Homework 6: Server-side Scripting

1. Objectives

- Get experience with the PHP programming language
- Get experience with Google Geocode and the forecast.io API.
- Get experience using an XML and a JSON parser in PHP.
- Getting hands-on experience in GCP App Engine, AWS or Azure.

1.1. Cloud exercise

The backend of this homework must be implemented in the cloud on GCP, AWS or Azure using PHP.

See homework 5 for installation of either one of these platforms. You only have to select one platform to implement your backend.

2. Description

In this exercise, you are asked to create a webpage that allows you to search for weather information using the Google Geocode and forecast.io API, and the results will be displayed in tabular format.

2.1. Description of the Search Form

A user first opens a page, called **forecast.php (or any valid web page name)**, where they can enter an address (street, city, and state). Figure 1 shows initial search screen which requests to give the location to provide weather details. In Figure 1, the State field includes a list of all US states, which are provided in section 3.7. In case the user wants to provide their current location, the user can select the Current Location checkbox, which will fetch the location using IP-API as given in section 3.3
If the user selects the current location checkbox, the input fields for Street, City and State should be cleared and disabled. Please refer the video for this behavior.

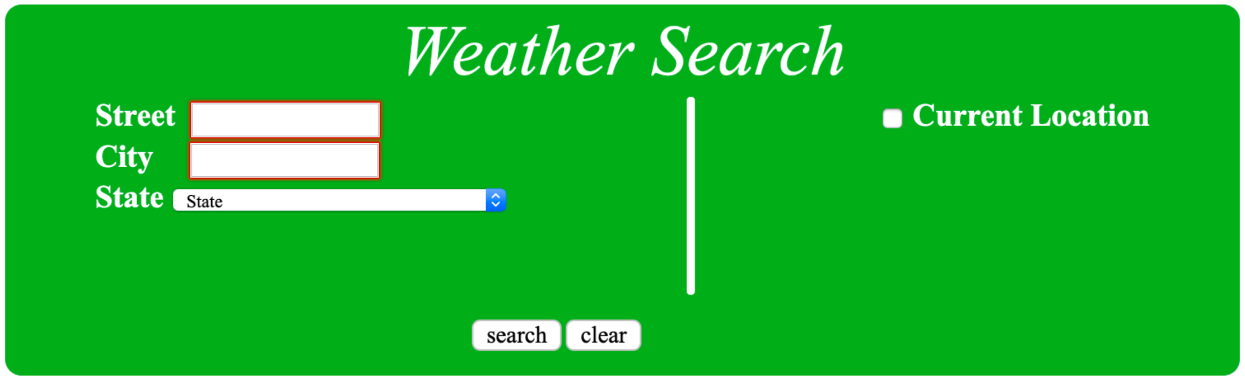


Figure 1: Initial Search Screen

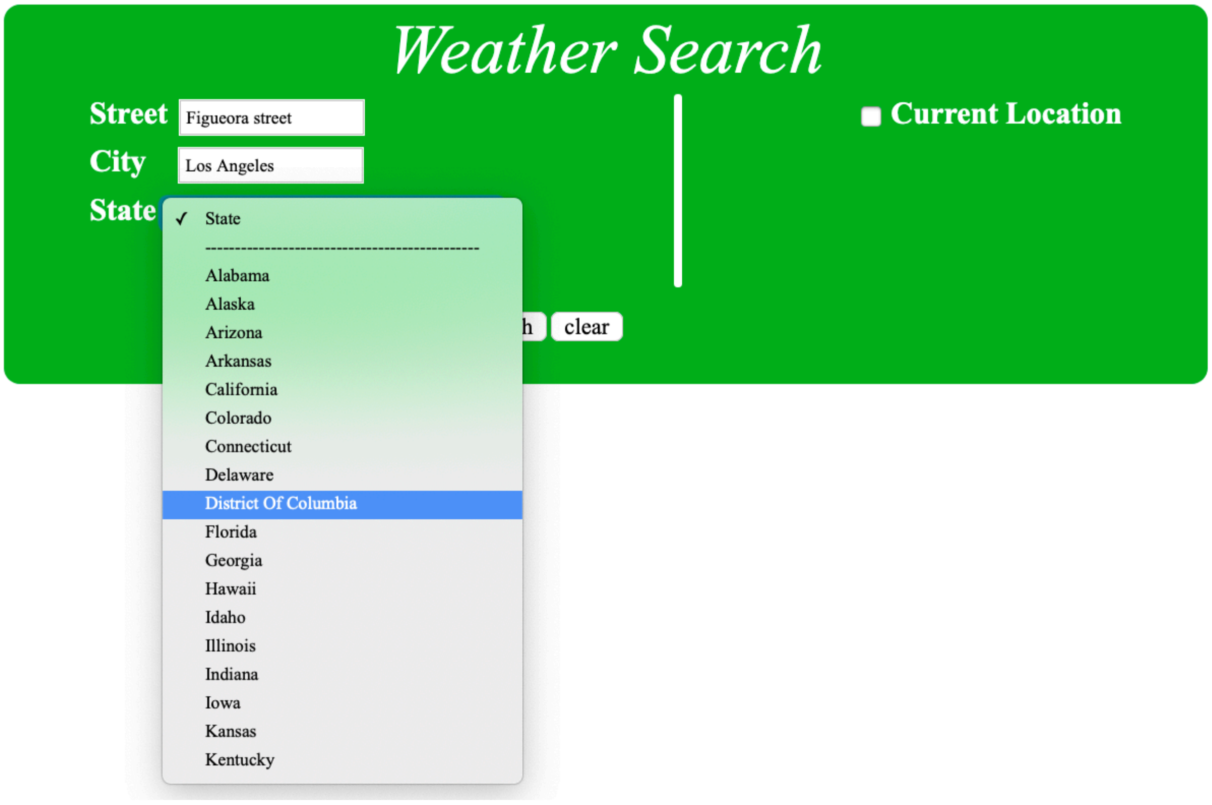


Figure 2: List of States

The search form has two buttons:

- **Search** button: This button validates whether the user provided values for street address, city and state. The validation should be implemented in a JavaScript function. If the user did not enter one of the data items, then an alert should be shown with an appropriate message prompting the user to provide complete information. An example of the alert is shown in Figure 3, and an example of valid input is shown in Figure 3. Once the user has provided valid data, your script should send a request to your web server for **forecast.php** **(or whatever your valid web page name is)** with the form data. You can use either GET or POST to transfer the form data to the web server. A PHP script will grab the data and send it to the Google GeoCode and forecast.io web services in sequence.
- **Clear** button: This button must clear the result area, all text fields, unselect the State value. The Clear operation is done using a JavaScript function.

