.3 Screen shots:




tk
chennai
Get Weather
City: Chennai
Conditions: mist
Temperature (°F): 80.58
FileNotFoundError: [Errno 2] No such file or directory: './img/50n.png'

# CHAPTER 8

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## 8.2 RESULTS

We successfully predicted the rainfall using the linear regression but here this is not very accurate only sometimes any way it depends upon the climate changes to season to season. Here we are taking only summer season weather data set it only useful to predict rainfall in summer season. Finally, it is agreed that we made an attempt on the following points

The description of the purpose the scope and applicability of this project.

- We specify the system's necessary specs as well as the actions that can be performed on these objects.
- We define the system's required specifications and the actions that can be taken on these objects.
- We comprehend the problem domain and create a system model that represents the operations that can be performed on the system.
- We went into great lengths about the features and processes, providing a lot of important information.
- We created the user interface as well as system security issues.
- Finally, the system is built and tested in accordance with the test cases