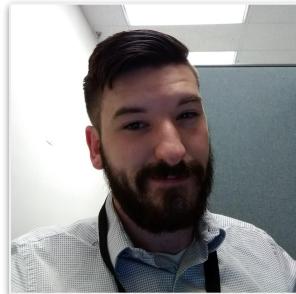


Crime Hot Spot - Design

TEAM SILVER
CS 410
OLD DOMINION UNIVERSITY
NOVEMBER 29, 2018

Meet Team Silver: "We're Going for the Gold!"



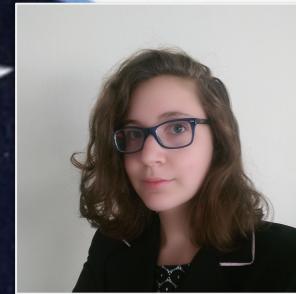
Raphael
Project Manager



Thom
Project Sponsor



David
Technical Lead



Stephanie
Domain Expert/Solution Analyst



Kenneth
Mobile Development/
Software Tester



Kevin
Mobile Development/
Marketing



Vairon
Full Stack Development



G-Man
Application Deployment/
Business Analyst/ Marketing



Kayla
Content Manager/
Mobile Development

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Key Terms

- **SafetyScore™** - A measure of risk at a point on the map that is calculated based on the severity of nearby crimes, the times of those crimes, their distance from the point, length of time since the crime was committed, and the time of day and day of week that the crime was committed.
- **Heat map:** a two-dimensional representation of data in which values are represented by colors. A simple heat map provides an immediate visual summary of information. More elaborate heat maps allow the viewer to understand complex data sets.^[5]
- **Risk:** the likelihood of being the victim of a crime . Areas are considered higher risk based on the severity of the crimes, the likelihood of their recurrence, and user-adjusted weights.
- **User-friendly:** Someone with basic computer/internet skills should be able to navigate the application with minimal instruction

Problem Background

Crime maps represent crime data geographically for aid in analysis.^[4]

Traditionally used by crime analysts.

- Recent increase in public online availability.

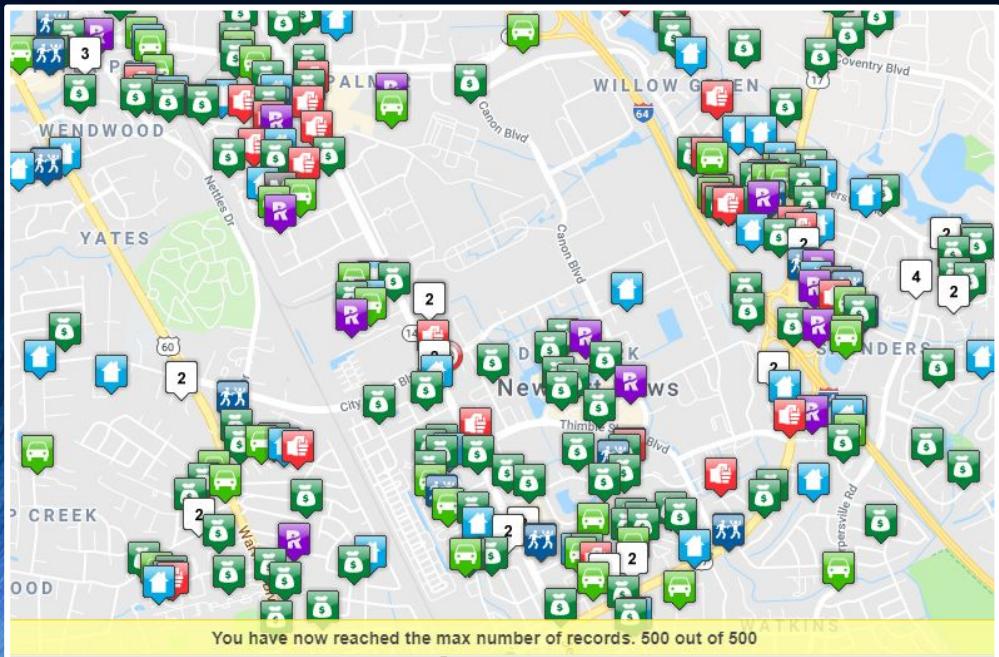
Negative side effects of concentrated crime.

- Misrepresentation.
- Visual crime overload.
- Difficult to differentiate.

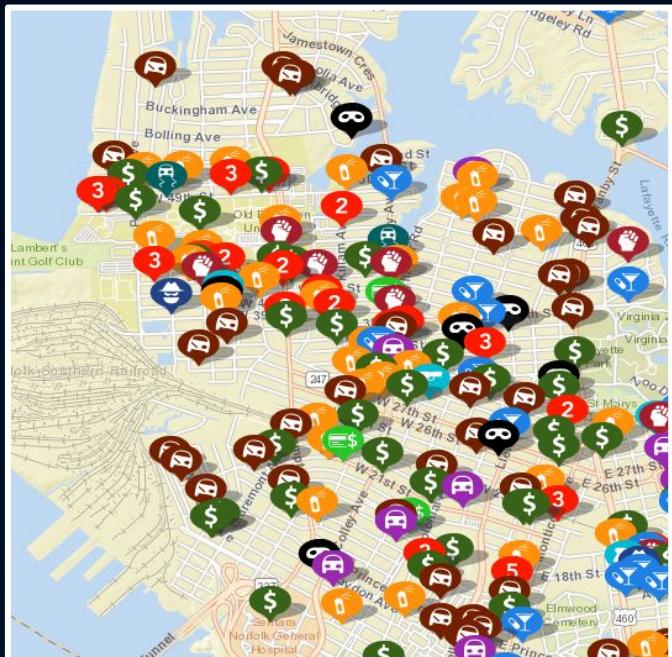


F.2

Problematic Approaches



F.3



F.4

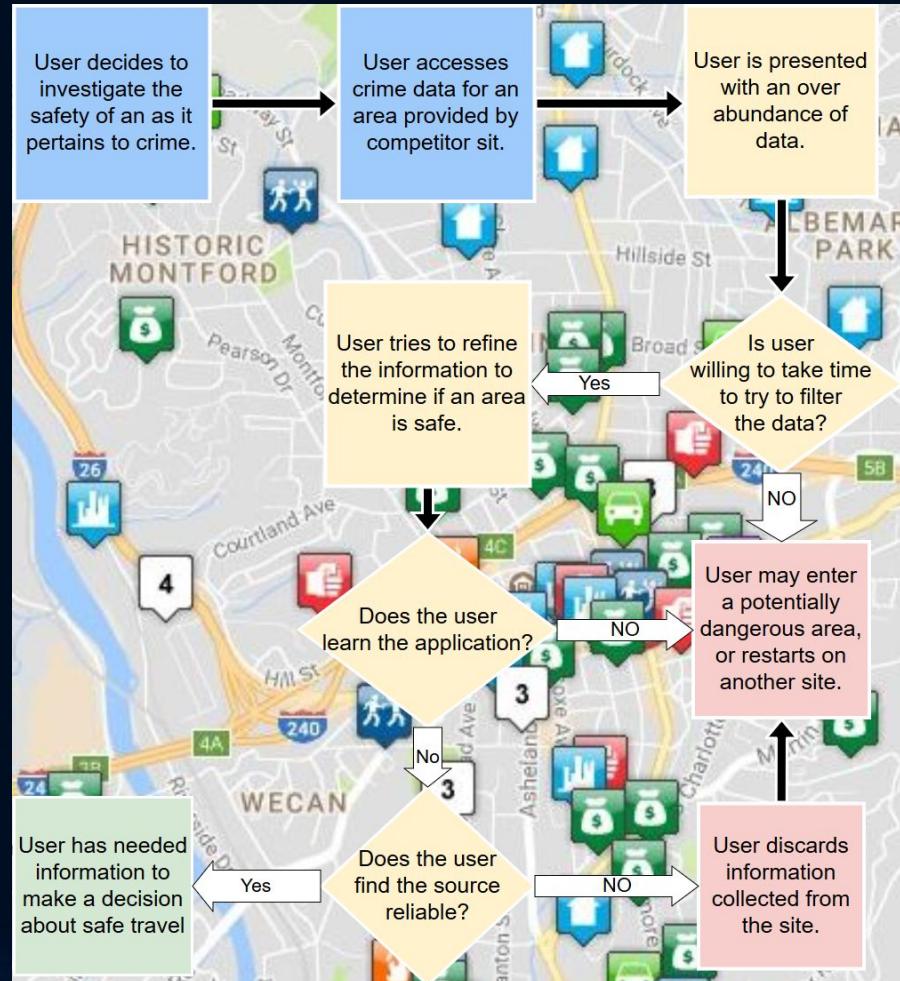
Problem Statement

Current crime maps do not display data in a way that allows the user to make effective and informed decisions about their safety.

Current Process Flow

Current mapping programs drown the user with information discouraging use while a cleaner presentation would make the tool usable.

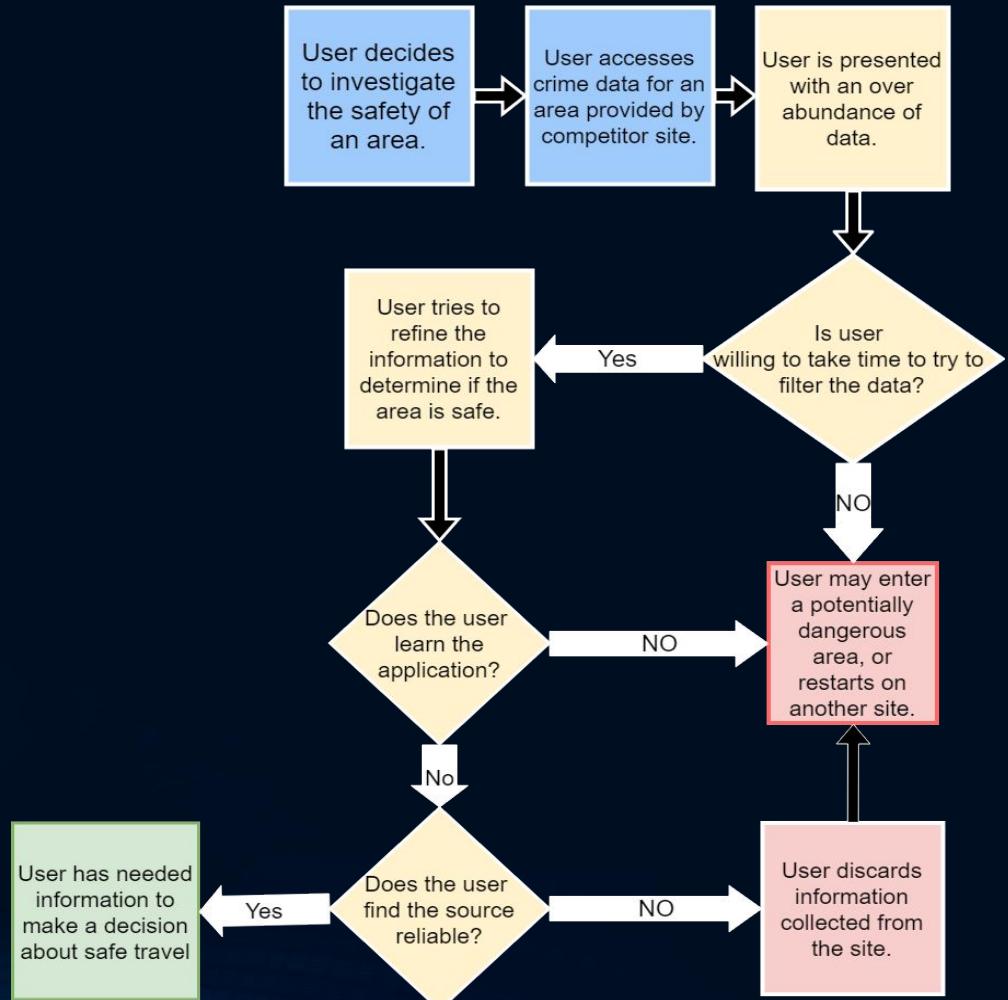
Current mapping programs provide no statistical information as to the safety of an area, only noting that the crimes took place.



