Author: Tan Thiam Huat Date: 9th-July-2024

This documentation lists out the steps for building the Carpark Availability app from the ground up. It is developed using tools from **Microsoft Power Platform (Power Apps, Power Automate)**.

The carpark data is extracted from the API at https://api.data.gov.sg/v1/transport/carpark-availability. This JSON data is merged with another dataset available at https://beta.data.gov.sg/datasets/148/view to create a richer dataset. The data extraction and manipulation are performed using Python code, which is available in the Appendix.

Power Automate can run a Python script, but it requires some additional setup because Power Automate does not natively support Python scripts directly. Below are a few ways to achieve this:

1. **Using a Python web service hosted on PythonAnywhere**:
    - Go to the **Web** tab in the PythonAnywhere dashboard.
    - Click **Add a new web app**.
    - Choose **Flask** as the framework (you can also choose other frameworks like Django, or just use a simple WSGI app).
2. **Using an Azure Function App**:
    - Write the Python script as an Azure Function.
    - Deploy the function to Azure, which provides an endpoint URL.
    - Use Power Automate to make an HTTP request to the Azure Function App endpoint to trigger the execution of the Python script.
3. **Using a Power Automate Desktop**:
    - Power Automate Desktop allows for more direct execution of scripts.
    - Create a desktop flow that runs a Python script using the "Run Python script" action available in Power Automate Desktop.

We will describe each of the above methods in details.

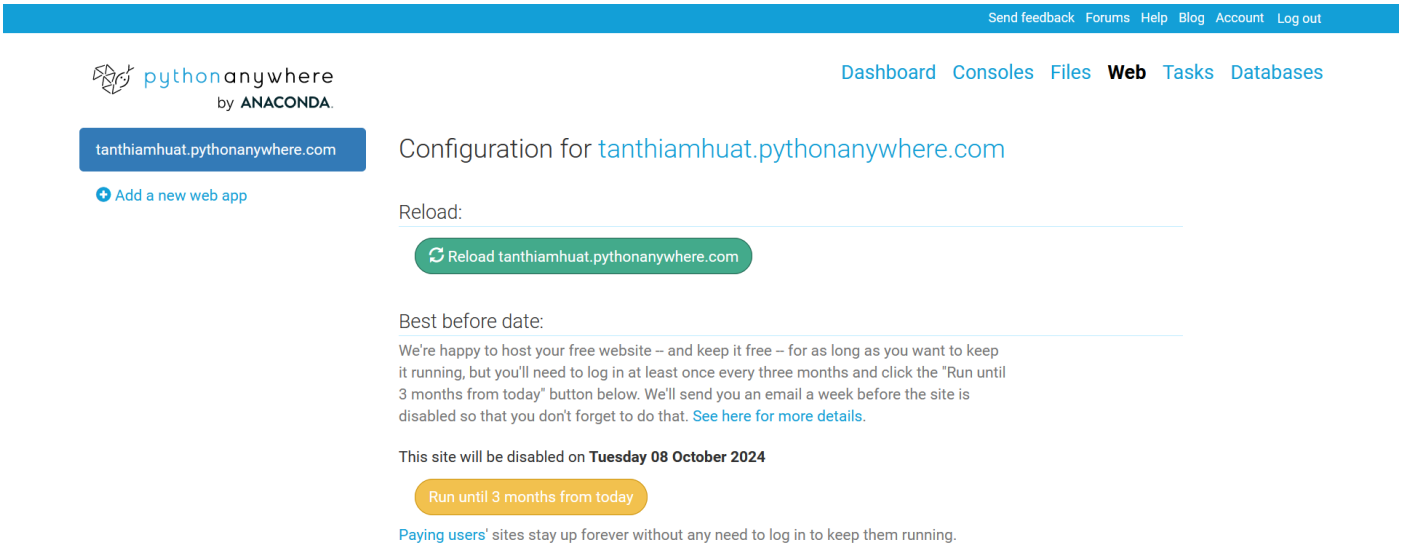
Assuming that the above data extraction and manipulation are completed, Power Apps will directly query its JSON data from the web URL. The cleansed data from the Python script is shown below.

