

CS171

Weather Chatbot Report - Part 4

Brief summary of my weather chatbot project:

- A: My Weather Chatbot code runs without compiler or runtime errors, and the user could successfully interact or terminate the program.
- B: My Weather Chatbot project is all written by me which builds upon Part 1 of the project(three .py files). I am using OpenWeather APIs that can be used to access weather information and I didn't use any API to do natural language processing.
- C: The chatbot can accept questions or statements in conversational English. My chatbot can accept a variety of grammatical forms, sentences with different days or specific past time. My chatbot could also handle the invalid sentences, and reply with appropriate messages back to the user.
- D: My weather chatbot responds in straightforward English sentences, and it could distinguish the invalid sentence and with a straightforward reply message. Also, my weather chatbot could make a reply based on the user.
- E: My chatbot can hold a conversation. If a user introduces their name, my chatbot could remember it and use the name in the greeting. Also, my chatbot holds conversations that prompt users if they want to know more weather details.
- F: My weather chatbot responds in a friendly, helpful way when the input from the user contains unrecognized words, unparseable grammar, unexpected characters, or any other impediment to a regular response. Also, my chatbot accepts a variety of input, like a user could type 'yep', 'ye', 'ok', etc instead of using 'yes'.
- G: My weather chatbot has helpful and interesting information to provide, and it could give extra weather information to users(like humidity, pressure ...). Also, my chatbot has the expertise and ability to suggest to users what is the best cloth to wear based on the real weather.
- H: The scope of the chatbot's capabilities follows reasonably closely to the goals specified in parts 2 and 3 of the project, I finished everything listed in the project phase 1-3 and implemented some other cool features.

Introduction:

Part2:My chatbot project will focus on the weather domain, and I try to make my chatbot AI 'smart enough' to be able to understand and help users to find answers regarding the weather. I get motivated to do this because I care about weather so much because weather is one of the most closely-related topics in our life. Also, everyone cares about it because we want to forecast the weather and be able to make a decision on what cloth to wear, place to go, current temperature. So I choose this particular domain to let people interact with chatbot and get to forecast and get to know the current or past weather.

I want to highlight some features in my weather chatbot. Firstly, it could greet people and remember their name or some other important detail for the future consecutive conversation. Also, my chatbot is not case-sensitive and it is able to understand the complex sentence, so my chatbot could handle and understand these varieties of questions and reply to the user. My weather chatbot is also able to provide authentic weather data back to the user, and it will be able to access network-available databases in real time using API. Beyond this, my chat should be able to handle the invalid sentences like invalid meaning sentences or sentences with a big grammar error. Plus, my chatbot could have the expertise to suggest ideal clothes to wear based on the temperature, so that the weather chatbot is not only able to answer the user's question but also tells them what clothes to wear.

Part3: I am not changing the functionality as described in part2, and I also added some cool features in part3 like the weather chatbot asking the users if they want to know more information about weather (like humidity, weather report and rain information). By adding more temperature information and cloth suggestion features, I think my chatbot will become more professional and attract more users to use this weather chatbot. (the extra weather information and expertise on cloth suggesting feature)

```
chatbot: do you want more detailed information
Y/N: y
chatbot: the humidity is 32
chatbot: the pressure is 1018
chatbot: the weather is haze
chatbot: Do you want some useful cloth suggestions?
Y/N: sure
chatbot: I will recommend and give you a list of best cloth to wear based on The Travel Insider and the local temperature
chatbot: chill temperature and I recommend you to have minimal outerwear like a parka, biker jacket or leather jacket
Tops (for Layering): Shirts, Hoodies, Dresses
Lightweight Outerwear: Leather jackets, Biker jackets, Parkas, Pea Coat
Bottoms: Jeans, Trousers, Skirts Shoes: Sneakers, Boots
Accessories: A light scarf *optional
```

Part4: I am not changing the functionality as described in part2 and part3. In part4, I added a feature that users could ask questions to get calendar and current data information.

```

input(type the question here): show me monthly calendar
3/16/2021
      March 2021
Mo Tu We Th Fr Sa Su
 1  2  3  4  5  6  7
 8  9 10 11 12 13 14
15 16 17 18 19 20 21
22 23 24 25 26 27 28
29 30 31

input(type the question here): I want to know current date
Chatbot: let me tell you current date and time:
Chatbot:  3/16/2021
Chatbot: let me know if you need more help

```

Technical Overview:

Part2: I will use python programming language to complete my chatbot project because python is more intuitive and easy to work on because start code is also provided in python. Also, I will build the rest of the project based on the first project I will not use external libraries. I think I will use APIs in my chatbot project because I think I can use API to deliver a user response or request to an online database system in the real time, also I can send the online temperature database system's response or relevant temperature data back to a user. Therefore, I think API is useful to make my chatbot more intuitive and authentic to the user, and my chatbot will also use these real time temperature data to suggest what cloth to wear for the user.

