# Report Of Creating Crime Map Of Leeds

## Introduction

The complexity of crime is reflected across multiple dimensions, especially in spatial feature. Crime mapping technologies have been developed through the integration of GIS and computer programming and have application to many cities (Keatley et al., 2021). It can display the locations of crimes, dynamically record specific crime details on an electronic map, and generate heatmaps to understand the density of crimes. This allows for early warnings to citizens, helping them avoid dangerous areas. It also provides relevant information to the police to deploy more officers in certain locations and assists the government in avoiding poor urban design decisions.

This version of crime mapping project is an initial design, with Leeds selected as a pilot city for implementation.

## 2. Requirements Gathering

There are three main user groups:

The general public: needs access to updated crime maps for personal safety, helping them avoid dangerous areas.

Police Department: The police department uses this technology to identify high-crime areas and reinforce police presence.

Urban planners: City planners use this map to observe high-crime areas, improve spatial design in those regions, and prevent the development of environments that foster criminal activity.

Requirements: First, display the number, specific locations, and detailed information for each type of crime. Second, generate a heatmap based on the density of crime locations. Third, The map should respond quickly, feature a clean interface, and have intuitive and easy-to-use function buttons.

## 3. Technologies Used

The main technologies used in this project include Leaflet.js and the core front-end components: HTML, CSS, and JavaScript.

Leaflet.js provides the foundational map framework; it is open-source, allowing seamless integration with web applications and supporting interactive functionalities. Additionally, it offers a wide range of built-in plugins, including heatmap generation and native marker placement.

HTML is responsible for building the basic structure of the web page. JavaScript serves as the primary technology, handling tasks such as data format conversion, creating dynamic web functionalities, and enabling interactive features. CSS is used to enhance the visual appearance of the application.

## 4. Implementation

1. The project began by collecting **crime data** from https://data.police.uk/data/, using CSV files for the **West Yorkshire area in February 2025**. Key fields included location coordinates, investigation status, and crime type. The records of leeds were filtered using Excel, then converted to JSON format with JavaScript. The JSON data was transformed into a JavaScript array was called “crimedata”, where each object represents an individual crime record.

1. The basic web framework was built using HTML and Leaflet.js. First, a page title was set, followed by a text block introducing the map. According to the requirements, a dropdown menu was created to allow users to select crime types. Three functional buttons were added: Show, Generate Heat Map, and Clean, responsible respectively for displaying the selected crime type’s locations and details, generating a heatmap, and clearing all markers and data elements from the map. Additionally, a crime counter was implemented to display the number of selected crime incidents in Leeds. The map module was then embedded using Leaflet.js. With these components in place, the basic structure of the application was completed.

3.The most time-intensive part of the development process was building the JavaScript functionality. Writing multiple functions required careful application of programming concepts, especially logical structures, loops, and accessing values within objects and arrays.

A challenge was the design of the interaction between the Show, Generate Heat Map, and Clean buttons, together with the dropdown menu for crime type selection. When constructing the show function, it was necessary to implement logical conditions and a for loop to filter the selected crime type from the dataset. The crimedata objects contained many fields with long attribute names, which made direct calls cumbersome.

To improve efficiency and readability, a temporary array: “markers” was created to store important values like latitude, longitude, location, and crime status. These were then used to generate markers more easily, avoiding having to loop through crimedata again when generating the heatmap.

4.Since each click on the Show and Generate Heat Map buttons involved changing (and regenerating) the map markers, the corresponding functions needed to handle cleaning up the previous data. As a solution, a multiple specific cleaning functions was created — for example, one to clear markers, one to clear heatmaps — and then developed a main clean function that calls them together and also contains set “count” and “markers” to empty.

## 5. Future Improvements

One current limitation of the website is that when loading a large volume of crime data, the page experiences noticeable lag. A potential solution would be to implement techniques such as incremental rendering (loading markers one by one) or only displaying markers within the current visible map bounds.

Additionally, the crime data is currently stored locally in a JavaScript file, which means it cannot be updated in real time.

Creating a database table and using a combination of JavaScript and PHP to dynamically read and update the data is the suitable way to improve this application. This would allow the application to pull live crime data and ensure that the map reflects the most recent information. By integrating SQL and PHP, a query mechanism could be developed to allow users to retrieve specific crime information dynamically.

During this process, security measures such as preventing SQL injection and ensuring safe data handling will be carefully considered.

## 6. Conclusion

This project developed a preliminary crime mapping application focused on Leeds city, using Leaflet.js integrated with HTML, CSS, and JavaScript， Allowing users to select different types of crimes, view their locations and details, generate heatmaps based on crime density, and clear data dynamically.

By using this application, Citizens can be warned of high-risk areas to improve personal safety, police departments can allocate resources more effectively based on crime patterns, and city designers can identify and improve poorly planned urban spaces that may foster criminal activity.

## 7. References

Keatley, D.A., Arntfield, M., Gill, P., Clare, J., Oatley, G., Bouhana, N. and Clarke, D.D. 2021. Behaviour tracking: using geospatial and behaviour sequence analysis to map crime. *Security journal.* [online] 34(1), pp.184–201.[Accessed: 25 April 2025].

Available from: <https://doi.org/10.1057/s41284-019-00216-3>