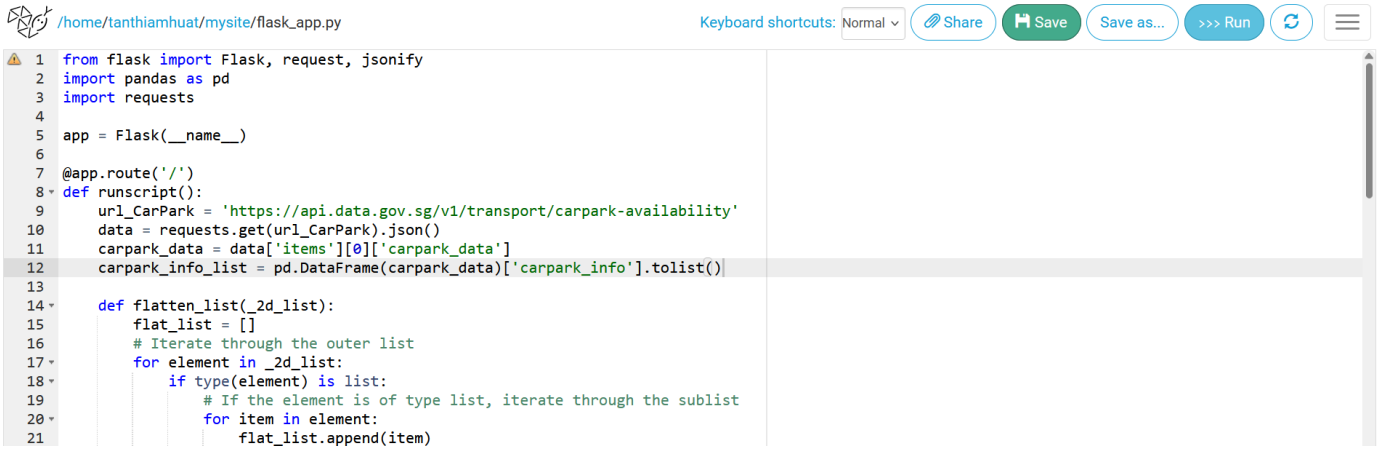
carpark_detailedinfo - DataFrame

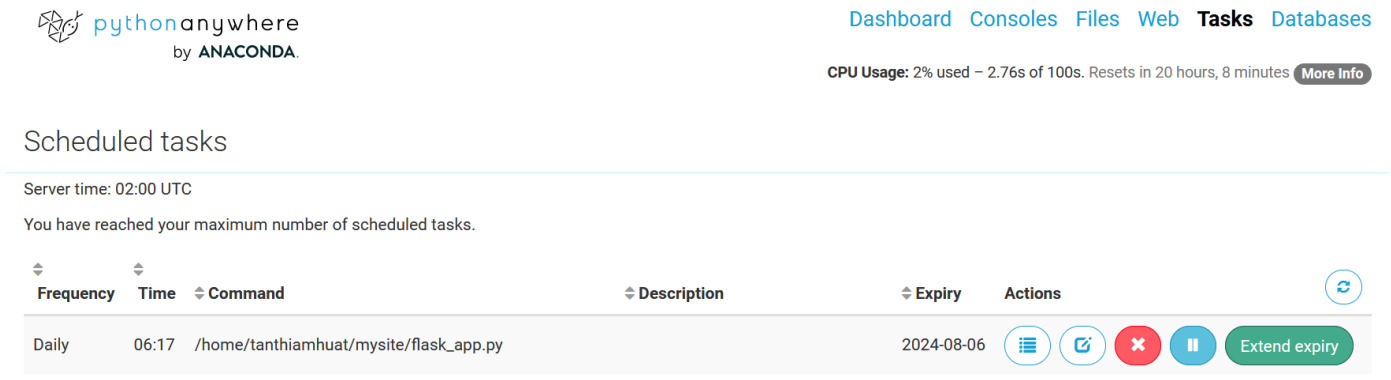
index	total_lots	lot_type	lots_available	carpark_number	update_datetime	address	car_park_type	type_of_parking_system	short_term_parking	free_parking	night_parking
0	105	C	27	HE12	2024-07-09T09:01:13	BLK 78/81 REDHILL LANE	SURFACE CAR PARK	ELECTRONIC PARKING	WHOLE DAY	SUN & PH FR 7AM-10.30PM	YES
1	583	C	263	HLM	2024-07-09T09:01:07	BLK 533A HONG LIM MSCP	MULTI-STOREY CAR PARK	ELECTRONIC PARKING	WHOLE DAY	NO	YES
2	329	C	159	RHM	2024-07-09T09:01:14	BLK 88A REDHILL CLOSE	MULTI-STOREY CAR PARK	ELECTRONIC PARKING	WHOLE DAY	SUN & PH FR 7AM-10.30PM	YES
3	97	C	12	BM29	2024-07-09T09:01:12	BLK 163 BUKIT MERAH CENTRAL	BASEMENT CAR PARK	ELECTRONIC PARKING	WHOLE DAY	NO	YES
4	97	C	0	Q81	2024-07-09T09:01:04	BLK 43 HOLLAND DRIVE	SURFACE CAR PARK	ELECTRONIC PARKING	WHOLE DAY	NO	YES
5	176	C	27	C20	2024-07-09T09:00:55	BLK 449-451 CLEMENTI AVENUE 3	SURFACE CAR PARK	ELECTRONIC PARKING	WHOLE DAY	NO	YES
6	228	C	100	FR3M	2024-07-09T09:01:15	BLK 8A EMPRESS ROAD	MULTI-STOREY CAR PARK	ELECTRONIC PARKING	WHOLE DAY	NO	YES
7	289	C	283	C32	2024-07-09T09:01:57	BLK 514-519 WEST COAST ROAD	SURFACE CAR PARK	ELECTRONIC PARKING	WHOLE DAY	SUN & PH FR 7AM-10.30PM	YES
8	332	C	167	C6	2024-07-09T09:01:20	BLK 328-334 CLEMENTI AVENUE 2	SURFACE CAR PARK	ELECTRONIC PARKING	WHOLE DAY	SUN & PH FR 7AM-10.30PM	YES