Part3: No changes.

Part4: No changes. I also added requirements.txt into the zip file to show which library needs to be installed.

```

pip install requests, json, re, string,
pip install datetime # find current date and also use for weather search on specific
past day
from geotext import GeoText #find location
from geopy.geocoders import Nominatim# use location to find latitude and
longitude
from nltk.corpus import words # use for the tokenize

```

The project consists of three parts, CYKParse.py is using the C1K(with added grammar rules and lexicon rules) to parse the sentence based on speech. Proj1.py handles the greeting, gets the real temperature using OpenWeather API, suggests the user the best cloth to wear and it is the main file to run. Tree.py uses binary tree to carry extra piece of information, lexicon items on each leaf .

Phases:

Part2: I think I will divide my project into 3 phases. In the first phase, I think I will make the chat bot understand the greeting and make the chatbot able to reply to the greeting back to the user. Also, I will try to handle the invalid sentence with invalid meaning in this case and reply with an appropriate message back to the user. Also in this phase, my chatbot could remember the user name so that it could use the user's name as the start of the greeting.

For phase 2, I think I will implement an API and use Json to retrieve the data form online database in real time. So the temperature data should be obtained from the real time online database and not hard-coded. Also, I will make my chatbot have expertise on suggesting what cloth to wear in this phase, so I will build an internal cloth database and make suggestions based on the real time temperature get form API, and the chatbot response should also add the recommendation of cloth to the user.

For phase 3, I think I will keep modifying the Parse tree, improving the lexicon and may change the grammar rule a little bit to make the chatbot handle and understand the variety of questions, and maybe I need to change the grammar a little bit to accept more variety of sentence. Also I will keep improving the chatbot to handle the invalid sentence with big grammatical errors, and make a reply to the user that “Sorry, I don’t understand this, please say in another way”. Besides, I have to modify the chatbot response and make it more accurate to answer the user's question. Finally, I will wrap up everything and make final check and modification to see if it is robust enough to answer a variety of questions.

Part3: In Part3, I already finished implementing phase1 and all of phase 1 features are working. Also, I finished implementing almost all features in phase2 and some features in phase3. Now, my chatbot now can understand the greeting and make the appropriate reply back, and it could remember the username so that it could use the user's name as the start of the greeting. Besides, my weather chatbot could get the current and forecast real temperature through the online API(openweathermap). What’s more, I finished the chatbot expertise on suggesting the best cloth to wear as described in phase2. For the input handling as described in phase3, my chatbot could also handle the invalid sentence

with the appropriate reply in the phase3, and I changed the lexicon and grammar rule a little bit in part 3.

In part4, I will wrap up every left thing and finish implementing the rest of the features. I will finish the history API to enable users to get history weather data, finish the input handling(C1K and key work searching) to make the chatbot could handle more variety of sentences by changing the grammar rule, lexicon rule or the parse tree if necessary. Finally, I will make the weather chatbot robust and edit some reply messages to make it more accurate.

Part4: No changes, I successfully wrap up everything and finish implementing all features in phase1 to phase3 and also successfully finished implementation of some extra cool features, like more detailed weather information, clothes suggestion, real monthly calendar, and current date features. All codes run without Errors.

Examples:

Part2:I think I will make a conversation impact on the subsequent answers by the chatbot. Starting from the greeting, like if the user said my name is John and type 'hi' to the chatbot, then the chatbot should remember that name and reply to the message starting with "John", like "John, How are you". If the user asks the question about the weather, my chatbot should be able to understand the variety of questions which not only start with 'WQuestion' but it should also understand sentences starting with 'Verb' or others. Also, my chatbot has the expertise to make a recommendation on clothes to wear based on the cold, warm or hot weather from real time. Sometimes, the user asks some questions with invalid meaning or contain grammatical errors, my chatbot should be able handle these situations and reply to the message "Sorry, I don't understand this, please say in another way."

