

Geo-location Authentication Revised Project Report

Fan Zhang, Zhiqi Chen

12/12/2012

Revisions for suggested improvements from reviewers

Group 8 provide three valuable suggestions. Two of the suggestions can be integrated into our project. The third suggestion is also very good idea for authentication. However, it is not relevant with Geo-location, so it cannot be adopted into our project.

The first suggestion group 8 provided is to use IP lookup to double check the person's identity. Some people may feed fake location coordinate to the Geo-location authentication application. If there is no other way to double check the person's identity, the person will be forward to the normal user authentication process, which will need username and password. In order to build a robust program, this situation should be fully considerate. In fact, depending on the security requirement of the website, how strictly the authentication process may vary differently. Geo-location authentication could be used for the website requires more strictly security requirements. Add IP lookup function will help enhance the security for the Geo-location authentication. MAC address lookup could also be integrated into Geo-location authentication process if the security requirements are very high.

The second suggestion group 8 provided is change Geo-location authentication from authenticated buildings to circle areas. Due to the inaccurate of geo-location, it is very difficult to provide a reliable way to apply geo-location authentication. Since this service cannot be done reliably, it may looks meaning less to do this project. The solution for right now is to let user to set their favorite authenticate zones. For example, a bank's website may allow user to set several location as their preferred authenticated areas, like home, work office. When user set their authenticated areas, they just need to set a point on map, and then specify the radius of the area. User can only access their online bank account within their preferred authenticated areas. Since users can set the radius by themselves, it may reduce the side effect caused by inaccuracy of geo-location.

The last suggestion group 8 provided is making another authentication scheme, which not to use geo-location. Instead of using the client's current location, we could have the user select a location in the world and use that as part of their key. The user would have to pick that location when entering a password. This is similar to the new picture passwords, where users pick a few locations on a picture as their password, but are much harder to build a dictionary for to attack the password than normal text only passwords. This idea is very attractive, however, it is not related to the geo-location, so we will not adopt this idea in our project.

Project Introduction

Geo-location authentication is one implementation of geo-code Internet. It limited

the website access permission based on the geo-location. Geo-location has the ability to determine where is the user's physical location. We want to combine geo-location as a part of authentication scheme. That is to combine user's physical location with password and username. The objective for our project is to reduce Internet frauds and hacker attacks, so that increase Internet security. At the same time, this project will help user to control the administrative privileges much easily than before. For example, the website administrators specify the people who are in UMN campus can browse the UMN website.

Geo-location authentication will improve the security. This technique can be implemented in some top classified organizations that require the user's location in order to reduce hacker's attacks. For example, a company website usually includes lots of business documents, trading record and trade secrets. Maybe this information could attract the hackers to attack in order to get some business information. If the company use geo-location authentication, only people in the company have the permission to browse the company's website, it will reduce the attack risk. The company's business documents and secrets will be much more safe.

Using geo-location authentication will be much more convenience. It can share the resource with people in the same geo-location much easily. For example, UMN libraries has lots of ebooks, geo-location authentication can set the people in UMN campus automatically have the permission to use these ebooks. There is another example, as we know every year, UMN will spend lot of money to buy the IEEE account. If we can set the geo-location as the UMN campus, and the people in this location can use the UMN account to browse the IEEE website, it will be much more convenient for professors and students.

Codified Information

To implement our project, it involves several techniques. First of all, HTML 5 Geolocation is used to locate a user's position. We want to restrict our area to University of Minnesota, Twin city campus. Shapefiles for twin city campus buildings are converted into KML file in order to display in Google Maps as KmlLayer. To improve user's experience, jQuery is used to get the coordinates of certain area or building which is selected by website administrator. Then when users try to access the website, the website will get user's current location and determine whether it is inside of the area which is selected by website administrator. To simplify our code, we want to implement function built in Google Map API. The codified documents are listed below:

W3C Geolocation API: <http://dev.w3.org/geo/api/spec-source.html>

Shapefile introduction: <http://en.wikipedia.org/wiki/Shapefile>

KML tutorial: https://developers.google.com/kml/documentation/kml_tut

KML reference: <https://developers.google.com/kml/documentation/kmlreference>

KmlLayer example:

<https://google-developers.appspot.com/maps/documentation/javascript/examples/layer-kml>

jQuery API: <http://api.jquery.com/>

Geometry library documentation:

<https://developers.google.com/maps/documentation/javascript/reference#poly>

Project Milestone

- Implement Geolocation with HTML5 to locate user's location, shown in figure 1.
- Convert shapefile into KML and display in Google Maps, shown in figure 2.
- Extract each building's coordinates and displayed as polygon on Google Maps, shown in figure 3.
- Implement function to determine whether a coordinate is inside an area or not
- Develop the demo website which fetch the @UMNCSE twitter feeds, shown in figure 4.
- Project validation