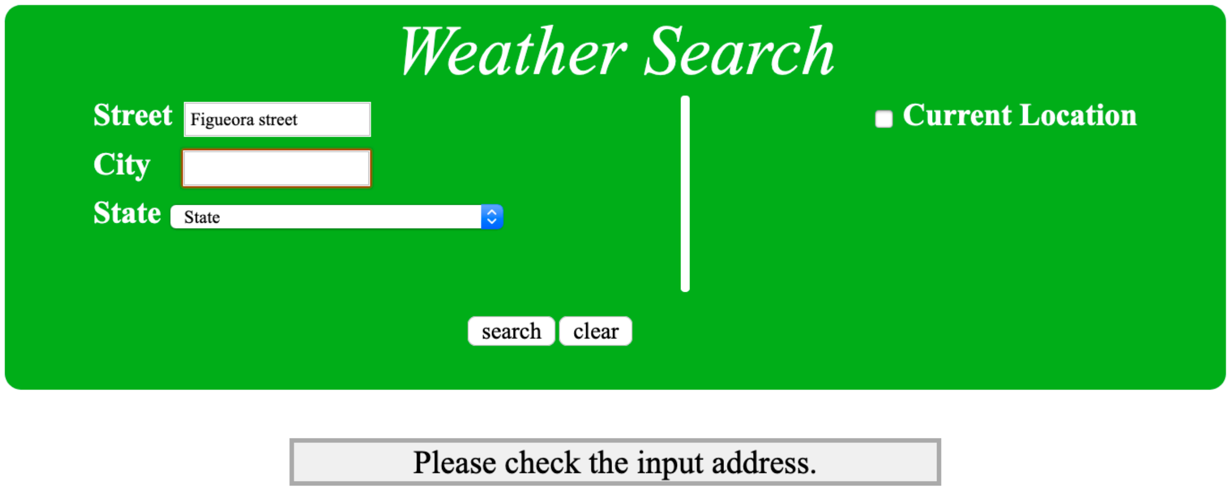


Figure 3: An Error Message When Proving Incomplete Address (e.g., the values of city and state fields are missing)

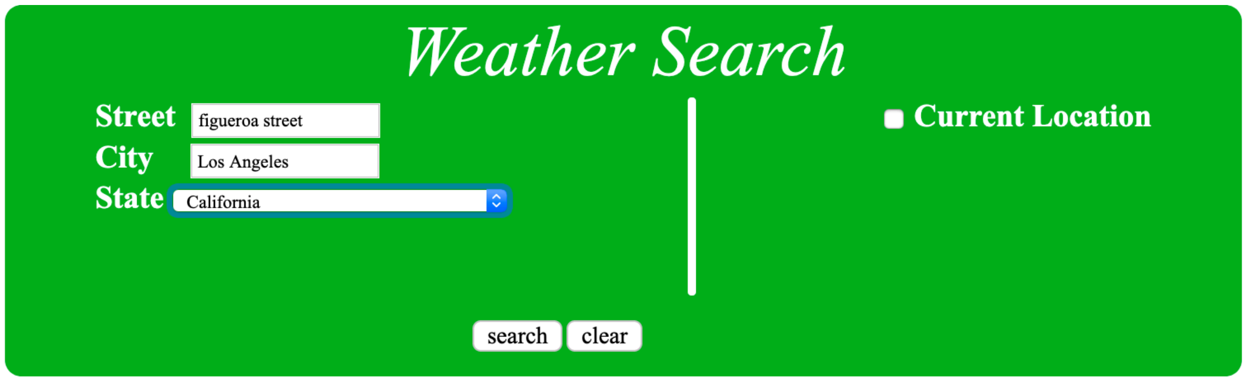


Figure 4: An Example of Valid Input

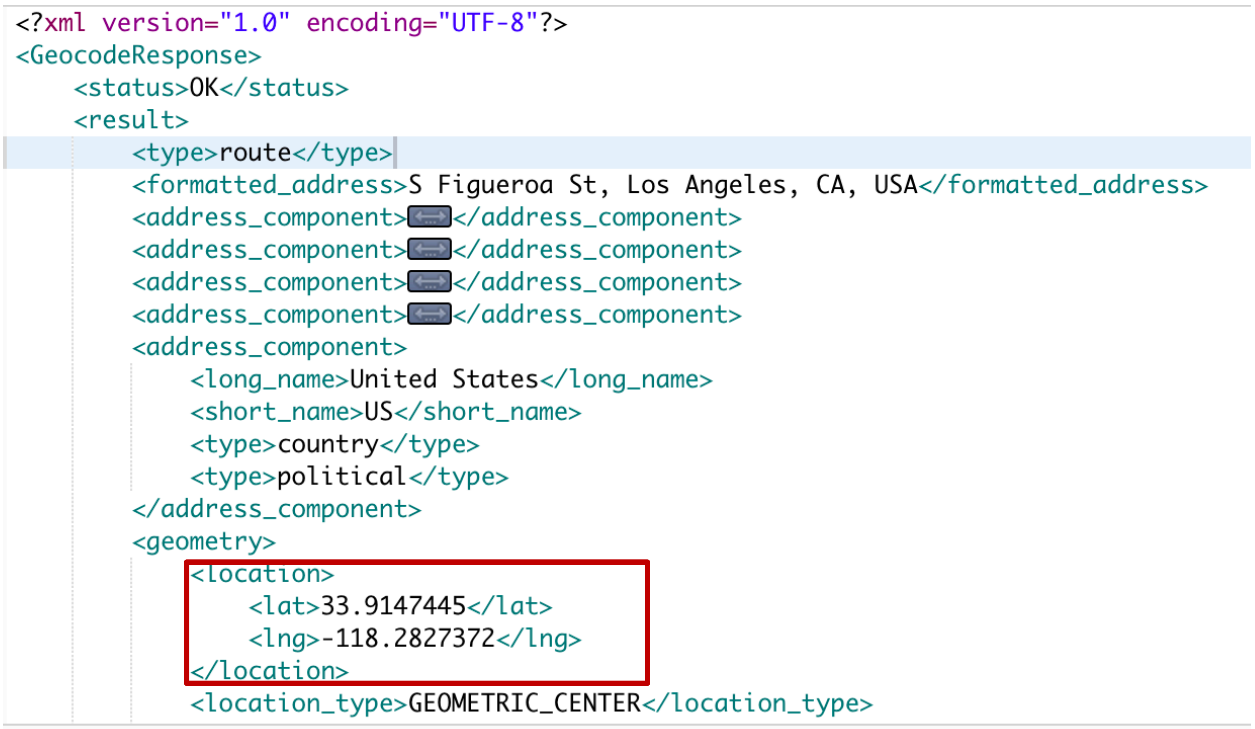
2.2. Displaying Results

In this section, we explain how to use the form data to construct web services calls to Google GeoCode and forecast.io API and display the result in your page.

