

Lab 2 - Product Specification Outline

Lab 2: Crime HotSpot Product Specification

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3/8/2019

Version 1.0

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Introduction

1.1 Purpose

For much of its existence, crime mapping has been the sole domain of law enforcement. Until recently, mapping software was often expensive and resource intensive, making it impractical for use by the general public. For example, according to the ESRI website for the professional mapping software ArcGIS, a standard professional license for the program is \$2750.00 per year, per person using the software. While some online mapping tools did exist, most--such as MapQuest--were only useful for getting directions. Now, as internet speeds increase, smart phones become more capable, and the overall cost of online resources decreases, viable, powerful online mapping tools are more accessible to the general public.

Crime HotSpot will provide a crime mapping solution for the general public, presenting its information clearly and concisely, and with an interface that is easy to navigate for anyone who has a basic knowledge of computers. Crime HotSpot will give the user the ability to hone in on certain risk categories without giving so many options as to become overwhelming. The product will also provide context to ensure the crime data is presented in a way that does not skew the true picture of safety.

1.2 Scope

To solve the problems in the current crime mapping solutions, Crime HotSpot will use a proprietary SafetyScore metric to analyze the available crime data and indicate higher risk areas as brighter parts of the map. The SafetyScore will take into account the type, date, time, and severity of individual crimes. This number will be modified to account for distance from the user's location and the time since the crime occurred. The data will then go through a final

adjustment for population density in the area being represented to ensure the SafetyScore truly represents the user's safety accurately, and within the context of their location and selected timeframe.

This information will be presented on a heat map, shown in Figure 1, which can easily convey the intensity of the safety risk at a quick glance for different areas.

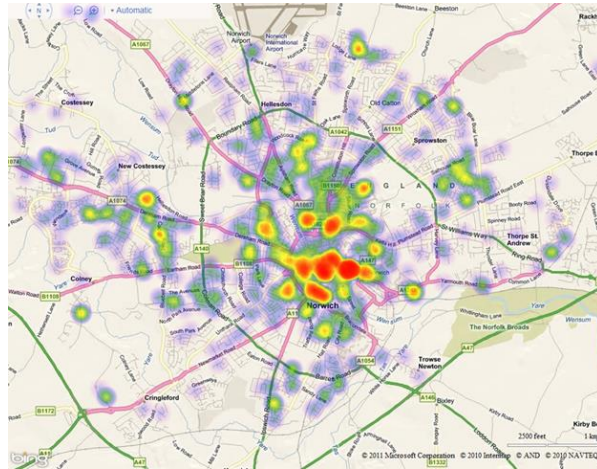


Figure 1: An example of a heat map

On the initial load, the map will display all available crime statistics surrounding the location designated by the user. This page will also feature quick filters to allow the user to highlight certain high-level categories of crime. For those who wish to retrieve more specific information, there will be an analytics page offering additional data representation options and the ability to more finely tune how much they wish to weigh the importance of certain crime categories.

With these improvements, Crime HotSpot will provide the user with a better solution flow, shown in Figure 2, enabling them to see better information in a format that will more readily fulfill their needs.

