System and method that allows for cost effective location detection accuracy that exceeds current FCC standards.

Accurate Location Detection

911 Help SMS App

White Paper

Cost Effective Location Detection Techniques Used by the 911 Help SMS App

to Overcome Smartphone Flaws and GPS Discrepancies

Minh Tran, DMD

Box 1089

Springfield, VA 22151

Phone: (267) 250-0594

Email: MinhTran@Fix311.com

Introduction

As of April 2015, approximately 64% of Americans own smartphones. Although there has been progress with E911 and NG911, locating cell phone callers remains a major obstacle for 911 dispatchers. This white papers gives an overview of techniques used by the 911 Help SMS App to more accurately locate victims indoors and outdoors when using smartphones.

Background

Location information is not only transmitted to the call center for the purpose of sending emergency services to the scene of the incident, it is used by the wireless network operator to determine to which PSAP to route the call. With regards to E911 Phase 2, wireless network operators must provide the latitude and longitude of callers within 300 meters, within six minutes of a request by a PSAP. To locate a mobile telephone geographically, there are two general approaches. One is to use some form of radiolocation from the cellular network; the other is to use a Global Positioning System receiver built into the phone itself.

Radiolocation in cell phones use base stations. Most often this is done through triangulation between radio towers.

Problem

GPS accuracy varies and could incorrectly place the victim's location at their neighbor's home. When outdoors, GPS accuracy can be affected by available satellites, atmospheric effects, sky blockage, WAAS corrections, and receiver quality. GPS signals can also be affected by multipath issues, where the radio signals reflect off surrounding terrain; buildings, canyon walls, hard ground, etc. These delayed signals can cause measurement errors that are different for each type of GPS signal due to its dependency on the wavelength. When indoors, GPS satellite signals can be easily blocked inside of buildings and homes.

Using cell towers to detect location is not as accurate as GPS. Locating a mobile phone based on a single cell tower can place the mobile phone in a broad area, but it cannot pinpoint it. As the phone connects to more towers, the accuracy improves. By using cell tower triangulation (3 towers), it is possible to determine a phone location to within an area of about ¾ square mile. In densely populated urban areas, the cell towers are close together, and a much closer estimation of phone location can be made than in a rural area, where the towers are far apart. If the nearest cell tower is busy, the cell signal would be picked up by the next nearest tower which could decrease location accuracy to beyond ¾ square mile or 30 meters of that cell tower. Sometimes, the diverted signal may go to a cell tower that is out of the PSAP's jurisdiction.

Wi-Fi-based positioning system (WPS) or WiPS/WFPS is used where GPS is inadequate due to various causes including multipath and signal blockage indoors. Wi-Fi positioning takes advantage of the rapid growth of wireless access points in urban areas.   The Wi-Fi hotspot database gets filled by correlating mobile device GPS location data with Wi-Fi hotspot MAC addresses. The possible signal fluctuations that may occur between the phone and the access point can increase errors and inaccuracies in the path of the user. Additionally, in a power outage scenario, W-Fi detection may not be possible.

Phone settings can be a barrier for location detection. Due to privacy concerns, a user may unknowingly disable certain settings that are needed by the phone to allow for location detection. When the settings are off, the phone may not be able to detect its location.

Solution

The 911 Help SMS App employs five methods to improve the discrepancies of location detection provided by the smartphone.

The first method auto enables certain settings that may have been unknowingly turned off by the user. If the mobile App is not able to enable the settings due to the smartphone's operating system restrictions, then the App will inform the user to enable the specific settings that will allow the phone to have the best chance for location detection.

The second method involves asking the user if they are Home or Not Home (Image 1). By informing the App that the user is Home, the App will know that the user is indoors and will bypass GPS location detection to avoid location detection errors and save time overall. When Not Home, the app will attempt a GPS location detection of the user.

Home vs Not Home

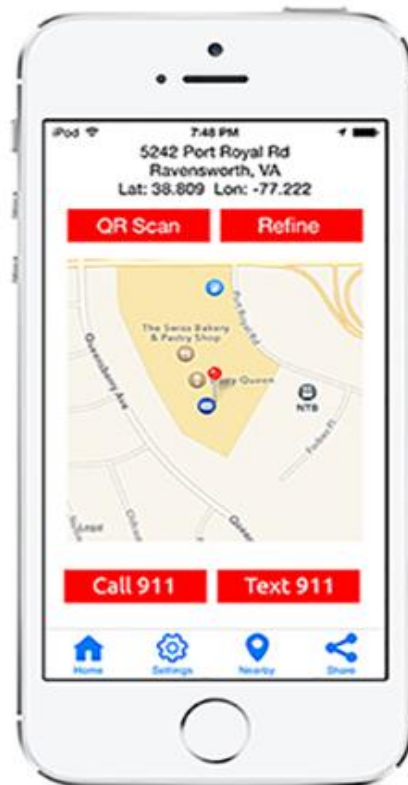Image 1   Image 2

The third method shows the user a map with a pin placed over their current location (Image 2). The App will also display the physical address, current altitude (iPhone 6), and GPS coordinates of the current location. If the situation is not life threatening (ie bystander), the user can view the map to double confirm the location detected by the phone. If the location is incorrect, the user can manually refine the location on the map before contacting 911. This is helpful when indoors or when GPS is not accurate outdoors.

The fourth method involves scanning a QR code geotag (Image 3). The QR code geotag can hold information that includes the room number, floor level, building extension (east wing, west wing), building name, building address, entrance instructions, latitude and longitude coordinates. By utilizing a geotag, the user can pass on their location information to 911 (via Text 911). Geotags can be placed in the mall, large office buildings, classrooms, apartment complexes, and even outdoor areas where the GPS signal is non-existent.

