

Visualizing Crime Locations in London

Assignment 11

Spatial Information Infrastructure

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Akhil Patil, Pramit Ghosh, Raphael Witt, Shenaha Sivakumar, Zhendong Yuan

Aim

The main aim of this assignment is to visualize the crime data for London during the years 2000-2017 using a user interface where the user can choose a temporal range and the application will plot the location of crimes which had occurred during the given period of time.

Use Case Scenarios

There has been an enormous increase in the crime in the recent past. Crime deterrence has become an upheaval task. The cops in their role to catch criminals are required to remain convincingly ahead in the eternal race between law breakers and law enforcers. There is need for user interactive interfaces based on current technologies to give the users a much needed edge and the new emerging pattern of the crime numbers that occurred in London, UK in a given period of time can be mapped to study the spatial distribution of the crimes in London.

Data Collected

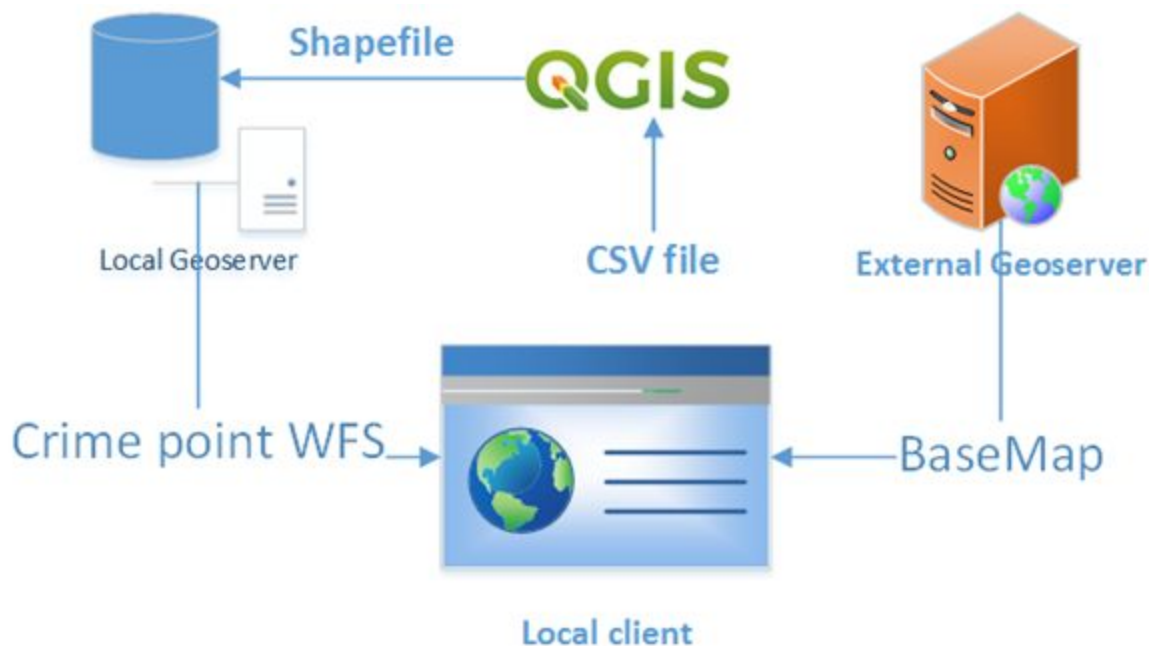
The latest complete copy of all the crime data can be downloaded in CSV format from the archive page from data.police.uk/data/archive/latest.zip. URLs are structured consistently in the following format so you can download newer versions programmatically each month.

[https://data.police.uk/data/archive/\[year\]-\[month\].zip](https://data.police.uk/data/archive/[year]-[month].zip)

Because the data file is so large, they also provide Custom CSV Download and JSON API helper interfaces so you can easily access subsets of the data.

