Ubiquitous and Mobile Computing
CS 528: *WPI Bodyguard*

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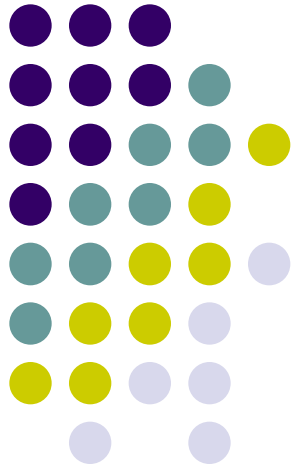
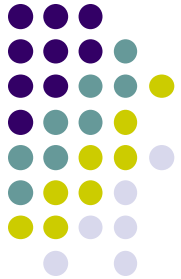
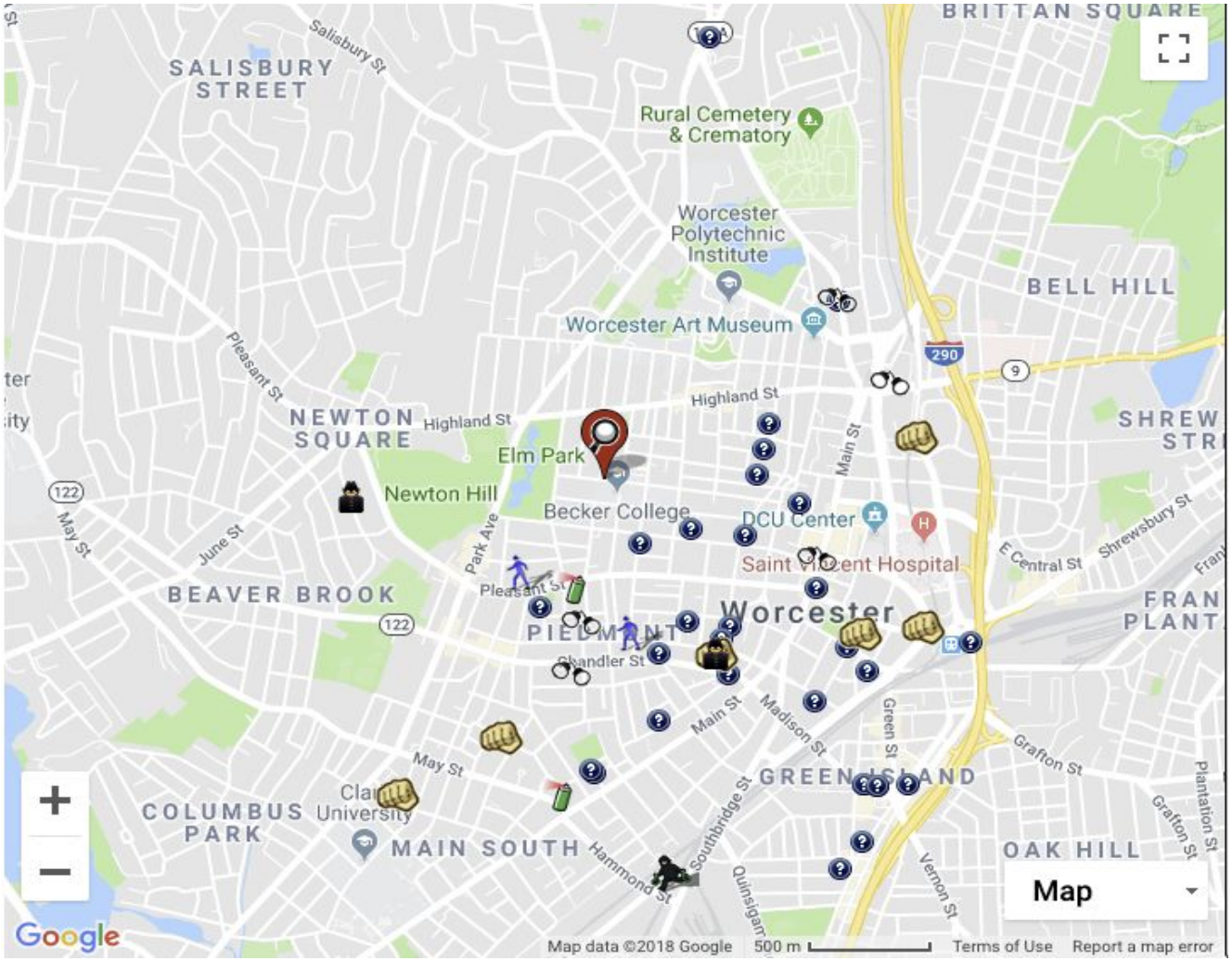