9	273	C	151	TG2	2024-07-09T09:01:13	BLK 49 TO 54 TEBAN GARDENS	SURFACE CAR PARK	ELECTRONIC PARKING	WHOLE DAY	SUN & PH FR 7AM-10.30PM	YES
10	577	C	375	BP1	2024-07-09T09:01:10	BLK 101/109 BUKIT PURMEI ROAD	SURFACE CAR PARK	ELECTRONIC PARKING	WHOLE DAY	SUN & PH FR 7AM-10.30PM	YES
11	133	C	100	TG1	2024-07-09T09:01:12	BLK 24 & 25 TEBAN GARDENS	SURFACE CAR PARK	ELECTRONIC PARKING	WHOLE DAY	SUN & PH FR 7AM-10.30PM	YES
12	189	C	136	TGM2	2024-07-09T09:01:14	BLK 61 TEBAN GARDENS ROAD	MULTI-STOREY CAR PARK	ELECTRONIC PARKING	WHOLE DAY	SUN & PH FR 7AM-10.30PM	YES
13	134	C	91	TE14	2024-07-09T09:01:15	BLK 140/142 JALAN BUKIT MERAH	SURFACE CAR PARK	ELECTRONIC PARKING	7AM-10.30PM	SUN & PH FR 7AM-10.30PM	NO
14	5	C	0	BM3	2024-07-09T09:01:22	BLK 49/50 HOY FATT ROAD	SURFACE CAR PARK	ELECTRONIC PARKING	WHOLE DAY	NO	YES
15	612	C	121	BM9	2018-12-17T07:42:34	BLK 58/59 LENGKOK BAHRU	SURFACE CAR PARK	ELECTRONIC PARKING	WHOLE DAY	SUN & PH FR 7AM-10.30PM	YES
16	155	C	1	HG44	2024-07-09T09:01:13	BLK 681-684 HOUGANG AVENUE 4/8	SURFACE CAR PARK	ELECTRONIC PARKING	WHOLE DAY	NO	YES
17	82	C	15	HG64	2024-07-09T09:01:12	BLK 682-684 HOUGANG STREET 61	SURFACE CAR PARK	ELECTRONIC PARKING	WHOLE DAY	NO	YES
18	326	C	207	BM27	2024-07-09T09:00:17	BLK 578A PASIR RIS STREET 53	MULTI-STOREY CAR PARK	ELECTRONIC PARKING	WHOLE DAY	SUN & PH FR	YES

