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mLSIS, a Mobile Land Surveyors Information System

Wouldn't it be convenient to be able to do research while in the field? Surveyors often need information from existing records while in the field. Existing records for things such as surveys, control points, land ownership, floodplain, and others are needed while in the field in order for a surveyor to help plan and execute a survey project. What things are available, where things are, how they fit together with other things on the ground, and other relevant bits of information regarding these things, such as who owns the property, what a property corner is made of, the elevation of a nearby benchmark, etc. are examples of the types of existing information that a surveyor may need while in the field. For example, to start a boundary survey for a property, the surveyor must find where the property is located, go to it, know what the dimensions are supposed to be, find the property corners if any exist, and find nearby corners. Therefore, all surveys begin with a bit of research into the existing records, making copies of those records, and interpreting those records to understand where the survey is located and oriented in the world as well as how things fit together.

Whether existing records are in paper or other hardcopy form or digital, taking

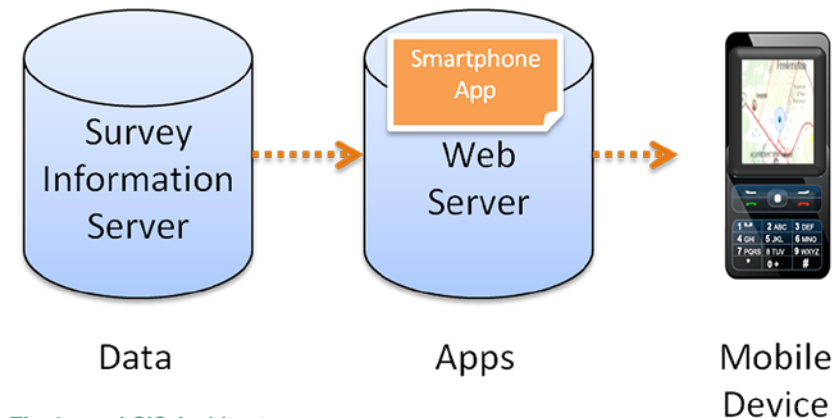


Fig 1 – mLSIS Architecture

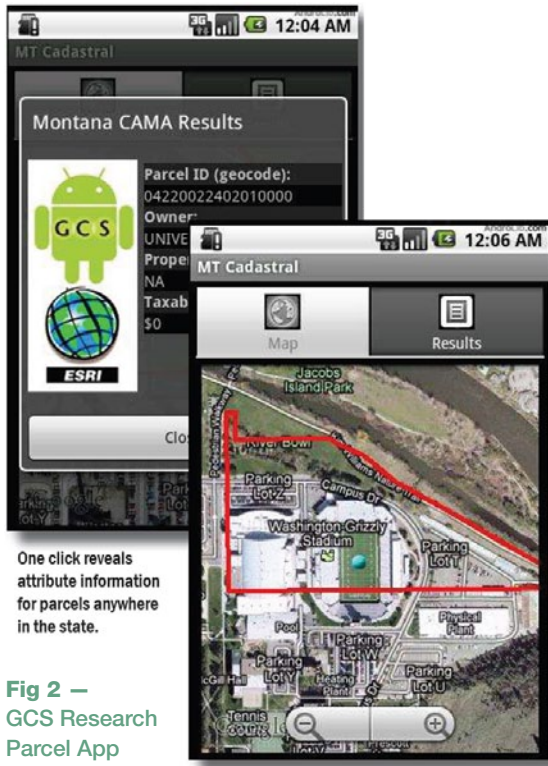
records into the field typically requires making a copy (either paper or digital) prior to leaving the office. Sometimes records are missed or forgotten or other information may become apparent while in the field which requires additional research. Wouldn't it be convenient to be able to do instantaneous research while in the field? With smartphone technology, teamed with web services and GIS, mobile access to information is now feasible and fairly simple to set up and implement. Smartphones can access the World Wide Web wherever phone service is available. Additionally, the location of the phone can be used to tailor information services appropriate for that location.

A Land Survey Information System is an information system of data of

interest to surveyors. Since most of what surveyors do is location based, it makes sense that surveyors need location-based services as part of their work. A mobile Land Survey Information System (mLSIS) is one that serves the data such that it can be consumed by mobile devices. The ingredients necessary to make this a reality are digital data, web services, applications that run on a smart phone and smartphone type of mobile devices (fig 1).

An mLSIS can provide the surveyor with access to existing spatial data without having to download or copy large data sets. With mLSIS a surveyor can have location-aware access to relevant documents, and to data that are displayed in geographic space in context with other spatial data. Imagine

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One click reveals attribute information for parcels anywhere in the state.

Fig 2 –
GCS Research Parcel App

Parcel polygon boundaries are streamed to the phone via ArcGIS Server Map Services.