What is the problem?



- What Problem: People need instant alert of being in a dangerous area, and somebody should be informed if he stays there.
- Why Problem: New students are generally unfamiliar with the risk level of neighborhood, and they might encounter danger if staying too long.
- How to solve: An application uses user's location and the GeoFence of dangerous areas to recognize whether user stays there for a long time. If yes, then not only the user should be noticed, but also his/her family should be informed.

Crime spots around Worcester

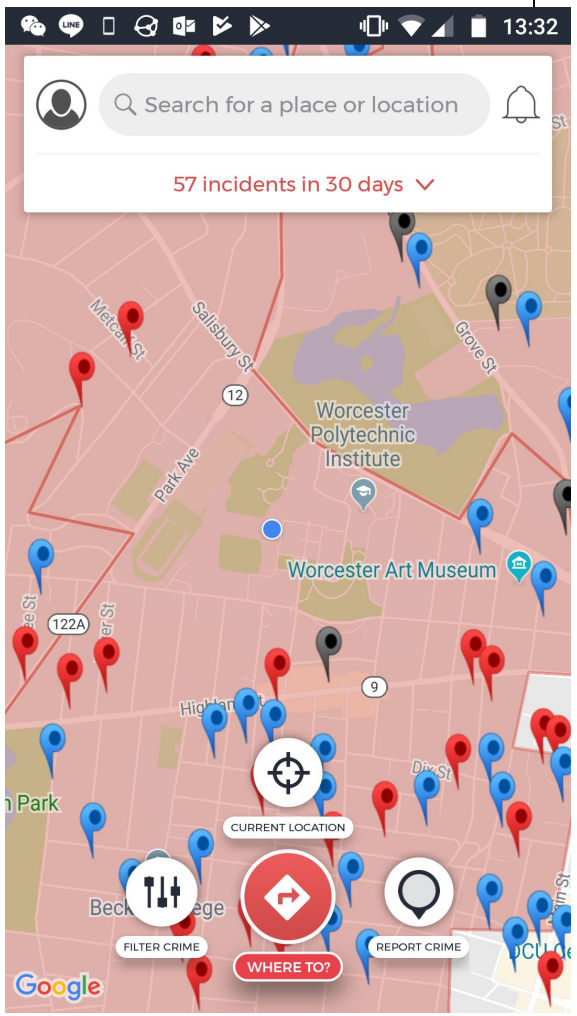


WPI nearby safety notification

Oct 9, 6:16 pm	Highland St.	Breaking & Entering
Oct 2, 12:45 pm	50/60 Prescott St.	Suspicious Motor Vehicle
Sep. 28, 1:12 pm	Hackfeld Rd	Larceny of Bicycles
Aug. 29, 7:39 pm	Highland St.	Assault & Battery