Current Process Flow

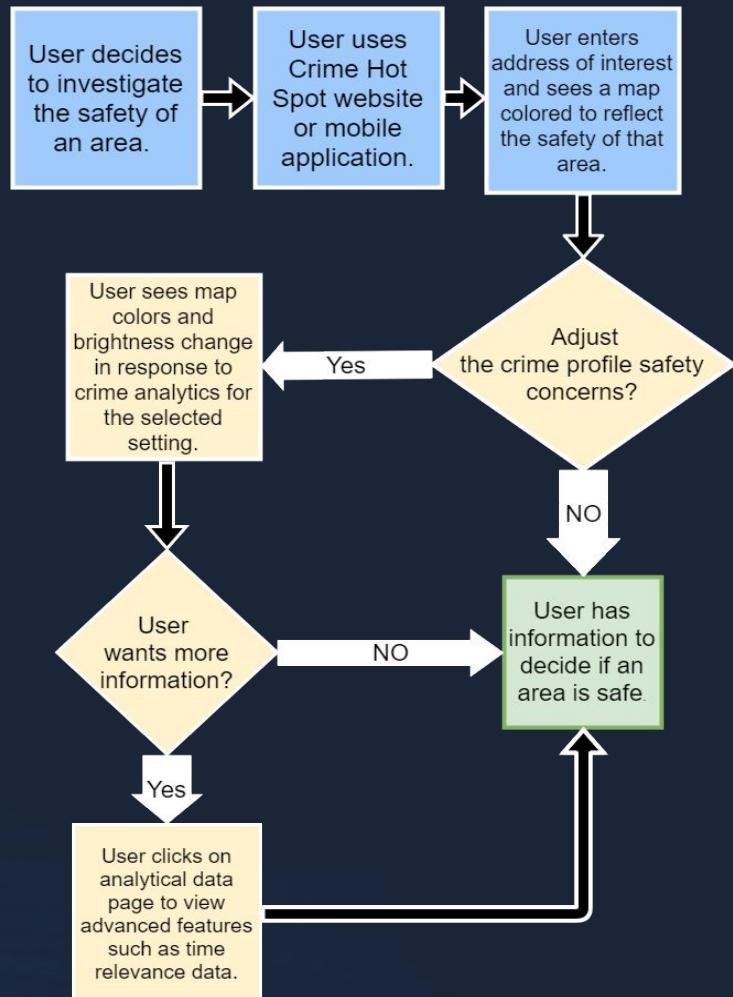
Current mapping programs drown the user with information discouraging use while a cleaner presentation would make the tool usable.

Current mapping programs provide no statistical information as to the safety of an area, only noting that the crimes took place.



Solution Process Flow

- Allows the user to see crime data displayed in color coordinated fashion
- Allows the user to have tailored results without a steep learning curve to take advantage of the data to make valuable decisions
- Allows the user to examine with greater detail if they wish to know more

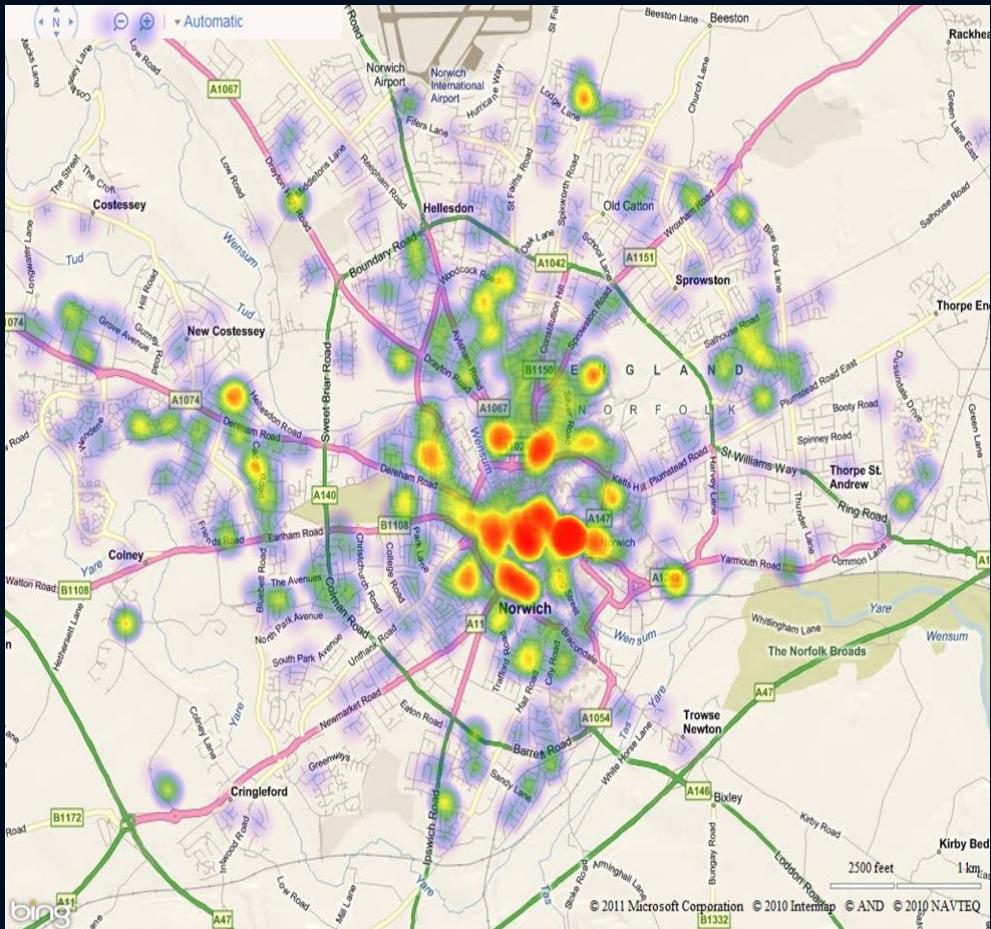


Crime Hot Spot

“... crime hot spot maps can most effectively guide police action when production of these maps is guided by theory. With the appropriate crime theory, crime maps can communicate vital information ...”^[3]

To use a weighted heat-map instead of icons to describe crime. The heat map will represent a “SafetyScore™”, which will clearly indicate the relative safety of an area.

Our map will bring the power of this technology to the public in a powerful and easy to use form.



What will it do?

- Provide an easier to use and easier to understand crime map presentation
- Give context to crime data to make it more meaningful
- Allow users to tailor the results to their needs
- Add convenience and real-time functionality with a companion mobile app

How will it do this?

- "Heat map" style of visualization instead of icon-based
- SafetyScore™ rating for map areas to determine the "heat"
- Factors affecting the SafetyScore™ appear when area on heat map is hovered over

How will it do this?

- An overall rating or crime SafetyScore™ for an area would be calculated and weighted, based on:
 - number
 - age
 - date ranges
 - violence level of crimes
 - population density of the area

How will it do this?

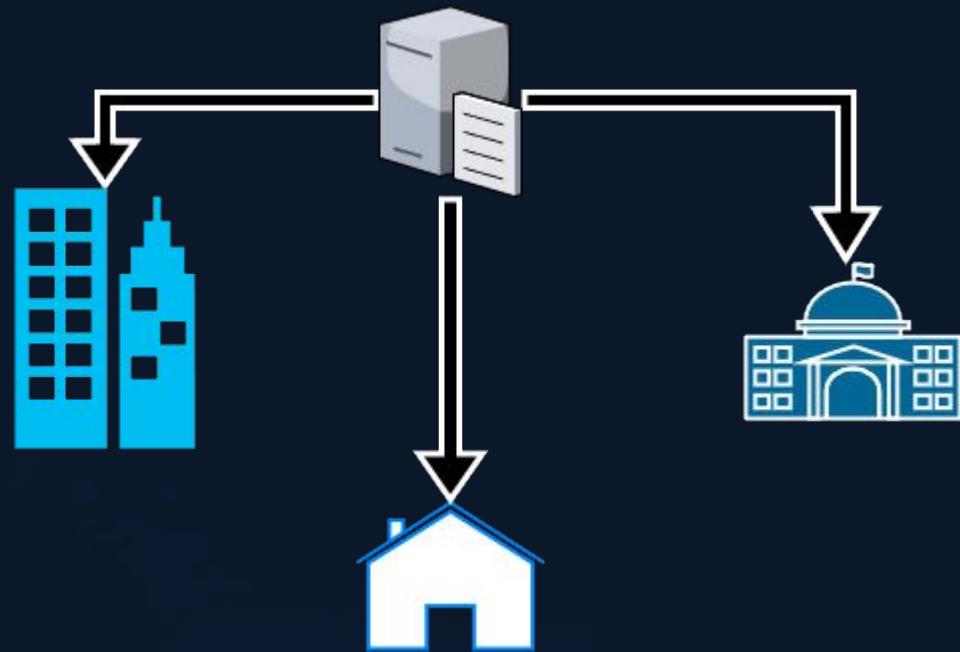
- Interface of buttons, switches and sliders used to control filters
- Filters allow users to show data as it is relevant to their safety concerns, location, and/or time
- User can select which crime characteristics to show or emphasize based on:
 - type of crime
 - severity of crime
 - time since crime occurred
 - time of day and day of week the crime occurred on
- Filters can be saved in the app, tailoring the experience for each individual user
- Additional analytics will be available with preset and custom filtering options to control how crime characteristics are visualized

How will it do this?

- Companion mobile app will provide safety information about user's current location
- Notifications can warn user when
 - New crime reports become available for their area
 - The user enters a more dangerous area
- User can use the app to find areas that are safer

Customers

- Advertising Sponsors
 - Realtors
 - Local businesses
- Grant Programs
 - Local, state, and national
 - Non-governmental public safety



End Users

- Business owners
- Tourists and people unfamiliar with an area
- Anyone with an interest in the safety of a geographical area



F.6

Risk Matrix

Technical – Challenges that are of a technical nature.

Financial – Challenges that are of a financial nature.

Schedule – Challenges related to the team's individual schedules.

Customer – Challenges that concern the customer base.

| | | Probability | | | | |
|----------|-------------|-------------|--------|----------|--------|-------------|
| | | Very Low 1 | Low 2 | Medium 3 | High 4 | Very High 5 |
| Severity | Very High 5 | C2 | C1 | | | |
| | High 4 | | T2, F2 | | | |
| | Medium 3 | C3 | | | S2 | T1 |
| | Low 2 | | | | | S1 |
| | Very Low 1 | | C4 | | F1 | |

Key:

- **Acceptable:** The risk is acceptable and no further resolution is needed.
- **Permissible:** The risk is at a level that any controls that could be put in place without causing undue hardship should be used.
- **Considerable:** The risk must be considered and contingencies prepared.
- **Catastrophic:** The project cannot proceed until a resolution is identified to mitigate the challenge.

T1

Technical – Challenges that are of a technical nature.

Challenge – JS MEAN stack requires learning multiple programming systems and how they interact in a short period of time.

Probability – 5

Severity – 3

Resolution – Distribute the Stack programming responsibilities amongst the team making individual experts in specific areas and group generalists.

| | | Probability | | | | |
|----------|-------------|-------------|--------|----------|--------|-------------|
| | | Very Low 1 | Low 2 | Medium 3 | High 4 | Very High 5 |
| Severity | Very High 5 | C2 | C1 | | | |
| | High 4 | | T2, F2 | | | |
| | Medium 3 | C3 | | | S2 | T1 |
| | Low 2 | | | | | S1 |
| | Very Low 1 | | C4 | | F1 | |

Key:

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T2

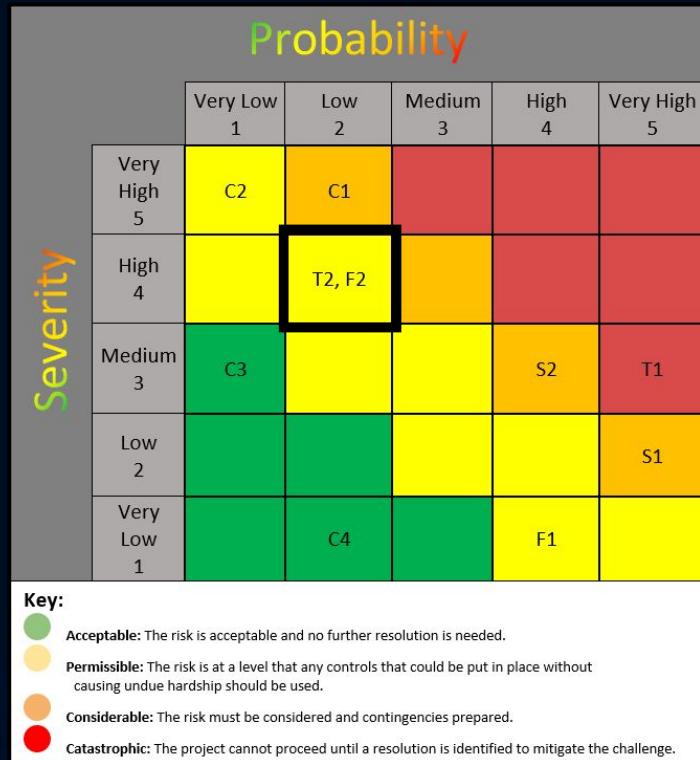
Technical – Challenges that are of a technical nature.

Challenge – Technical Specialist goes missing, quits, or has a life event that precludes them from providing further contributions.

Probability – 2

Severity – 4

Resolution – Ensure that designated generalists each have an understanding of where the technical specialists are at in the problem and be able to rotate into any position's duties.