Zimmer, continued from page 56 driving down the road with a mobile phone that tells you where you are, who owns the property to the left and to the right of you, how far away the nearest geodetic control point is, shows an aerial photograph of the area, and calculates the driving route to the property destination. All this is within easy reach today.

Geographic Information Systems facilitate storing, querying, and accessing all sorts of spatial information including those data that surveyors require to do their work. As governments build geographic databases and make those data available to the public through web services, some of the information that surveyors require is there for the taking, although only a little survey information such as control points and survey records are there yet.

Let's take a look at a couple of examples of mobile surveyor information systems applications that are in use today.

Mobile access to land ownership information.

GCS Research [of Missoula Montana] developed an application using an Android-enabled smartphone to create a

location-based application to access parcel information. The Parcel App (fig 2) allows smartphone users to access real estate information remotely. Using the built-in GPS, users can pinpoint their current location in the state and download parcel information. The app works in Montana and Vermont where there are state-wide cadastral databases, and San Diego and Denver where there are city-wide cadastral databases published as map services.

The Parcel Apps allow smartphone users to access real estate information remotely from anywhere in the world or while standing on a property in the respective jurisdiction. Users can rely on the phone's built-in GPS to pinpoint their current location in the state, or they can zoom into a mapping interface to select an area of interest by "double-tapping" the touch screen. Within seconds, the application retrieves location-specific property information for the selected site from two web-enabled databases.

The first is a parcel boundary file maintained in a cadastral database. This cadastral information is managed in an ArcSDE geodatabase and served over the web by ESRI's ArcGIS Server solution. The smartphone application traces the property boundaries in red on the phone's map display. Next, the application accesses the cadastral system where it retrieves property details such as owner name, parcel legal description, acreage, assessed value, and zoning code. The mobile mash-up leverages the Android mobile operation systems to deliver an easy-to-use, personal solution for anyone wanting to have the information at their fingertips (from <http://www.gcs-research.com>, 2012).

Mobile access to existing survey control point information

Service New Brunswick Control Point Finder Application

Service New Brunswick (SNB) is the provincial government services department for the province of New Brunswick Canada. SNB's GIS division maintains a database of High Precision Control Points (HPN) which it makes available to the public through an online map service. The map service is accessible via the SNB website.

To demonstrate how survey information could be accessed while in the field,

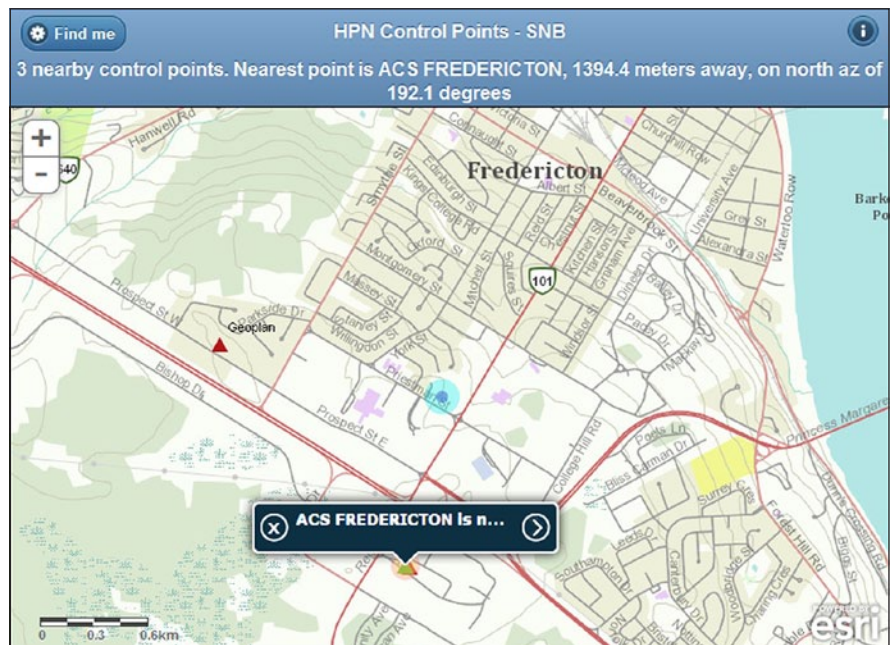


Fig 3 – Service New Brunswick Mobile Control Point Finder Application

| ACS FREDERICTON | |
|---------------------|------------------|
| Mon: | 28149 |
| Name: | ACS FREDERICTON |
| Owner: | SNB |
| Publication Date: | 7/14/2004 |
| Status: | LOC |
| Inspect Date: | 5/1/2008 |
| Latitude: | 45° 56' 00.5890" |
| Longitude: | 66° 39' 35.5649" |
| Ellipsoid Height: | 95.971 |
| Easting 83cs: | 2487601.199 |
| Northing 83cs: | 7437047.558 |
| Orthometric Height: | 118.423 |
| Level Height: | |
| Order: | |
| PT Scale Factor: | 0.999937 |
| Elevation Factor: | 0.999981 |

Fig 4 – Control point popup information

I created a mobile application using the SNB HPN map service. This mobile application will find the user's location, create a background map for location context, then display the SNB HPN points on the map. The application will also find the control point nearest the user and update that information as the user moves. Additional information about a particular point is presented in a popup when the user clicks on a point.