Figure 1. Geolocation in HTML5 to get user's current location

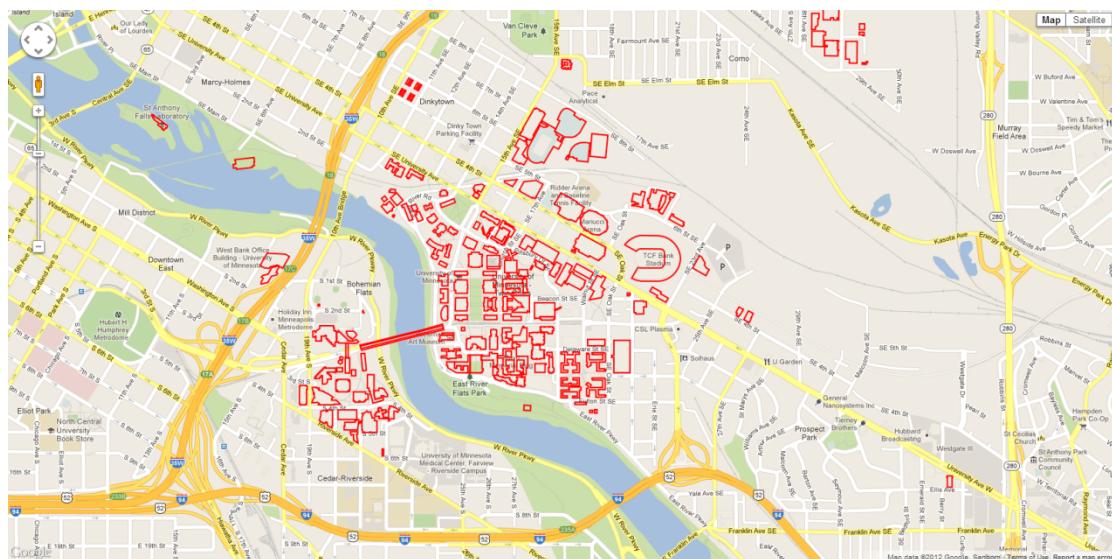


Figure 2. KmlLayer on Google Maps

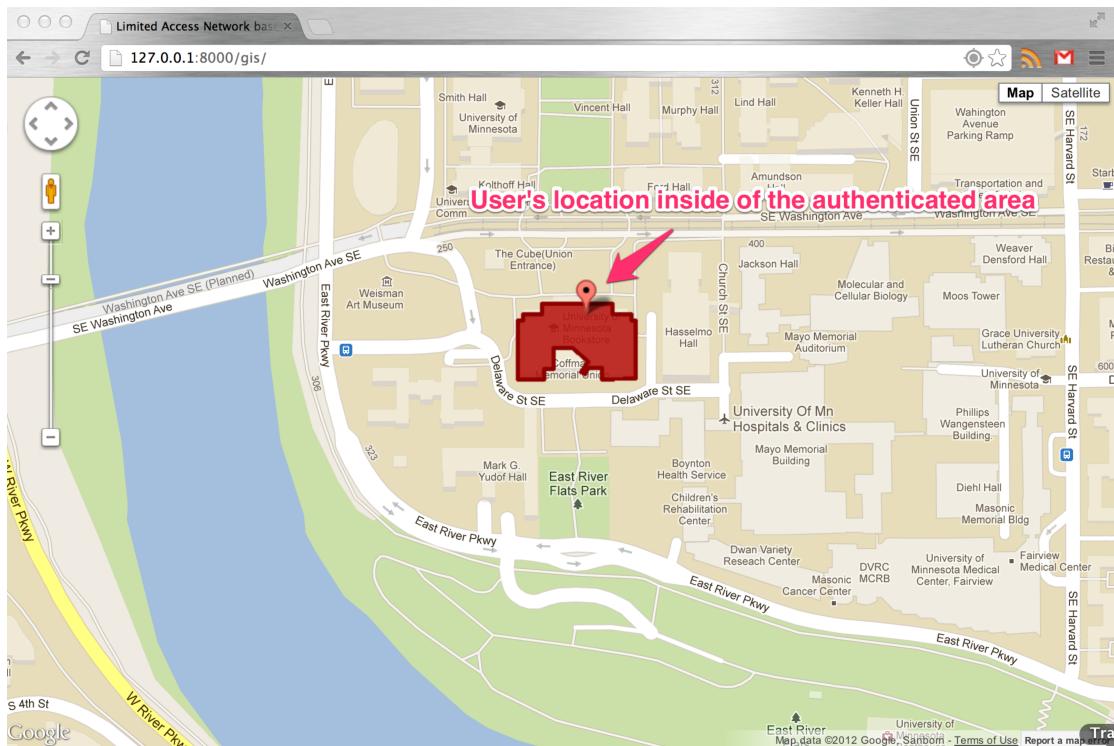


Figure 3. Coffman Union on the Google Maps

#UMN campus is beautiful all dressed in white after the snow! See it live on our CSE webcam. http://t.co/Reg1MMXK http://t.co/CiD6upEq	Don't miss 100,000 dazzling lights at the #UMN CSE Winter Light Show TONIGHT, 5:30, 6:30, 7:30 pm, Civil Eng Plaza. http://t.co/xSp6FPW6	Even without snow, the University of Minnesota's Walter Library is beautiful at night! #UMN http://t.co/YTE1HOrj	#UMN College of Science & Engineering welcomes Avago Technologies for a career info session with students today. @Avagotech
#UMN "Seeing Symmetry" math art exhibit opening and artist lecture is Thurs. 12/6, 4:40 p.m. Walter Library. @umllib	#UMN astronomers part of international team seeking help from the public to identify star clusters in Andromeda Galaxy. @diagtodays	#UMN College of Science & Engineering welcomes Beckman Coulter for career info session with students TODAY. @diagtodays	Congrats to #UMN civil engineering student Tucker Burch, runner up in the Dow sustainability innovation competition. http://t.co/SySUoRa5
#UMN civil engineering prof Julian Marshall is part of research team to study low-carbon, sustainable cities. @UofMAmplatz	Just 4 days until the #UMN Winter Light Show Premiere on 12/7, 5:30 p.m., Civil Engineering Bldg. @UofMAmplatz	#UMN alumnus and inventor of the Post-it Note Art Fry (ChemE '55) spoke to CSE students today about how to turn ideas into innovations.	#UMN receives \$1.8M grant for membrane research that could cut US energy consumption by as much as 3%. @ENERGY @ARPAE

Figure 4. Demo website fetch @UMNCSE twitter feeds

Novel Information

For use the KmlLayer in Google Maps, the KML file must be located on a server which can be reached by Google. If the KML is on the local host machine, the

KmlLayer will not show up since Google could not read the file. A trick here is we can put the KML file in the dropbox's public folder during the coding process. By doing this, we can still develop our website on local machine, no need to synchronize to the server side.

Challenges

Our objective is the website master can specify a certain area, which allows users in this certain area can get access to the website, while users outside of the area will not be able to access the website. For right now, we have the shapefile for University of Minnesota Twin city area. This shapefile contains both buildings in Como area, East Bank, West Bank, and St. Paul area. In order to display this shapefile into Google Maps, the shapefile need to change its format to KML file. KML file format is