Where in the world ...? Geolocation for beginners

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"Geolocation" is a broad term used to describe the use of technology such as global positioning systems, mobile/cell phone signal tracing and computer internet protocol analysis. It makes it possible for items like computers, cameras, mobile phones and cars to record and broadcast their locations in space and therefore the locations of the people who are using, carrying or driving them. This article describes some types of geolocation and how they are currently being put to use, from games to serious commercial applications.

GPS, MOBILE PHONE AND IP GEOLOCATION

The worldwide satellite-based GPS (global positioning system) was developed for military purposes by the US Department of Defence between 1973 and 1994. It was released for public use by the Reagan administration after the former Soviet Union shot down a South Korean airliner that had strayed off course. In the original release, the location signal was intentionally degraded to prevent its use for military purposes, but this limitation was removed by the Clinton administration in 2000. Following later improvements, standard GPSs now typically function with an accuracy of five metres or less,[1] though this can vary with access to satellites and ionospheric conditions. Combining GPS with specialised proprietary systems such as WAAS (Wide Area Augmentation System) can improve its accuracy even further.[2]

As mobile phone system use spreads across the globe, it becomes possible to use the monitoring signals transmitted to and from phone transmission masts to determine the geographic location of a phone. The accuracy of phone geolocation varies with the density of masts in the area, but in the US it has been shown to give positions within a kilometre of the actual location.[3] This is not adequate for detailed mapping or tracking, but some major companies including Google are continuing with research in this area.[4] Many iPhones and other "smart" mobile phones now come with access to GPS, or some other geolocation system, and established smartphone apps like Twitter are now being modified to include geolocation data from their users.

IP (internet protocol) geolocation relies on the practice of assigning temporary or permanent IP numbers to computers that connect to the internet. These numbers are assigned on a country-by-country basis, and sometimes allocated within a country to geographical regions. To determine the location of a URL host on the web, for instance, it is necessary to convert the URL to its corresponding IP number (this can be done through sites like Self SEO)[5] and then look up the location of the IP address on a site such as IP Geolocator.[6]

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All webpages cited were viewed 31 January 2012.

[1] Earth Measurement Consulting, "GPS Accuracy and Limitations", http://www.earthmeasurement.com/GPS_accuracy.html.

[2] Wikipedia, "Wide Area Augmentation System", http://www.en.wikipedia.org/wiki/Wide_Area_Augmentation_System.

[3] IPligence, "IP Geolocator", http://www.ipligence.com/geolocation.

[4] Bronzi R, "Geolocation & Google Mobile Project", *Bruce Clay Inc Blog* (12 October 2010), http://www.bruceclay.com/blog/2010/10/geo-location-google-mobile-project.

[5] Self SEO, http://www.selfseo.com/find_ip_address_of_a_website.php.

[6] IP Geolocator, http://www.ipligence.com/geolocation.

The results of IP geolocation are very variable. My own computer, in Blaxland, NSW, was allocated to Sydney by one service, and to Canberra by another. One URL I tried could not be allocated even at the country level, while another was assigned to a specific town in Texas. The process is further confounded by the fact that organisations based in, say, Melbourne may still choose for various reasons to have their sites hosted in Sydney, Bangladesh or the UK. Its low accuracy currently makes IP geolocation a crude tool. At the moment, its main use is by repressive governments attempting to block local access to external websites, and by locally-based businesses that are unable or unwilling to deal with overseas customers. Amazon, for instance, uses IP geolocation to block Australians from access to those of its books that are subject to zonal regulations. It can also be used to customise the user experience of a particular website; Google, for instance, changes its homepage depending on the national IP number of the computer logging in.

GPS USE IN VEHICLES AND CAMERAS

The single most prominent use of geolocation today is in the navigation of cars and other vehicles, where a GPS-equipped device maps the vehicle's position onto a chart or street directory. Modern GPS devices also have powerful ancillary features that can determine latitude and longitude as well as altitude, speed, and direction. Users can be warned when approaching known speed cameras or radar locations, and notified when they are speeding. At present, most vehicular GPS devices are receivers only, but with the incorporation of cellular technology they will become capable of receiving and responding to local communications so that details of, say, traffic jams or roadworks could be broadcast by authorities and incorporated into GPS navigation options. Ultimately, GPS devices may be able to "read" the positions of other vehicles in their immediate neighbourhood, which gives them a major role in the development of autonomous vehicles – eg self-driving cars. Military devices, especially the pilotless "drones" increasingly used by the US, also make use of GPS technology.

The combination of GPS and/or cell phone technology and digital photography now allows digital snapshots to be "geotagged" with a location.[7] This can then be used to link them to online charting systems like Google Earth. Many mobile phones now include cameras and GPSs, and any photos they take may be automatically geotagged with the latitude and longitude at which they were taken – sometimes without the user realising it!

