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

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Incident</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct 9, 6:16 pm</td>
<td>Highland St.</td>
<td>Breaking &amp; Entering</td>
</tr>
<tr>
<td>Oct 2, 12:45 pm</td>
<td>50/60 Prescott St.</td>
<td>Suspicious Motor Vehicle</td>
</tr>
<tr>
<td>Sep. 28, 1:12 pm</td>
<td>Hackfeld Rd</td>
<td>Larceny of Bicycles</td>
</tr>
<tr>
<td>Aug. 29, 7:39 pm</td>
<td>Highland St.</td>
<td>Assault &amp; Battery</td>
</tr>
</tbody>
</table>
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.
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

Data Set

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

```json
{
    "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)

Total 28 points
<table>
<thead>
<tr>
<th>Task</th>
<th>Team Member</th>
</tr>
</thead>
<tbody>
<tr>
<td>GeoFence</td>
<td>Jonathan Wang</td>
</tr>
<tr>
<td>CrimeService+DBSCAN</td>
<td>Nathan Hsu Wen Ge</td>
</tr>
<tr>
<td>Send messages to emergency contacts</td>
<td>Guangda Li</td>
</tr>
<tr>
<td>MainActivity &amp; Services design</td>
<td>Maoyu Chien</td>
</tr>
</tbody>
</table>
## Time Schedule

<table>
<thead>
<tr>
<th>Timeline</th>
<th>Task Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/1</td>
<td>Proposal Pitch</td>
</tr>
<tr>
<td>11/8</td>
<td>Complete function of gather latest data from database</td>
</tr>
<tr>
<td>11/15</td>
<td>Use the data to finish DBSCAN</td>
</tr>
<tr>
<td>11/22</td>
<td>Use the data from DBSCAN to register geofence</td>
</tr>
<tr>
<td>11/29</td>
<td>Complete sending messages automatically</td>
</tr>
<tr>
<td>12/6</td>
<td>Test and refactor application</td>
</tr>
<tr>
<td>12/13</td>
<td>Presentation</td>
</tr>
</tbody>
</table>
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