Top Ten Tips For Building Apps With Maps

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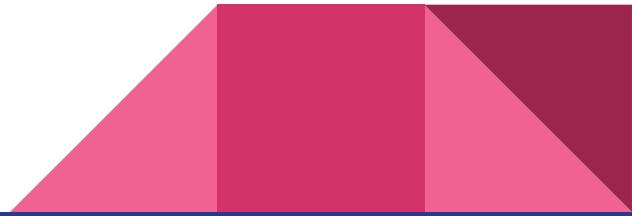
Slides:
github.com/rachelhyman/nsscotland

Maps are hard.

But also good.

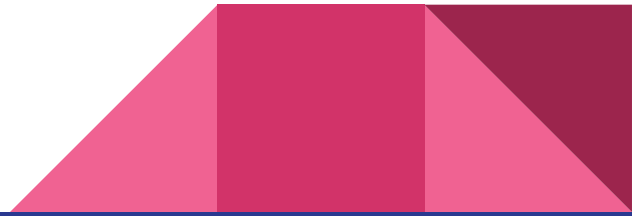
Permissions

1. Encapsulate obtaining permissions & getting location in one method.



1. **Encapsulate obtaining permissions & getting location in one method.**

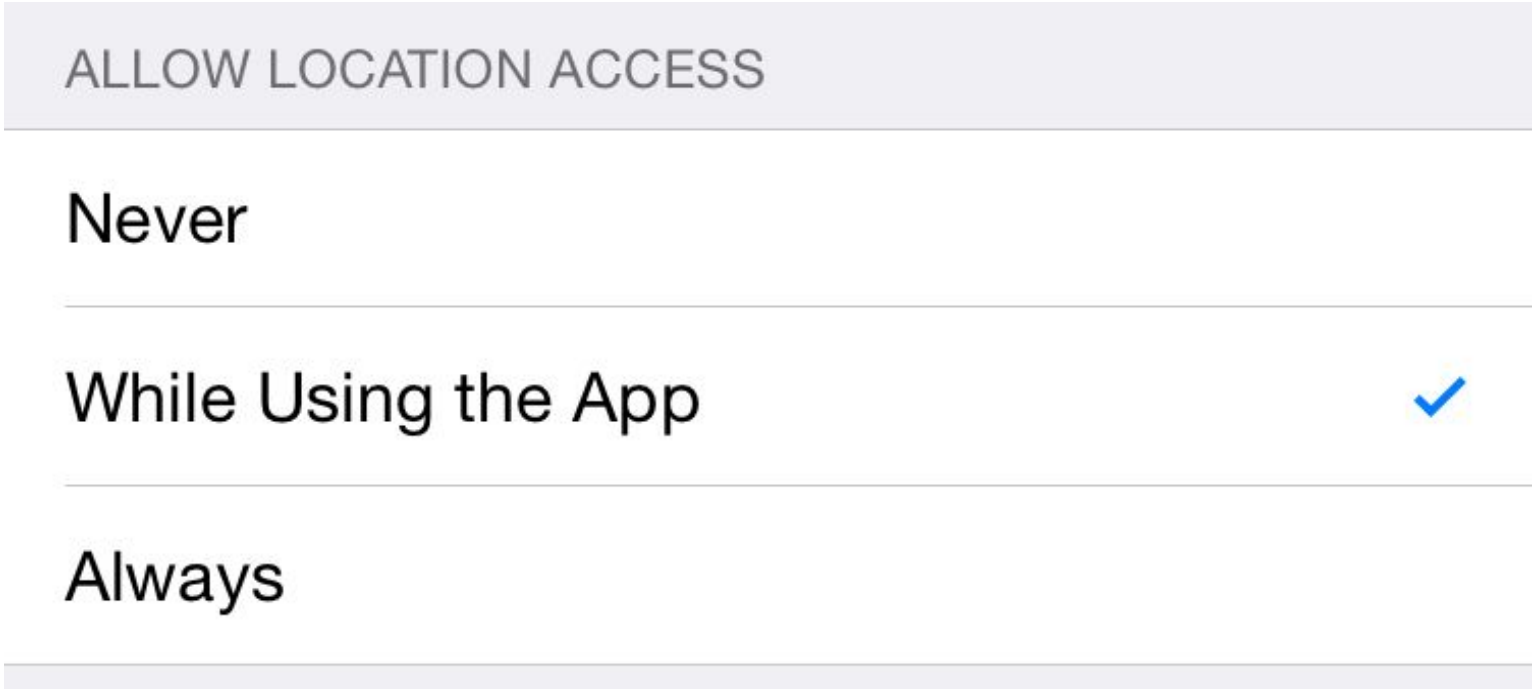
```
-(void)tryToGetLocationWithResult:
    (void(^)(BOOL permissionsGranted,
    CLLocation *location))completion;
```



