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PAPER 604: PRINCIPLES AND APPLICATION OF REMOTE SENSING, GIS AND GPS

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GEOGRAPHICAL DATA ACQUISITION TECHNIQUES

Acquiring geographic data is an important factor in any geographic information system (GIS) effort. Geographical (spatial) data is any information about a location, structure or other object in physical space. It can include attributes such as the latitude and longitude of a structure, the size and shape of features on Earth. Geographical datasets are acquired and structured to take advantage of the visualisation and analytical abilities of GIS. It is conventional to distinguish between *primary* and *secondary* data sources because acquisition methods, data formats and structuring processes differ considerably between the two. Primary data consist of measurements or information collected from field observations, survey, and remote sensing. Secondary data refer to information that has already been processed and interpreted, available most often as paper or digital maps

Primary data:

Primary, or 'raw', geospatial data has not been significantly processed or transformed since the information was first captured. Primary data acquisition is a direct data acquisition methodology that is usually associated with some type of in-the-field effort. In the case of vector data, directly captured data commonly comes from a global positioning system (GPS) or other types of surveying equipment such as a total station. Total stations are specialized, primary data capture instruments that combine a theodolite (or transit), which measures horizontal and vertical angles, with a tool to measure the slope distance from the unit to an observed point. Use of a total station allows field crews to quickly and accurately derive the topography for a particular landscape.

Figure: GPS Unit (left) and Total Station (right)

In the case of GPS, handheld units access positional data from satellites and log the information for subsequent retrieval. A network of twenty-four navigation satellites is situated around the globe and provides precise coordinate information for any point on the earth's surface. Maintaining a line of sight to four or more of these satellites provides the user with reasonably accurate location information. These locations can be collected as individual points or can be linked together to form lines or polygons depending on user preference. Attribute data such as land-use type, telephone pole number, and river name can be simultaneously entered by the user. This location and attribute data can then be uploaded to the GIS for visualization.

Raster data obtained via direct capture comes more commonly from remotely sensed sources. Remotely sensed data offers the advantage of obviating the need for physical access to the area being imaged. Satellites and aerial cameras provide the most ubiquitous sources of direct-capture raster data. The development of satellites capable of higher resolution imagery and image recognition algorithms have made it possible to automatically capture higher volumes of data with greater accuracy. Additionally, technology such as hyperspectral imaging and multispectral imaging has offered the ability to capture a larger variety of information; for instance, hyperspectral imagery can be used to quickly identify natural resources such as oil.

Secondary data:

Secondary data acquisition is an indirect methodology that utilizes the vast amount of existing geospatial data available in both digital and hard-copy formats. Such digital GIS data are available from a variety of sources including:

International agencies: USGS Global Visualization Viewer (GloVis), NASA Earth Observation (NEO), USGS Earth Explorer, ESA's Sentinel data, NASA Earth Data, NOAA (National Oceanic and Atmospheric Administration), NOAA Digital Coast, IPPMUS Terra, Land, Atmosphere Near real-time Capability for EOS (LANCE), VITO Vision etc.,

State governments: National Remote Sensing Centre (NRSC) of the Indian Space Research Organisation (ISRO)/ DOS, Bhuvan NOEDA, Datameet, India OpenData: data.gov.in etc.,

Commercial websites: ESRI, GeoEye, Geocomm, etc.

These secondary data are available in a wide assortment of file types, extents, and sizes but is ready-made to be used in most GIS software packages. Often these data are free, but many sites will charge a fee for access to the proprietary information they have developed.

Although these data sources are all cases where the information has been converted to digital format and properly projected for use in a GIS, there is also a great deal of spatial information that can be gleaned from existing, nondigital sources. Paper maps, for example, may contain current or historic information on a locale that cannot be found in digital format.