Overview of Architecture

Crime data for London which was obtained in a Comma Separated Values (CSV) format, was imported to the QGIS and was converted to a shapefile with point features determined by the coordinates of the crimes. Geoserver was setup on the local machine which could provide access to this data through WFS. The frontend used a combination of HTML, CSS formatting and JavaScript with Ajax to communicate with multiple servers. This crime data was queried using HTTP GET requests to fetch the required coordinates of the crimes and were plotted on an interactive mapping pane where the basemap was fetched from an external source.



BackEnd

The downloaded CSV was provided as an input to QGIS for the purpose of converting it into an ESRI Shapefile with point features. In QGIS a new field of datatype 'Date' was added and was populated by values from the field 'Month' which has data in the form "YYYY-MM" in the original CSV file. Once the new field was populated with a timestamp (the date was chosen to be the first day of the month and the time was chosen to be 00:00:00 hours), the points were exported as a single shapefile and uploaded to the Geoserver. Once uploaded in a separate newly created workspace, shapefile was published with WFS enabled. In the "Dimensions" tab, Time was enabled for the field with the timestamp so that it could be used as a filter during querying.

Querying

Once the data is published with WFS services enabled, it could be queried using HTTP GET requests. Records between two months were accessed using a CQL_FILTER parameter in the URL as shown below:

```
http://localhost:8080/geoserver/SII_WS17_18/ows?service=WFS&version=1.0.0&request=GetFeature&typeName=SII_WS17_18%3Acrimes_datefield&outputFormat=application%2Fjson&CQL_FILTER=%22ymonth%22%20AFTER%202016-01-01T00%3A00%3A00Z%20AND%20%22ymonth%22%20BEFORE%202016-04-31T23%3A59%3A59Z
```

Values in CQL_FILTER had to be URL encoded so that it is read correctly. The template of the CQL Filter used was as follows:

```
CQL_FILTER="ymonth" AFTER <From_Date> AND "ymonth" BEFORE <To_Date>
```

Where 'ymonth' is the newly created date field and the Date parameters (From_Date and To_Date) are in the format "<YYYY>.<MM>.<DD>T<HH>:<MM>:<SS>Z". While querying, the values for the date and time for <From_Date> was always of the form: <YYYY>.<MM>.<01>T00:00:00Z whereas for <To_Date> it was <YYYY>.<MM>.-31T23:59:59Z. It was checked and verified that having 31 as the date value in To_Date while querying for months having 30 days caused no problems or errors.

FrontEnd

We developed an interactive web-based user interface where the user can visualize the places or locations of the crimes in a mapping window with a basemap from an external source. But since the basemap doesn't have a clear definition of various street, hence we added a street map for clear definition. As the UI is interactive, the stakeholders and the users of this interface could zoom in, zoom out and pan the map to check the exact points and visualize the spatial distribution of crime in the given period.

Forms were provided in the UI for the users to select the temporal range in which the crimes were to be fetched and visualized. It had a granularity of 1 month since the data itself had such a temporal resolution. Once the user selected the months, this data was used to make a request to the Geoserver backend using a WFS service which provided the points in a JSON format as a response. This JSON was then parsed and visualized in the frontend.

Experiences Gained

The major learnings from this assignment was the procedure to set up and interact with a geoserver and the way it can be used through a web application. We also got the practical hands-on regarding the usage of WFS and other related services.

Conclusion

We created a user interface where the users can visualize the crime data for intended period of time of their choice. Apart from security forces this interface can serve multiple user groups like NGOs in social service, property buyers, parents selecting school for their children, etc.

Reference

- Crime and Policing in England
<https://www.police.uk/>
- ASB Incidents, Crime and Outcomes
<https://data.police.uk/about/#general>
- URL Encode Decode - URL Percent Encoding and Decoding.
<https://www.url-encode-decode.com/>
- Feature Type
<http://docs.geoserver.org/stable/en/user/rest/api/featuretypes.html>

Annexure

Code for the frontend is published on Github:
<https://github.com/RaphaelW1tt/SII-Final-Project>