Using a Python web service hosted on PythonAnywhere

- Go to the **Web** tab in the PythonAnywhere dashboard.
- Click **Add a new web app**.
- Choose **Flask** as the framework (you can also choose other frameworks like Django, or just use a simple WSGI app).

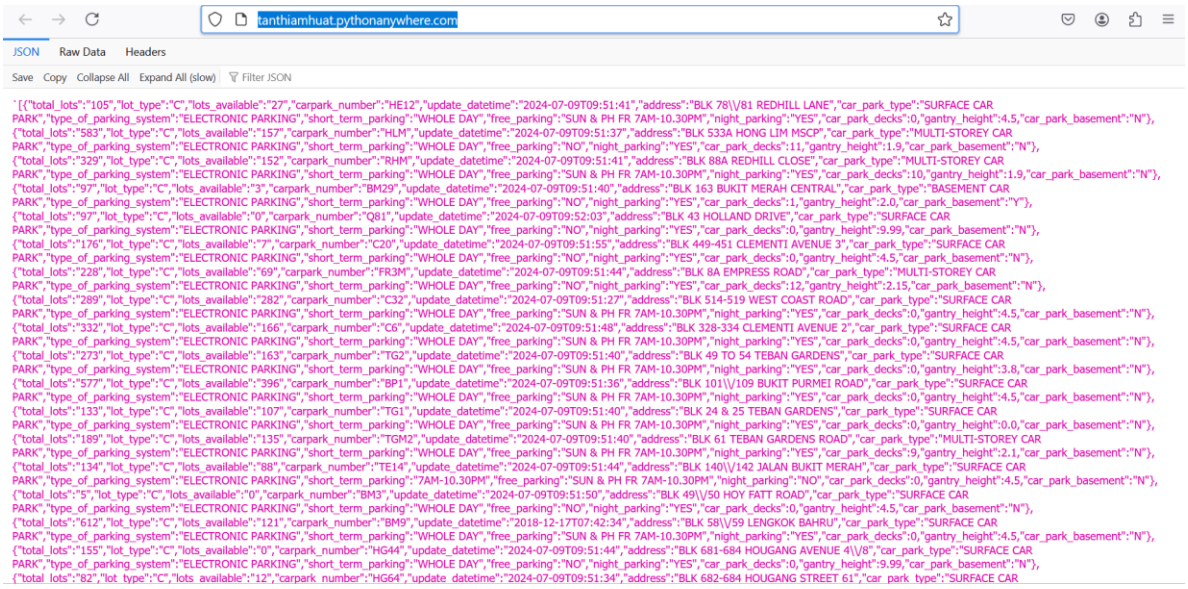






The flask_app.py file is scheduled to run on a daily basis, which is included in the free subscription. If you need more granular scheduling, such as on an hourly basis, a paid subscription is required.

The output of the web application (http://tanthiamhuat.pythonanywhere.com/) is shown below.



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{"total_lots":"134","lot_type":"C","lots_available":"88","carpark_number":"TE14","update_datetime":"2024-07-09T09:51:44","address":"BLK 140\\/142 JALAN BUKIT MERAH","car_park_type":"SURFACE CAR PARK","type_of_parking_system":"ELECTRONIC PARKING","short_term_parking":"7AM-10.30PM","free_parking":"SUN & PH FR 7AM-10.30PM","night_parking":"NO","car_park_decks":0,"gantry_height":4.5,"car_park_basement":"N"},
{"total_lots":"5","lot_type":"C","lots_available":"0","carpark_number":"BM3","update_datetime":"2024-07-09T09:51:50","address":"BLK 49\\/50 HOY FATT ROAD","car_park_type":"SURFACE CAR PARK","type_of_parking_system":"ELECTRONIC PARKING","short_term_parking":"WHOLE DAY","free_parking":"NO","night_parking":"YES","car_park_decks":0,"gantry_height":4.5,"car_park_basement":"N"},
{"total_lots":"612","lot_type":"C","lots_available":"121","carpark_number":"BM9","update_datetime":"2018-12-17T07:42:34","address":"BLK 58\\/59 LENGKOK BAHRU","car_park_type":"SURFACE CAR PARK","type_of_parking_system":"ELECTRONIC PARKING","short_term_parking":"WHOLE DAY","free_parking":"SUN & PH FR 7AM-10.30PM","night_parking":"YES","car_park_decks":0,"gantry_height":4.5,"car_park_basement":"N"},
{"total_lots":"155","lot_type":"C","lots_available":"0","carpark_number":"HG44","update_datetime":"2024-07-09T09:51:44","address":"BLK 681-684 HOUGANG AVENUE 4\\/8","car_park_type":"SURFACE CAR PARK","type_of_parking_system":"ELECTRONIC PARKING","short_term_parking":"WHOLE DAY","free_parking":"NO","night_parking":"YES","car_park_decks":0,"gantry_height":9.99,"car_park_basement":"N"},
{"total_lots":"82","lot_type":"C","lots_available":"12","carpark_number":"HG64","update_datetime":"2024-07-09T09:51:34","address":"BLK 682-684 HOUGANG STREET 61","car_park_type":"SURFACE CAR

Using an Azure Function App:

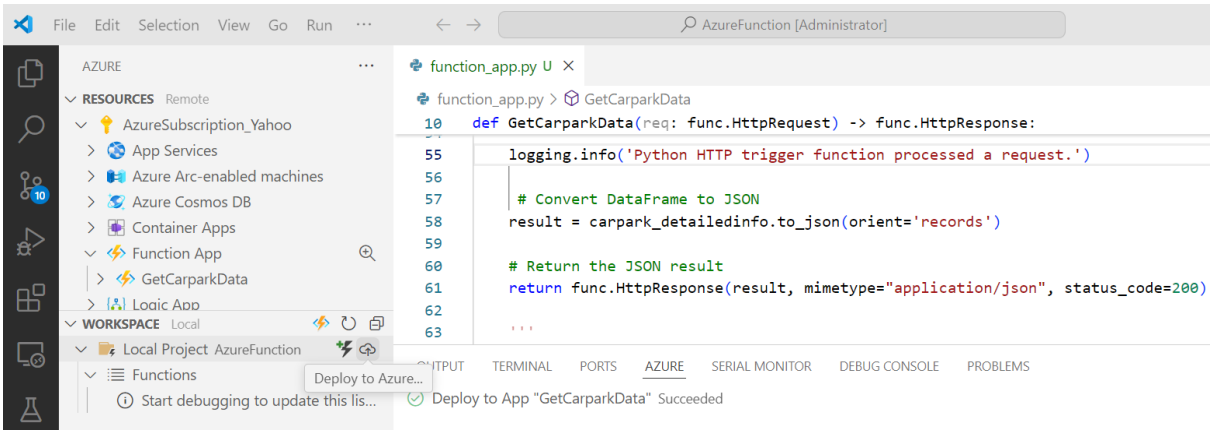
- Write the Python script as an Azure Function in Visual Studio Code. See https://www.youtube.com/watch?v=YQtVJ7qVXDs
- https://learn.microsoft.com/en-us/azure/azure-functions/functions-develop-vs-code (make sure the correct Python interpreter is selected and the virtual environment is created)
- Change to the correct directory to activate the virtual environment, after which you should see (.venv) in green