S1

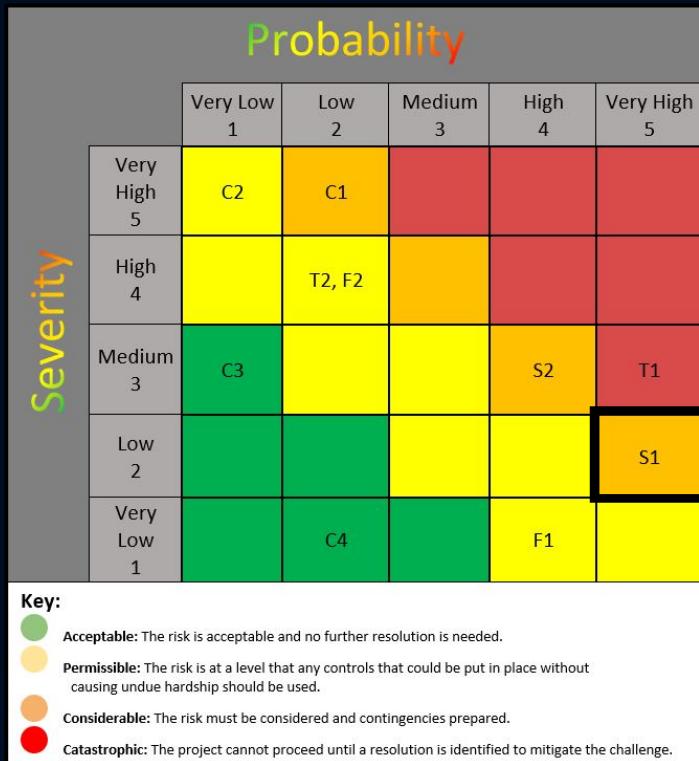
Schedule – Challenges related to the team's individual schedules.

Challenge – Regular communication is challenging due to collaboration occurring online and team members' preexisting time commitments.

Probability – 5

Severity – 2

Resolution – Make some individuals generalists that assist the team in all areas. These generalists are also responsible for keeping track of progress so that they may pick up slack in any area.



S2

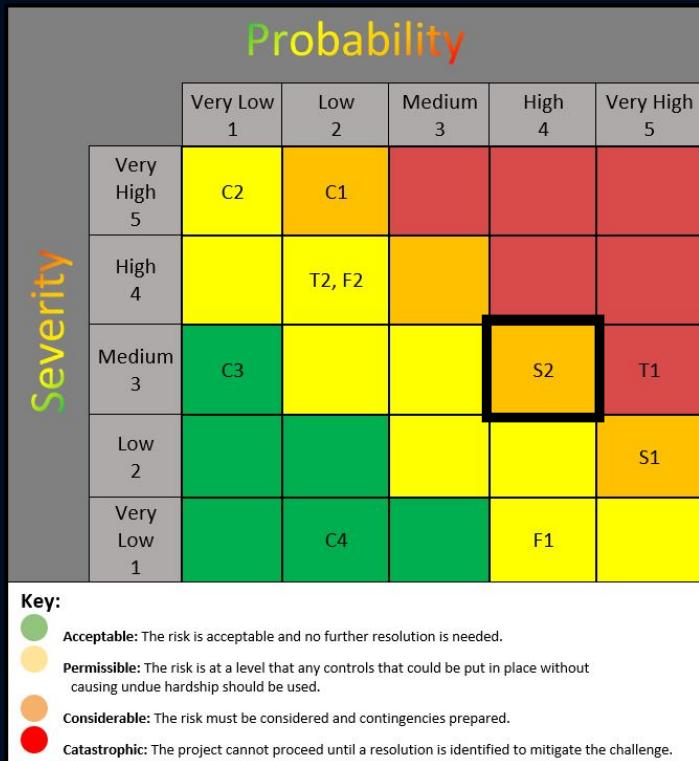
Schedule – Challenges related to the team's individual schedules.

Challenge – Team does not set regular deadlines and things that theoretically sound easy are difficult in implementation.

Probability – 4

Severity – 3

Resolution – Team uses agile development practices and has daily scrums and progress reports.



F1

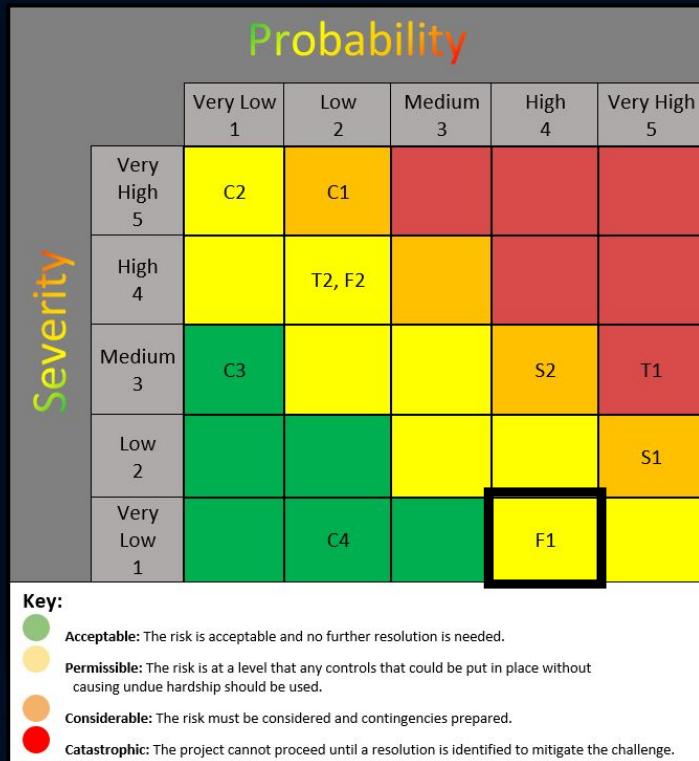
Financial – Challenges that are of a financial nature.

Challenge – Mapping APIs have a cost for use.

Probability – 4

Severity – 1

Resolution – Use mid-level API that only charges with large use.



F2

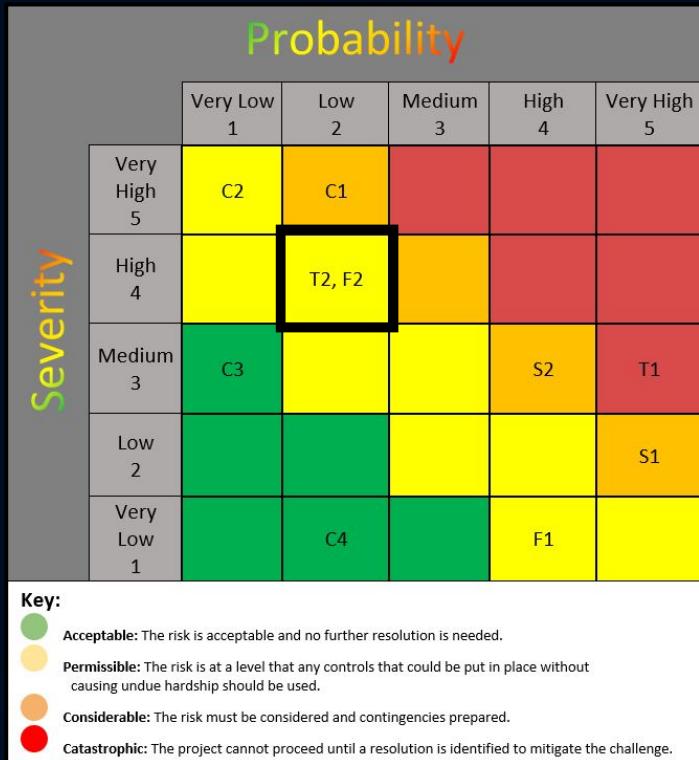
Financial – Challenges that are of a financial nature.

Challenge – Cost of continued web hosting for a free product could become too great.

Probability – 2

Severity – 4

Resolution – Web hosting services can be provided by ODU for the purposes of this course. As the product grows after production revenue from advertising is expected to handle this cost.



C1

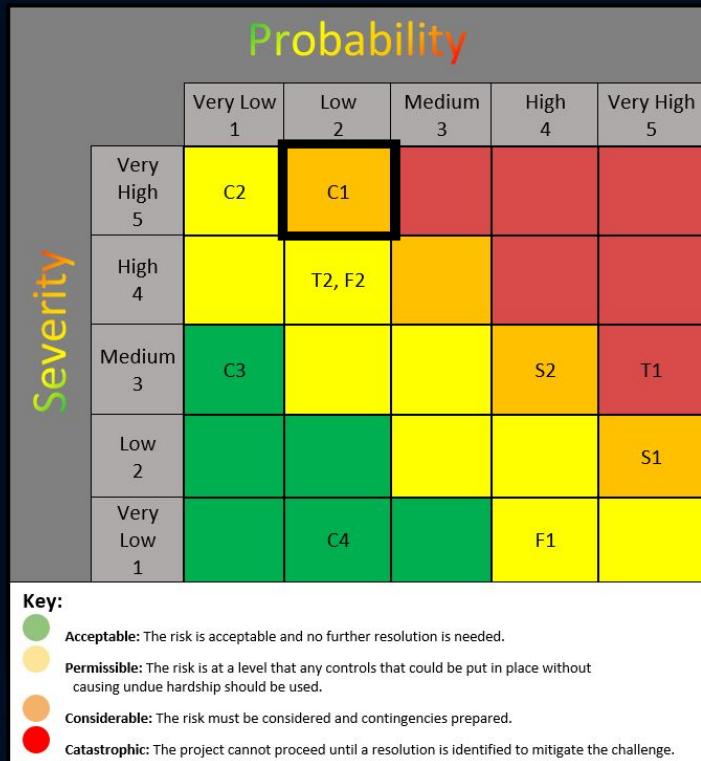
Customer – Challenges that concern the customer base.

Challenge – Organizations from which data is collected may feel it too onerous to update the database.

Probability – 2

Severity – 5

Resolution – Make the data input simple.



C2

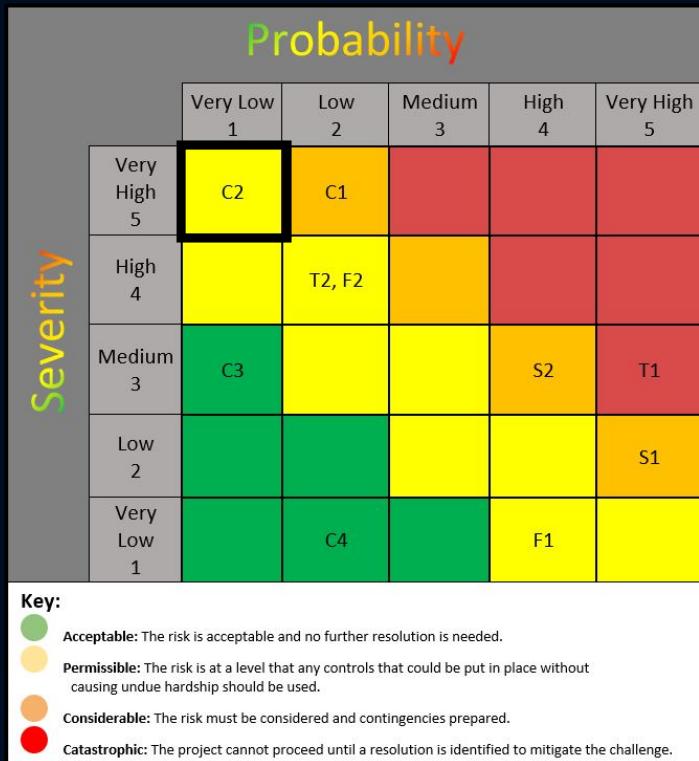
Customer – Challenges that concern the customer base.

Challenge – User base cannot understand how to use the product.

Probability – 1

Severity – 5

Resolution – Make front end as simple as possible while maintaining usability; a quick optional tutorial could also be implemented.



C3

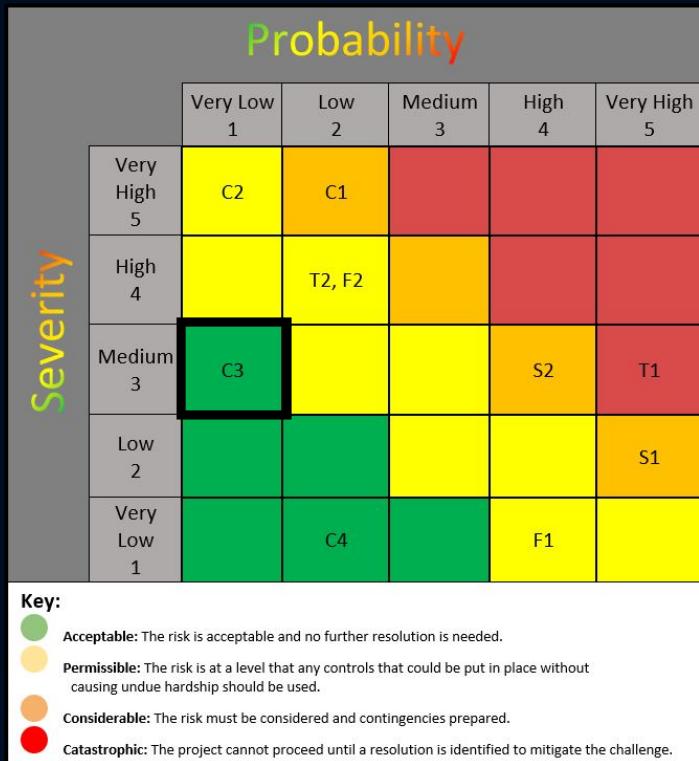
Customer – Challenges that concern the customer base.