Related Work

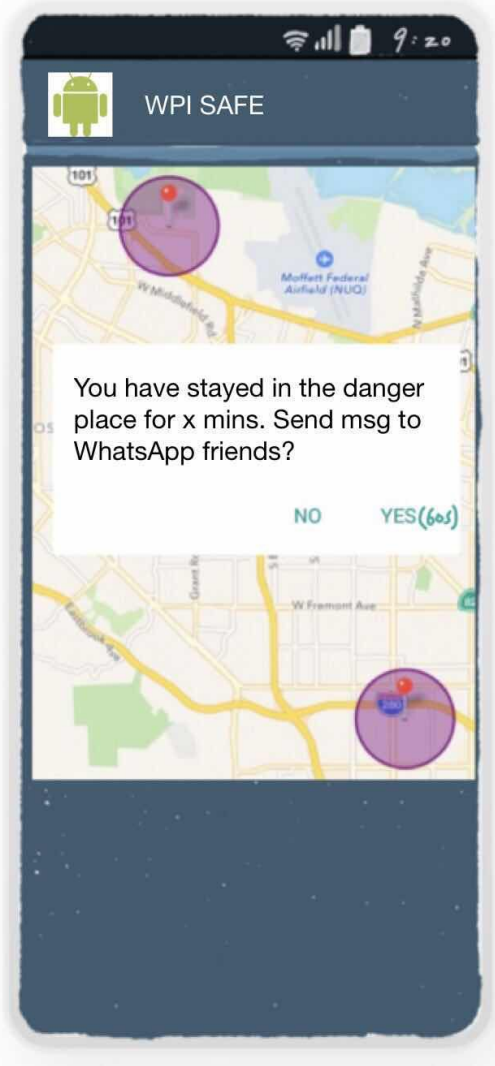
- RedZone Map:
  - official site: https://www.redzonemap.com/
  - The app shows the incidents occurred in the past according to user's location.
  - User can share and report crime incidents.
  - The app provides safer routes to user.
  - The app notifies user if an incident is happening.

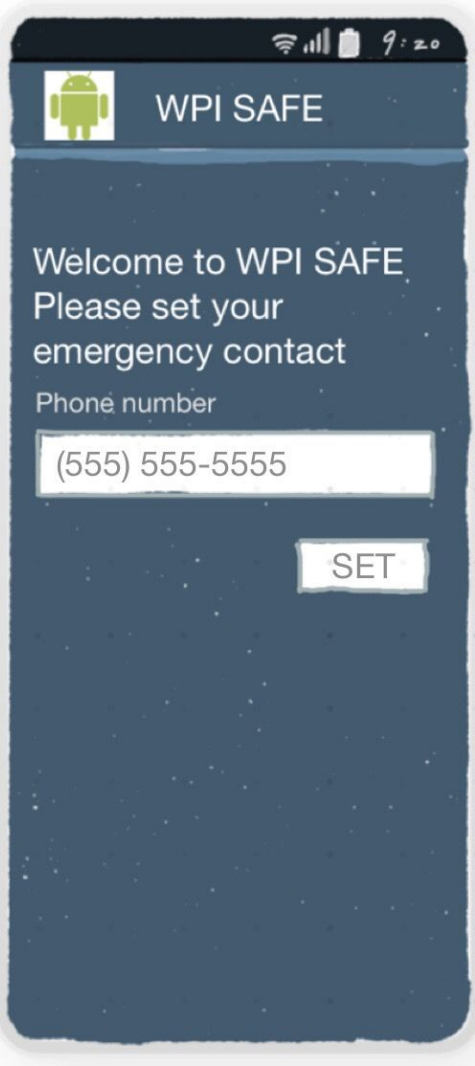


RedZone Map

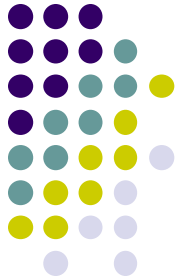
How does it work?

