Google Earth

Applications for Ham Radio

Darryl Smith, VK2TDS
http://www.radio-active.net.au
vk2tds@tapr.org

Abstract

Applications for maps and mapping software have increased exponentially in the last few years. With the increased availability of wireless data links and cheap GPS receivers have come applications that could only be dreamed of a decade ago. To support this infrastructure, Google have released a digital terrain model of the earth with superimposed aerial photographs with an open interface for adding all sorts of information on top of this model. This paper looks at the Google Earth product and some applications to Ham Radio.

Introduction

Just before the 2002 DCC in Denver I was shown a demonstration of a network based application for viewing satellite and aerial photos of the world by a friend. You could type in an address and it could fly you to that location. To say that I was impressed was an understatement. To run this software you needed a fast internet connection and the latest nVidia graphics card. I was hooked on this software from Keyhole.

Since then a number of things have changed. Firstly GPU's (or Graphical Processing Units) are getting faster, with speed increases that break Moore's Law from 18 months to six months per doubling. My Dell laptop has a 128 M Byte nVidia GPU in it, and the OfficeEffects plugin for PowerPoint does not run well on it – since the laptop is 18 months old, despite the fact that this graphics card was the fastest one on the market for a laptop.

Then network infrastructure has increased in speed since 2002. Back then I had recently stopped paying US$0.10 per mByte downloaded over the Internet. Now internet access commonly is either unlimited or allows at least 10 GBytes/Month to be downloaded for US$30 at a minimum of 512 kBit/Sec

At the same time broadband infrastructure has become more prevalent in homes, as have cheap PC's with decent graphics and memory. And the commercial world has been searching for business applications for these graphics cards.

NASA released their Whirlwind software (http://worldwind.arc.nasa.gov) last year but this was a 180 MByte download increasing the pain of installation. The images were static with updates downloadable meaning maintenance was required to keep images up to date.

Last in 2004 Google purchased Keyhole and made some changes. Then in the middle of this year it released a new version and made it free for non-commercial use.

What makes Google Earth different is that in many times the resolution is much higher than in Whirlwind, and the Google solution is being constantly updated with new images.

Google Earth also contains the databases of roads and buildings making it into a more complete day to day mapping solution than Whirlwind which is more a cute 'Globe' toy.

Capabilities

Inside Google Earth, the authors have included a way to add meta-data to the application, using an XML variant called KML. The KML text files can both be included by other KML files and include other KML files, creating an entire hierarchy.

KML files also contain things such as waypoints, routes, links, comments, popup windows and anything else that you could imagine being useful in an application like Google Earth.

In the Google Earth application, 'My Places' is a persistent store of saved positions and routes, as well as links to included KML files.

External KML files can be added through a 'Network Link' capability where the file is loaded either through a filename or a URL as a once off load, or periodically. This functionality allows Google Earth to be used as a real time vehicle tracking system.

More information on KML can be found on http://earth.google.com

Applications

Google Earth lends itself to so many applications, and the imagination of the user and author of add-ins is the only limitation.

I will now describe two applications for Google Earth – a Vehicle Tracking system, and a RF Path visualization tool.

Vehicle Tracking

The use of Google Earth for Vehicle Tracking is an obvious application for the technology. Vehicle Tracking Systems have a number of common features which should be included in any interface. They include Current Vehicle Locations, Track History and following a vehicle with the best map.

Google Earth does not really scale to an unlimited number of vehicles. It will work, but the user interface does not work well. What happens when you open a KML files is that the next layer in the hierarchy is displayed. If you attempted to place the entire APRS Data Stream into a KML file it would be really big, and it would be unusable to drill down onto an area.

Thankfully there are two strategies that can be used here. Firstly the stations to be displayed can be broken down into hierarchies based on type (Mobile, Fixed, Wx), or callsign. In Australia you might place VK* at the top of a tree, followed by VK2*, and then VK2T*. This allows easy navigation but might not be the best way of you have a lot of vehicles.

The other way is to filter the data stream based on where you are looking at, and what the zoom level is. Generating KML files based on state, and then region within a state, and then city might help with information overload.

In this case you might choose when generating the KML file to not have positions displayed unless you specifically turn it on. In that way someone in Delaware will not be attempting to load the current positions of all the Californian hams, unless they actually want to do that.

In a commercial application, having the hierarchy broken down by company and then by business unit and branch might work too.

History

The User Interface to Google Earth for external applications gives us two options for displaying history.

The first is to generate a KML file on demand that includes a history trail. This can be generated through an application such as WinAPRS, XASTIR or OziAPRS [provided the interface is written], or generated via a Web Page such as FindU.

With a Web Page, you would enter the callsign of the vehicle and the date range, and it would generate a route on the map for you.

What I have done where the number of vehicles is more limited is automatically attach route history for the last 25 hours onto the KML file with the current positions. This might work with 10 vehicles, but will not work well with 1000.

In this case, as the day goes on, the track for the previous day disappears as if it was a huge snake.

Meta-Data

Positions are not the only data that can be displayed in the application. Caption data can be added to waypoints with a simple KML tag.

Clicking on a vehicle will actually bring up a HTML page that can be included in the KML file. This could include speed, heading and last heard data, but can include more. Since it is a HTML document, it can include a link to a Web Page.

You could then have a link on the vehicle so that clicking on it sends you to their Home Page, or a page to send a message to the unit.

The HTML page could also include details of the last 60 minutes of beacons sent by the vehicle.

Weather Stations

Weather Stations are just another class of vehicle. Graphics can be added in the

KML file for things such as the wind direction and speed.

Bringing up the details on a weather station could then provide a link to the FindU history page making things more useful.

Path Analysis

The digital terrain model in Google Earth provides a number of opportunities in the radio sphere to provide useful engineering analysis. The US$20 Google Earth Plus gives the ability to add paths using the graphical User Interface rather than needing to do it programmatically.

What makes this useful is that when you create a new path you can have the line either 'Clamped To Ground', 'Relative To Ground' or 'Absolute'. Clamping the line to ground means that the line between the two points will be drawn at ground level regardless of the terrain. This is the path that you would walk if you were to take the shortest route between the two points.

When a line is drawn relative to the ground it will go between the points at each end. This is the path that a light or a radio signal would travel if sent from one location to the other.

Once this line is drawn you can then do a fly through of the entire path, seeing what obstructions might be in the way.

With some work programming it would be possible to show the Fresnel zones for a microwave link, seeing where they intersect with the terrain.

Whist the digital terrain model is good, it is not perfect. There is often some mis-match between the photo and the terrain, both because of an offset error, and because granularity with the height data.

Thankfully though this tends to be insignificant, particularly when you turn on the 3D models of major cities in the USA.

Conclusion

What I have attempted to do in this article is give some ideas for people wanting to experiment with Google Earth, and introduce it as a tool to help with their enjoyment of the hobby.

I have not tried to go into too much detail – just enough to whet the appetite of the reader.