Challenge – Users are colorblind.

Probability – 1

Severity – 3

Resolution – Offer the user various color schemes to choose from in order to accommodate common types of color blindness.



C4

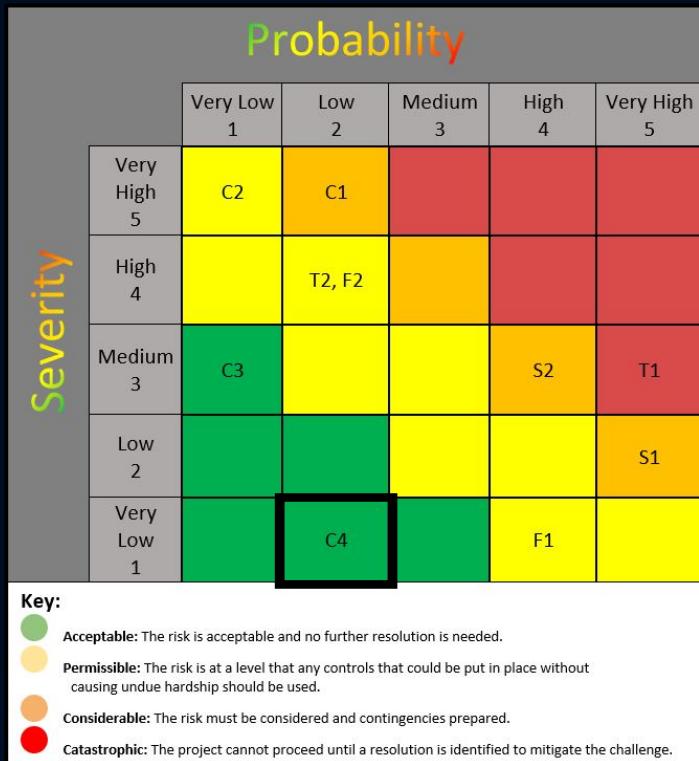
Customer – Challenges that concern the customer base.

Challenge – User prefers an icon map as opposed to the SafetyScore Heatmap.

Probability – 2

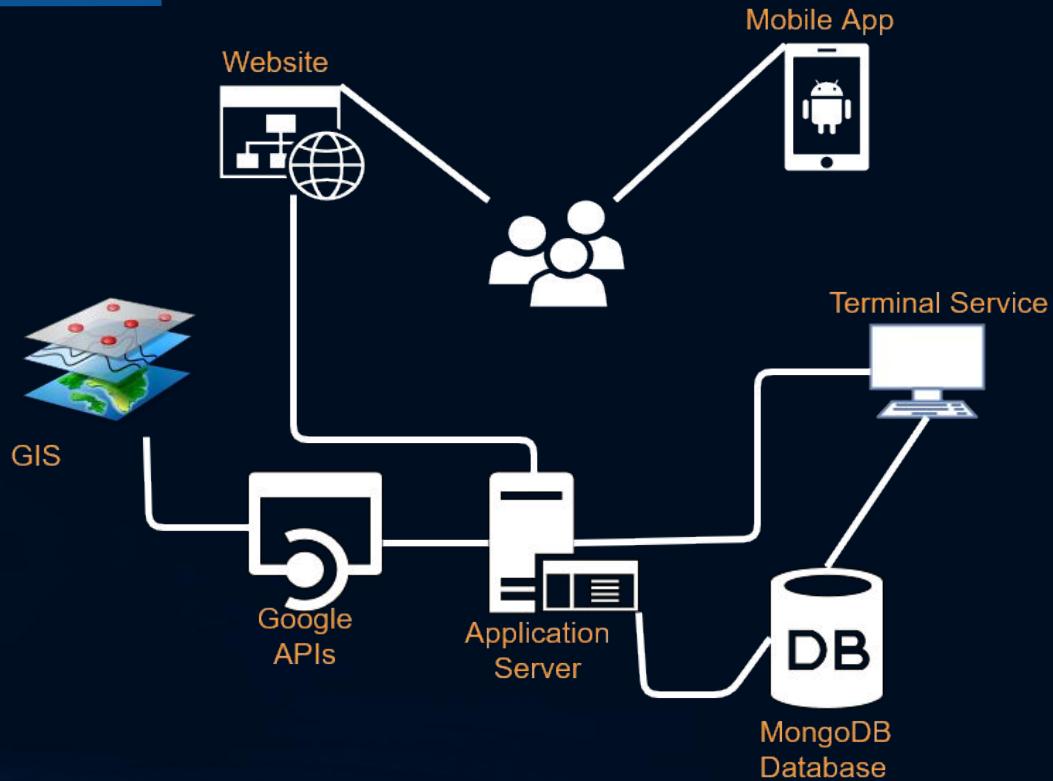
Severity – 1

Resolution – Nothing. This customer is not a part of the target demographic. Our goal is to pick up the shortfalls of the icon graphs numerical approach. The customer is free to use other products but will be provided numerical statistics with the hover function of our system.

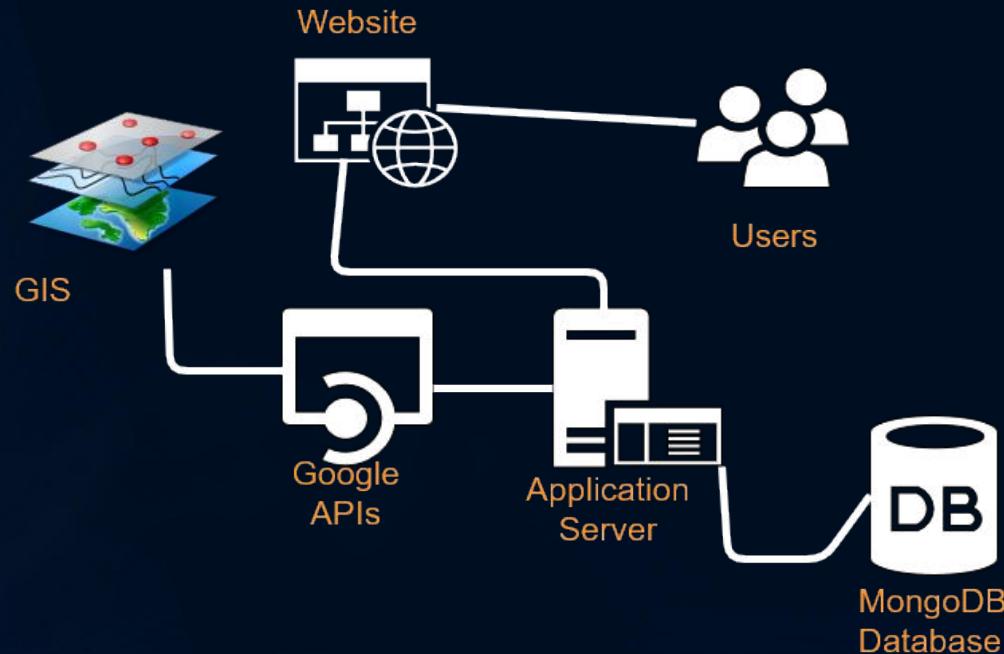


Major Functional Components

- The user accesses our solution via our website or mobile app
- The website or mobile app sends a GET request with the location and view preference information to the dynamic application server (DAS)
- The DAS queries the MongoDB Atlas for crime data
- The DAS uses the Google Maps API to create a heat map, which is returned to the website or mobile app
- A terminal service is available to update the crimes database



Major Functional Components Prototype

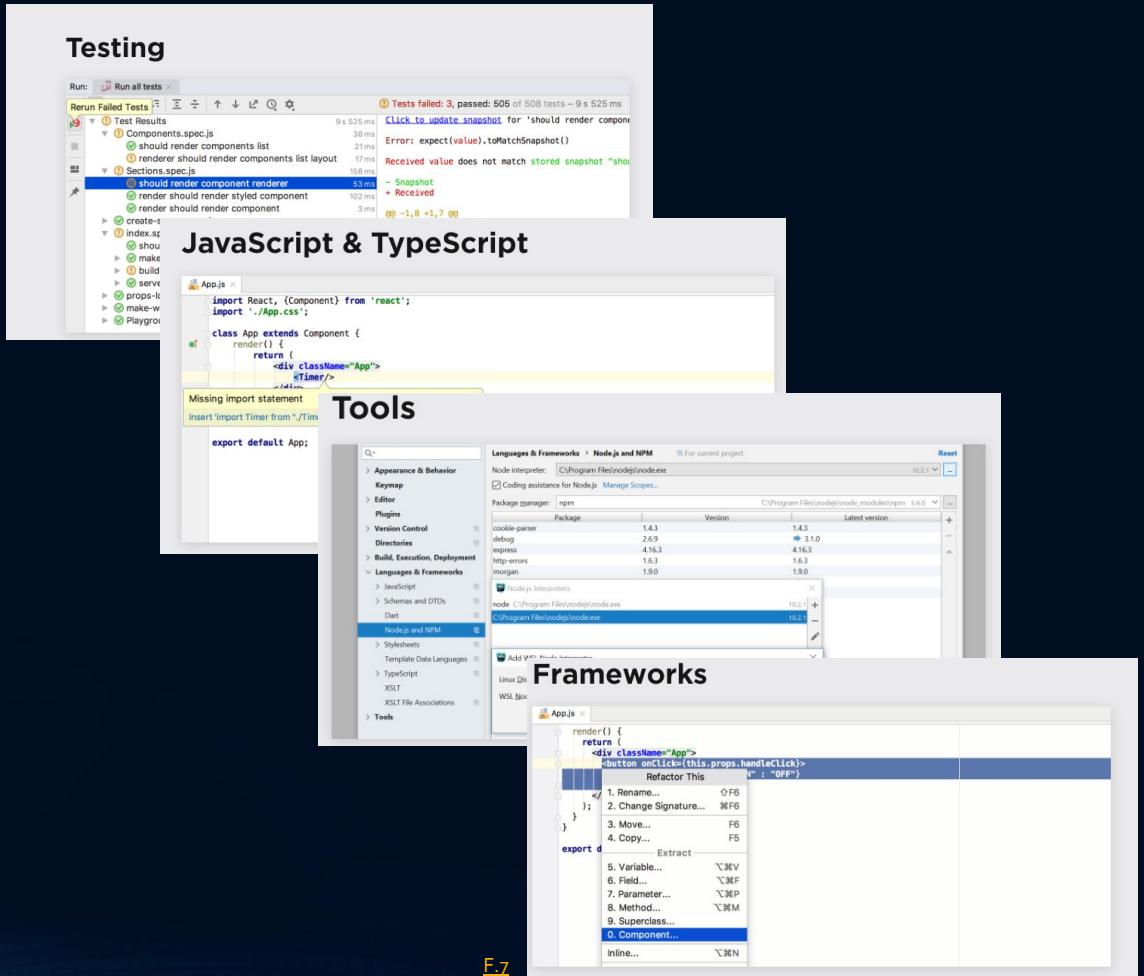


Software Tools and APIs

- Languages: JavaScript, CSS, HTML
- Frameworks: MEAN stack (MongoDB, Express.js, Angular.js, Node.js)
- IDE:
 - Webstorm for MEAN stack development
- Build Management: Gulp.js
- Test Framework:
 - Unit Testing: Mocha.js
 - Website testing: Postman
- Source and version control: Git through Gitlab
- Package and Dependency management: Bower
- Third-Party API: Google Maps API