Sample user input question:	Sample chatbot reply:
Hi, my name is Peter.	Hi Peter, I am weather bot
Good morning	Morning Peter, How can I help you?
Hello	Hi Peter, how can I help you?
What is the temperature in New York now	It's 17 degree, it's warm T-shirt is recommend to wear
Will Tustin be hotter than Katy tomorrow	Yes, it is
I want to know the temperature in Oakland	It's 1 degree, it's cold and coat is recommended to wear
Could you let me know the Riverside temperature	It's 30 degree, it's hot and shorts is

	recommended to wear
Tell me the temperature in New York today	It's 1 degree, coat is recommended to wear
Berkeley temperature now	It's 27 degree, it's warm and T-shirt is recommend to wear
I want to know if Tustin is colder than 10 celsius	Yes
What is the Oakland temperature forecast	It's 30 degree, it's hot and shorts is recommended to wear
I want to drink	Sorry, I don't understand this, please say in another way.
What New Yrk now the temperate	Sorry, I don't understand this, please say in another way.
asd**721''{]	Sorry, I don't understand this, please say in another way.
Thank you	You are welcome, see you next time

Part3: I added some sample user input questions.

Added Sample user input question:
what's the temperature in Riverside
Let me know the Riverside forecast temperature
forecast temperature in Tustin
Will tomorrow be hotter than today in Irvine
What is the forecast temperature in New York
Will today be cooler than tomorrow in New York

For the sample chatbot reply, I changed my chatbot to reply with more detailed information to the user in part3 based on the temperature, like the cloth suggestion is more detailed 'the temperature is suitable and I recommend you to wear thin clothesLighter weaves of wool are suited for hot weather..... madras cotton' instead of

original short reply 'it's hot and shorts is recommended to wear'. Also, I made chatbot more open and lenient to various user input, like when chatbot asks users if they want more information, the user can type 'y', 'Yes', 'yes', 'ok', 'OK', 'fine', 'sure', and my chatbot could still understand them.

Part4: I added some sample user input questions.

Added Sample user input question:
Irvine 3/14/2021
what is Tustin temperature on 3/13/2021
I want to know 3/12/2021 temperature in New York
How is 3/12/2021 temperature in Riverside
Chicago today, Chicago forecast ...
Irvine, temperature forecast ?
forecast temperature,,,,,, in Tustin!!!
Show me this month's calendar, monthly calendar, calendar,
let me know current date
I wnat to kneo irvne temperare (handle invalid sentence with giant spelling error)

I added and implemented my chatbot to understand more variety of sentences in part4. Now, my chatbot could understand the question asking the historical weather as I planned in phase 3, and the user could give a date and my chat bot will use API to get real history weather. Also, my chatbot could also understand the question with different types of punctuations which are in different positions of sentence.

Input Handling:

Part2: I will keep implementing and working on C1K parse to convert text inputs from users. As my goal for phase 1, I will make the chatbot understand the greeting language and make it able to reply with corresponding greetings to the user. My approach for this step is looking for keywords with if-else statements and hard-code to make sure it could make a greeting back to the user. For the more complex input, my chatbot should also be able to handle and understand the variety of questions that do not start with 'WQuestion'

but start with 'Verb', like "Will tomorrow be hotter than today". I also have to modify the `updateRequestInfo` function to Also, I think my chatbot should be able to understand the time difference like "today", "now", "tomorrow" and other kinds of time words. If the grammar on the question does not match or the question continues Non-ASCII word, I will treat them as invalid sentences.

Part3: No changes for handling the invalid meaning sentence. In part3, I use (`unicodedata.normalize`) to normalize the input and tokenize the input to each word . list. Then I use `.isascii()` to check if the input is valid or not. Also, I am using multiple ways to handle the input in part 3. For the sentence kinda complex, I'm thinking and using C1K parse to convert text inputs from users and I made my chatbot handle some abbreviations like "what's" instead of "what is". Also, for the intuitive, easy and short sentence, I decided to use the if-else statement and search the keyword to handle the input sentence. Last, my goal stayed the same as part3 to make my chatbot able to handle the variety of questions starting from different types and speech.

Part4: No changes, I also added the functionality of tokenize the word, so my chatbot could handle and understand the sentence with the punctuation. Like the chatbot could process the sentence 'how's the weather in Irvine today?' which ends in question marks or 'Irvine, temperature forecast ?' which has more punctuations in a sentence and punctuation position is also different.

