Software Requirements Specification for Crime HotSpot Prototype

Version 2.0

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1. Introduction

This section describes the format of this document as well as provides the bibliography of the references used and definitions of terms used.

1.1 Purpose

This document provides the software requirements specification for the Crime HotSpot prototype web application. This document will define the requirements for the webpage and the backend server application.

1.2 Document Conventions

This document will conform to the IEEE 830-1998 convention for software requirements specifications.

1.3 Intended Audience and Reading Suggestions

This document is intended for the use of ODU CS411W Spring 2019 Team Silver for use in the development of the Crime HotSpot prototype as well as the ODU Faculty administering said course for grading purposes.

1.4 Product Scope

The Crime HotSpot web application will be an online information tool that will allow users to make effective and informed decisions with regards to the safety of a given geographical area according to provided crime statistical data.

The principal component of this application is the webpage which will display weighted crime statistics as a heatmap overlay on a geographical map. Areas with more aggressive crime rates will be able to be identified on the map and thereby possible to be avoided. Prudent actions such as not placing oneself in areas of known danger is a time tested and proven method of improving an individual's personal safety.

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1.6 Definitions

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.

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

Comma-Separated Values (CSV) file - a delimited text file that uses a comma to separate values.

Geographic Information System (GIS) - a framework for gathering, managing and analyzing data in respect to spatial location.

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 websites 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 that is easy for humans to read and write as well as 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.

1.7 Overview

Section 2 of this document describes the Crime HotSpot prototype web application in general terms.

Sections 3 of this document presents the detailed requirements, organized by feature.

2. Overall Description

This section provides a plain, non-technical, language description of the Crime HotSpot web application. Covered in this section will be an overview perspective of the product functions.

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2.1 Product Perspective

Crime mapping is a common practice by law enforcement and aids people in learning the dangers inherent in areas due to crime. Crime mapping tools are generally applications that display crime statistical data on a geographical map as icons though other methods are used. Various icons indicate certain crime types and each of these icons point at the coordinates of the incident.

This approach often leads to areas cluttered with icons as criminal activity increases in an area. As the only distinction between the types of crimes is different crime types is the icon displayed for each crime. Areas with a high number of non-violent crimes, such as shoplifting at market areas, may be unjustly categorized as unsafe by the users while other areas are deemed safe though the prevalent crimes are more violent.

Another common crime mapping method is the use of heatmaps that provide a heat overlay for a geographic map according to the number of crimes. This method also can cause relatively safe areas to be deemed unsafe when they are based only on numerical crime data.

Unlike other crime mapping solutions Crime Hotspot will apply a subjective score to each plotted crime on a heatmap that signifies the affect a user perceives a crime to have on the safety of an area. This will allow areas with numerous non-violent crimes to appear innocuous and areas with violent crimes to stand out.

2.2 Product Functions

This section will discuss the application functions in the order that the user will see presented.

2.2.1 User Interface

The user interface, a webpage, is the first thing the user will interact with. The webpage will provide the user with the relevant information requested and means to interact with said data.

2.2.1.1 Geographical Map

The Crime HotSpot prototype will be a web application that when loaded will display, primarily, a geographical map of a region. As the data used in the Crime HotSpot prototype is a static set of crimes provided by the ODU Campus Police force, the prototype will load with the map centered on ODU main campus located in Norfolk, VA. The map will load such that all crimes in the crime report will be able to viewed at the initial zoom level.

The user will be able to shift the center of the map to a location of their choosing. In the final version this would initiate a map refresh that would restart backend functions such as requesting new crime data that covers the region of display. As the prototype has limited data, the re-centering will only shift the map thereby showing surrounding regions. The zoom level will be adjustable from the initial preset to a defined maximum and minimum value. This will prevent the ability of users to pin point crime locations using the heatmap.

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2.2.1.2 Crime Heatmap

In the Crime HotSpot application, and by extension the prototype, information on criminal activity will be presented to the user as a weighted heatmap. A heatmap is a tool used to present information over an area by using colors, warmer colors representing higher levels than cooler colors. As data points coalesce on an area the area becomes denser and thereby hotter than areas with less data points. In a weighted heatmap, a weight is added to the data points indicating the degree of relevance of the data point. Just as with a standard heat map, data dense areas are hotter than less dense areas, but unlike the standard heatmap less dense areas can out weigh denser areas if the weight of the individual data points is sufficiently high. This leads to a map that, while paying attention to the numerical count of data points, places a higher emphasis on the relevance of the individual data point.