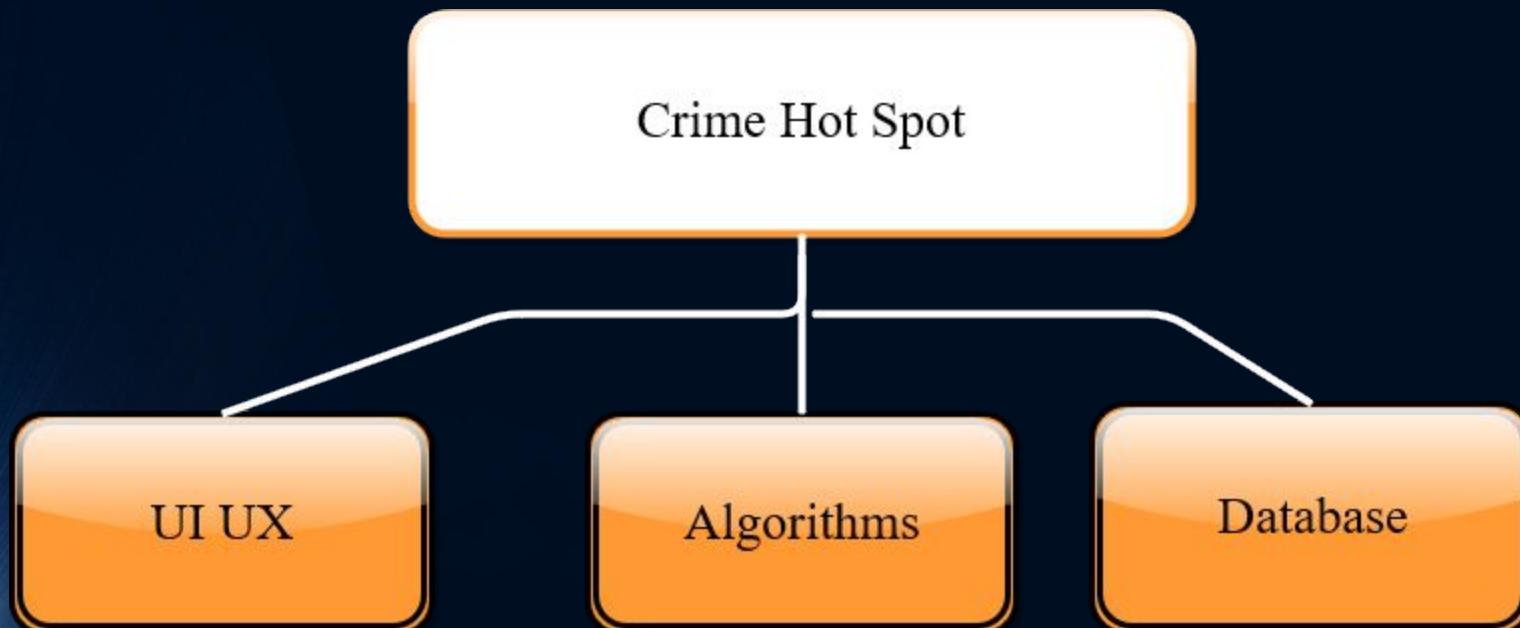
JetBrains WebStorm

- JavaScript IDE
- Debugging
- Testing
- Tracing and Profiling
- Creating Tools
- Using Frameworks

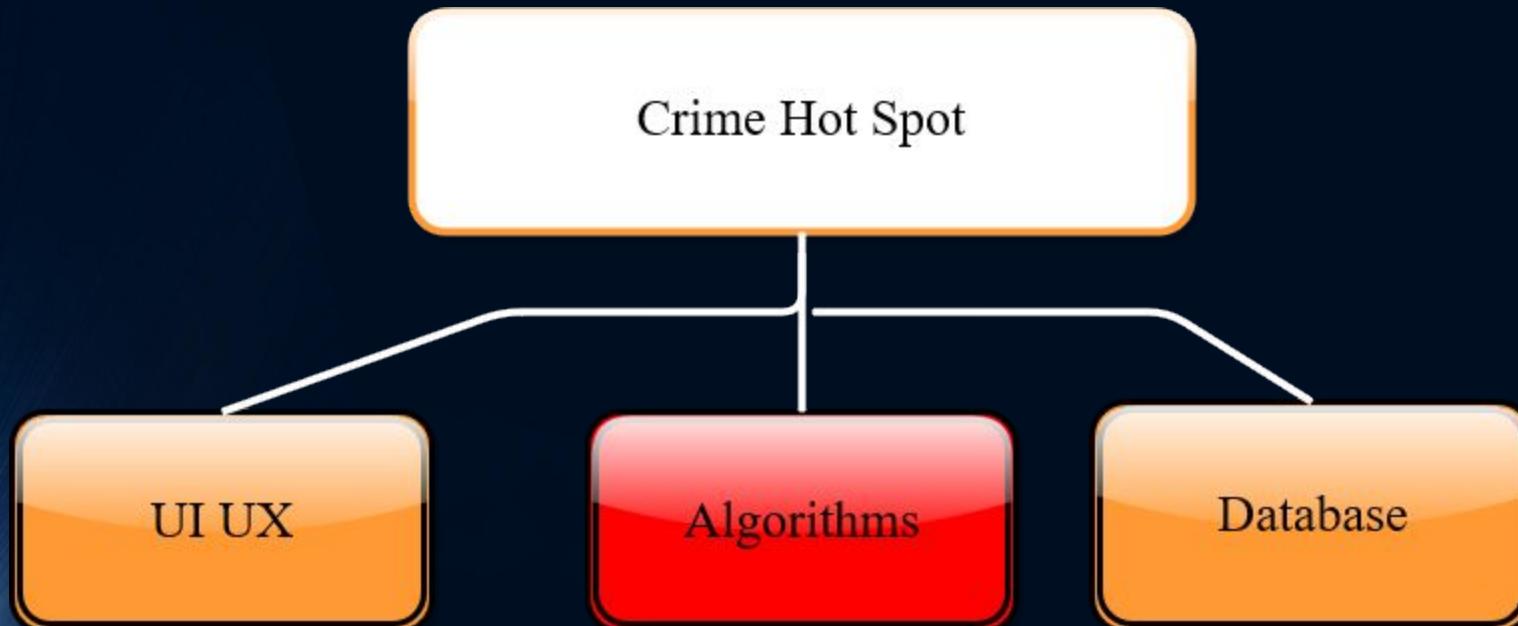


E.7

Work Breakdown Structure:



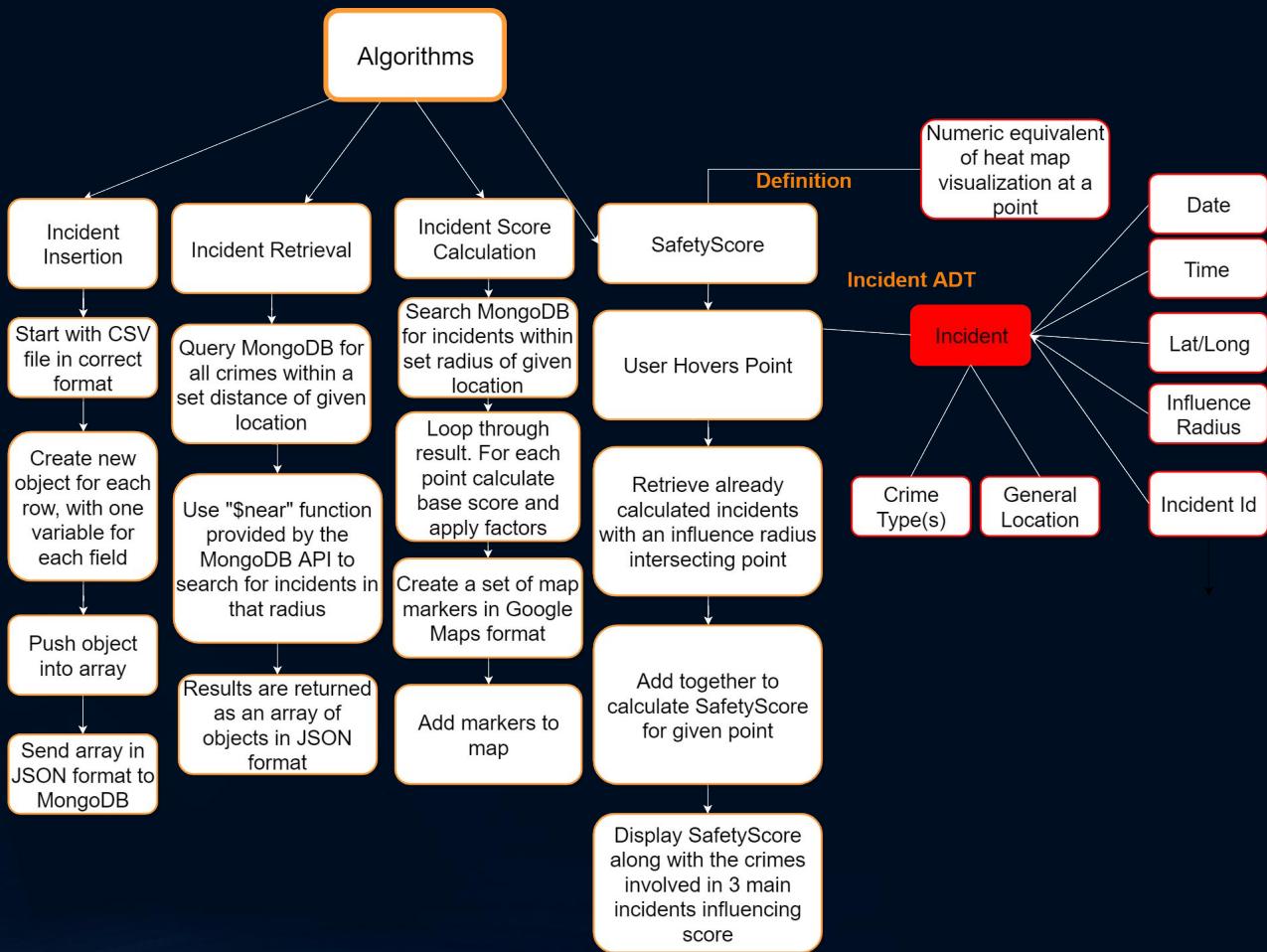
Algorithms



WBS: Algorithms

Please refer to handout p.8

- Incident Calculation
- Data Insertion
- Data Retrieval
- SafetyScore Calculation

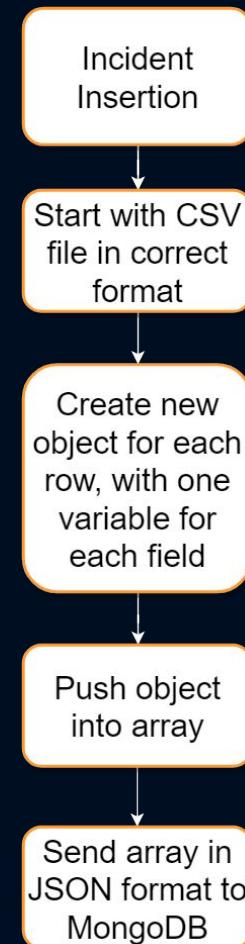


Additional Information

ADT

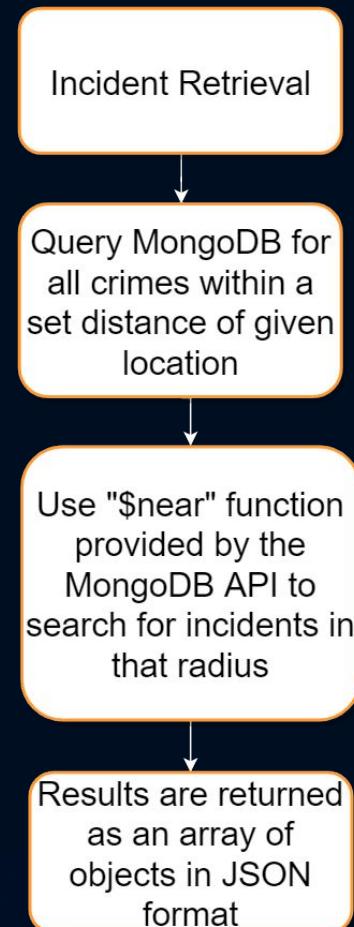
WBS: Data Insertion

- MongoDB makes insertion into the database simple, as each incident will be stored as a JSON document which will be indexed and optimized by MongoDB
- Data will need to be cleaned and saved in .csv format
- Processing of the file will be handled by our terminal service API built into the Node server
- Once loaded, the data will be converted to JSON format and sent to the MongoDB database to be stored as geolocations, which allows for additional functionality



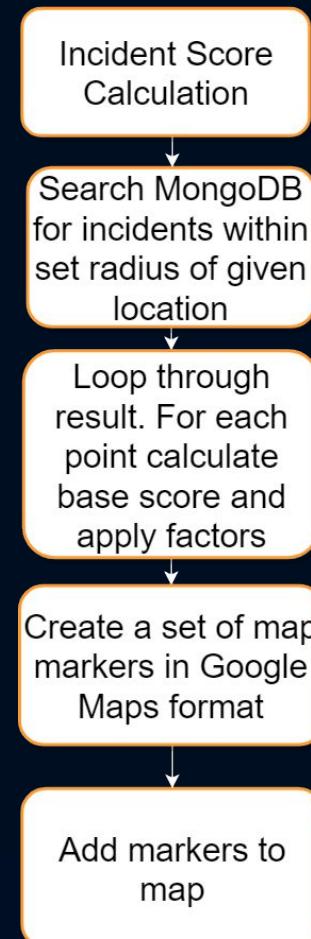
WBS: Data Retrieval

- MongoDB provides methods through its API to retrieve geolocations that are “near” a given location
- Once retrieved, the results are returned to the DAS
- The results can be accessed as an array of JSON objects