Internal Representations and Data Sources:

Part2: I think I will hard-code some of the information like greetings, and the message(Sorry, I don't understand this, please say in another way) when the question has invalid meaning and big grammatical error. For those questions about the weather, I will use an API to make my chatbot have access to a network-available database in real time, request the latest weather data from the online database and send it back to the user, so this part will not be hard-coded. Besides this, I will make a cloth database which serves as suggesting the best cloth to wear for the user, and this cloth database will build internally like in a dictionary which gives the cloth recommendation based on the weather in the real time from an online weather database.

Part3: I made slight changes in this part 3. No changes for API part and everything works accurately now. For the feature that chatbot could give the best clothes to wear based on the temperature in real time, I used a different way in part3. My original thought for this is to make a cloth database like store information in a python dictionary. However, in part3, I find out it is easier and better to directly print the suggestion for the user based on the range of the temperature instead of using the python dictionary, and it is more intuitive and fast. Beside, I add an interesting feature that asks the user if they want to get

more information through API, like humidity, rain and weather report, so I think this feature makes my weather chatbot more professional and intuitive for users to use.

(The information for chatbot to make suggestion based on range of temperature and get extra weather information through API)

```
def clothrecommendation(celsius): # the ggat expertise on suggesting the best cloth to wear based on the temperature.
    print('chatbot: I will recommend and give you a list of best cloth to wear based on The Travel Insider and the local temperature.')
    if celsius<0:
        print('chatbot: the temperature is sooo low...take care of your self and double-layered and hooded down jackets is recommended!')
        print('Outerwear: Double-Layered hooded down jackets (Preferably waterproof)\nTops: Sweaters, Jumpers, TurtleNecks\nBottoms: Pants, Leggings (Preferably waterproof) Thermal underwear\n')
        print('\n')
    if celsius>0 and celsius<=5:
        print('chatbot: Temperature is low! I recommend you to wear puffer coat, wrap-style overcoat, or even a down jacket. A chunky snood or infinity scarf and a wooly beanie..')
        print('Outerwear: Padded or Puffer Coat, Overcoats (Trench Coats, Fur or Faux Fur Coats etc.), Down Jackets\nTops: Sweaters, Jumpers, TurtleNecks\nBottoms: Jeans, Trousers\nThermal Unde')
        print('\n')
    if celsius>15:
        print('chatbot: the temperature is suitable and I recommend you to wear thin clothes!')
        print('Lighter weaves of wool are suited for hot weather. Heavy fabrics tend to cling to your skin and trap sweat - adding a layer of heat between the fabric and your body. Instead of')
        print('\n')
    if celsius>=10 and celsius<=15:
        print('chatbot: chill temperature and I recommend you to have minimal outerwear like a parka, biker jacket or leather jacket')
        print('Tops (for Layering): Shirts, Hoodies, Dresses\nLightweight Outerwear: Leather jackets, Biker jackets, Parkas, Pea Coat\nBottoms: Jeans, Trousers, Skirts Shoes: Sneakers, Boots\n')
        print('\n')
```

```
humidity = main['humidity']#humidity
pressure = main['pressure']#pressure
report = data['weather']# weather
print('chatbot: the ',location, 'temperature is ', temperature - 273.15, 'celsius ', (temperature- 273.15)* 9/5+ 32, 'fahrenheit')
print('chatbot: do you want more detailed information')
user_detail_input = input('Y/N:')
if user_detail_input.lower() in ['y', 'Yes', 'yes', 'ok','OK', 'fine','sure']:
    print('chatbot: the humidity is ',humidity)
    print('chatbot: the pressure is ',pressure)
    print('chatbot: the weather is ', report[0]['description'])
```

Part4: No changes.

Output handling:

Part2: The English language replies are hard-coded and the data obtained from the online database, and I will keep implementing the reply function to make it able to reply to the greeting and actual question. For the greeting part, I think I will reply to the user based on what the user wrote and use if-else statements to find the keyword to make a reply. For the reply to a variety of questions, my weather chatbot reply will be based on the question the user asks and I will make a small cloth database to make it able to suggest the ideal cloth to wear for the user. Also, I will modify and change to make the chatbot able to reply when the question has invalid meaning and big grammatical error.

Part3: No changes for those feature in part2

More features added in part3, I clearly labeled the chatbot and user input in this part, like the chatbot replies always begin with 'chatbot: ...'. So it could clearly distinguish from the user input. Also, I give the user freedom to let them decide if they only want to know the temperature or more detailed information like humidity, weather report and rain. Also, I improved the replies feature using if statements to make the chatbot reply the user with appropriate replies and I made the chatbot remember the

username if they had one, like if the user has introduced his name, my chatbot will remember and greet back with the name.