The PHP script **forecast.php (or whatever your valid page name is)** will use the address information (street, city, and state) to construct a web service URL to query the Google Geocode API appropriately:

https://maps.googleapis.com/maps/api/geocode/xml?address=[STREET, CITY, STATE]&key=[YOUR_API_KEY]

How to create a Google API key (YOUR_API_KEY int the URL above) is explained in section 3.2. The response of this URL is an XML-formatted object. Two key pieces of data returned are the latitude and longitude values for the given address. Figure 5 shows an example of the XML data returned in the Google Geocode web service response. You will see in the next step that you must use the extracted latitude and longitude from the location tag to look up the weather for a given location.



```
<?xml version="1.0" encoding="UTF-8"?>
<GeocodeResponse>
    <status>OK</status>
    <result>
        <type>route</type>
        <formatted_address>S Figueroa St, Los Angeles, CA, USA</formatted_address>
        <address_component>⟺</address_component>
        <address_component>⟺</address_component>
        <address_component>⟺</address_component>
        <address_component>⟺</address_component>
        <address_component>
            <long_name>United States</long_name>
            <short_name>US</short_name>
            <type>country</type>
            <type>political</type>
        </address_component>
        <geometry>
            <location>
                <lat>33.9147445</lat>
                <lng>-118.2827372</lng>
            </location>
            <location_type>GEOMETRIC_CENTER</location_type>
```

Figure 5: A Sample Result of Google GeoCode Query

In case the user selects the current location checkbox, the co-ordinates are found using the IP-API as described in section 3.3.

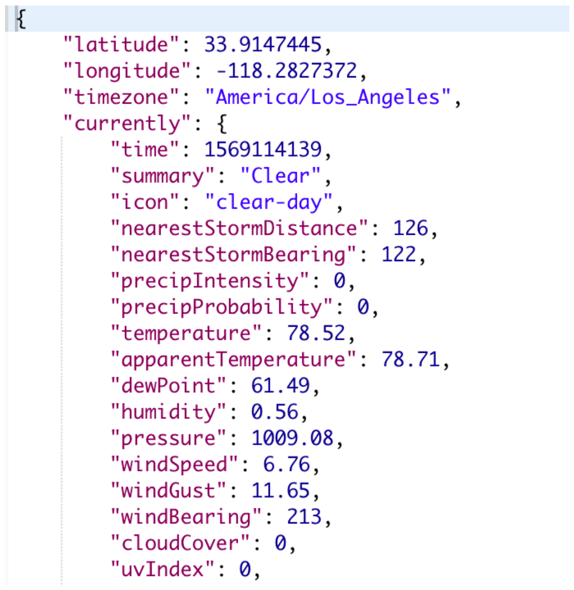
Next, using the latitude and longitude values, another web service URL needs to be constructed to query the forecast.io API to get the weather information for the given location such as:

https://api.forecast.io/forecast/[YOUR_API_KEY]/[LATITUDE,LONGITUDE]?exclude=minutely,hourly,alerts,flags

When constructing the Forecast.io web service API call, you should provide five parameters:

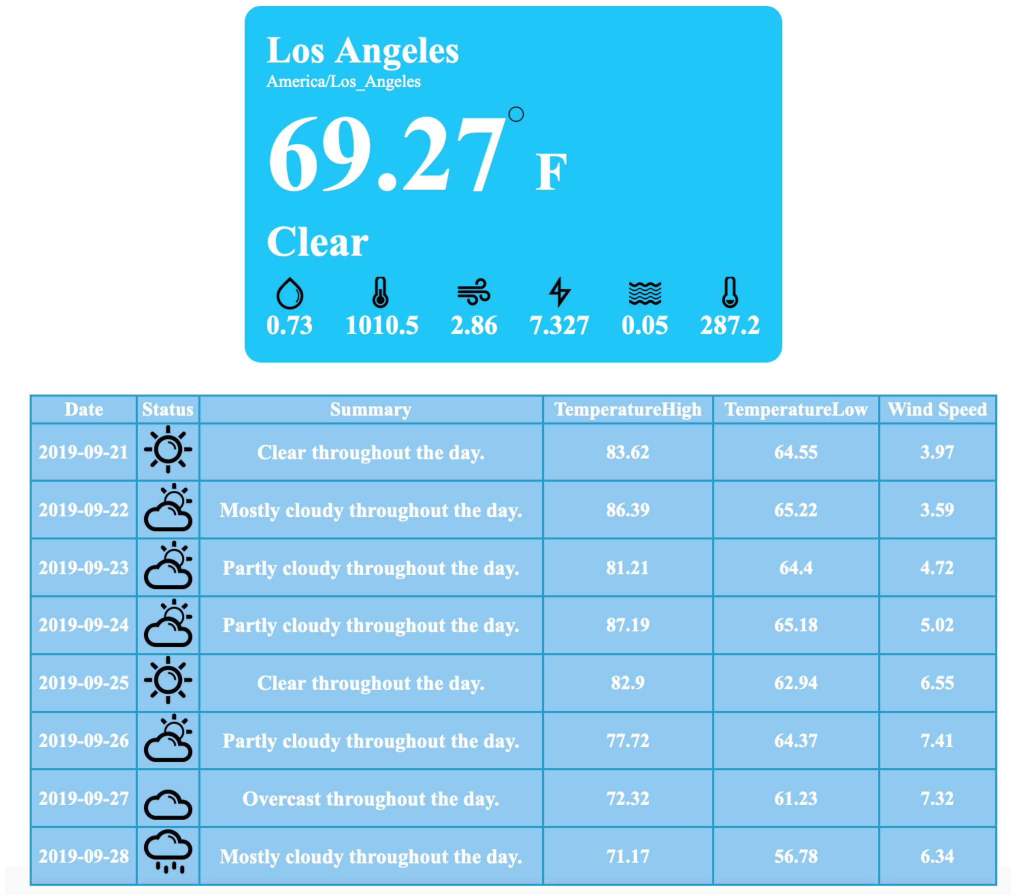
- The first parameter is your Forecast.io API key (a.k.a. the Dark Sky API key). How to create this key is explained in section 3.1.
- The second and the third parameter are the latitude and longitude values which are extracted from the XML-formatted data returned by the Google Geocode API.
- The name of the fourth parameter is *exclude*. The value of this parameter is "*minutely, hourly, alerts, flags*".