1. Encapsulate obtaining permissions & getting location in one method.

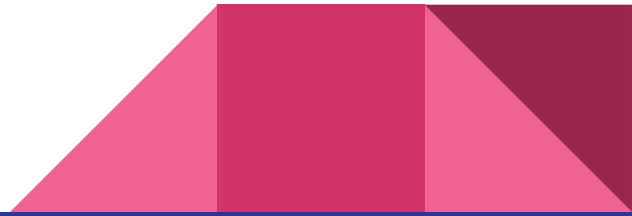
```
self.locationManager = [[CLLocationManager alloc] init];
self.locationManager.delegate = self;

[self.locationManager requestAlwaysAuthorization];
```

```
-(void)locationManager:(CLLocationManager *)manager
didUpdateLocations:(NSArray<CLLocation *> *)locations
```


ALLOW LOCATION ACCESS
Never
While Using the App
Always

Obtaining location fix

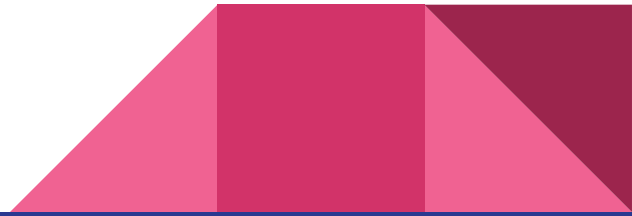
2. Set accuracy level of location manager appropriately.



2. Set accuracy level of location manager appropriately.

```
self.locationManager.desiredAccuracy = kCLLocationAccuracyNearestTenMeters;
```

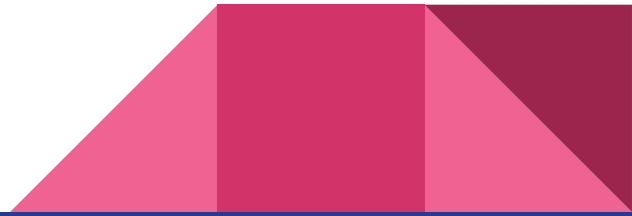
3. Don’t send the first location when you get a location manager delegate callback.



3. Don’t send the first location when you get a location manager delegate callback.

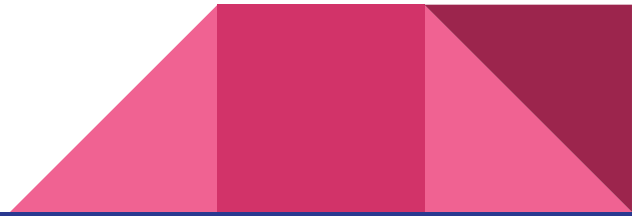
```
-(void)locationManager:(CLLocationManager *)manager
didUpdateLocations:(NSArray<CLLocation *> *)locations
```

```
locations.lastObject.horizontalAccuracy
```



