4D Geo Information Management System
GeoMan™

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Abstract

GeoMan is an integrated system for computer modeling of virtual and combined realities, which can simplify the laborious task of creating interactive multidimensional virtual worlds, based on real geospatial data, 3D objects models, photographs, video and topological information.

This solution was primarily meant to solve the task of settlement planning and its stable GIS development by optimizing construction, communications and infrastructure within the existing environment using the methods of situational analysis and 3D modeling. The result of such modeling is an optimal virtual instance of an existing territory allowing "what-if" analysis for selected set of input criteria's and risks allowed that is being connected with sensor networks and knowledge bases could create a complete system of regional management including real time actualization under the condition of continuous monitoring of spatial and metadata objects change.

Besides that, the system can be used for project research and investment foundation in architectural design and construction, cadastral registration and actualization of spatial data, reconstruction and demonstration of virtual historic monuments, museums, restoration of demolished worlds, ancient objects as well as development of methods and systems of edutainment (entertaining education) and construction of multidimensional reality training simulator centers.

This technology allows automating (decreases volume of manual designer work) the process of texturing of vector objects of the virtual world. These textures can be created using digital photo and video. This software allows a synthesis of a 3D virtual world based on fragmented information from sources such as 3D models of objects and nature, digital photo and video data, topographical and geo data.

The possibility of quick model construction of the given environment allows solving the task of training armed and rescue forces to conduct effective security and anti-terrorist operations, decreasing the risks and possible casualties due to perfecting the tactic of teamwork and joint activities within the virtual environment staying locally or at a long distance.

Finally, this spatial real-time model can potentially provide an infrastructure for fully automated management of new, intelligent transport systems using high-precision positioning equipment in real time.

This way, a universal approach of creating a task allocation system is realized, to be utilized by various government and commercial agencies which have strictly defined authority in the system. For example, an architectural bureau or a real estate agent can place information about his projects and objects in the regional GIS-system, being interested in using the newest 3D visualization, marketing and sale services.

The availability of services in the Internet is crucial in the technological approach with the possibility of using specialized clients who demand higher quality and security standards.

One of the important project components is the integration with the legally important systems of electronic docflow based on the regional identity certification center interacting with E-government services.

The main task of GIS in this relation – efficient capturing, accumulation, storing and analyzing spatially referenced data such as land/property cadastres used for cadastre cartography, land registers and efficient land resources management for their effective use within the new economic conditions. The system allows external GIS/CAD integrations for object or methods processing. For example, you can use 3DS MAX, Solid Works objects to populate model as well as external hydro or geodynamics modules to evaluate flood risk and surface robustness in high building construction.

GeoMan is easily integrated with electronic payment and marketing terminals to deliver commercial LBS services.

This way, GeoMan, thanks to component-based modular architecture allows constructing new generation integral management systems consolidating the interests of government and commercial structures and each citizen for a joint creation of an information and business space of their vital activities.

Project Goal

Our main goal in the project development was to deliver new generation of highly integrated toolset for GIS based:

Decision support & workflow management

- Situations modeling, fore sighting and development planning
- Intelligent Transportation Systems, planning and deployment
- Legal documents land/property, cadastres, other state registers

4D (3D + time) visualization, modeling

- Virtual and augmented reality construction;
- Infrastructure, architecture and construction projects;
- Virtual museums, monuments and historical retrospectives;
- Reconstruction and restoration of demolished or missing objects;
- Interactive virtual trainings and education, leisure centers.

Services rendering platform

- Location Based POI network, marketing and sales management
- E-government legal services for business and citizens care
- Environment and Infrastructure Security monitoring

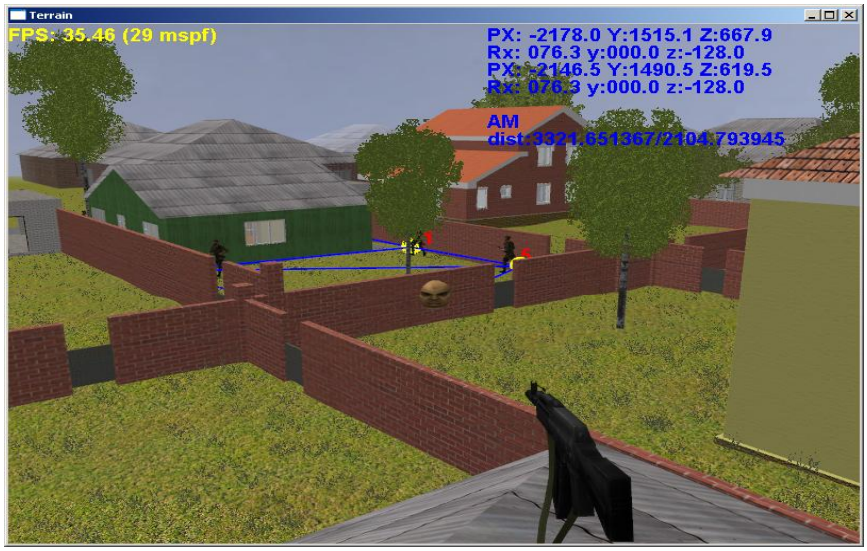
What do we have now?