- Update the requirements.txt file to contain all the necessary Python packages. Change to the directory which contains the requirements.txt, and type the following as seen below.

```
(.venv) PS D:\Portfolio\PowerPlatform\Carpark Availabillity\AzureFunction> pip install -r requirements.txt
```

After you have run through the Python code in Visual Studio Code and ensure that there is no error, you are now ready to deploy it to Azure Function App.

- Deploy the function to Azure Function App, which provides an endpoint URL.

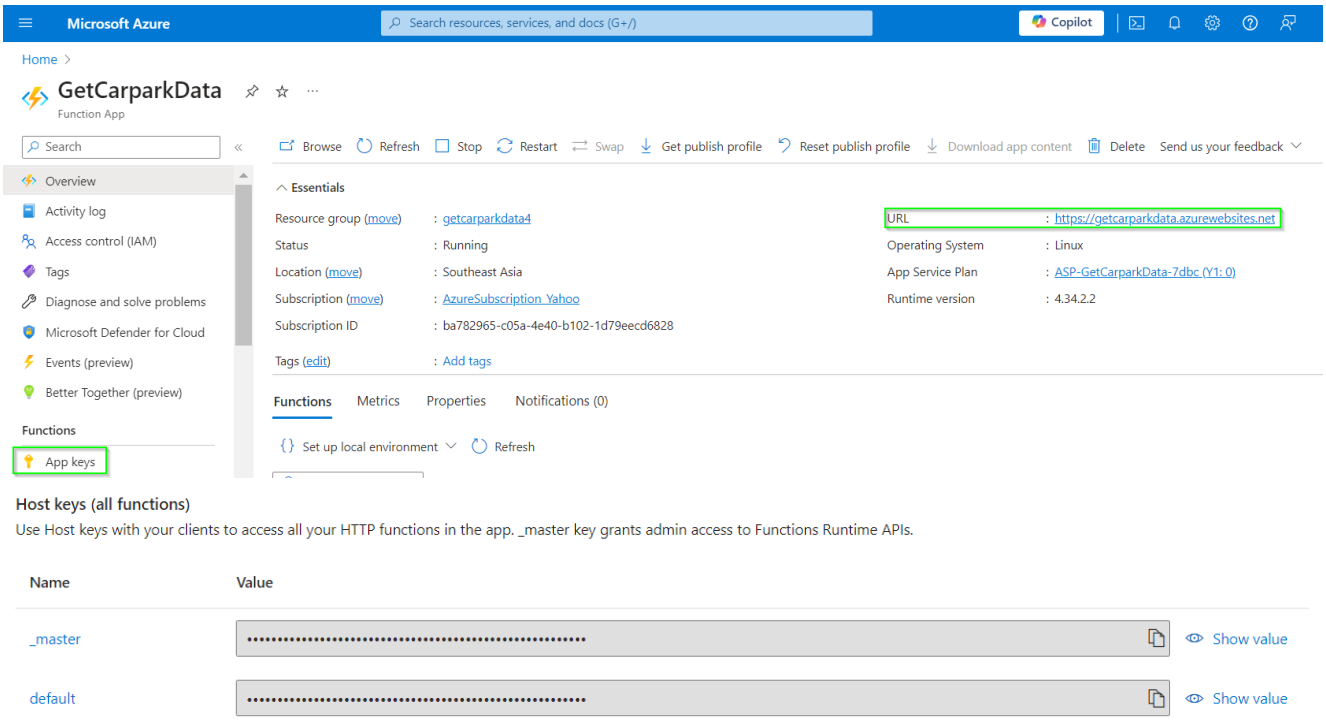


The deployment to Function App is successful.