<+41.87821133,-87.66428022>

+/- 8081.00m @ 10/10/15, 3:20:56 PM



<+41.87821133,-87.66428022>

+/- 8081.00m @ 10/10/15, 3:20:56 PM

<+41.87829632,-87.62968999>

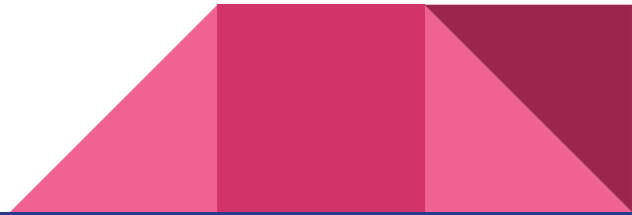
+/- 118.35m @ 10/10/15, 3:21:00 PM

<+41.86821133,-87.65428022>
+/- 8081.00m @ 10/10/15, 3:20:56 PM

<+41.86829632,-87.61968999>
+/- 118.35m @ 10/10/15, 3:21:00 PM

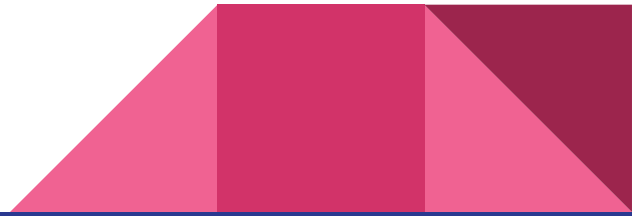
<+41.86851095,-87.61944450>
+/- 10.00m @ 10/10/15, 3:21:03 PM

There’s no one right way to filter locations. It’s a balancing act.



4. Request single location update* when possible.

*new in iOS 9

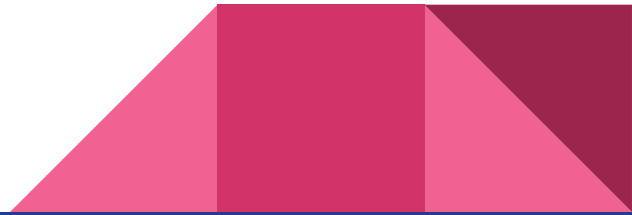


```
- (void)requestLocation
```

```
- (void)locationManager:(CLLocationManager *)manager
didUpdateLocations:(NSArray<CLLocation *> *)locations

- (void)locationManager:(CLLocationManager *)manager
didFailWithError:(NSError *)error
```

Testing on simulator

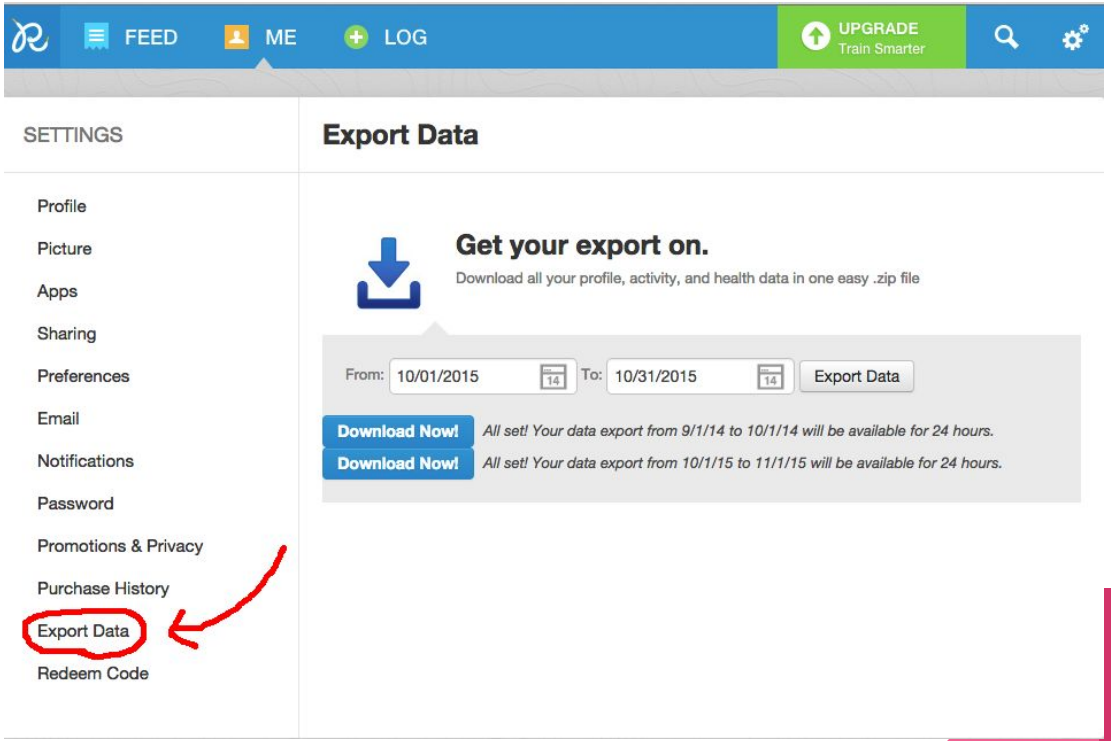
5. Use .gpx files to simulate routes.