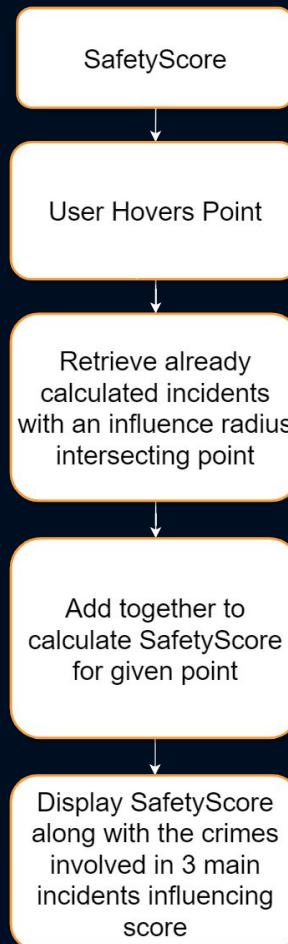
WBS: Incident Score Calculation

- Call the previously mentioned data retrieval function
- Call function that extracts facts about the crime incident then applies rules after parsing the incident.
- The incidents will be loaded as weighted location markers, which will be created from the processed incident information
- Once markers are added to the heatmap layer the results will be displayed on the website map

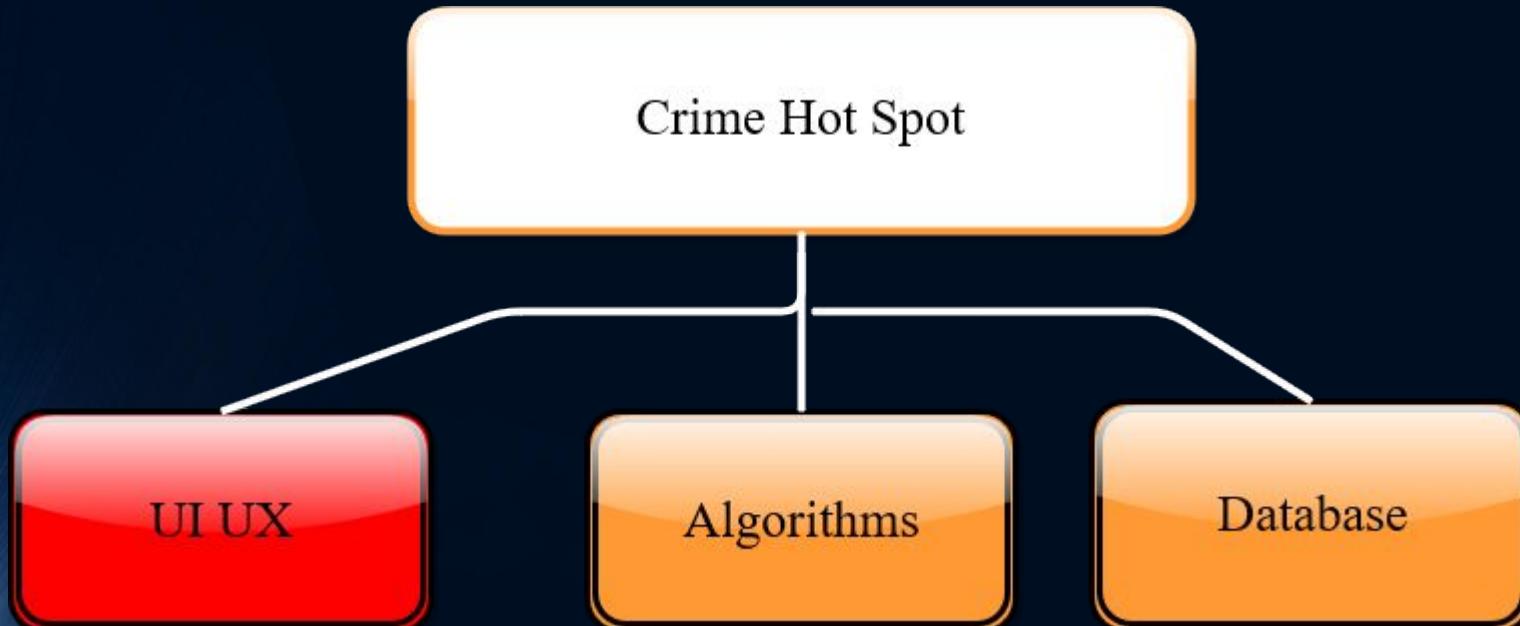


WBS: SafetyScore Calculation

- Explicit SafetyScore calculation is done when a user hovers over the map at a location
- When a page loads the incidents are calculated, these results are saved
- Finds incident radii where the radius of interest intersects with the hovered location
- Add incident scores to get calculated SafetyScore result

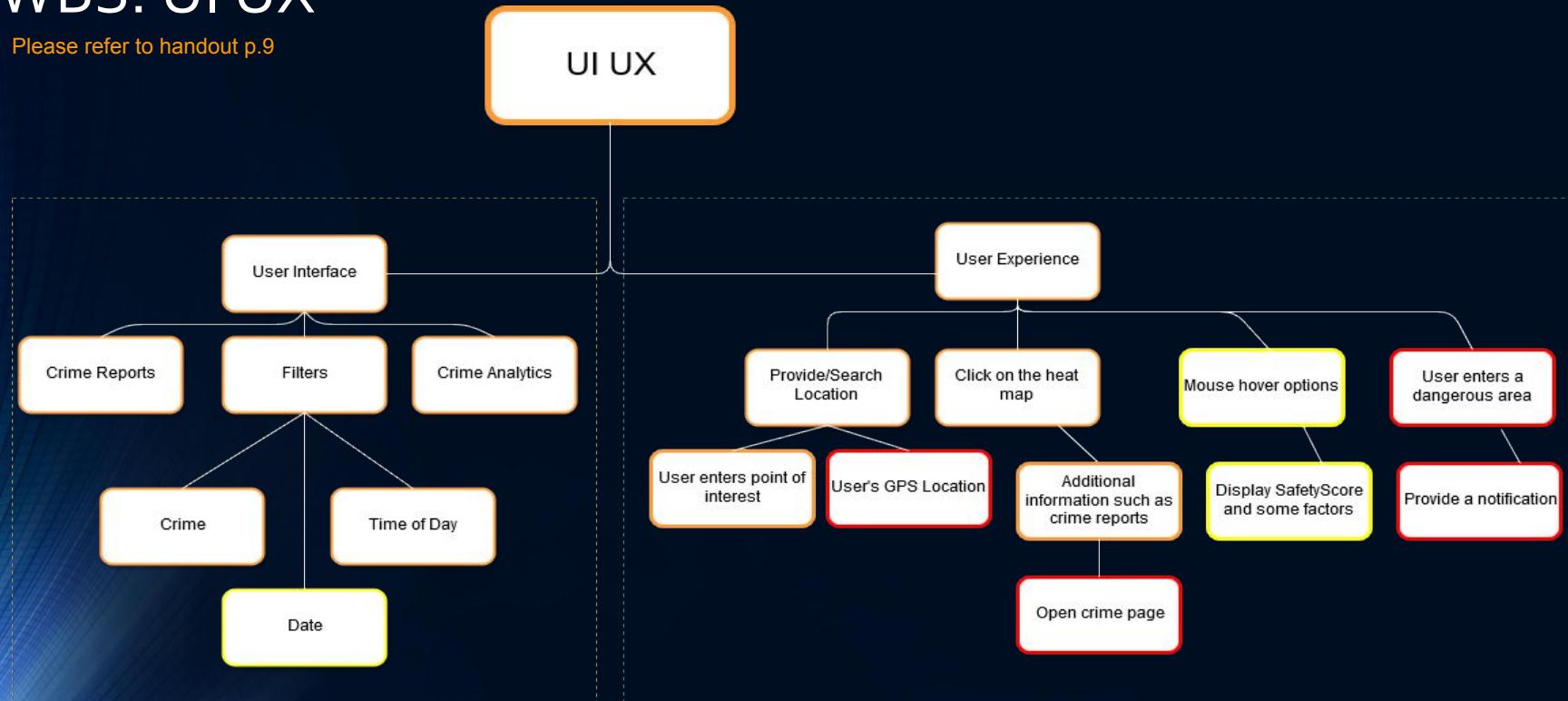


WBS: UI UX



WBS: UI UX

Please refer to handout p.9



Mobile App Specific

Both (Website and Mobile)