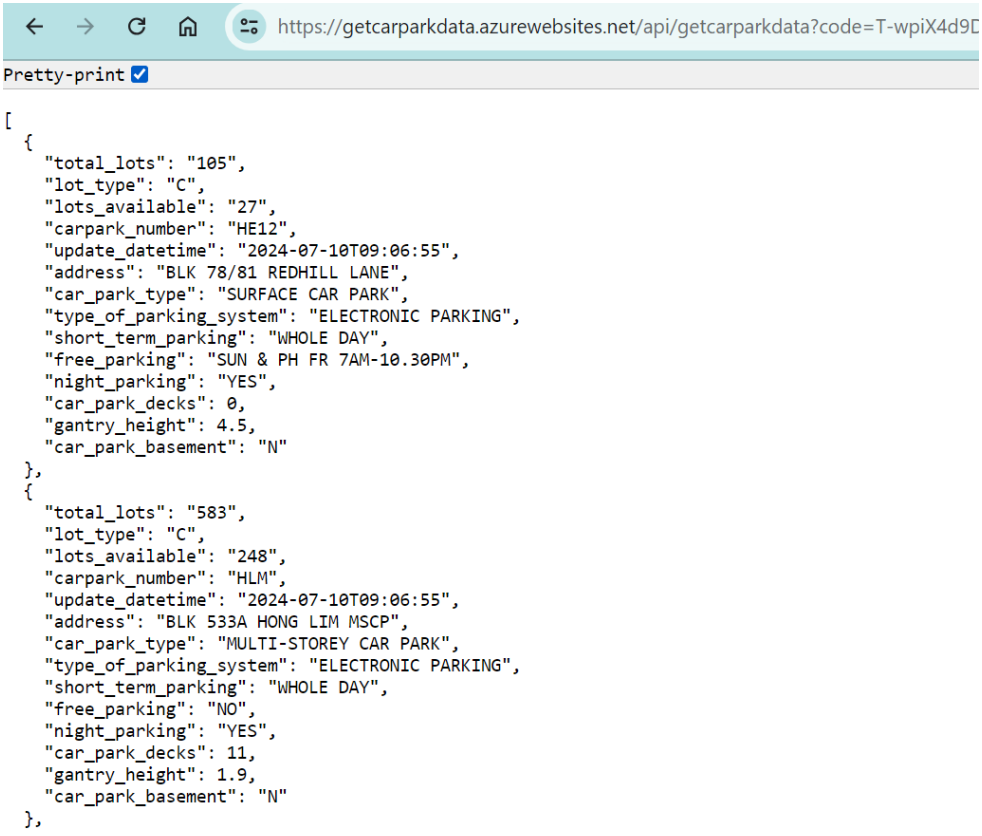
- Accessing endpoint URL.

  Assuming we have a function named MyFunction, and the Function App is named myfunctionapp, the URL structure would look like this:

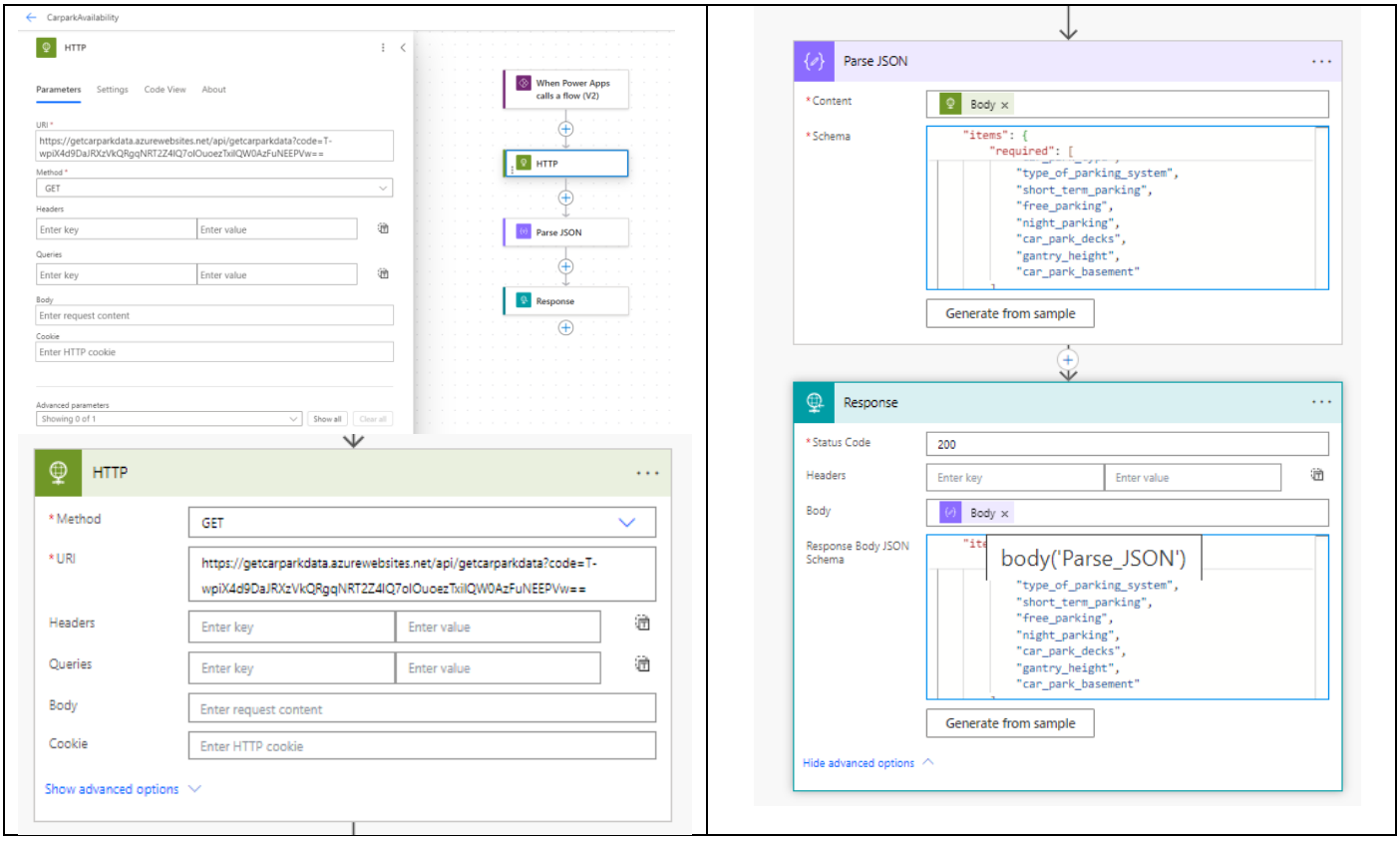
  https://myfunctionapp.azurewebsites.net/api/MyFunction?code=<your-function-key> Function key can be retrieved from either _master or default as seen below.