A versatile platform available for:

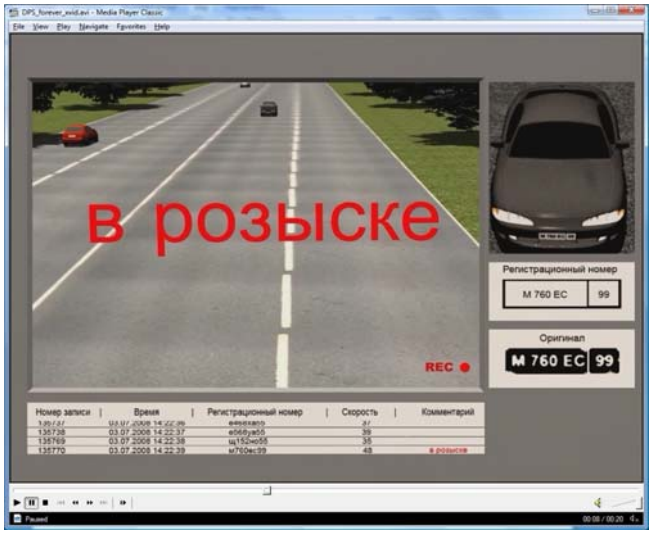
- Spatial GIS related businesses, utilizing virtual and augmented reality environment featuring significant improvement in laborious tasks cutting time to create integrated interactive multidimensional content;
- Synthesis of multidimensional world based on imported information like 3D models, Photographs, Video, Topology information;
- Interactive simulations and flythrough in multidimensional systems with scalable time factor.
- Development of simulators and trainers for professional and entertainment use armed and rescue forces to provide effective security and anti-terrorist activities.

As an example, let us introduce our joint project with Moscow Institute of Electronics and Mathematics with their locomotive inventions VirtuSphere. Our role was to use GeoMan™ to generate virtual instance of real settlement where counterterrorist attack is being prevented. This is an interactive scenario where you can simply train shouting or try to complete complex mission with hostages' release. The target of the technological process was to speed up the modeling process as much as to fit the several hours' boundaries, secondly – to enable network operation of the task force to prepare its anti-terrorist mission virtually for the object they will run in reality. To do the job, we need mostly CAD drawing of the building and landscape geodata. For the best results, we could consider in a model terrorist and weapons details, hostages number and other options.

As a control channel, every agent can have an extra mission overlay over the 3D glasses providing personal task details and team operation features.

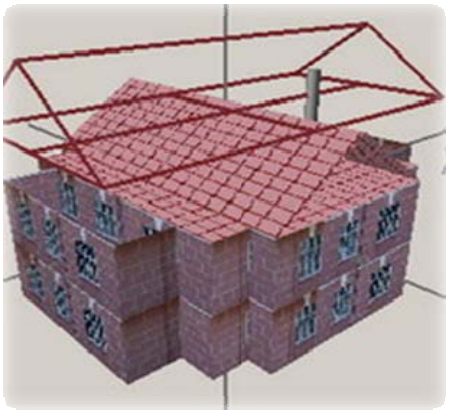


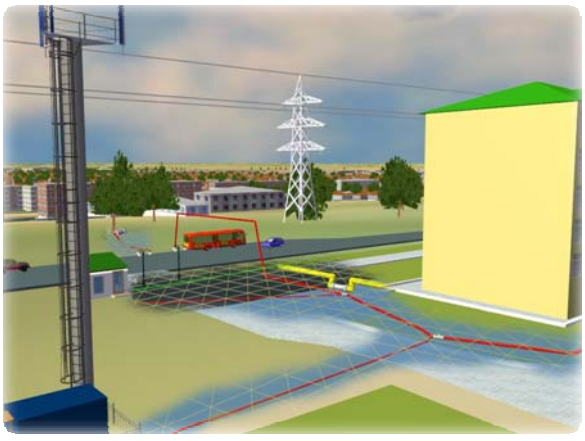
Another area of technology application of growing demand is Situational Centers for regional and municipal management, logistics and security operations; here we provide high end deployment including HPC system, visualization equipment and control equipment. One of the references worth to mention could be Main Moscow police department with patrol cars and tasks management solution utilizing GNSS equipment and GIS application to coordinate law enforcement operation.



Finally, technology is being applied now:

- To design, monitor and maintain
  - ✓ Architectural projects;
  - ✓ Environment & construction, communications and transportation infrastructure;
- To develop virtual exhibitions/presentations of museums, historical monuments
- To create complex 3D models for real-estate business





Carrying out the project with GeoMan™

Initial analysis and data acquisition:

- ✓ Geo data (local and remote probing);
- ✓ Ecological;
- ✓ Town planning (investment foundation, infrastructure, sustainability);
- ✓ Durability (seismic, climate, flooding using a geodynamic engine);
- ✓ Architectural design;

- Developing 3D digital landscape (DLM);
- Populating DLM with 3D objects, defining behavior;
- Apply aerial, terrestrial digital photography of the real world and actual location
- Final touch, based upon the real world 3D models
- Optimizing & Visualizing the resultant models
- Producing Demonstration materials and documents

Where do we go now?

We develop distributed hierarchical WEB service architecture with highly scalable and HPC oriented real time processing. We target compatibility and openness, developing interoperable and standards based technology. Open GIS is being a guideline.

We look for the complementary partnerships to enrich our joint efficiency.