Python programming and data visualisation
Project II
DOCUMENTATION

Authors **1**

Introduction **1**

Technologies **2**

OpenWeatherMap API **2**

Data Model **3**

Application Usage **4**

Conclusions **5**

Authors

- Piotr Wachulec, index number 269965
- Stanisław Pawlak, index number 279064

Introduction

Project goal was to create application, which makes weather forecast visualization for different localizations in Poland. The starting command should be:

```
python3 showforecast.py input_data_config.json
```

where showforecast.py should be main Python script, and input_data_config.json should contain all data needed to initialize program (e.g. chosen city names, ids and localizations).

Technologies

- Python 3.6
- PyQt5
- matplotlib
- vtk
- requests

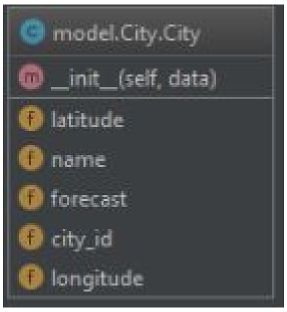
OpenWeatherMap API

We used free plan from https://openweathermap.org/api.
It allows to pull data from different cities for current moment and 5 days forecast data.
It contains structured prediction data for every 3 hours for next 5 days:

- `list.main`
  - `list.main.temp` Temperature. Unit Default: Kelvin, Metric: Celsius, Imperial: Fahrenheit.
  - `list.main.temp_min` Minimum temperature at the moment of calculation. This is deviation from 'temp' that is possible for large cities and megalopolises geographically expanded (use these parameter optionally). Unit Default: Kelvin, Metric: Celsius, Imperial: Fahrenheit.
  - `list.main.temp_max` Maximum temperature at the moment of calculation. This is deviation from 'temp' that is possible for large cities and megalopolises geographically expanded (use these parameter optionally). Unit Default: Kelvin, Metric: Celsius, Imperial: Fahrenheit.
  - `list.main.pressure` Atmospheric pressure on the sea level by default, hPa
  - `list.main.sea_level` Atmospheric pressure on the sea level, hPa
  - `list.main.grnd_level` Atmospheric pressure on the ground level, hPa
  - `list.main.humidity` Humidity, %
- `list.weather` (more info Weather condition codes)
  - `list.weather.id` Weather condition id
  - `list.weather.main` Group of weather parameters (Rain, Snow, Extreme etc.)
  - `list.weather.description` Weather condition within the group
  - `list.weather.icon` Weather icon id
- `list.clouds`
  - `list.clouds.all` Cloudiness, %
- `list.wind`
  - `list.wind.speed` Wind speed. Unit Default: meter/sec, Metric: meter/sec, Imperial: miles/hour.
  - `list.wind.deg` Wind direction, degrees (meteorological)
- `list.rain`
  - `list.rain.3h` Rain volume for last 3 hours, mm
- `list.snow`
  - `list.snow.3h` Snow volume for last 3 hours

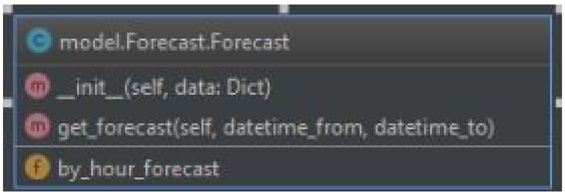
Data Model

- City - mapped from API to store add process information about localizations. Especially useful when city name or id was needed.



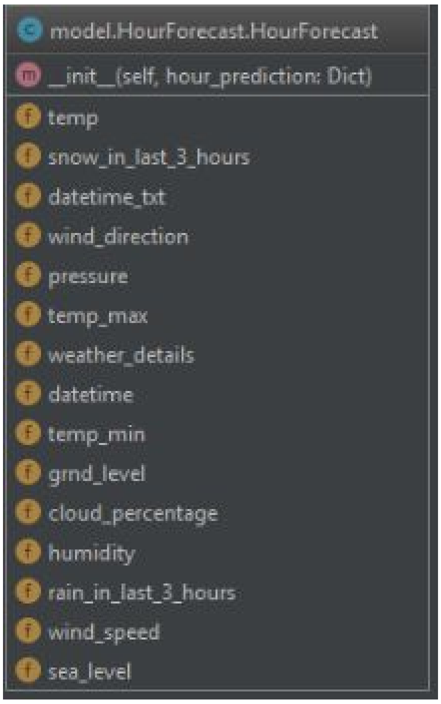
```
model.City.City
__init__(self, data)
latitude
name
forecast
city_id
longitude
```

- Forecast - used for filtering data by time.