(part code for output handling)

```
name = output[-1]
print('chatbot: hi', name)
n = False
if user_input in finalgreeting:## handle the input if user want to quit
    if name != '':# no name
        print('chatbot:',user_input,',', name, 'Thank you for using the weather chatbot, have a good day!')
        break
    else:
        print('chatbot: Thank you for using the weather chatbot, have a good day!')#break the program
        break
if (len(place) == 0 and output[0] not in greetingsummary):
    if n is True:
        print('sorry, could you please say in another way. It seems missing some important information for me to understand!')
        n = True
for i in output:# invalid sentence handling
    if not i.isascii():# check if valid
        print('chatbot: sorry, I don\'t understand this, could you please say in another way? ')
if user_input in greetingsummary:
    print('chatbot: ', user_input, ', I\'m chatbot and how can I help you')
    continue
```

Part4: No changes, and I fixed some chatbot replies to make it more clean and in a courtesy way.

The interaction between user and chatbot(updated)

Below are the screenshots that show the weather chatbot running, with inputs (from the user) and outputs (from the chatbot). I demonstrated how the chatbot works with greeting, input handling with invalid sentences and actual different types of questions. The last image displays how interaction looks like(layout).

1: The greeting interaction between user and chatbot example:

(In this part, the chatbot could make a reply based on the greeting and reply back with an appropriate message, and the chatbot could also remember the user's name and use the name in the reply to greet back to the user. This picture also shows the program will terminate if user say word like goodbye and chatbot lenient to user input like by, bye and etc)

```
welcome to the weather chatbot!
input: hello
chatbot: hello , I'm chatbot and how can I help you
input: I am Peter
chatbot: hi Peter
input: by
chatbot: by , Peter Thank you for using the weather chatbot, have a good day!

Process finished with exit code 0
```

2 The error handling example:

(This picture shows how the chatbot handles the wrong sentence and invalid meaning sentence. Like first two sentences have misspelling the word or with dramatic grammar error and last two sentences are invalid and the question they are are unrelated, so the chatbot could detect and understand those invalid and wrong input and reply with appropriate message back to user to tell them to correct)

```
input: What New is Yrk now the temperature
sorry, could you please say in another way. It seems missing some important information for me to understand
input: What New Yrk now the temperate
sorry, could you please say in another way. It seems missing some important information for me to understand
input: asd**721"{}
sorry, could you please say in another way. It seems missing some important information for me to understand
input: I want to drink
sorry, could you please say in another way. It seems missing some important information for me to understand
```

3: The comparison question ‘Will tomorrow be hotter than today in Irvine’ interaction example:

(The question compares the location’s tomorrow temperature with today’s temperature with the variance of the cooler or hotter. The chatbot should prompt yes if the real tomorrow temperature is higher than today’s. I also let chatbot use a python dictionary to visualize the real temperature to see if hotter or cooler not)

```
input: Will tomorrow be hotter than today in Irvine
{'tomorrow': 12.8400000000000032, 'today': 14.0900000000000032}
chatbot: No, it's not
input:
```

```
input: Will tomorrow be cooler than today in Berkeley
{'tomorrow': 8.8400000000000032, 'today': 10.2700000000000039}
chatbot: Yes, it is
input: |
```

4: The sentence start from ['Verb'], and sentence is ‘forecast temperature in Tustin’:

(The chatbot could handle the variety of sentences and make the appropriate and accurate temperature back to the user. Since the question asks for the forecast, my chatbot will use API to get real data and send it back to the user. Also, my chatbot enable the user get additional weather report and best cloth suggestion)

```

input: forecast temperature in Tustin
chatbot: the city is: Tustin and the country is: US
chatbot: the Tustin temperature is 15.920000000000016 celsius 60.65600000000003 fahrenheit
chatbot: do you want to know more detailed information?
Y/N: sure
weather scattered clouds
chatbot: Do you mane some useful cloth suggestions?
Y/N: y
chatbot: I will recommend and give you a list of best cloth to wear based on The Travel Insider and the local tempreture
chatbot: the temperature is suitable and I recommend you to wear thin clothes
Lighter weaves of wool are suited for hot weather. Heavy fabrics tend to cling to your skin and trap sweat - adding
a layer of heat between the fabric and your body. Instead of wearing heavier versions of cotton - such as twill, which is what your jeans

```

5: The question, ‘what's the temperature in Irvine’, starts from 'WQuestion' with abbreviation of ‘is’.