The response from a query of the Forecast.io web service is a JSON-formatted object. An example of a returned JSON-formatted object from the Forecast.io API is available in Figure 6. You need to parse the returned JSON-formatted object and extract some fields. After extracting the data, the PHP script should display the data in a tabular format below the search form. A sample output is shown in Figure 7.



```
{
    "latitude": 33.9147445,
    "longitude": -118.2827372,
    "timezone": "America/Los_Angeles",
    "currently": {
        "time": 1569114139,
        "summary": "Clear",
        "icon": "clear-day",
        "nearestStormDistance": 126,
        "nearestStormBearing": 122,
        "precipIntensity": 0,
        "precipProbability": 0,
        "temperature": 78.52,
        "apparentTemperature": 78.71,
        "dewPoint": 61.49,
        "humidity": 0.56,
        "pressure": 1009.08,
        "windSpeed": 6.76,
        "windGust": 11.65,
        "windBearing": 213,
        "cloudCover": 0,
        "uvIndex": 0,
```

Figure 6: Part of Sample JSON-formatted object returned from Forecast.io API call



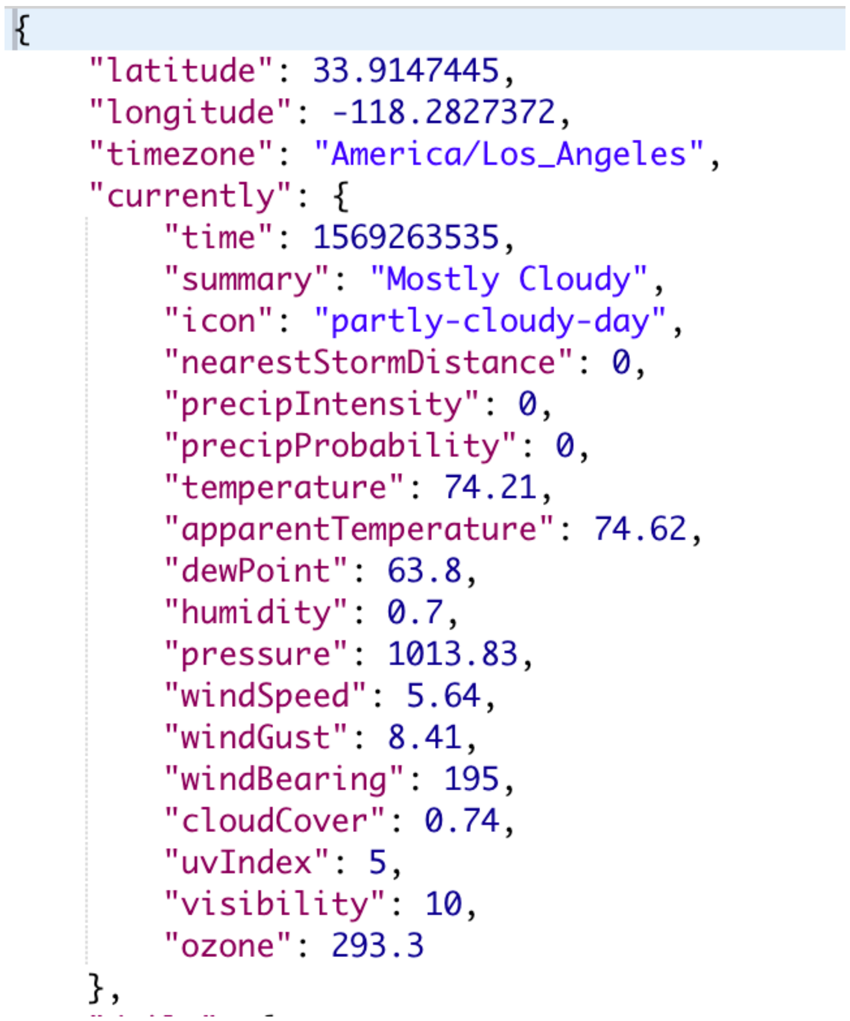
Los Angeles
America/Los_Angeles
69.27 ° F
Clear
0.73 1010.5 2.86 7.327 0.05 287.2

Date	Status	Summary	TemperatureHigh	TemperatureLow	Wind Speed
2019-09-21	☀	Clear throughout the day.	83.62	64.55	3.97
2019-09-22	⛅	Mostly cloudy throughout the day.	86.39	65.22	3.59
2019-09-23	⛅	Partly cloudy throughout the day.	81.21	64.4	4.72
2019-09-24	⛅	Partly cloudy throughout the day.	87.19	65.18	5.02
2019-09-25	☀	Clear throughout the day.	82.9	62.94	6.55
2019-09-26	⛅	Partly cloudy throughout the day.	77.72	64.37	7.41
2019-09-27	☁	Overcast throughout the day.	72.32	61.23	7.32
2019-09-28	🌧	Mostly cloudy throughout the day.	71.17	56.78	6.34

Figure 7: Search Result

You need to map the data extracted from the result of the Forecast.io API call to your Card view of the current weather at that location and the table providing temperature predictions for the whole week:

The details for the Card are from the corresponding JSON structure:



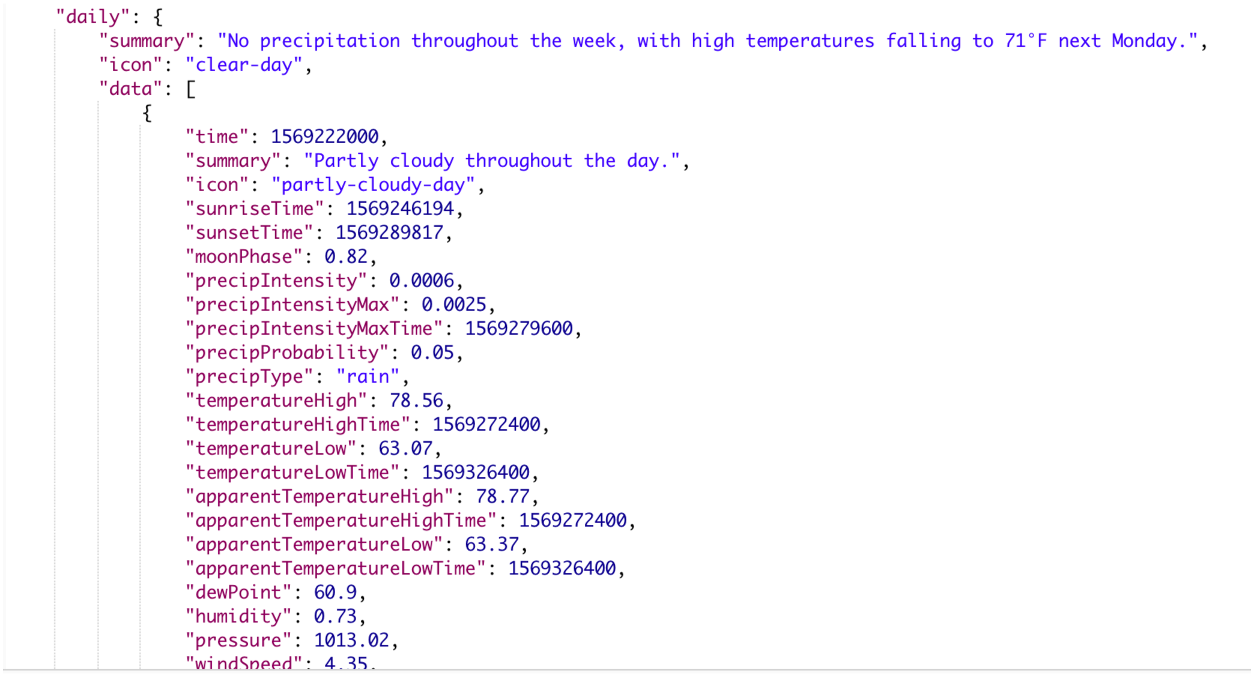
```
{
    "latitude": 33.9147445,
    "longitude": -118.2827372,
    "timezone": "America/Los_Angeles",
    "currently": {
        "time": 1569263535,
        "summary": "Mostly Cloudy",
        "icon": "partly-cloudy-day",
        "nearestStormDistance": 0,
        "precipIntensity": 0,
        "precipProbability": 0,
        "temperature": 74.21,
        "apparentTemperature": 74.62,
        "dewPoint": 63.8,
        "humidity": 0.7,
        "pressure": 1013.83,
        "windSpeed": 5.64,
        "windGust": 8.41,
        "windBearing": 195,
        "cloudCover": 0.74,
        "uvIndex": 5,
        "visibility": 10,
        "ozone": 293.3
    },
```