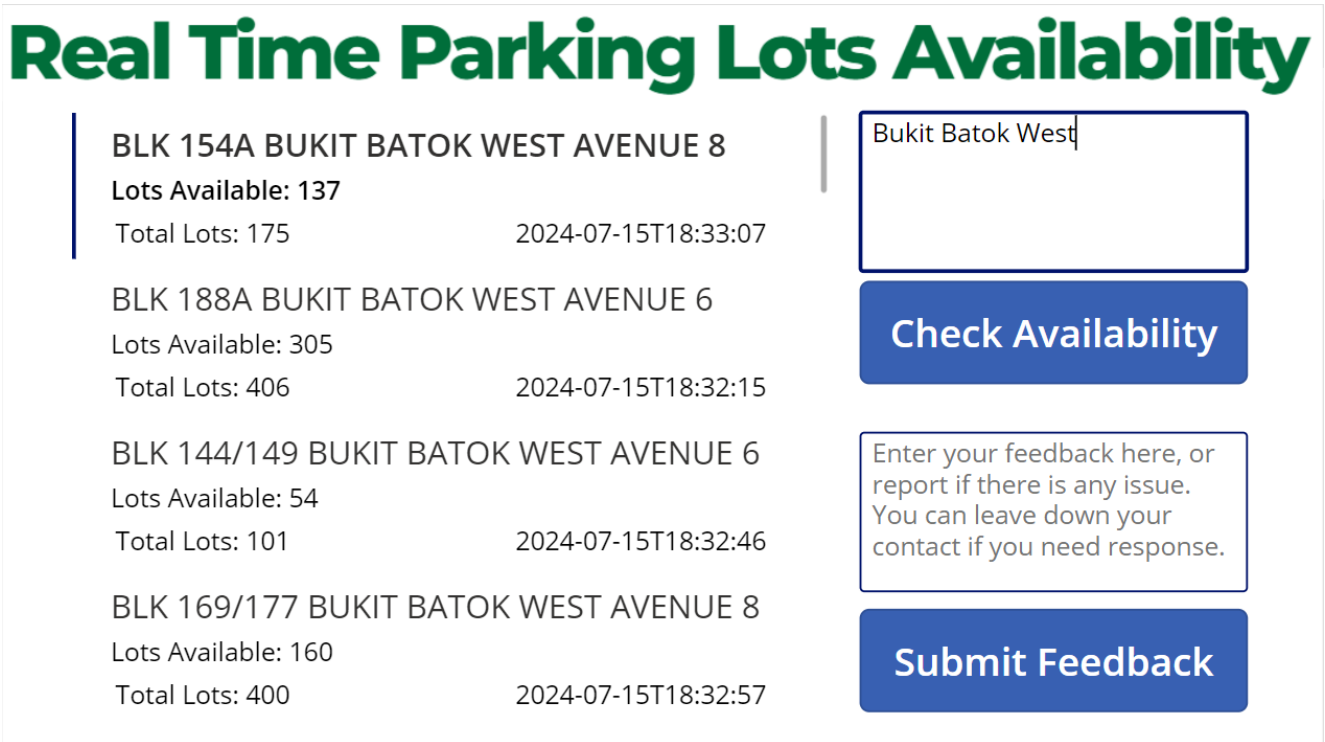
For our case, we have the URL is shown with its JSON data.



- Use Power Automate to make an HTTP request to the Azure Function URL endpoint to trigger the execution of the Python script.