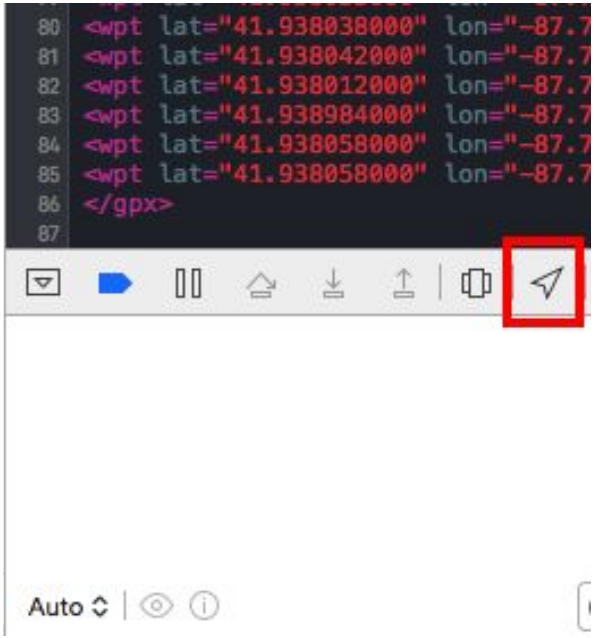


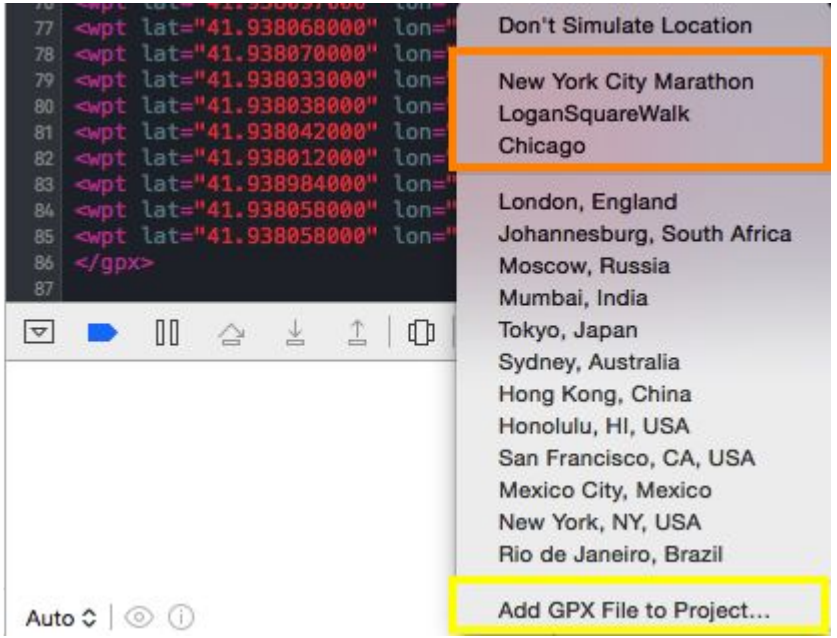
```
<gpx>
<wpt lat="41.961236000" lon="-87.747535000">
<ele>182.8</ele>
<time>2014-09-26T12:59:15Z</time>
</wpt>
.
.
.
</gpx>
```