RECREATIONAL GPS

Recreational use of geolocation is becoming common with the arrival of hand-held GPS devices and improvements in the size and lifespan of their batteries. Most serious bushwalkers now carry some form of GPS-equipped device, even if this is only a distress beacon for emergency use.[8] These beacons assist with the rescue of an estimated 1,500 people worldwide every year, and are now available for free loan from NSW police stations and the National Parks and Wildlife Service. A distress beacon was instrumental in the rescue of a man and two boys whose boat sank off Sydney's North Head in January 2012.[9]

In addition to aiding with navigation on walks, GPS is used in several specialised sports. The most popular of these is geocaching, where a container is placed in some unfrequented location and its coordinates are published on the web. People using GPS to find the container can take the contents and replace them with their own, leave a message, and post their success on the web. The "official" global geocaching site[10] records over 1.6 million cached items worldwide, and a total of five million seekers. The Australian branch also has an active website.[11]

[7] Wikipedia, "Geotagging", http://www.en.wikipedia.org/wiki/Geotagging.

[8] Wikipedia, "Distress Radiobeacon", http://www.en.wikipedia.org/wiki/Distress_radiobeacon.

[9] AAP, "GPS Beacon Helped Sea Rescuers: Police", *The Sydney Morning Herald* (5 January 2012), http://www.news.smh.com.au/breaking-news-national/gps-beacon-helped-sea-rescuers-police-20120105-1plzb.html.

[10] Geocaching, http://www.geocaching.com.

[11] Geocaching Australia, http://www.geocaching.com.au.

Geocaching is a solitary sport, but other geolocation-related games involve collaboration and/or competition with others. Active sports include Tourality, a version of orienteering where the aim is to reach a given location before others. For the less athletically inclined there are GPS-based apps for the iPhone and other "smart" mobile devices that use the user's actual location as a setting for simulated activities like gang warfare or espionage, linking the player up with other locals using the same app.[12]

COMMERCIAL AND GOVERNMENT USE

The commercial use of geolocation technology also ranges from the trivial to the vital. Many retail and service businesses, particularly in the US, now maintain sites on Foursquare[13] and Gowalla,[14] both mobile-phone-based social networking systems. Smartphone-equipped visitors to restaurants, cafes or sports venues are invited to "check in" and record their presence. In return, they are informed about other Foursquare users and current events nearby, and may earn "rewards" of various kinds as a result of their patronage.

At the other extreme, geolocation is coming to play an important role in primary industries like agriculture and mining. Sheep farmers, for instance, can scan ear tags with a GPS-equipped device to record the location of their stock while counting them and checking their health. Australian miners can now use a ground-based version of GPS to track their position in deep open cut mines,[15] where satellite coverage is not available. And employers now have the opportunity to keep tabs on any staff who are on business-related trips.[16]

Geolocation also plays a major role in security and jurisprudence. A story from 2011 in the *Standard-Examiner*[17] describes the increasing use of cell phone records to track the movements of suspects in US criminal cases. Some iPhones and iPads come with a tracking app which allows them to be located if lost or stolen – at least until the battery runs out.[18] Espionage agencies are known to have access to cell phone records. Various websites offer to sell users software that reveals the "secrets" of cell phone tracking. Illicit use of cell phone records by private investigators, including geolocation data, is reported to be on the rise. And when a US criminal is apprehended and convicted, he or she may be fitted with a GPS-equipped ankle monitor to keep tabs on his or her subsequent movements. An estimated 130,000 of these monitors were in use in the US in 2007, although their popularity may now be declining.[19]

Geolocation – both legitimate and illicit – is also finding its way into journalism. The BBC used a geolocation app to report on the London Tube strikes in November 2010.[20] Media outlets now routinely record and collate GPS data on the location of crimes,[21] or other events of interest.

PRIVACY ISSUES

Naturally, the same privacy issues apply to geographic data as to other personal information. There are legitimate reasons for someone to object to their movements being tracked. Discrete devices like mobile phones can be turned off, but this itself is a fact on record which may provoke inquiry or

[12] Bryant M, "5 Fun Geolocation Games to Try Today", *The Next Web Blog* (26 December 2010), http://www.thenextweb.com/location/2010/12/26/5-geolocation-games-to-try-today.

[13] Foursquare, https://www.foursquare.com.

[14] Gowalla, http://www.gowalla.com.

[15] Latimer C, "World First Mine Positioning", *Australian Mining*, http://www.miningaustralia.com.au/features/world-first-mine-positioning.

[16] ProMapMe, "Geolocation for Business Travelers", http://www.promapme.com/business-travelers.htm.

[17] Sampson PJ, "Using Cell Phones to Track Criminals' Movements is on Rise", *Standard-Examiner* (19 January 2011), http://www.standard.net/topics/cell-phones/2011/01/19/using-cell-phones-track-criminals-movements-rise.

[18] Grubb B, "iPlods in Pursuit of iPads: How Police Use GPS to Track Criminals", *The Sydney Morning Herald*, http://www.smh.com.au/technology/technology-news/iplods-in-pursuit-of-ipads-how-police-use-gps-to-track-criminals-20110526-1f4z3.html.

[19] Wikipedia, "Ankle Monitors", http://www.en.wikipedia.org/wiki/Ankle_monitor.

[20] London Tube Strike Map, http://www.tubestrike.crowdmap.com/main.

[21] "Police Log", *Central Michigan Life*, http://www.cm-life.com/police-log.

investigation. And "turning off" may not be an option for GPS devices embedded in cars or other vehicles. Like Winston Smith's television in *1984*, geolocation devices may provide a way for authorities of one kind or another to make sure their subordinates are where they should be all the time. There are drawbacks as well as benefits to knowing where in the world you are.