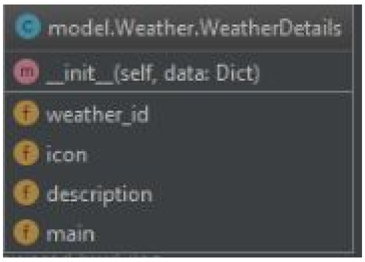
```
model.Forecast.Forecast
__init__(self, data: Dict)
get_forecast(self, datetime_from, datetime_to)
by_hour_forecast
```

- HourForecast - mapped from API, used to store information about city weather prediction in specified hour.



```
model.HourForecast.HourForecast
__init__(self, hour_prediction: Dict)
temp
snow_in_last_3_hours
datetime_txt
wind_direction
pressure
temp_max
weather_details
datetime
temp_min
grnd_level
cloud_percentage
humidity
rain_in_last_3_hours
wind_speed
sea_level
```

- WeatherDetails - details about weather in specified localizations and hour.



model.Weather.WeatherDetails

__init__(self, data: Dict)

weather_id

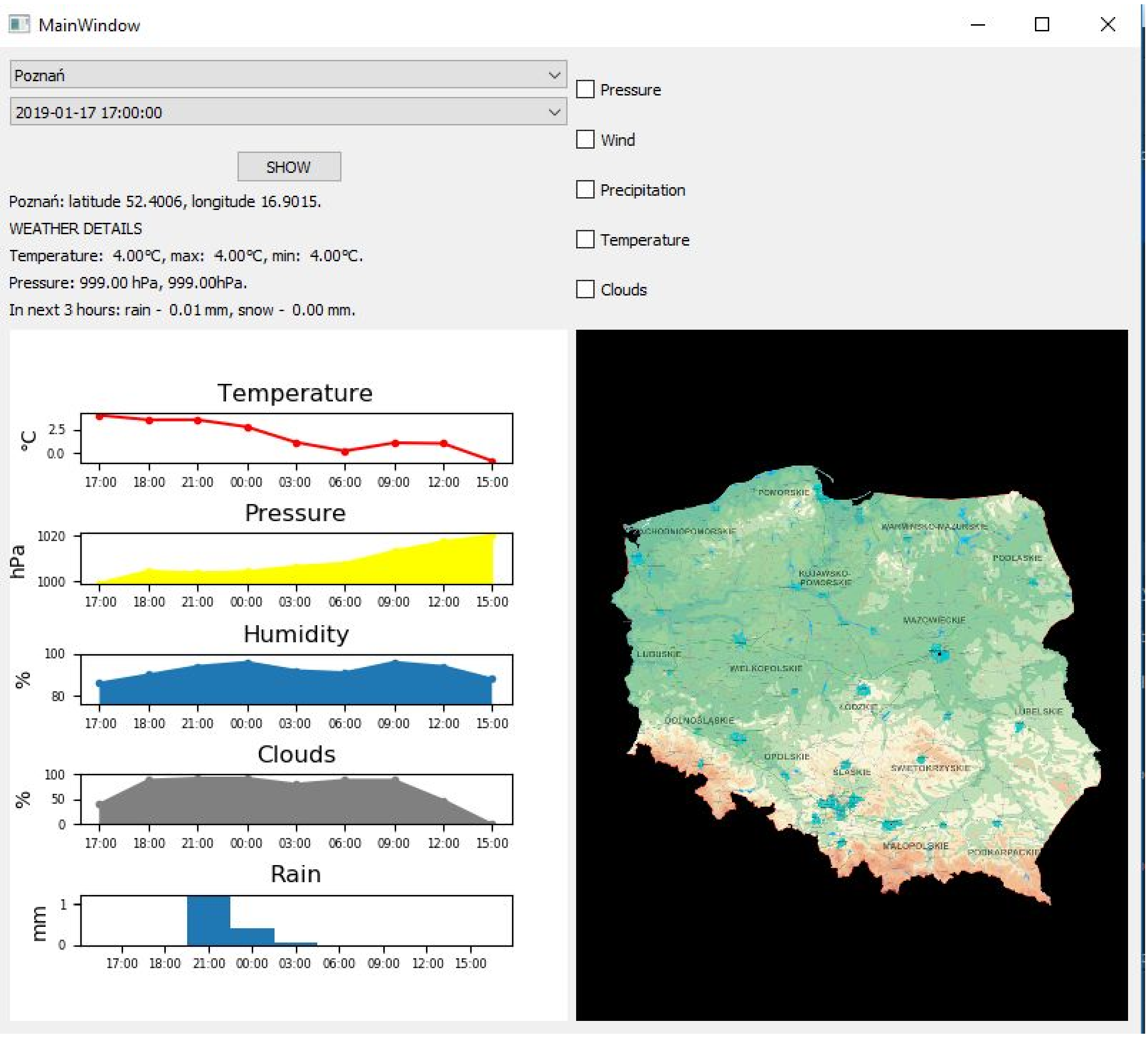
icon

description

main

Application Usage

You can change data plotted either by changing the city or by changing the date.
The forecast notes are shown below. On the right you can check one of checkbox to add this type of visualization for cities on map of Poland.