(This question starts from what’s instead of what and my chatbot could also handle the sentence with abbreviation. Therefore, my chatbot enables the user to type certain questions starting with abbreviations like “what’s” and “how’s”. So, I make my chatbot to be able to handle the variance of abbreviations)

```

input: what's the temperature in Irvine
chatbot: the city is: Irvine and the country is: US
chatbot: the Irvine temperature is 15.930000000000007 celsius 60.674000000000014 fahrenheit
chatbot: do you want to know more detailed information?
Y/N: sure
weather scattered clouds
chatbot: Do you mane some useful cloth suggestions?
Y/N: y
chatbot: I will recommend and give you a list of best cloth to wear based on The Travel Insider and the local tempreture
chatbot: the temperature is suitable and I recommend you to wear thin clothes
Lighter weaves of wool are suited for hot weather. Heavy fabrics tend to cling to your skin and trap sweat - adding
a layer of heat between the fabric and your body. Instead of wearing heavier versions of cotton - such as twill, which is what your jeans

```

6: The question, ‘I want to know the temperature in Tustin today’, starts from [‘Pronoun’]

(This sentence starts with the Pronoun and my chatbot could also handle this kind of question and use the API to get the temperature, and chatbot could could also make the appropriate and accurate reply back to the user)

```

input: I want to know the temperature in Tustin today
chatbot city: Tustin country: US
chatbot: the Tustin temperature is 18.550000000000001 celsius 65.39000000000001 fahrenheit
chatbot: do you want more detailed information
Y/N: y
chatbot: the humidity is 20
chatbot: the pressure is 1022
chatbot: the weather is clear sky
chatbot: Do you mane some useful cloth suggestions?
Y/N: y
chatbot: I will recommend and give you a list of best cloth to wear based on The Travel Insider and the local tempreture
chatbot: the temperature is suitable and I recommend you to wear thin clothes
Lighter weaves of wool are suited for hot weather. Heavy fabrics tend to cling to your skin and trap sweat - adding
a layer of heat between the fabric and your body. Instead of wearing heavier versions of cotton - such as twill, which is what your jeans

```

7: This question is from part1, ‘what is the temperature in Irvine tomorrow’, and my chatbot is able to give it the accurate real temperature instead of hard-coding like in part1(chatbot could get weather in celsius and fahrenheit, and when user want more information, my chatbot are lenient and open to the various of user_input)

```
input(type the question here): what is the temperature in Irvine tomorrow

chatbot: the city is: Irvine and the country is: US
chatbot: the Irvine temperature is 9.679000000000016 celsius 49.40600000000003 fahrenheit
*****
chatbot: do you want to know more detailed information?
Y/N: yes
*****
chatbot: the weather is clear sky
chatbot: the humidity is 47
chatbot: the pressure is 1017
chatbot: Do you want some useful cloth suggestions?
Y/N: yes
*****
chatbot: I will recommend and give you a list of best cloth to wear based on The Travel Insider and the local temperature
chatbot: Temperature is low! I recommend you to wear puffer coat, wrap-style overcoat, or even a down jacket. A chunky snood or infinity scarf and a wooly beanie
Outerwear: Padded or Puffer Coat, Overcoats (Trench Coats, Fur or Faux Fur Coats etc.), Down Jackets
Tops: Sweaters, Jumpers, TurtleNecks
Bottoms: Jeans, Trousers
Thermal Underwear: Long-sleeved thermal top, Thermal leggings (at least one of each to layer underneath your jeans or sweaters for extra warmth)
Accessories: Beanies, Berets, Touchscreen-Friendly Gloves, Scarves, SocksBoots
```