Website

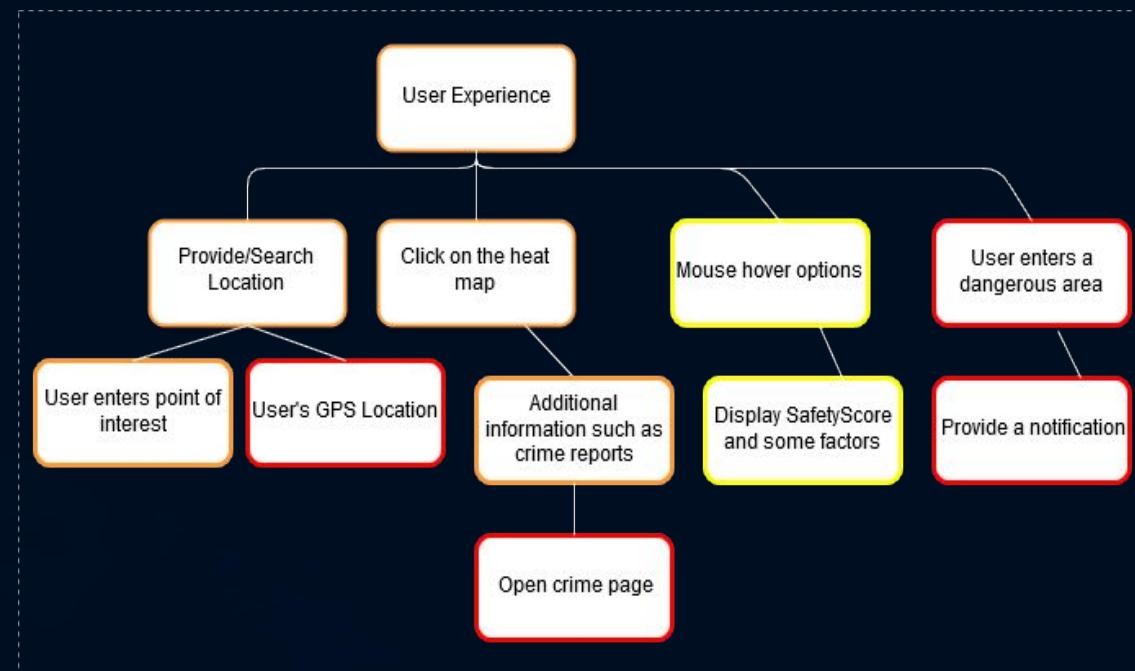
WBS: UI

- Power without complexity
- Avoid information overload
- Interface consistency

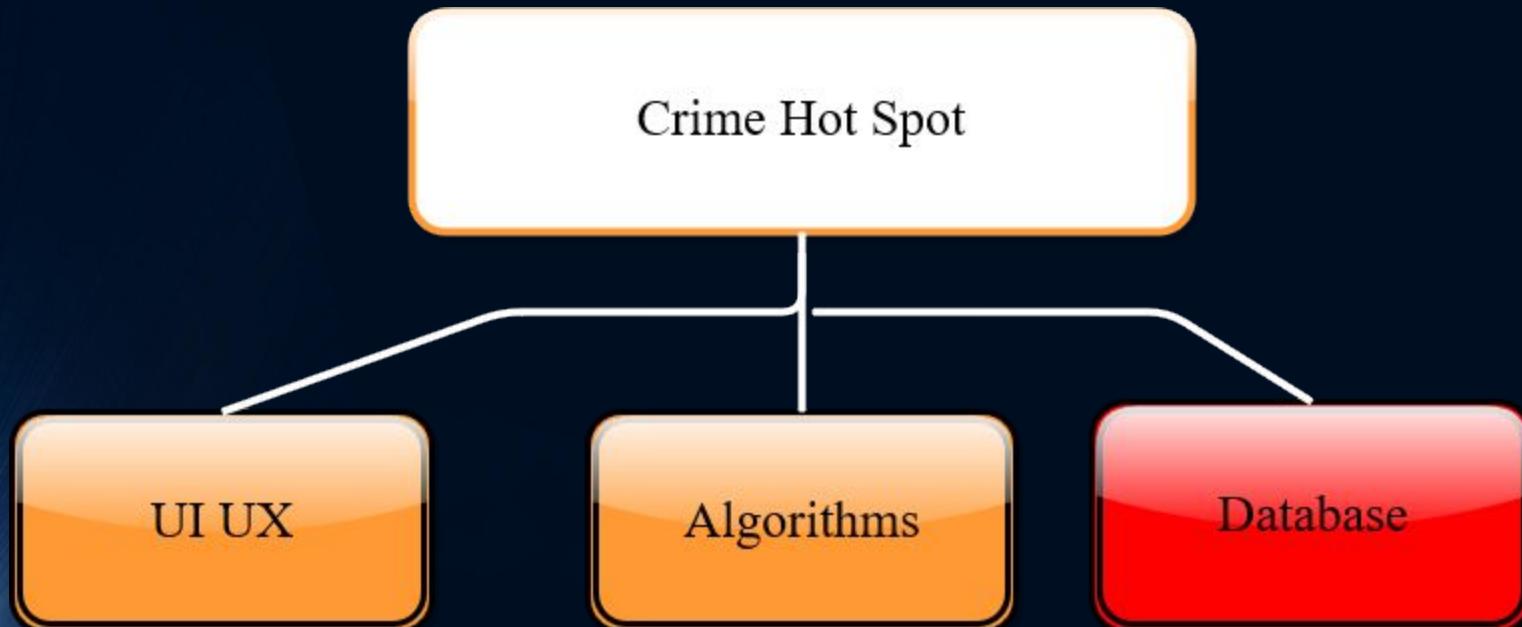


WBS: UX

- Reactive
- Aids in quantifying the data
- Limited user driven events



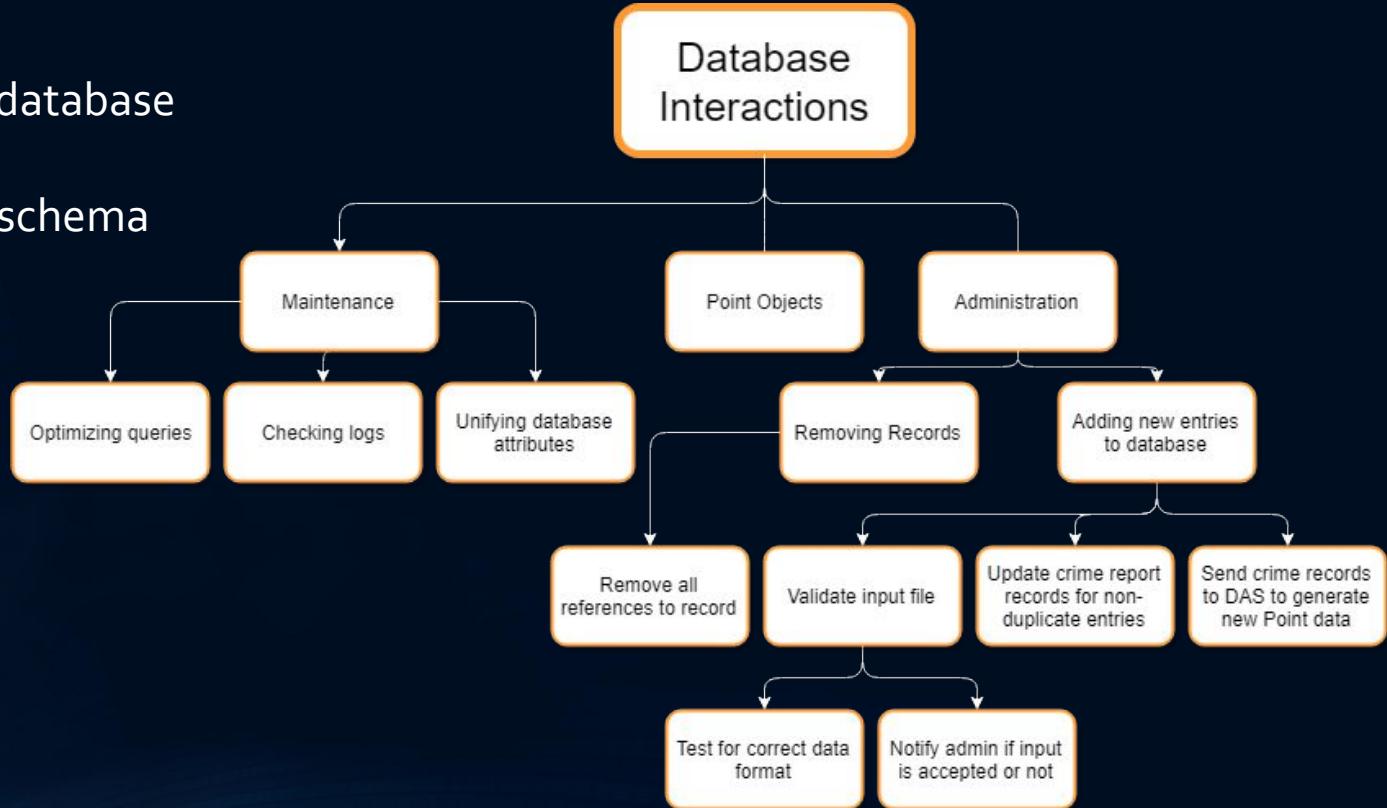
WBS: Database



WBS: Database

Please refer to handout p.10

- Maintaining the database
- Modifying point schema
- Administration



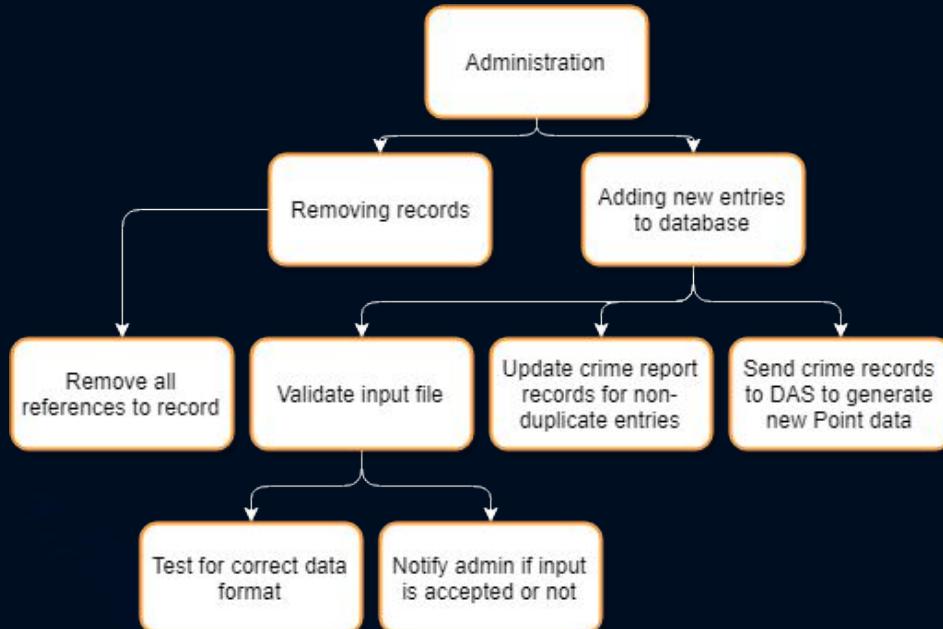
WBS: Database Organization

- Radius
- Latitude
- Longitude
- Crime Types
- General Location
- Occurrence Date
- Unique ID
- Time of Day

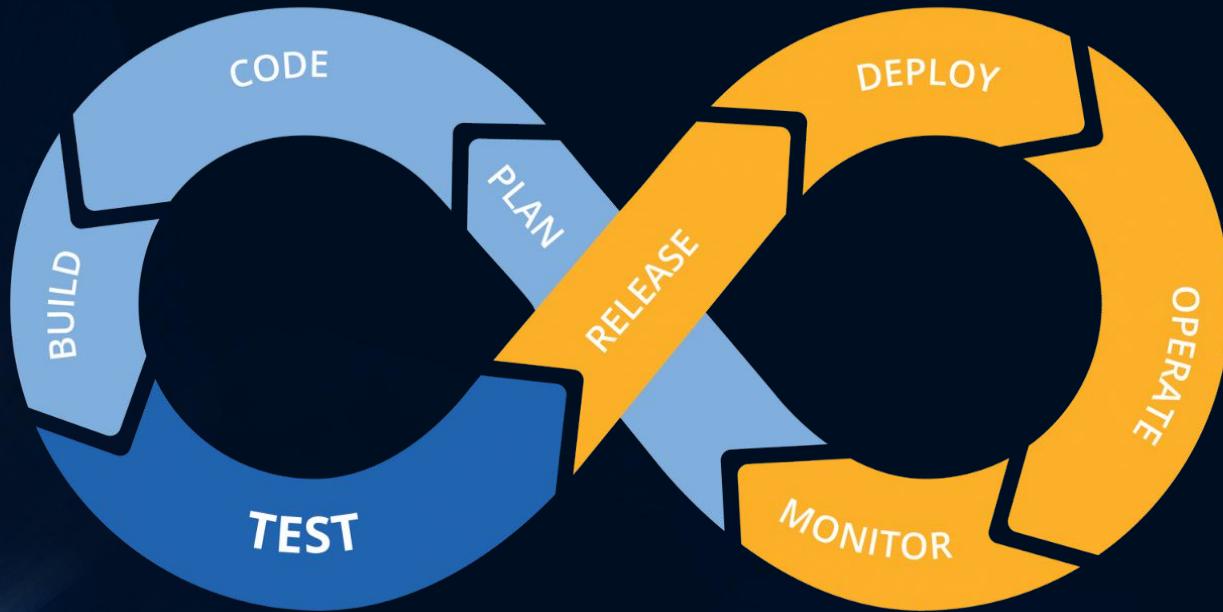


WBS: Database

- New database entries would be added through a format such as CSV
- Each crime record will be sent to DAS to be converted into data points for use on the map
- Ensure accurate erasure of records.



Agile Development Model



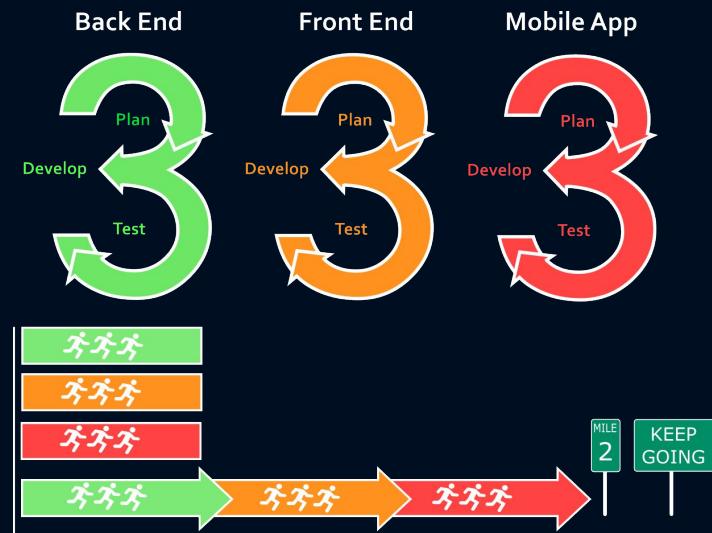
F.8

Why are we using agile development?

- Agile development allows for:
 - adaptive planning
 - evolutionary development
 - early delivery
 - continual improvement
 - rapid and flexible response to change
- The main goal is to provide software not documentation
- Main principles:
 - frequent communication between customers, teams and programmers
 - simplicity - the art of maximizing the amount of work not done - is essential

How We Do Agile

- $\log_3(\text{Development})$
 - 3 or more teams of 3
 - milestones = $\log_3(9 \text{ developers})$
 - 2 milestones a sprint
- Group Task boards
- 3 stand up meetings a week
 - Monday: individual dev reports and demonstrations
 - Wednesday: feedback on progress and roadblocks
 - Friday: weekly planning for next week and individual team reports



Stages of Agile: Plan, Code, Build and Test

- Plan:
 - Three meetings a week through Google Hangouts
 - Slack for communications
 - Wrike for task assignment and breakdown
- Code:
 - Webstorm for MEAN stack development
 - Webstorm for web app development
 - Android Studio for mobile app development
- Build and Test:
 - Gradle for both building and unit testing

Agile: Slack Communication

CS Silver Group ▼ 🔔

• Raphael J. Sandor

≡ Jump to...

≡ All Threads

Channels ⊕

general selected

random

resources

web

Direct Messages ⊕

slackbot

• Raphael J. Sandor (you)

○ Dave Hall

○ G-Man.

○ Kayla

• Kenneth Watson

○ Kevin Chahine

• Kevin Chahine, Kennet...

○ Thom

○ Vairon Mendoza

≡ 9

#general

☆ | 80 | 5 | Company-wide announcements and work-based matters

Put a thicker border on the last two rows or competition matrix. Thursday, October 18th

📞 ℹ️ ⚙️ 🔍 Search 👤 ⭐️ ⋮

Thom 2:56 PM
Great Job everyone.