Figure 8: Sample JSON-formatted object returned from Forecast.io API call for the card layout

Table Column	**Data from result of Forecast.io API call**
City	The value of the city can be taken from the input form if the user provides the address or from ip-api to get current location.
Timezone	The value of the key "*timezone*".
Temperature	The value of the key *"temperature"* in the

	currently object. You should display the value with a degree sign and F to indicate temperature in Fahrenheit. For the degree sign use this image - https://cdn3.iconfinder.com/data/icons/virtual-notebook/16/button_shape_oval-512.png
Summary	The value of *"summary"* in the *currently* object.
Humidity	The value of "*humidity"* in the *currently* object. It should also be provided with the corresponding icon - https://cdn2.iconfinder.com/data/icons/weather-74/24/weather-16-512.png
Pressure	The value of "*pressure"* in the *currently* object. It should also be provided with the corresponding icon - https://cdn2.iconfinder.com/data/icons/weather-74/24/weather-25-512.png
Wind Speed	The value of *"windSpeed"* in the *currently* object. It should also be provided with the corresponding icon for it - https://cdn2.iconfinder.com/data/icons/weather-74/24/weather-27-512.png
Visibility	The value of "*visibility"* in the *currently* object. It should also be provided with the corresponding icon for it - https://cdn2.iconfinder.com/data/icons/weather-74/24/weather-30-512.png
CloudCover	The value of "*cloudCover"* in the *currently* object. It should also be provided with the corresponding icon - https://cdn2.iconfinder.com/data/icons/weather-74/24/weather-28-512.png
Ozone	The value of "*ozone"* in the *currently* object. It should also be provided with the corresponding icon for it - https://cdn2.iconfinder.com/data/icons/weather-74/24/weather-24-512.png

The details for the Table are from the corresponding JSON structure:



```
"daily": {
    "summary": "No precipitation throughout the week, with high temperatures falling to 71°F next Monday.",
    "icon": "clear-day",
    "data": [
        {
            "time": 1569222000,
            "summary": "Partly cloudy throughout the day.",
            "icon": "partly-cloudy-day",
            "sunriseTime": 1569246194,
            "sunsetTime": 1569289817,
            "moonPhase": 0.82,
            "precipIntensity": 0.0006,
            "precipIntensityMax": 0.0025,
            "precipIntensityMaxTime": 1569279600,
            "precipProbability": 0.05,
            "precipType": "rain",
            "temperatureHigh": 78.56,
            "temperatureHighTime": 1569272400,
            "temperatureLow": 63.07,
            "temperatureLowTime": 1569326400,
            "apparentTemperatureHigh": 78.77,
            "apparentTemperatureHighTime": 1569272400,
            "apparentTemperatureLow": 63.37,
            "apparentTemperatureLowTime": 1569326400,
            "dewPoint": 60.9,
            "humidity": 0.73,
            "pressure": 1013.02,
            "windSpeed": 4.35,
```

Figure 9: Part of Sample JSON-formatted object returned from Forecast.io API call for the table layout

Table Column	**Data from result of Forecast.io API call**
Date	The value of *"time"* in the *data* object of the *daily* object.
Status	The value of *"icon"* in the *data* object of the *daily* object. It is possibly one of the following values: • clear-day | clear-night: The icon for this is https://cdn2.iconfinder.com/data/icons/weather-74/24/weather-12-512.png • rain: The icon for this is https://cdn2.iconfinder.com/data/icons/weather-74/24/weather-04-512.png • snow: The icon for this is https://cdn2.iconfinder.com/data/icons/weather-74/24/weather-19-512.png • sleet: The icon for this is

	https://cdn2.iconfinder.com/data/icons/weather-74/24/weather-07-512.png • wind: The icon for this is https://cdn2.iconfinder.com/data/icons/weather-74/24/weather-27-512.png • fog: The icon for this is https://cdn2.iconfinder.com/data/icons/weather-74/24/weather-28-512.png • cloudy: This icon for this is https://cdn2.iconfinder.com/data/icons/weather-74/24/weather-01-512.png • partly-cloudy-day | partly-cloudy-night: The icon for this is https://cdn2.iconfinder.com/data/icons/weather-74/24/weather-02-512.png
Summary	The value of *"summary"* in the *data* object of the *daily* object.
TemperatureHigh	The value of *"temperatureHigh"* in the *data* object of the *daily* object.
TemperatureLow	The value of *"temperatureLow"* in the *data* object of the *daily* object.
Wind Speed	The value of *"windSpeed"* in the *data* object of the *daily* object.

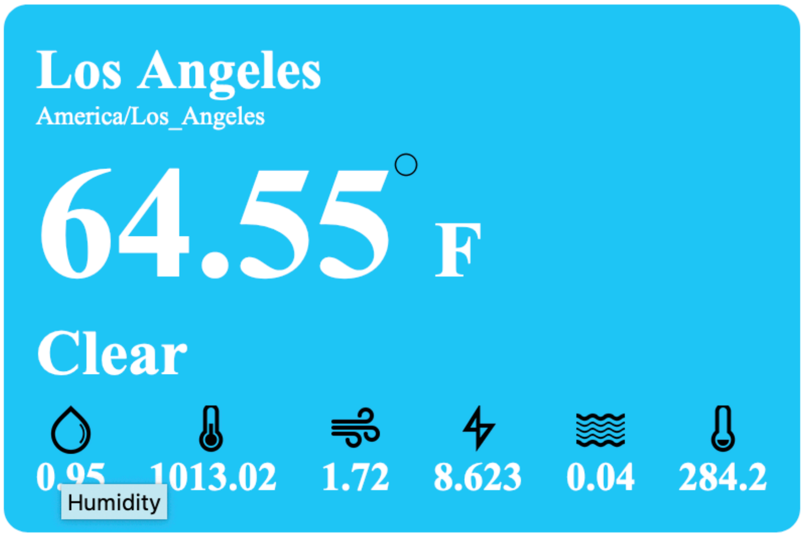


Figure 10: On Hover

On hovering the icons in the card, it should display the type of parameter. Please refer the video for this behavior.