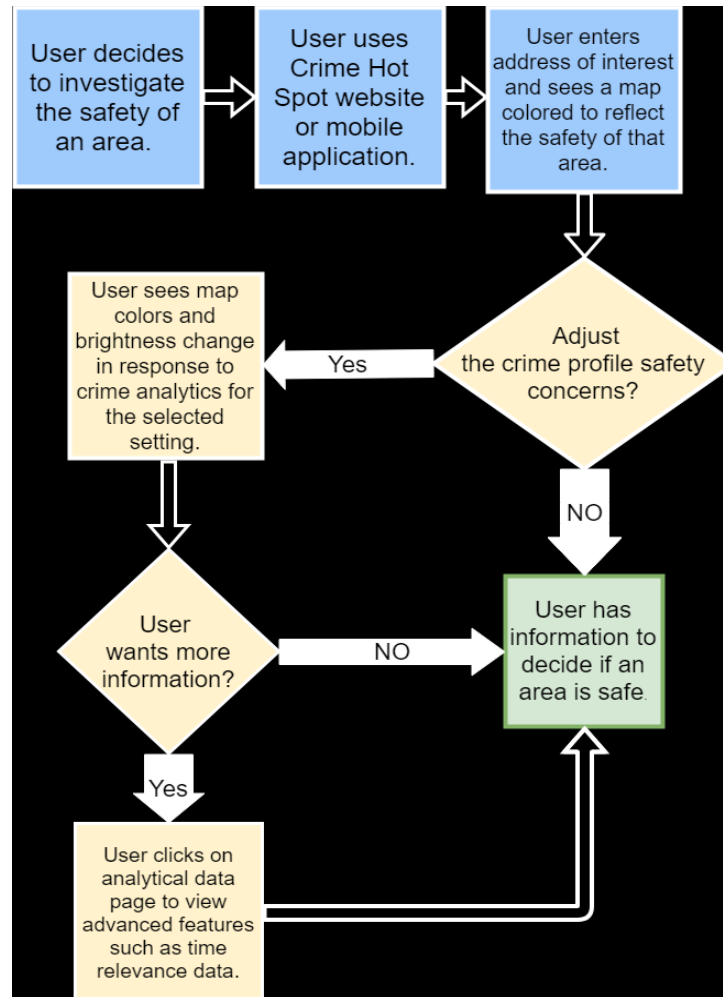


Figure 2: The proposed solution flow

1.3 Definitions, Acronyms, and Abbreviations

Crime Map: A map that has crime statistical data overlaid on it to provide information on the criminal activity of an area.

Application Programming Interface (API): a set of functions and procedures allowing the creation of applications that access the features or data of an operating system, application, or other service.

Heatmap: a representation of data in the form of a map or diagram in which data values are represented as colors.

JavaScript MEAN Stack: MEAN is a free and open-source JavaScript software stack for building dynamic web sites and web applications. The MEAN stack is MongoDB, Express.JS, AngularJS (or Angular), and Node.js.

JavaScript Object Notation (JSON): a lightweight data-interchange format. It is easy for humans to read and write. It is easy for machines to parse and generate. It is based on a subset of the JavaScript Programming Language

SafetyScore: A number, proprietary to Crime HotSpot, that represents the relative safety of an area.

Soft Target: A person or property which presents as having poor defenses against crime.

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1.5 Overview

This product specification provides the hardware and software configuration, external interfaces, capabilities, and features of the Crime HotSpot prototype. The information provided in the remaining sections of this document includes a detailed description of the hardware, software, and external interface architecture of the Crime HotSpot prototype; the key features of the prototype; the parameters that will be used to control, manage, or establish each feature; and the performance characteristics of that feature in terms of outputs, displays, and user interface. The specific functional requirements for the prototype and real world product will be in Section 3.

2 General Description

2.1 Prototype Architecture Description

The Crime HotSpot prototype architecture will be identical to the original program solution architecture with exclusion of the mobile application. While the goal of the mobile application was to provide an alternate way of viewing the crime data processed by the application server, it was not a key component of the problem solution and was not necessary to demonstrate proof-of-concept. All other components will remain the same.

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The Major Functional Components diagram for the prototype, shown in Figure 6, shows the same overall structure, but with the mobile application removed.

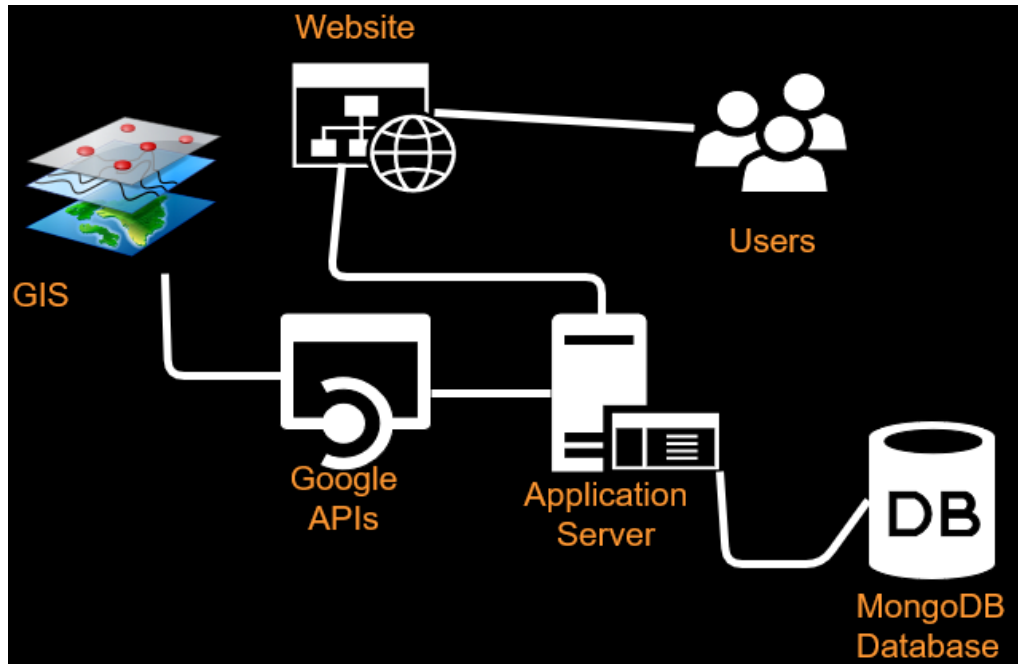


Figure 3: Prototype major functional components.