Poznań: latitude 52.4006, longitude 16.9015.

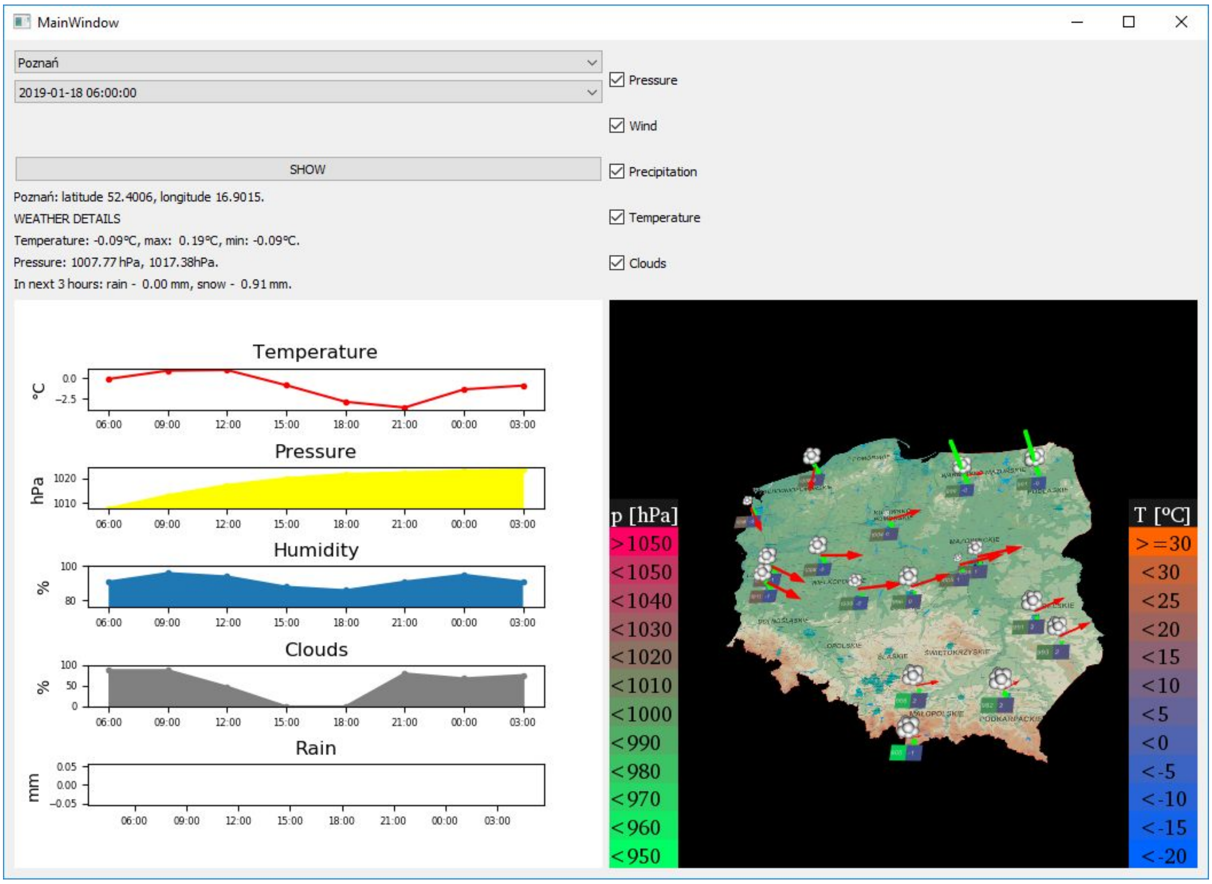
WEATHER DETAILS

Temperature: 4.00°C, max: 4.00°C, min: 4.00°C.

Pressure: 999.00 hPa, 999.00hPa.

In next 3 hours: rain - 0.01 mm, snow - 0.00 mm.

Example of map:



MainWindow

Poznań

2019-01-18 06:00:00

Poznań: latitude 52.4006, longitude 16.9015.

WEATHER DETAILS

Temperature: -0.09°C, max: 0.19°C, min: -0.09°C.

Pressure: 1007.77 hPa, 1017.38hPa.

In next 3 hours: rain - 0.00 mm, snow - 0.91 mm.

☑ Pressure

☑ Wind

☑ Precipitation

☑ Temperature

☑ Clouds

Conclusions

1. OpenWeatherMap API is really simple and easy to use in QtApplication, but it has also some drawbacks. You must register to get a key to API, and the data structure varies between request, which logically should has the same structure. Sometimes the response is different than it is described in documentation, which is annoying. In some smaller cities like Świebodzin, which we also used the data is not updated with the same time period, so it also could lead to errors.
2. Matplotlib is also easy to start, but drawing customized plots require more time and focus.
3. VTK is really fast working tool, also easy to combine with QtApp. The drawback could be need for some boiler plate code every time you want add new object to scene.