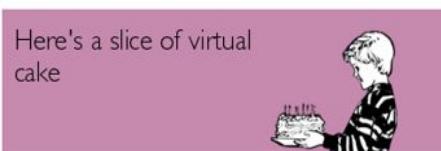
Dave Hall 2:56 PM
so sounds like overall very positive, no major reworks, just tweaks on slides and some speaker phrasing?

Raphael J. Sandor 3:02 PM
Good job everyone I'm super impressed.

Stephanie 3:04 PM
Yeah, it went pretty smoothly.

Raphael J. Sandor 3:06 PM
Despite everyone seeing my password
Lmao

Vairon Mendoza 3:20 PM
Pasted image at 2018-10-18, 3:20 PM ▾



Message #general ⊕ 👤 😊

Stages of Agile: Deploy - Task Board

Design Presentation

List Board Table Gantt Chart Files Stream

SHOW TO: All ▾

New (6)

- DH** Nov 14
- Database design Nov 28
DH G KW
- Parsing Tool for police data Nov 21
VM RJ G
- Prototype Dec 28
DH RJ VM SZ

In Progress (8)

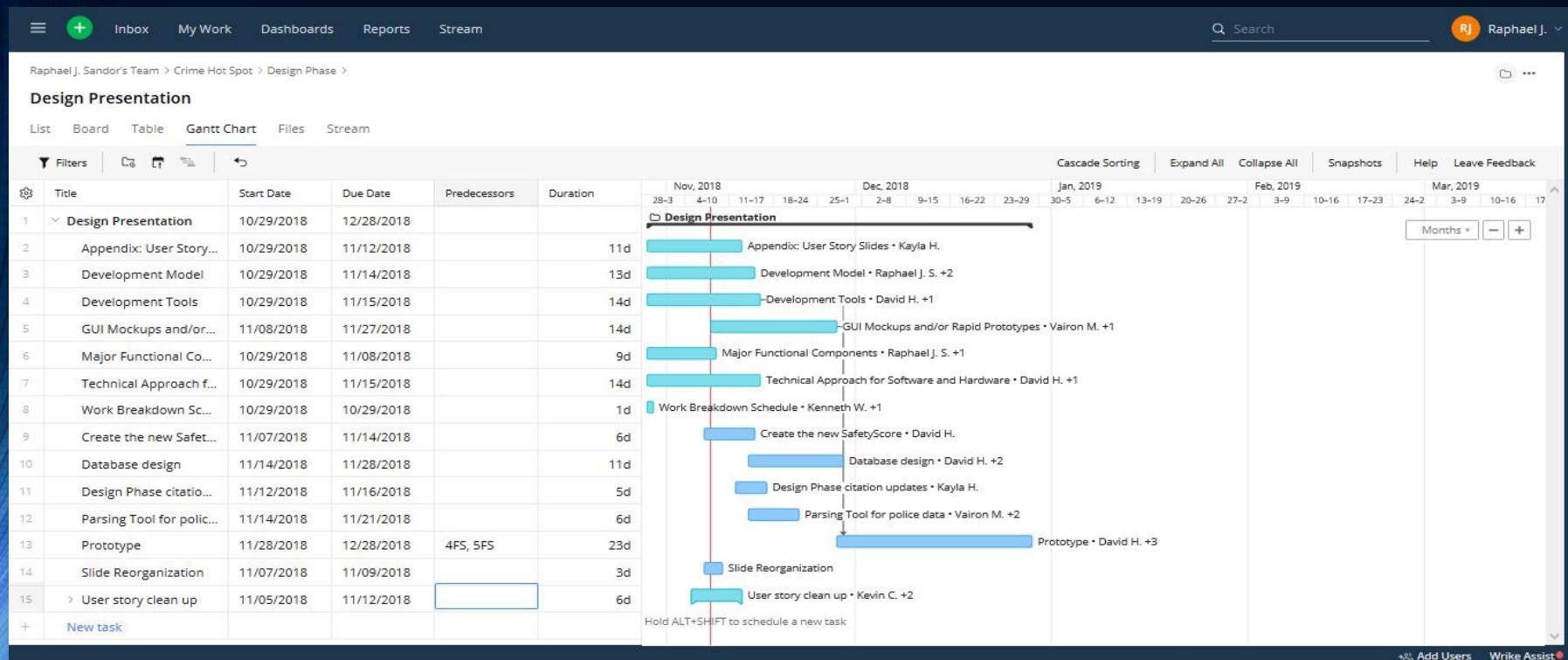
- User story clean up Nov 12
KC KH TL
- Appendix: User Story Slides Nov 12
KH
- Development Tools Nov 15
DH RJ

Completed (8)

- User Roles and Stories Nov 7
KH TL
- All Feasibility Elements Nov 8
TL KH
- Identification of Technical Risk and Customer Risks Nov 15
TL RJ KH KC

E.10

Stages of Agile: Deploy - Gantt Chart



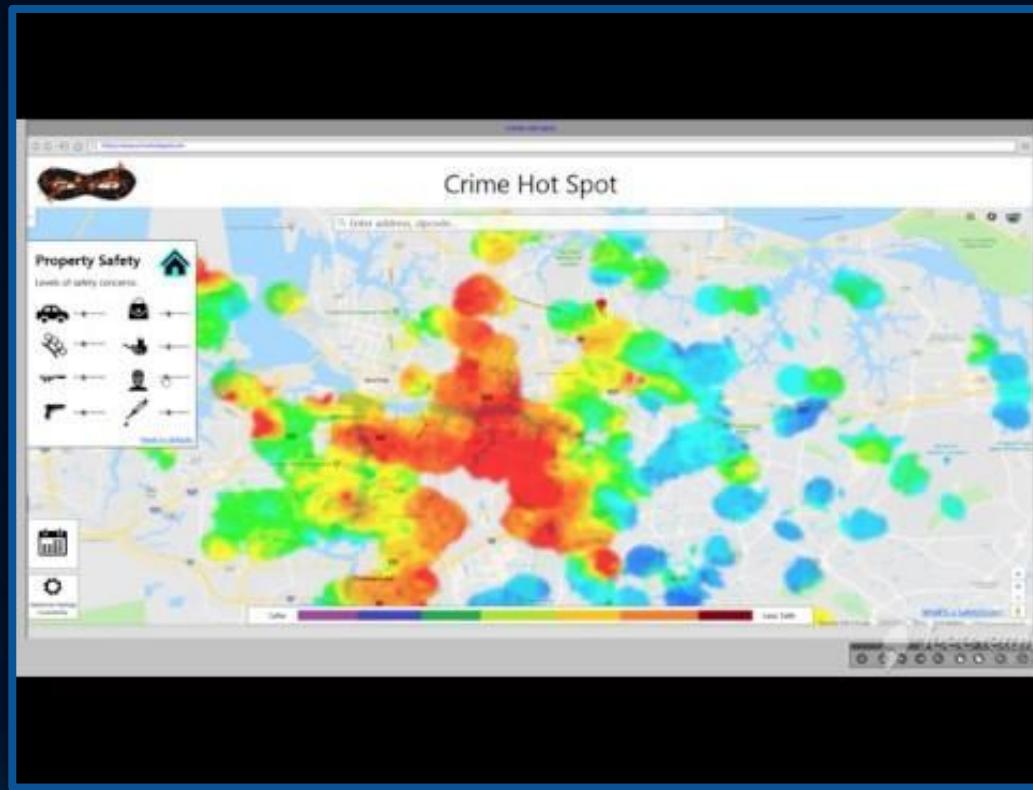
Stages of Agile: Release and Deploy

- Release:
 - Working software is released privately to acceptance testers through GitLab
- Deploy:
 - Website is deployed publicly through Git
 - Mobile app is deployed publicly through Google Play

Stages of Agile: Operate and Monitor

- Operate:
 - Entails ensuring that the servers are running, meeting requests and providing information within tolerance levels for the workloads being placed on the server.
- Monitor:
 - Checking and flagging any errors that were not caught during testing.
 - Mobile app errors are recorded through LogCat.

GUI Walkthrough



Conclusion

Crime Hot Spot will make crime data and threat understandable to everyday users.

By visualizing with a heat map and quantifying with a SafetyScore, we will open the opportunity for everyone to make informed crime safety decisions.

Glossary

SafetyScore™ - A measure of danger at a point on the map that is calculated based on the severity of nearby crimes, the times of those crimes, their distance from that point, length of time since the crime was committed, and the time of day and day of week that the crime was committed in relation to now.

Heat Map - a two-dimensional representation of data in which values are represented by colors. A simple heat map provides an immediate visual summary of information. More elaborate heat maps allow the viewer to understand complex data sets.^[5]

Terminal Service - Allows an administrator or developer to make modifications and control a server or computer remotely.

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Appendix A: Problem Background

The FBI estimates for the United States - 2017

- 7.7 million property crimes occurred in 2017.[\[1\]](#)
- 1.2 million violent crimes occurred in 2017.[\[1\]](#)

In 2016, U.S. residents age 12 or older experienced 5.7 million violent victimizations, or 21.1 victimizations per 1,000 persons.[\[2\]](#)

The FBI Vs. Neighborhood-Scout Statistics

- Violent crimes, Norfolk 2017: FBI - 1,363[\[1.a\]](#) | NS - 1,660 [\[6\]](#)
- Property crimes, Norfolk 2017: FBI - 9,192[\[1.a\]](#) | NS - 10,161 [\[6\]](#)

Appendix B: Competition Matrix

| Characteristics / Programs | Crime Hot Spot | LexisNexis Community Crime Map | SpotCrime | CrimeMapping | AreaVibes | Trulia |
|--|----------------|--------------------------------|-----------|--------------|-----------|--------|
| Generalized crime data | ✓ | ✓ | | | ✓ | ✓ |
| Crime types differentiated by category | ✓ | | | | | |
| Filter options: date, crime type | ✓ | ✓ | | ✓ | | |
| Weighted to user relevance (SafetyScore™) | ✓ | | | | | |
| Supplemental analytics | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Companion app | ✓ | | | | | |
| Distributes data evenly across area of concern | ✓ | | | | | |
| Cluttered icon graph presentation | | ✓ | ✓ | ✓ | ✓ | ✓ |

Appendix C: User Roles

- Administrator - A person who will be maintaining the database
- Website User - An end user of the web application
- Mobile User - An end user of the mobile application

Appendix C: User Stories - Administrator

- As an administrator, I would like to securely log into the website.
- As an administrator, I would like a program/tool to read and analyze multiple crime data files and make a unified format.
- As an administrator, I would like to submit crime data in .csv format.
- As an administrator, I would like to edit the crime database.
 - As an administrator, I would like to add a record to the crime database.
 - As an administrator, I would like to delete a record from the crime database.
 - As an administrator, I would like to modify a record from the crime database.

Appendix C: User Stories - Website User

- As a website user, I would like to view a crime statistic heat map layer over a street map view of an area of interest that I designate.
 - As a website user, I would like the application to know my location.
 - As a website user, I would like to enter the zip code of the location of interest.
 - As a website user, I would like to see a street map of the area of interest.
 - As a website user, I would like to see a heat map layer on the street map indicating the safety of an area.
- As a website user, I would like to use social networking to better my understanding of the crimes in an area.
 - As a website user, I would like to be able to view crime reports and local news relevant to the address I have provided on a separate tab.
 - As a website user, I would like to share the current view via a social media platform.
 - As a website user, I would like to open a crime map based on a shared link.

Appendix C: User Stories - Website User

- As a website user, I would like to report relevant data that is used to comprise the heat map.
- As a website user, I would like to be presented computation statistics when hovering the pointer over an area.
- As a website user, I would like to save my preferences so they are used next time I log in.
- As a website user, I would like to be notified if the database has no crime data for an area.
- As a website user, I would like to be able to assign weights to crimes represented in the heat map layer.
 - As a website user, I would like to assign weights to crimes based on crime type.
 - As a website user, I would like to assign weights to crimes based on severity.
 - As a website user, I would like to filter out crimes based on age.
 - As a website user, I would like to filter out crimes based on day of the week.
 - As a website user, I would like to filter out crimes based on time of day.

Appendix C: User Stories - Mobile User

- As a mobile user, I would like to get information about my current location.
 - As a mobile user, I would like to see my current location on the heatmap.
 - As a mobile user, I would like to see the safety score of my current location.
 - As a mobile user, I would like to be notified if I enter a dangerous area.
 - As a mobile user, I would like to be notified if a new crime is added near my location.
- As a mobile user, I would like to be able to filter the data represented in the heat map layer.
 - As a mobile user, I would like to assign weights to crimes based on crime type.
 - As a mobile user, I would like to assign weights to crimes based on severity.
 - As a mobile user, I would like to filter out crimes based on age.
 - As a mobile user, I would like to filter out crimes based on day of the week.
 - As a mobile user, I would like to filter out crimes based on time of day.
- As a mobile user, I would like my weights and filter preferences to be saved.
- As a mobile user, I would like to be notified if the database has no crime data for an area.
- As a mobile user, I would like to be able to look at other locations on the heat map.