8: The full screen-shot of interaction between chatbot and user.(This picture aims to show the layout of the output, and only includes three sentences here because of limitation of the length of interface)

```
input: I want to know the temperature in Tustin today
chatbot city: Tustin country: US
chatbot: the Tustin temperature is 18.550000000000001 celsius 65.39000000000001 fahrenheit
chatbot: do you want more detailed information
Y/N: yes
chatbot: the humidity is 20
chatbot: the pressure is 1022
chatbot: the weather is clear sky
chatbot: Do you want some useful cloth suggestions?
Y/N: yes
chatbot: I will recommend and give you a list of best cloth to wear based on The Travel Insider and the local temperature
chatbot: the temperature is suitable and I recommend you to wear thin clothes
Lighter weaves of wool are suited for hot weather. Heavy fabrics tend to cling to your skin and trap sweat - adding
a layer of heat between the fabric and your body. Instead of wearing heavier versions of cotton - such as twill, which is what your jeans are made of - opt for poplin, seersucker and madras cotton.

input: what's the temperature in Irvine

chatbot: the city is: Irvine and the country is: US
chatbot: the Irvine temperature is 15.930000000000007 celsius 60.674000000000014 fahrenheit
chatbot: do you want to know more detailed information?
Y/N: yes
weather scattered clouds
chatbot: Do you want some useful cloth suggestions?
Y/N: yes
chatbot: I will recommend and give you a list of best cloth to wear based on The Travel Insider and the local temperature
chatbot: the temperature is suitable and I recommend you to wear thin clothes
Lighter weaves of wool are suited for hot weather. Heavy fabrics tend to cling to your skin and trap sweat - adding
a layer of heat between the fabric and your body. Instead of wearing heavier versions of cotton - such as twill, which is what your jeans are made of - opt for poplin, seersucker and madras cotton.

input: Recommend temperature in Tustin
chatbot: the city is: Tustin and the country is: US
chatbot: the Tustin temperature is 15.920000000000016 celsius 60.65600000000003 fahrenheit
chatbot: do you want to know more detailed information?
Y/N: yes
weather scattered clouds
chatbot: Do you want some useful cloth suggestions?
Y/N: yes
chatbot: I will recommend and give you a list of best cloth to wear based on The Travel Insider and the local temperature
chatbot: the temperature is suitable and I recommend you to wear thin clothes
Lighter weaves of wool are suited for hot weather. Heavy fabrics tend to cling to your skin and trap sweat - adding
a layer of heat between the fabric and your body. Instead of wearing heavier versions of cotton - such as twill, which is what your jeans are made of - opt for poplin, seersucker and madras cotton.

input:
```

9: This question is asking the past or historical weather information, and I am using oncall OpenWeather API to support the user to get the history weather with additional weather information based on the past date. The user can type a specific date(the US way month/day/year) to get the historical weather information.

```
input(type the question here): How's Irvine weather on 3/15/2021
chatbot: Irvine, Orange County, California, United States
1615737600.0
chatbot: the Irvine temperature is 12.700000000000045 celsius 54.860000000000085 fahrenheit
*****
chatbot: do you want to know more detailed information?
Y/N: y
*****
chatbot: the uvi is 6.36
chatbot: the humidity is 67
chatbot: the pressure is 1025
```

10: I also added the tokenization feature into my weather chatbot so that the chatbot could understand the sentence with different punctuation

```
input(type the question here): Irvine, temperature forecast ?
chatbot: the city is: Irvine and the country is: US
chatbot: the Irvine temperature is 9.670000000000016 celsius 49.40600000000003 fahrenheit
*****
chatbot: do you want to know more detailed information?
Y/N: y
*****
chatbot: the weather is clear sky
chatbot: the humidity is 47
chatbot: the pressure is 1017
chatbot: Do you mane some useful cloth suggestions?
Y/N: nope
ok, great
```

11: My chatbot also could handle and understand the different positions of punctuation, and it also could process the duplicate punctuation. The following two images show my weather chatbot could successfully understand it.

```

input(type the question here): I want to know New York temperature, today!
chatbot city: New York country: US
chatbot: the New York temperature is -0.25999999999999999 celsius 31.532000000000018 fahrenheit
*****
chatbot: do you want more detailed information
Y/N: sure
*****
chatbot: the humidity is 19
chatbot: the pressure is 1028
chatbot: the weather is clear sky
chatbot: Do you want some useful cloth suggestions?
Y/N: I don't want to
ok, great

```

```

input(type the question here): Forecast temperature..... in Tustin!
chatbot: the city is: Tustin and the country is: US
chatbot: the Tustin temperature is 9.150000000000034 celsius 48.47000000000006 fahrenheit
*****
chatbot: do you want to know more detailed information?
Y/N: y
*****
chatbot: the weather is clear sky
chatbot: the humidity is 47
chatbot: the pressure is 1017
chatbot: Do you want some useful cloth suggestions?
Y/N: y
*****
chatbot: I will recommend and give you a list of best cloth to wear based on The Travel Insider and the local temperature
chatbot: Temperature is low! I recommend you to wear puffer coat, wrap-style overcoat, or even a down jacket. A chunky snood or infinity scarf and a wooly beanie
Outerwear: Padded or Puffer Coat, Overcoats (Trench Coats, Fur or Faux Fur Coats etc.), Down Jackets
Tops: Sweaters, Jumpers, Turtlenecks
Bottoms: Jeans, Trousers
Thermal Underwear: Long-sleeved thermal top, Thermal leggings (at least one of each to layer underneath your jeans or sweaters for extra warmth)
Accessories: Beanies, Berets, Touchscreen-Friendly Gloves, Scarves, Socks/Boots