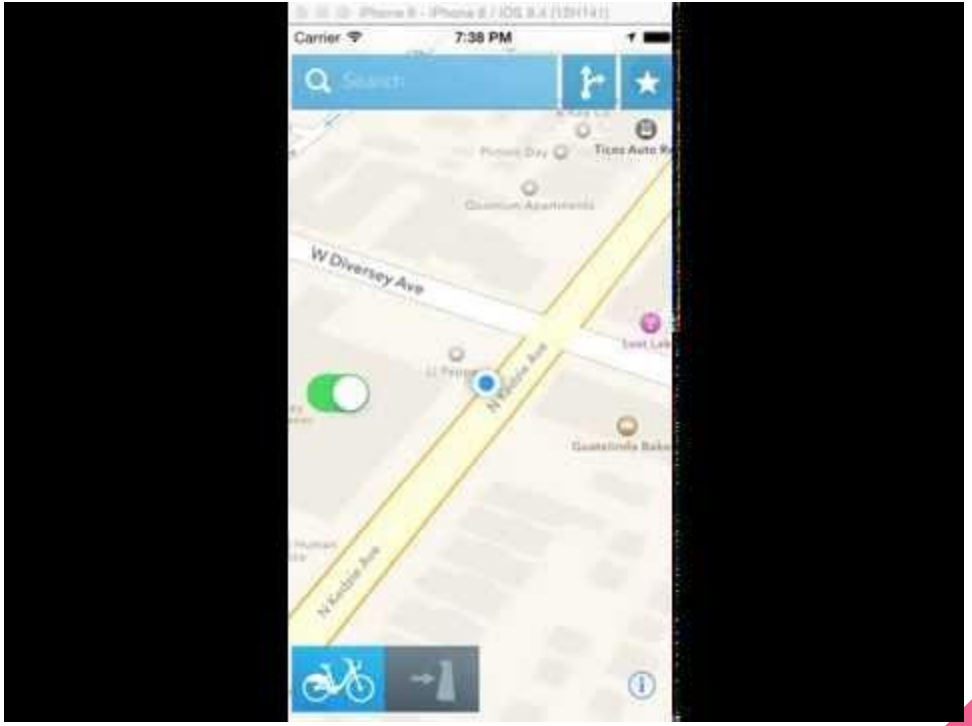
```
<gpx>
<wpt lat="41.968236000" lon="-87.742535000"><ele>182.8</ele>
<time>2014-09-26T12:59:15Z</time></wpt>
<wpt lat="41.968369000" lon="-87.742150000"><ele>182.9</ele>
<time>2014-09-26T12:59:16Z</time></wpt>
<wpt lat="41.968494000" lon="-87.742259000"><ele>182.9</ele>
<time>2014-09-26T12:59:17Z</time></wpt>
<wpt lat="41.968573000" lon="-87.742325000"><ele>182.9</ele>
<time>2014-09-26T12:59:24Z</time></wpt>
<wpt lat="41.968668000" lon="-87.742344000"><ele>182.9</ele>
<time>2014-09-26T12:59:33Z</time></wpt>
<wpt lat="41.968759000" lon="-87.742372000"><ele>182.9</ele>
<time>2014-09-26T12:59:41Z</time></wpt>
</gpx>
```

Record in Runkeeper and export data

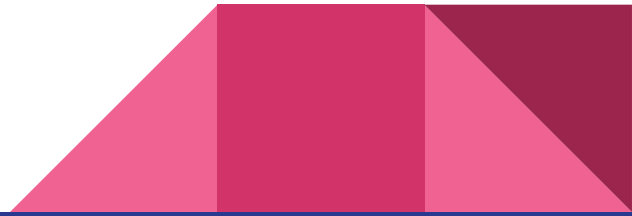



80 <wpt lat="41.938038000" lon="-87.7
81 <wpt lat="41.938042000" lon="-87.7
82 <wpt lat="41.938012000" lon="-87.7
83 <wpt lat="41.938984000" lon="-87.7
84 <wpt lat="41.938058000" lon="-87.7
85 <wpt lat="41.938058000" lon="-87.7
86 </gpx>
87
Auto


77 <wpt lat="41.938068000" lon="
78 <wpt lat="41.938070000" lon="
79 <wpt lat="41.938033000" lon="
80 <wpt lat="41.938038000" lon="
81 <wpt lat="41.938042000" lon="
82 <wpt lat="41.938012000" lon="
83 <wpt lat="41.938984000" lon="
84 <wpt lat="41.938058000" lon="
85 <wpt lat="41.938058000" lon="
86 </gpx>
87
Auto
Don't Simulate Location
New York City Marathon
LoganSquareWalk
Chicago
London, England
Johannesburg, South Africa
Moscow, Russia
Mumbai, India
Tokyo, Japan
Sydney, Australia
Hong Kong, China
Honolulu, HI, USA
San Francisco, CA, USA
Mexico City, Mexico
New York, NY, USA
Rio de Janeiro, Brazil
Add GPX File to Project...