The concept of the weighted heatmap is integral to the development of the Crime HotSpot web application. Reporting crimes to a user as a numerical stack or by some other method that is succinctly summarized causes misinformation. Often the the user will look at the summary report of such systems and note a high number of crimes and not take the extra step needed to identify the validity of the crimes to the users need for information. This will cause users to view relatively safe areas that have high levels of nonviolent as dangerous and areas with fewer violent crimes as safe. By scaling the crimes according to violence, the Crime HotSpot prototype will provide the user with a more informative summary of data than would be possible with the use of a simple heatmap or icons.

2.2.1.3 Analytics

Most users of the Crime HotSpot web application will be using is to research the crime levels of specific locations. A user could be researching an area as a new home site, a location for a new store front or as a place to visit. What ever the reason for the interest in a location the user will have a need for valid information and hard statistics. The crime heatmap is a versatile tool for summarizing large amounts of information over a given area. What the crime heatmap lacks is a means of providing specific information on specific locations.

When a location in the map is clicked on, the Crime HotSpot application will display a popup with the Safety Score and a detailed accounting of the crimes, by category, in close proximity to the location. The Safety Score will correlate to the heat level of the location selected.

Not all users will have the same concerns as to the affects certain types of crime have on a location. Some users may view theft as a predominant concern while other are more concerned with violence. To meet concerns of the user and in an effort to provide more than a one size fits all solution Crime HotSpot will permit the user limit control functions to adjust the scoring of crimes, according to crime type. These functions will allow the user to increase or decrease the severity of a crime category as a way of adapting the application to the user's world view.

2.2.2 Services

This section will describe functions that happen in the background and are invisible to the user.

2.2.2.1 Crimes Database

Crime HotSpot will display information on crimes as a weighted heatmap overlay on a geographical map. The crime statistical data must be stored in a way that provides access to the information for the website. The crimes database will be built on the MongoDB Atlas platform. MongoDB Atlas allows a means of collecting stored information according to geographical coordinates. While the crime information for Crime HotSpot prototype is static and no loads will be executed by re-centering of the map, this is still an important feature as it will enable the Safety Score information to be collected according to a pre-defined influence radius of crimes.

2.2.2.2 Node Server

Webpages are not particularly suited to interacting with databases or doing computations. While it is true that it can be done there are numerous more elegant solutions. Among those solutions is the use of a node server. The versatility of JavaScript has spawned many accompanying programming methods, of particular interest for the development of the Crime HotSpot prototype is Node.js. Crime HotSpot will utilize Node.js as a node server in the JavaScript MEAN stack. It is by this server that all crime statistics will be requested from the crimes database and all calculations performed.

The node server is a pivotal piece of the Crime HotSpot application. Not only does this server provide the crime statistics and need computations for the webpage it also handles request to the Google Maps JavaScript API which is used for GIS functions. These calls are used to provide the geographical map as well as the heat map overlay that is presented by the webpage. As the user directs changes via the webpage new calls are made to the API to update the heatmap layer.

2.3 User Classes and Characteristics

Crime HotSpot is envisioned as an application accessible by various web browsers by the average user of the internet. This application will require no training or special knowledge. The ideal result is that a user can view the web application and immediately glean valuable information related to the safety of a geographical location.

2.4 Operating Environment

The Crime HotSpot web application will be accessible via web browser such as Google Chrome, Mozilla Firefox and Microsoft Edge.

The back-end of the Crime HotSpot prototype will operate on a node.js server. This server will provide crime data to the application for display.

The crimes database will be built and operated on the MongoDB Atlas platform.

2.5 Design and Implementation Constraints

The application shall be accessible and operate on the following browser versions: Google Chrome version 68.0.3440.106, Microsoft Edge version 44.17763.1.0 and Firefox version 65.0.1. The application may operate on other browsers and versions not listed.

The node server shall operate on node.js version 10.15.1 LTS and will provide data from a crimes database build in MongoDB.

2.6 User Documentation

A user's manual describes the user functions of the web application shall be provided as a site link in the web application.

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2.7 Assumptions and Dependencies

The prototype Crime HotSpot web application will utilize the JavaScript Google Maps API as the GIS provider. This service will also be utilized to provide the heat map that is the core of the Crime HotSpot solution.

The prototype web application will store crime data that has been provided by ODU campus police in database built on MongoDB Atlas.

Both of these services are fee for service tools. As such no personal accounts or API keys, not provided by the university, will be turned over to the university as part of the delivery.

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