1. Set the emergency contact
2. Show different geofences nearby
3. Send notification if necessary



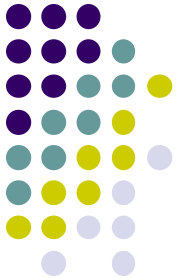


Software Architecture



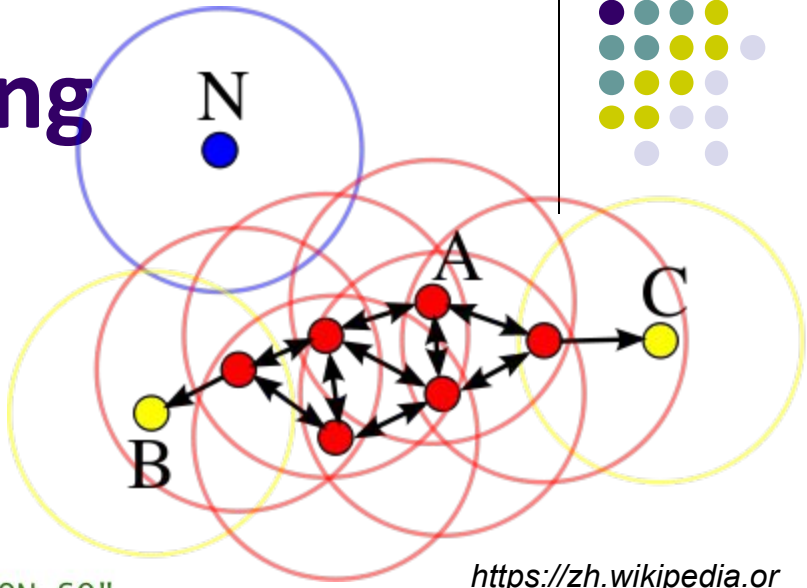
- CrimeService:
  - Get crime spots via web API.
  - Cluster crime spots.
  - Schedule crime spots retrieval.
- GeoFence Service
  - Handle GeoFence event and notify AlarmService.
- AlarmService
  - Pop up a dialog warning user when geofence get triggered.
  - Send a message to emergency contacts if user doesn’t respond to the pop-up dialog for some time (60s).
- MainActivity
  - Show a map indicating geofence spots and user’s position.
  - Provide an interface for entering emergency contacts.

Third Party Libraries



1. CrimeSpot Http Request from https://m.spotcrime.com/mobile/index.html
2. GeoFence from Google
3. DBSCANClusterer from Apache Foundation.

Data & Machine Learning



https://zh.wikipedia.org/wiki/DBSCAN

Data Set

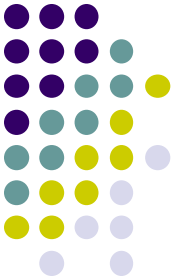
- Retrieve from https://spotcrime.com/
- Data sample:


```
{
  "cdid": 114731689,
  "type": "Arrest",
  "date": "10/25/18 05:22 AM",
  "address": "00 BLOCK WASHINGTON SQ",
  "link": "https://spotcrime.com/crime/114731689
    -7fd86e6f72e551986779e1b358da6129",
  "lat": 42.2611926,
  "lon": -71.79496069999999
},
```


DBSCAN Clusterer:

- 3rd-party library from Apache foundation
- Do cluster on the crime spots to prevent too many geofences.

Difficulty Points



- Location sensor (GPS) (4 points)
- Send SMS (4 points)
- Programmable API(4 points)
- GeoFencing (6 points)
- Machine Learning - DBSCAN (10 points)

Task

GeoFence	Jonathan Wang
CrimeService+DBSCAN	Nathan Hsu Wen Ge
Send messages to emergency contacts	Guangda Li
MainActivity & Services design	Maoyu Chien

Time Schedule

Timeline	
11/1	Proposal Pitch
11/8	Complete function of gather latest data from database
11/15	Use the data to finish DBSCAN
11/22	Use the data from DBSCAN to register geofence
11/29	Complete sending messages automatically
12/6	Test and refactor application
12/13	Presentation

Evaluation Plan

- Successfully collect data and cluster crime spots.
- Successfully generate spots for setting GeoFence according to results of clustering.
- Successfully pop up a dialog to remind the user that he might be in danger and choose to send a message to emergency contact or not.
- Successfully send message in real-time when the user has no response to the dialog for a period of time that has already been set.
- Successfully received message by emergency contact.

References

- https://m.spotcrime.com/mobile/index.html
- https://www.redzonemap.com/
- https://developer.android.com/training/location/geofencing
- https://commons.apache.org/proper/commons-math/javadocs/api-3.6/org/apache/commons/math3/stat/clustering/DBSCANClusterer.html