Geospatial revolution

Geoinformatics is considered to be one of the three most progressive sectors alongside biotechnologies and nanotechnologies. It is thus no wonder that giants like Google, Microsoft and Nokia invest heavily in this business. What is going on?

Geoinformatics is an earth science heavily based on geodesy that uses the most recent technologies to deal with spatial data.

Spatial data can be in the form of an image, vector, text or even a point cloud or 3D model. What makes the data spatial is the relation to a specific position (the coordinates) or geographical area. This is why the data is referred to as "georeferenced."

Geoinformation systems

Spatial data is the blood of GIS (Geoinformation systems). The spatial data lifecycle begins when the data is collected. The current development of this technology aims to design and manufacture of automated systems for massive gathering and processing of positional and image data. These automated systems are based on 3D laser scanning and photogrammertry. After processing, the data is imported into GIS where it is stored, and then the magic begins.

Spatial "awareness" enables the interconnection of data from various areas of life to be overlaid with, for example: demographic, crime, health, education and infrastructure data to do advanced analysis that can show the quality of a neighborhood. That is the great advantage of this system - there is simply no other way to do this scientifically.

GIS can answer very complex questions in a comprehensive, graphical way. This system is good for states, municipalities, environmental agencies, police, fire fighters, emergency rescue, disaster managers, traffic authorities, utility companies (water, gas, electricity, oil), power plants, industrial plants and even insurance companies.

The first appearance of geoinformation systems dates back to 1960, when the world's first true operational GIS was developed in Canada by the federal Department of Forestry and Rural Development with the help of NASA. Development continued and in the 80s graphical user interface (GUI) was introduced, which gave users the ability to sort, select, and extract data on the basis of different criteria. A variety of analysis techniques were incorporated into a growing number of GIS solutions.

In the 90s, GIS became viable technology for state and municipality planning thanks to increasing computer power and plummeting hardware prices. The Open Geospatial Consortium (OGC) was founded in 1994 to define standards for interoperability. In the late 90s the first Internet-based products were released and web GIS applications were developed. The last decade has brought plenty of new developments, including wireless technology, mobile devices, smart objects, sensor web, Google Earth, INSPIRE and lot of other things..

WEB 2.0

Current and future GIS development evolves along with the web because web applications are accessible to a virtually unlimited number of users. When set up properly, one application can be used throughout an entire organization, from the cleaning lady to the general manager, displaying data and functions allowed for each particular role. Usually nothing needs to be installed other than perhaps a plug-in. Both the application and data are stored together on the server, which makes it very easy to maintain, update and upgrade.

WEB 2.0 is changing the ways software developers and end-users use the web. We are getting back to the original idea defined by World Wide Web inventor Tim Berners-Lee, who intended it to be a collaborative medium. In this concept, the Web is understood as a platform to harness collective intelligence and become a kind of global brain. Web sites may have an "architecture of participation" that encourages users to add value to the application as they use it. Software gets better as more people use it. Applications offer rich user experiences with their own API that can be easily customized enabling user-centered design, control over their own data, information sharing, interoperability and collaboration. The business model is changing from software package providing to software as a service (SaaS).

2D, 3D, 4D

The majority of GIS applications today are in 2D as a result of the geoinformatics evolution. Current measuring technology allows the massive gathering and processing of 3D spatial data in a short amount of time. On the GIS side there are software vendors who provide desktop and web solutions, which enable the creation of 3D GIS applications. The future of GIS is without a doubt going to be 3D and, consequently, 4D – and of course web based. But why is 3D so important? If 2D GIS answers the "Where is it?" question, 3D GIS also answers "What does it look like?" In 3D we are able to present the world as we perceive it, and just as a (2D) picture is worth a thousand words, the (3D) virtual reality model is worth a thousand pictures. This is very important in city management and urban planning.

3D GIS depicts reality through graphic 3D models, which create a virtual environment close to reality. The creation of 3D models depends on their complexity as well as the accuracy needs and their depiction in a system. The level of detail (LOD) defines how truly a model copies reality. Depending on the user's needs, we can create a simple model in LOD 1 (the so-called "boxes") up to detailed models of building interiors (LOD4).

But comprehensive perception of the real world in a virtual environment is not the only advantage of 3D GIS. There are types of analysis that can be done only in 3D: line of sight analysis and shadow analysis for new construction projects assessment, solar analysis for projecting the potential power of industrial and residential photovoltaic systems, fire and

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flood analysis for emergency management, and noise analysis for citizens' health protection, among others.

Emerging phenomena is time – that's the 4th dimension. Real time data gathered from different sources is very important for disaster management, security and military applications. For example, forest fire analysis must take into account the shape of the terrain, the wind speed and availability of fuel (wood). In an environment of 3D/4D WEB GIS the results of this analysis are displayed as a continuous fire - just like in a 3D game. But with timeframe and equivalent footprint (draped on terrain) which can serve for buffer analysis – to determinate area for evacuation.

Mobile applications and Augmented Reality

Smartphones and tablets are ubiquitous today. Besides classic GIS applications, there are a lot of navigation applications for drivers, hikers, sightseers and tourists of all kinds being developed on all main platforms. And navigation system is nothing more than real-time GIS application.

Augmented reality (AR), a technology that enables a user to augment his own perception of reality by overlaying outside information, is certainly changing our world. There are plenty of applications for smartphones and tablets that superimpose georeferenced spatial data (3D models, images, texts, etc.) over actual images provided by an integrated camera. However, it is not very convenient to walk with a smartphone in front of your face, so Google is working on AR glasses with integrated Google apps. But Google is not alone in this effort. Companies like Nokia, Vuzix or Oakley are developing their own concepts.

Conclusion

Geoinformation systems are becoming a part of everyday life. Advancements in massive data gathering and processing technology enable us to create rich and up-to-date content for a virtual environment of 3D or even 4D GIS. The possibility to move such solutions from desktop to Web opens door for everyone to be a user and creator at the same time by simply using and providing information to create a virtually living organism. The future will surely bring even more applications thanks to the evolution of the web and augmented reality.

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