In summary, the search mechanism to be be implemented behaves as follows:

- Based on the input data in the search form, construct a web service URL to retrieve the XML-formatted output from the Google GeoCode API.
- Parse the returned XML and extract the latitude and longitude values.
- Call the Forecast.io API (latitude and longitude are parameters in the web service URL) and retrieve the JSON-formatted output.
- Parse the returned JSON-formatted output and extract the weather information.
- Display the weather information in tabular format.

2.3. Displaying Detailed Summary of the Weather

On clicking the summary present in the above table, the page should display a detailed description of the weather. The Daily Weather Detail provides details provided by the forecast.io API. The API call to query the weather information is given as:

https://api.darksky.net/forecast/[YOUR_API_KEY]/[LATITUDE],[LONGITUDE],[TIME]?exclude=minutely

Note: The time parameter is from the *data* object selected from the table which is part of the daily object from the 1st API call.

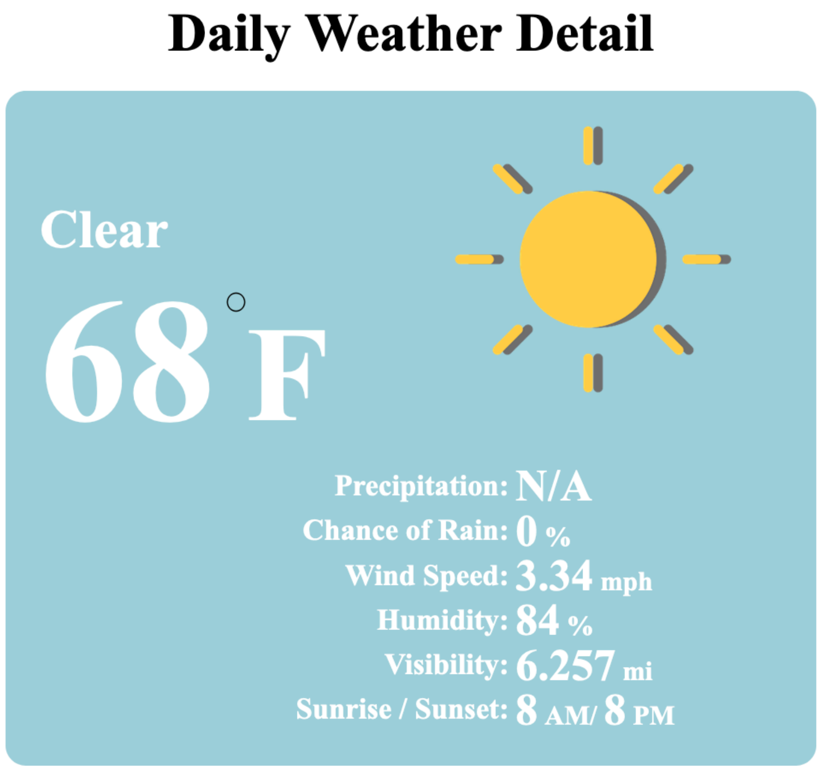
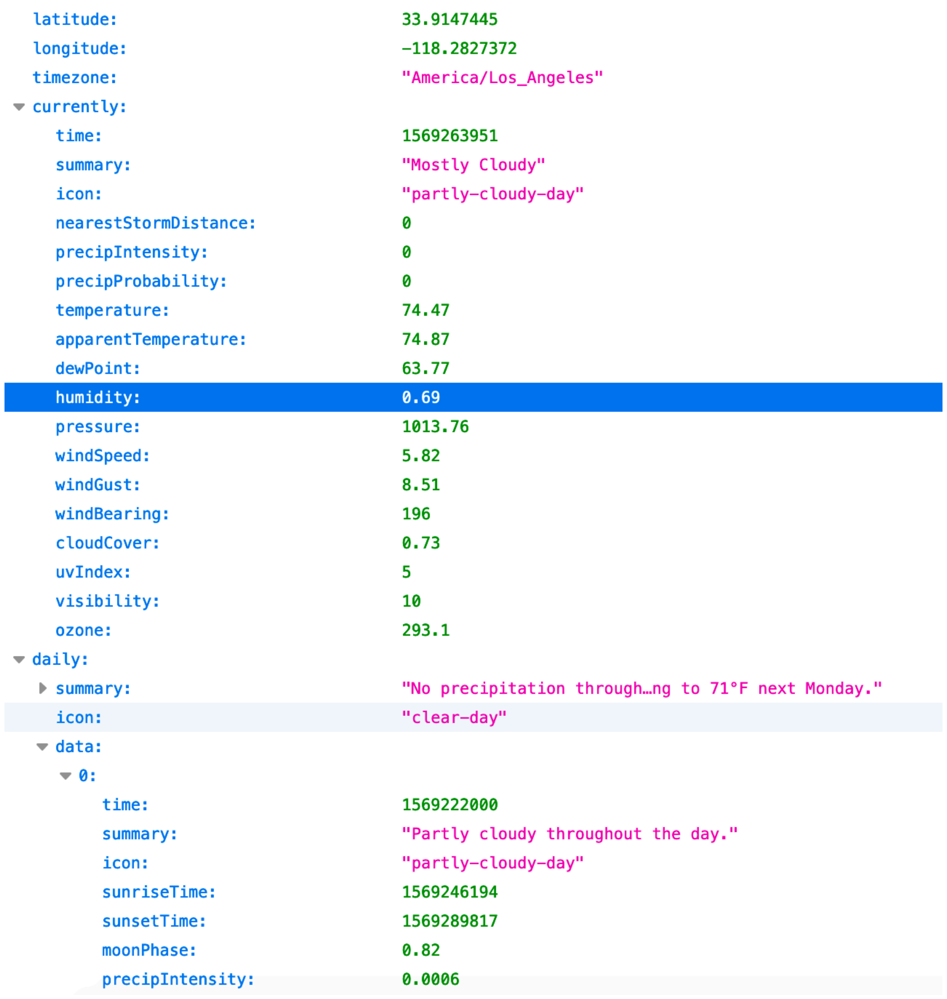