The crimes database will be built using MongoDB Atlas, a cloud managed document database. Using MongoDB Atlas reduces the back-end infrastructure that must be managed and allows development to focus on adding user functionality. Crime incidents, provided in a comma-delimited file, will be cleaned and normalized to fit into a geolocation schema provided by the MongoDB API. This will allow for simpler queries relating to specific locations and the ability to easily retrieve results within a given radius of the location of interest.

The application server will act as the hub of our web application and will be implemented using Node.JS as a runtime environment and Express.JS to provide the server framework. When a user location is provided through the front end, the application server will query the MongoDB. The results from the geolocation search will be processed to calculate the SafetyScore, including the initial score and the dynamic factors specific to the user's location. The results will be stored as JSON objects. The application server will select appropriate incidents incidents and create the

Google Maps tags necessary to render the base map and heatmap layer on the client system. This will be accomplished by making calls to the Google Maps API, which will render the maps on the client side.

The front-end of the web application will be implemented using Angular.JS, a JavaScript framework for front end development. As the focus is on clean design and a straight forward interface, the map itself will be the main feature of the page, with the menu options limited to navigation to the analytics page and the ability to select from one of several "quick filters" to easily modify the way the risk information is represented in the heat map. The analytics page will provide the ability to look at the data using non-geographical visual representations such as graphs, charts, and tables.

2.2 Prototype Features and Capabilities

To simplify the crime incident analysis, the Crime HotSpot prototype will group the crime incidents into 4 categories: moderate crimes against a person, severe crime against a person, crimes against the public (such as a DUI, which does not have a specific victim but represents a public risk), and crimes against property. Each of these categories will be assigned a static number reflecting the severity of the crimes involved and the likelihood of their occurring. This number will be used as the primary base factor for calculating the SafetyScore.

While the intention of the real-world product would be to have a dynamic database, able to be loaded from a diverse dataset and update on a regular basis, our prototype will use a representative static database instance as a proof-of-concept for the heatmap. An administrator will use a script to facilitate the cleaning and normalizing of the data and will load the data directly into the MongoDB database. Crime data provided by the ODU police department representing crimes from the recent past year will be used for our prototype.

Given that crime pattern analysis and predictive analytics are a deep and complex field, the real-world product would involve lengthy and significant consultation with a professional crime pattern analyst or analysts to give the SafetyScore true predictive capabilities. The formulas and analytical methods used to calculate the SafetyScore in the prototype are designed to create a roughly representative assessment of risk to create the heatmap and provide proof of concept.

2.3 External Interfaces

2.3.1 Hardware Interfaces

N/A

2.3.2 Software Interfaces

Crimes Database (CD) Interface: The CD is a document-based MongoDB database hosted using the cloud based Atlas service. Queries are made using HTTP GET and POST calls from the Dynamic Application Server (DAS). ID (assigned by MongoDB Atlas), Crime Category, Description, Date/Time, List of Offenses, Severity Score, Latitude, and Longitude are stored in and retrieved from the CD.

Google Maps API: The Google Maps API provides libraries and third party support for the map drawing operations of the program. The primary library is accessed as an anchor link in the HTML source by including a distinct API key. The Visualization library, used to draw the heat map, is accessed as an argument embedded in the anchor.

2.3.3 User Interfaces

Users will interact with the Crime HotSpot web application using a web browser.

The page will present the base and heat map, quick-filter buttons to alter the crimes being highlighted on the heat map, and a navigation menu to provide access to the analytics page, the about page, and the site map.

Text information will be entered using the keyboard. The mouse will be used to change the zoom of the map and move the area of interest. Clicking on the map will cause a tooltip to open at the location of the click, providing additional information about the SafetyScore of the area.

2.3.4 Communications Protocols and Interfaces

All communication between the users' browser, the DAS, and MongoDB Atlas will be through standard HTTP requests