supported by Google Maps and Google Earth. We have already converted the shapefile into KML file successfully. However, all the buildings in Twin city campus are shown in Google Maps since all the data are stored in a single KML file. In order to fulfill our project's objective, we need to manipulate KML via Google Maps API. There are three challenges: 1. Retrieve coordinates from KML file. 2. Determine if a coordinates are inside a KML region. 3. The accuracy of geolocation.

1. Retrieve coordinates from KML file.

In order to create a user-centered UI, we want to build functions to highlight the buildings user selected. However, it seems there is no way to access the Javascript objects Google Maps creates when we add a KmlLayer. Because Google Maps renders layer overlayed tiles that get rendered on the server side.

2. Determine if a coordinates are inside a KML region.

After reviewing the Google Maps API about KmlLayer, it found out that there is no functions like containsLocation(point: LatLng, polygon: Polygon) on KmlLayer.

3. The accuracy of geolocation

The W3C Geolocation API is intentionally agnostic to the method the browser uses to locate the device. A browser on a mobile device or a laptop will likely give an accurate result. A device connected via Ethernet will only give a result as accurate as the IP address can reveal.

Solution Strategies

1. Retrieve coordinates from KML file.

There are some possible ways to overcome the limitation.

- Create multiple KML files, one for each set of placemarks. Once user choose a certain area or building, it is easy to show the corresponding KmlLayer.
- Use jQuery to extract the coordinates of the user specified area or building.

We can store the coordinates and placenames in a local array and render the shape as polygon.

2. Determine if a coordinates are inside a KML region.

Since we need to extract the coordinates for the area or building, we can create a polygon use the Geometry library of Google Maps API and use function containsLocation() to compute whether the given coordinates lies inside the specified polygon.

3. The accuracy of geolocation

Although we can set enableHighAccuracy attribute as true, it still hard to satisfy the performance in some case, such as if a user stands close to the boundary of an area or a building.

Reference

- Localizing the Internet: Implications of and Challenges in Geo-locating Everything Digital, Michael R. Evans, Chintan Patel
- Geolocation API Specification, <http://dev.w3.org/geo/api/spec-source.html>
- Google Maps API, <https://developers.google.com/maps/documentation/javascript/reference>
- jQuery API: <http://api.jquery.com/>
- KML reference: <https://developers.google.com/kml/documentation/kmlreference>