```

12: I also implemented extra features into the chatbot, so it understood the question like “show me current date”, and my weather chatbot could understand it and print the today’s date. This small interaction makes the weather chatbot closer to real life.

```

Welcome to use the weather chatbot program!
The help is on the way!

input(type the question here): let me know current date
Chatbot: let me tell you current date and time:
Chatbot: 3/16/2021
Chatbot: let me know if you need more help

```

13: I also added another cool feature in part4 of my chatbot, so the chatbot could provide current month calendar to the user, if they ask ‘show me calendar’ or ‘I want to see calendar of this month’, the weather chatbot could understand it and print the current month calendar to user, this feature is practical for user to use.

```
input(type the question here): show me calendar
3/16/2021
      March 2021
Mo Tu We Th Fr Sa Su
 1  2  3  4  5  6  7
 8  9 10 11 12 13 14
15 16 17 18 19 20 21
22 23 24 25 26 27 28
29 30 31
```

14: Spelling error can happen when the user types too fast and my chatbot could detect them and print the appropriate message back to the user and prompt them to say in another way.

```
input(type the question here): I want to know irvine temperare
sorry, could you please say in another way. It seems missing some important information for me to understand
```

15: The question, ‘Tell me the temperature in New York 3/13/2021’, starts from [‘Verb’]
(This sentence starts with the Verb and asks the history weather based on the specific date and the weather chatbot could also handle this kind of question and use the onecall API to get the 3/13/2021 temperature. As the current and forecast temperature, the chatbot able to provide detailed weather information.)

```
input(type the question here): Tell me the temperature in New York 3/13/2021
chatbot: New York, United States
1615564800.0
chatbot: the New York temperature is 17.0 celsius 62.6 fahrenheit
*****
chatbot: do you want to know more detailed information?
Y/N: sure
*****
chatbot: the uvi is 4.6
chatbot: the humidity is 34
chatbot: the pressure is 1020
```

16: The sentence ‘Chicago today’, starts with [‘Noun’] and ends with [‘Adverb’], and my weather chatbot could handle this kind of small size of sentence.


```

input(type the question here): Chicago Today
chatbot city: Chicago country: US
chatbot: the Chicago temperature is 0.7800000000000296 celsius 33.40400000000005 fahrenheit
*****
chatbot: do you want more detailed information
Y/N:sure
*****
chatbot: the humidity is 86
chatbot: the pressure is 1014
chatbot: the weather is light intensity drizzle
chatbot: Do you mane some useful cloth suggestions?
Y/N:nahhh
ok, great

```

17: The new full screen-shot of interaction between chatbot and user.(This picture aims to show the new designed layout, with the user input and program output (how overall program interaction looks like , and only includes three sentences here because of limitation of the length of interface)

```

Welcome to use the weather chatbot program!
The help is on the way!

input(type the question here): hi
chatbot: hi , I'm chatbot and how can I help you

input(type the question here): Hello - I'm Peter
chatbot: Hello Peter , how can I help you?

input(type the question here): show me current date
Chatbot: let me tell you current date and time:
Chatbot: 3/16/2021
Chatbot: let me know if you need more help

input(type the question here): temperature in Irvine 3/16/2021
chatbot: Irvine, Orange County, California, United States
1615737600.0
chatbot: the Irvine temperature is 12.700000000000045 celsius 54.860000000000005 fahrenheit
*****
chatbot: do you want to know more detailed information?
Y/N:
*****
chatbot: the uvi is 6.36
chatbot: the humidity is 67
chatbot: the pressure is 1025

input(type the question here): Will tomorrow be better than today in Irvine
{'tomorrow': 12.270000000000039, 'today': 9.140000000000043}
chatbot: Yes, it is

input(type the question here): let me know the Riverside forecast temperature
chatbot: the city is: Riverside and the country is: US
chatbot: the Riverside temperature is 10.970000000000027 celsius 51.74600000000005 fahrenheit
*****
chatbot: do you want to know more detailed information?
Y/N: yes
ok, great
chatbot: Do you mane some useful cloth suggestions?
Y/N:
*****
chatbot: I will recommend and give you a list of best cloth to wear based on The Travel Insider and the local temprature

```