Figure 11: Daily Weather detail

The values displayed in the Daily Weather Detail as shown in the following in table:



```
latitude:                33.9147445
longitude:               -118.2827372
timezone:                "America/Los_Angeles"
▼ currently:
  time:                  1569263951
  summary:               "Mostly Cloudy"
  icon:                  "partly-cloudy-day"
  nearestStormDistance:  0
  precipIntensity:       0
  precipProbability:     0
  temperature:           74.47
  apparentTemperature:   74.87
  dewPoint:              63.77
  humidity:              0.69
  pressure:              1013.76
  windSpeed:             5.82
  windGust:              8.51
  windBearing:           196
  cloudCover:            0.73
  uvIndex:               5
  visibility:            10
  ozone:                 293.1
▼ daily:
  ▶ summary:             "No precipitation through…ng to 71°F next Monday."
  icon:                  "clear-day"
  ▼ data:
    ▼ 0:
      time:              1569222000
      summary:           "Partly cloudy throughout the day."
      icon:              "partly-cloudy-day"
      sunriseTime:       1569246194
      sunsetTime:        1569289817
      moonPhase:         0.82
      precipIntensity:   0.0006
```

Figure 12: Part of Sample JSON-formatted object returned from Forecast.io API call for the card layout

Table Column	**Data from result of Forecast.io API call**
Summary	The value of *"summary"* in the *currently* object.
Temperature	The value of the key *"temperature"* in the *currently* object. You should display the value with a degree sign and F to indicate temperature in Fahrenheit. For the degree sign use this image - https://cdn3.iconfinder.com/data/icons/virtual-notebook/16/button_shape_oval-512.png
Icon	The value of *"icon"* in the *currently* object. It is

	possibly one of the following values: • clear-day | clear-night: The icon for this is https://cdn3.iconfinder.com/data/icons/weather-344/142/sun-512.png • rain: The icon for this is https://cdn3.iconfinder.com/data/icons/weather-344/142/rain-512.png • snow: The icon for this is https://cdn3.iconfinder.com/data/icons/weather-344/142/snow-512.png • sleet: The icon for this is https://cdn3.iconfinder.com/data/icons/weather-344/142/lightning-512.png • wind: The icon for this is https://cdn4.iconfinder.com/data/icons/the-weather-is-nice-today/64/weather_10-512.png • fog: The icon for this is https://cdn3.iconfinder.com/data/icons/weather-344/142/cloudy-512.png • cloudy: This icon for this is https://cdn3.iconfinder.com/data/icons/weather-344/142/cloud-512.png • partly-cloudy-day | partly-cloudy-night: The icon for this is https://cdn3.iconfinder.com/data/icons/weather-344/142/sunny-512.png
Precipitation	The value of "*precipIntensity*" in the *currently* object. The value is based on the following conditions: • value <=0.001, display – "None" • value <=0.015, display – "Very Light" • value <=0.05, display – "Light" • value <=0.1, display – "Moderate" • value >01, display – "heavy
Chance of Rain	The value of "*precipProbability*" in the *currently* object. The value is to be multiplied by 100 to give the percentage.
Wind Speed	The value of *"windSpeed"* in the *currently*

	object. The value should be provided with the unit *“mph”*.
Humidity	The value of “*humidity*” in the *currently* object. The value is to be multiplied by 100 to give the percentage.
Visibility	The value of “*visibility*” in the *currently* object. The value should be provided with the unit *“mi”*.
Sunrise / Sunset	The value of *“sunriseTime”* of the 1st element in the *data* object present in the *daily* object. The value of *“sunsetTime”* of the 1st element in the *data* object present in the *daily* object. **Note:** The values should just provide the hour and the period (AM/PM) and in 12 hr format.

Below the Daily Weather Detail, there is a chart for the Day’s hourly weather. This is hidden by default. When the user clicks on the ⌄ button, the “Day’s hourly weather” sub-section should be expanded, and when the user clicks on the ⌃ button, the “Day’s hourly weather” sub-section should be hidden (if it is open) and vice versa (see the video for the behavior).

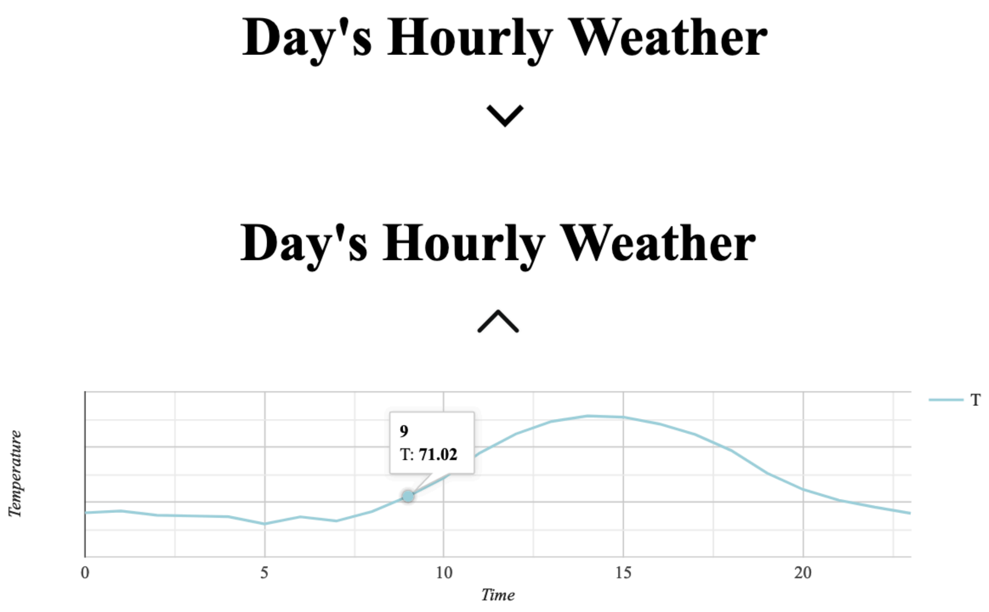


Figure 13: Toggling the buttons

The graph is a chart of the hourly temperature for that day. The hourly temperature can be found from the JSON structure –
Note: The value of the *"temperature"* is present in the data array of the hourly object.

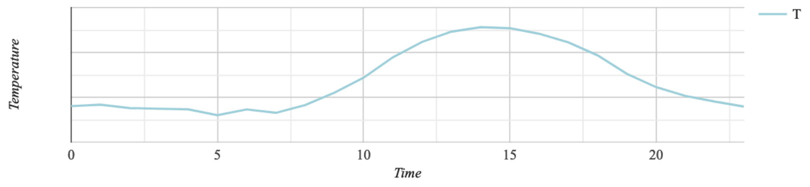


Figure 14: Hourly temperature for that day

The Chart is made with the help of Google Charts. Please find out how to use Google Charts here:
https://developers.google.com/chart/interactive/docs/gallery/linechart

This link will provide the necessary details to display a chart of the hourly temperatures for that day.