I built this app using data and services that are readily available: the Service New Brunswick High Precision Network control point map service, ESRI basemaps map service, ESRI javascript API, the HTML5 geolocation service, and javascript. The control point finder app (fig 3) is a combination of HTML code and javascript which connects to the services, bundles them into presentation form and provides some basic functionality such as compiling a list of control points within the map extents, formatting which information will appear in a popup (fig 4), programming the application to move the map as the user moves, and calculating the distance and direction to the nearest control point.

This code can be modified to support other control point map services such as the Multi-state Control Point Database of Idaho and Montana (<http://mcpd.mt.gov/MCPD>), as shown in figure 5. Others have created similar apps for accessing the National Geodetic Survey control points.

These examples demonstrate how surveyors can access existing information while in the field without having to copy data or datasets. The mLSIS dynamically selects subsets of the data that are appropriate to the location and data layers of interest to the surveyor.

The advantages of a mobile Land Surveyor Information System are:

- No need to go to the courthouse for research.
- No need to copy data.
- Research is done real-time.
- Research is done while in the field.
- Updates are automatic.
- Application knows your location and automatically pulls information pertinent to your location.
- Can help you navigate to features, making things easier to find.

With a bit more programming surveyors can also contribute information to online databases while in the field. For example, a surveyor could connect to an online database of corner records to search for corners or to create a new corner record while in the field, then post the new record to the online database.

The limiting factor is the availability of data that surveyors need. As long as the data are digitized they can be served to the public via the World Wide Web. If those data are spatially enabled by creating a graphic that is geo-referenced, then a map service can present the data in a spatial context. Thus, for example, an online database of corner records served through a map service could be used in to help surveyors find corners and their record information while in the field.

Mobile Land Survey Information Services can empower surveyors with quick access to information they need while in the field, while also providing spatial context to understand those data. This real-time information flow can go both ways allowing surveyors to be more efficient and more effective. *A*

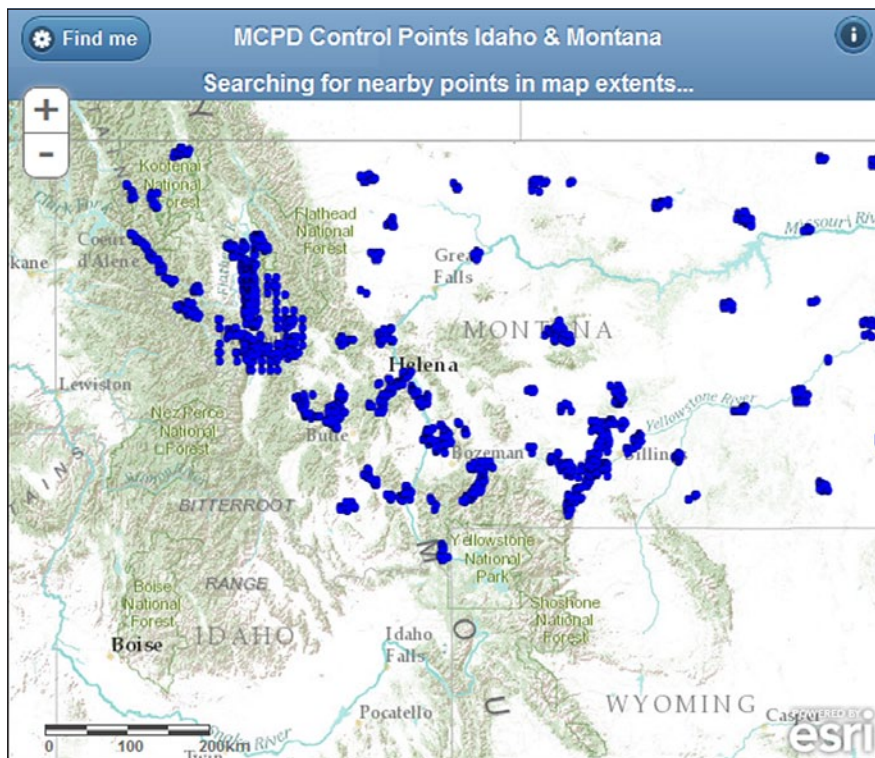


Fig 5 – MCPD mobile app