Geotags can be created at the following website link:

https://www.911helpsms.com/qr/

Geotag Scanning

Image 3

The fifth method involves the 911 Help SMS.com website which will display all attempts by the user to contact 911 (Image 4). The 911 Help SMS system will display a map of the user's current location as well as their home location. The purpose of the map is to compare the user's home location against their current location. When the user is Not Home and not using a geotag, the dispatcher would know that the location provided by the phone may not be 100% accurate.

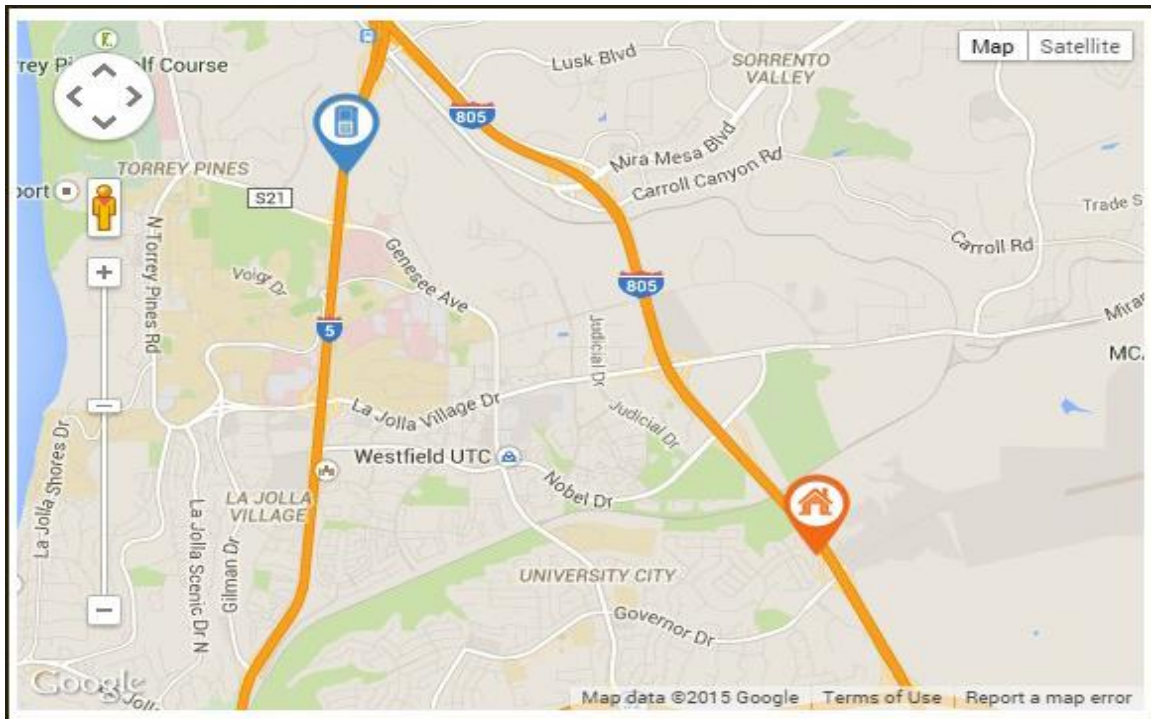Comparing Current vs Home Location

Image 4

When Shannell Anderson's SUV slid into a pond, she stayed remarkably calm. Until, after dialing 911 and reciting her location six times, her car submerged completely underwater as the operator warned- they couldn't help her.   When Shannell dialed 911, her phone signal connected to the cell tower in Cherokee county, despite her physical location in Fulton County. Carl Hall, George Chief of Public safety explained to 11 Alive, "it's the physical address of the cell tower.. not the telephone.. which determines which 9-1-1 center that call goes to." Dispatchers only realized Shanell's actual location when they stopped using 911's system and tried Google maps.

By using the 911HelpSMS.com website, the dispatcher can locate the user based on the phone location and not the cell tower location.

Additional Features

When Texting 911, the App will auto type the location information so that the user does not waste time typing during an emergency and to prevent user mistyping of information.

In 2014, 911 experienced four multi-state blackouts. When a 911 call or text 911 is triggered on the App, the 911 Help SMS server will simultaneously email and cell text chosen family members to inform the family members that the user is in distress. Should another blackout occur, at least selected family members are informed of the emergency. At all times, when 911 dispatchers make use of the 911HelpSMS.com website, they can view the list of family contacts submitted by the user.

Future

In the near future, we will develop other ways to detect indoor location without relying on geotag scanning. We strive to improve location detection by working directly with Apple, Google, and Microsoft to build a more efficient 911 App than what is available today. We have an interest in being able to send user medical history, allergies, medications, current doctors, and other medical information to 911 dispatchers. We are investigating the ability to deliver floor plans of buildings to the dispatchers.

For the past 5 years, we have been developing a nationwide 311 system capable of taking in photos and citizen comments in real time. This 311 system could be converted for 911 purposes to help reduce 911 infrastructure costs. The system could be rapidly deployed nationwide with minimal set up time for each jurisdiction. The system would allow PSAPs to share data and allow for cross country 911 reporting. The 311 system has been real world tested and is ready for 911 purposes today.

Fix 311 Website:

https://www.fix311.com/

Conclusion

In conclusion, the 911 Help SMS App has the ability to use different methods to establish location detection by auto adjusting device settings, using home default mode, viewing user history of movements with a map, allowing user to refine the location, and employing QR code geotags to allow for location detection accuracy that exceeds current FCC standards.