Carrier
7:38 PM
Search
W Diversey Ave
N Kedzie Ave

6. MKMapCamera.heading != CLLocation.heading, necessarily.



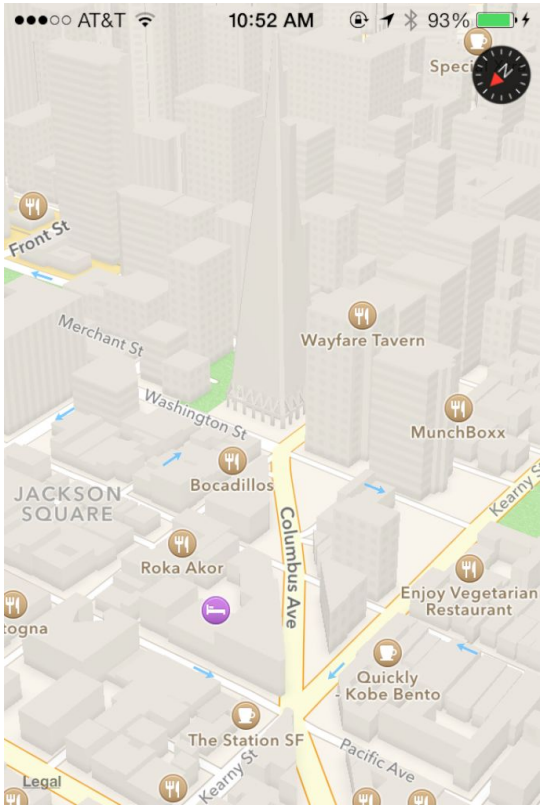
MKMapCamera

```
@property (nonatomic) CLLocationDirection heading;
```

The value 0 means that the top edge of the map view corresponds to true north. The value 90 means the top of the map is pointing due east. The value 180 means the top of the map points due south, and so on.

Documentation

MKMapCamera heading

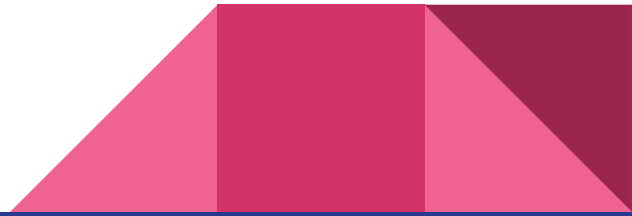


CLLocation

Property	Uses	Represents	Use case
heading	magnometer	Direction the device is pointing--the actual orientation of the device relative to true north/magnetic north	Walking speeds
course	GPS hardware	Direction of travel	Driving speeds

Documentation

7. Extrapolate heading info when there is none.



CLLocation:

```
<+41.87851095,-87.62944450> +/- 10.00m (speed 1.93 mps / course 22.15)
```

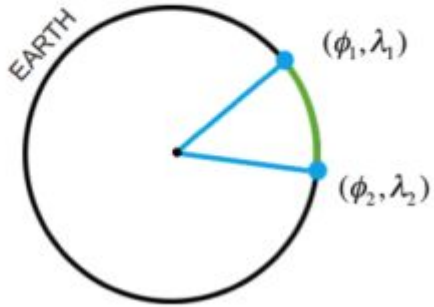
.gpx file:

```
<wpt lat="41.968236000" lon="-87.742535000">
<ele>182.8</ele><time>2014-09-26T12:59:15Z</time></wpt>
```

Haversine formula

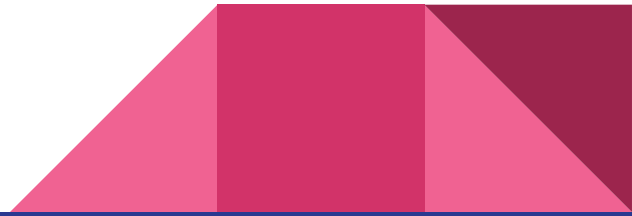
Used to calculate great-circle distances and initial bearing between two points on a sphere from their latitudes and longitudes (Wikipedia).

$$\text{haversine}\left(\frac{d}{r}\right) = \text{haversine}(\phi_2 - \phi_1) + \cos(\phi_1)\cos(\phi_2)\text{haversine}(\lambda_2 - \lambda_1)$$