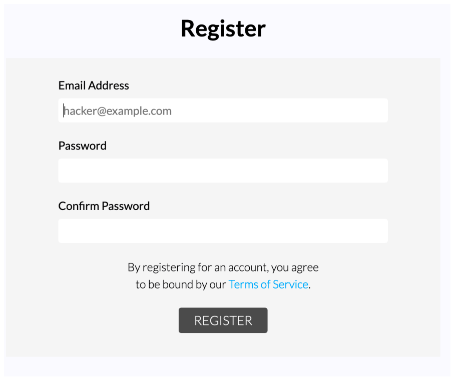
2.4. Saving Previous Inputs

In addition to displaying the results, your page should maintain the provided values to display the current result. For example, if one searches for "***Street:*** *Figueroa St*, **City:** Los Angeles, **State:** California", one should see what was provided in the search form and the corresponding results. It follows that you need to keep the whole search box/input fields and buttons even while displaying results/errors.

3. Hints

3.1. How to get Forecast.io API Key

Go to https://darksky.net/dev. Click on "Try For Free". You should fill out the form as shown in Figure 15. The API Key (Dark Sky API key) will be displayed. Copy this key as you will use it in the Forecast.io web service API call.



Register
Email Address
hacker@example.com
Password
Confirm Password
By registering for an account, you agree to be bound by our Terms of Service.
REGISTER

Figure 15: Forecast.io Registration Form

3.2 How to get a Google API Key

To get a Google API key, please follow these steps

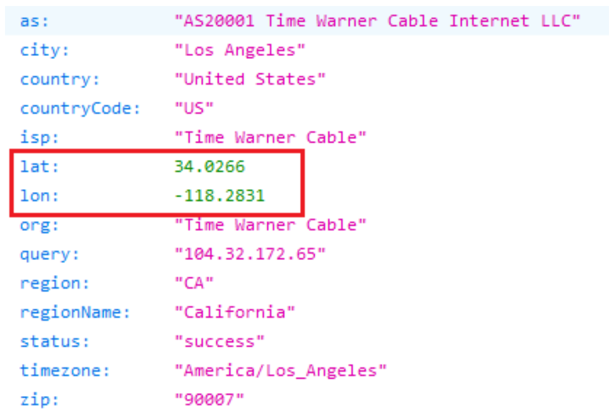
- Go to the Google Developers Console (https://console.developers.google.com/flows/enableapi?apiid=geocoding_backend&keyType=SERVER_SIDE&reusekey=true).
- Create or select a project.
- Click Continue to Enable the API.
- Go to Credentials to get a Server key (and set the API Credentials).

3.3. Get Geolocation using IP-API.com

You need to use *ip-api.com* for searching the geolocation based on IP addresses. An example call is as follows:

`http://ip-api.com/json`

The response is a JSON object shown in **Figure 16**.



```
as:            "AS20001 Time Warner Cable Internet LLC"
city:          "Los Angeles"
country:       "United States"
countryCode:   "US"
isp:           "Time Warner Cable"
lat:           34.0266
lon:           -118.2831
org:           "Time Warner Cable"
query:         "104.32.172.65"
region:        "CA"
regionName:    "California"
status:        "success"
timezone:      "America/Los_Angeles"
zip:           "90007"
```

Figure 16: Response from *ip-api.com API*

3.4 Parsing JSON-formatted data in PHP

In PHP 5 and 7, you can parse JSON-formatted data using the "*json_decode*" function. For more information, please go to http://php.net/manual/en/function.json-decode.php.

You can encode data into JSON-formatted objects using the "*json_encode*" function. For more information, please go to http://php.net/manual/en/function.json-encode.php.

3.5 Read and save contents in PHP

To read the contents of a JSON-formatted object, you can use the "*file_get_contents*" function. To save contents on the server side, you can use "*file_put_contents*" function.
3.6 Deploy PHP file to the cloud (GAE/AWS/Azure)

You should use the domain name of the GAE/AWS/Azure service you created in HW #5 to make the request. For example, if your GAE/AWS/Azure server domain is called example.appspot.co or example.elasticbeanstalk.com or example.azurewebsites.net, the following links will be generated:

GAE - http://example.appspot.com/forecast.php
AWS - http://example.elasticbeanstalk.com/forecast.php
Azure - http://example.azurewebsites.net/forecast.php

example in the above URLs will be replaced by your choice of subdomain.

3.7 List of US States and Their Two-Letter Abbreviations

Two-Letter Abbreviation	**State**
AL	Alabama
AK	Alaska
AZ	Arizona
AR	Arkansas
CA	California
CO	Colorado
CT	Connecticut
DE	Delaware
DC	District Of Columbia
FL	Florida
GA	Georgia
HI	Hawaii
ID	Idaho

IL	Illinois
IN	Indiana
IA	Iowa
KS	Kansas
KY	Kentucky
LA	Louisiana
ME	Maine
MD	Maryland
MA	Massachusetts
MI	Michigan
MN	Minnesota
MS	Mississippi
MO	Missouri
MT	Montana
NE	Nebraska
NV	Nevada
NH	New Hampshire
NJ	New Jersey
NM	New Mexico
NY	New York
NC	North Carolina
ND	North Dakota
OH	Ohio
OK	Oklahoma

OR	Oregon
PA	Pennsylvania
RI	Rhode Island
SC	South Carolina
SD	South Dakota
TN	Tennessee
TX	Texas
UT	Utah
VT	Vermont
VA	Virginia
WA	Washington
WV	West Virginia
WI	Wisconsin
WY	Wyoming

4. Files to Submit

In your course homework page, you should update the **Homework 6 link** to refer to your new initial web search page for this exercise (for example, **forecast.php**). This PHP file must be hosted on GAE, AWS or Azure cloud service. Graders will verify that this link is indeed pointing to one of the cloud services.

Also, submit your source code file **(it must be a single .php file, e.g. forecast.php)** to the GitHub Classroom repository so that it can be graded and compared to all other students' source code via the MOSS code comparison tool.

IMPORTANT: repeating the **REQUIREMENT** that the entire implementation needs to be submitted as a **SINGLE PHP file**, that will include all the required PHP, HTML, CSS and JavaScript. A penalty of 2 points will be assessed if the code is split over more than one PHP file.

****IMPORTANT**:**

- All discussions and explanations in Piazza related to this homework are part of the homework description and grading guidelines. So please review all Piazza threads, before finishing the assignment. If there is a conflict between Piazza and this description and/or the grading guidelines, **Piazza always rules**.
- You should not use JQuery for Homework 6.
- You **should not call the forecast.io APIs directly from JavaScript**, bypassing the Apache/HTTP proxy. Implementing any one of them in JavaScript instead of PHP will result in a **4-point penalty.**

The link to the video is: https://youtu.be/irN8ZV-GuR8