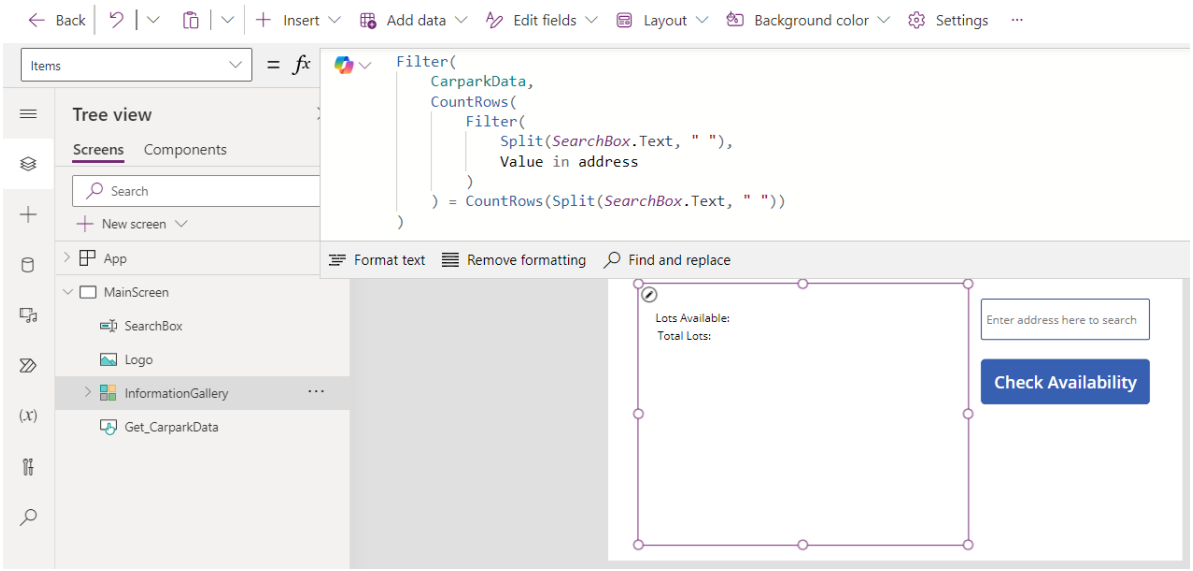


- Use Power App to link to Power Automate flow to retrieve relevant data.
- A useful link here https://dynatecon.com/2022/05/25/call-http-request-from-canvas-power-app-using-power-automate-flow-and-get-back-multiple-rows-as-response/ shows it flow.
- The Carpark Availability App is shown below.



Appendix: Python Code

```
import pandas as pd
import requests

url_CarPark = 'https://api.data.gov.sg/v1/transport/carpark-availability'
data = requests.get(url_CarPark).json()

carpark_data = data['items'][0]['carpark_data']
carpark_info_list = pd.DataFrame(carpark_data)['carpark_info'].tolist()

def flatten_list(_2d_list):
  flat_list = []
  # Iterate through the outer list
  for element in _2d_list:
    if type(element) is list:
      # If the element is of type list, iterate through the sublist
      for item in element:
        flat_list.append(item)
    else:
      flat_list.append(element)
  return flat_list

list_sizes = [len(v) for v in carpark_info_list]
size_list = pd.DataFrame({'list_sizes': list_sizes})

carpark_num_time = pd.DataFrame(flatten_list(carpark_data))[["carpark_number","update_datetime"]]
carpark_num_time_size = pd.concat([carpark_num_time,size_list],axis=1)

repeated_carpark_num_time_size = carpark_num_time_size.loc[carpark_num_time_size.index
                .repeat(carpark_num_time_size['list_sizes'])].reset_index(drop=True)

carparknum_time = repeated_carpark_num_time_size[["carpark_number","update_datetime"]]

carpark_info_temp = pd.Series.to_frame(pd.DataFrame(flatten_list(carpark_data))["carpark_info"])
carpark_info = pd.DataFrame(carpark_info_temp['carpark_info'].explode().tolist())

carpark_info_time = pd.concat([carpark_info,carparknum_time],axis=1)

# Download file here: https://beta.data.gov.sg/datasets/148/view
data = pd.read_csv('D:\\HDBCarparkInformation.csv')
data = data.rename(columns={'car_park_no': 'carpark_number'})

carpark_detailedinfo = carpark_info_time.merge(data, how='inner', on='carpark_number')
carpark_detailedinfo = carpark_detailedinfo.drop(['x_coord', 'y_coord'], axis=1)
```



This above expression filters the InformationGallery to show only the records where the address includes all the words entered in the Search textbox.
More specific:

- Split(SeachBox.Text, " ") splits the text entered in SeachBox into individual words.
- Filter(Split(SearchBox.Text, " "), Value in address) filters these words to see if each word is present in the address field of the CarparkData.
- CountRows(Filter(Split(SearchBox.Text, " "), Value in address)) counts how many of these words are found in the address.
- The expression compares this count with the total number of words split from SearchBox.Text. If the counts are equal, it means all the words entered in the SearchBox are present in the address field of some records in CarparkData.
- The main Filter function then filters CarparkData to include only those records where the count of words found in the address matches the count of words entered in the SearchBox.