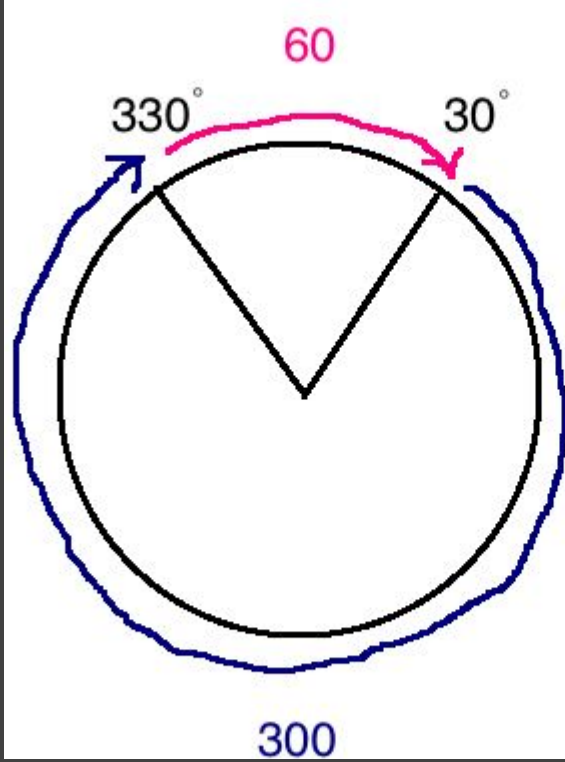


Code Sample

8. Smooth out big differences in estimated headings.



```
double sum = 0;
double lastHeading = 0;
int count = 0;

for (NSNumber *heading in array) {
    double headingDifference =
    fmin((360 - heading.doubleValue - lastHeading),
    fabs(lastHeading - heading.doubleValue));
    if (headingDifference > 20) {
     continue;
     }
     sum += heading.doubleValue;
     count++;
     lastHeading = heading.doubleValue;
     }
     double normalizedHeading = sum/count;
```



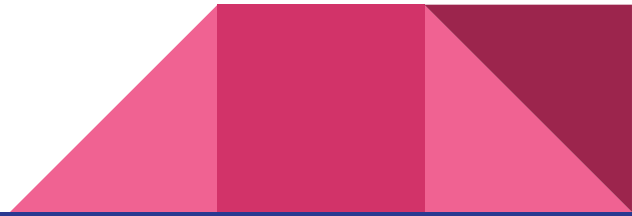
Map coordinate

screen coordinate APIs

9. Check if a map annotation has gone offscreen.

```
- (void)removeOffscreenAnnotations
{
    for (REHMapAnnotation *annotation in self.mapAnnotations) {
        CGPoint annotationScreenPoint = [self.mapView
convertCoordinate:annotation.coordinate toPointToView:self.mapView];

        if (!CGRectContainsPoint(self.mapView.bounds,
annotationScreenPoint)) {
            [self.mapView removeAnnotation:annotation];
        }
    }
}
```

10. Convert an MKPolygon to a CGPath to do point-in-polygon operations.



Washington Park
Hyde Park
University of Chicago
Midway Plaisance
Jackson Park Lagoon
Jackson Park
Jackson Park Golf Course
Oakwoods Cemetery
Brookdale
Parkside
Poverty Row
Brookline
Essex
South Shore
Grand Crossing
Cornell
E 53RD ST
E 55TH ST
E 57TH ST
E 61ST ST
E 67TH ST
E 69TH ST
E 71ST ST
E 72ND ST
E 73RD ST
E 74TH ST
E 75TH ST
E 76TH ST
E 77TH ST
E 78TH ST
E 79TH ST
S LAKE SHORE DR
S CORNELL AVE
S COTTAGE GROVE AVE
PAYNE DR
Lakefront Trail
Mapbox

```
    MKMapPoint *polygonPoints = polygon.points;

    CGMutablePathRef path = CGPathCreateMutable();

    //Loop thru polygon points creating a path:
    CGPathAddLineToPoint(path, NULL, polygonPoint.x,
polygonPoint.y);

    CGPoint screenPointToCheck = [self.mapView
convertCoordinate:coordinate toPointToView:self.mapView];

     BOOL containsPoint = CGPathContainsPoint(path, NULL,
screenPointToCheck, FALSE);
```

Code Sample

Happy mapping!

github.com/rachelhyman/nsscotland

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