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Sigtur-Zulia: An Application of GIS Technologies for Tourism Planning

In 1997, the Research Institute of Faculty of Architecture and Design, University of Zulia, started the R&D project of a decision making support system for tourism planning. For this, GIS technologies have been used for geocodification and spatial analysis of all the tourism facilities and resources existing in Zulia State, studying this kind of socioeconomic development according to critical poverty problems that are typical of their population. This paper describes this geographic information system, with the application of accessibility analysis, areas of influence, and three-dimensional studies through network analysis--three-dimensional analysis with ArcView GIS clients, ArcExplorer clients, and MapObjects clients, on an MS Windows NT client/server environment.

INTRODUCTION

Tourism activity means a highly complex of relations between factors that happens in the city. As urban planning activity, ordering the tourism system implies the management of a lot of information related to the cultural, social and economic context of each reality, and potential relations due to proximity or another location factors. Organizing and automating this amount of spatial data through GIS technology facilitates to planners, official employees and general public to use it in order to planning, development and marketing of tourism activity.

Maracaibo is almost 2 million persons city, located in front to the second biggest lake on South America. It's the capital city of Zulia State, at the western area of Venezuela. This region, with 43 thousand square kilometers and 1.140 kilometers of coast, contains a lot of potential places for tourism activity that, associated to the oil production, stockbreeding and farming, are supporting social-economic regional development.

Use of GIS technology for tourism planning offers a group of advantages in data documentation and processing (Caldera-Reyes, 1999):

- Thematic cartography can be generated in a fast and inexpensive way.
- Maps are produced in variable scales according to different kinds of users.
- Information can be updated fast and easily.
- To make applications with basic information and to produce new information through variable combination is faster and cheaper that crossing data in manual way.
- They can shows results in cartographic, statistical, or table form.
- Errors can be corrected dinamically, saving the time and material that they would cost if corrections need to be done on printed maps or tables.
- Cartography can be presented better and more accuracy.
- Information can be integrated easily, through automated relation between different database that describes the same geographic space according different themes.

These advantages help in the simplification of processing of voluminous geographic-tourist information, referred to natural and cultural resources, tourist facilities, accessibility, transport, land uses among others. Also, they can drive spatial analyses necessary to generate thematic maps or statistical reports, as much for academic, institutional, enterprise interest as for own tourists requirements.

The SIGTUR project

Starting on 1997, the ToURism Planning Geographic Information System (SIGTUR, abbreviation in Spanish) was born as a research program created by 6 professors from the Faculty of Architecture and Design Research Institute (IFA) and the Postgraduate Studies Division (DPG) on University of Zulia (LUZ). With a initial financing from Human and Scientist Development Council (CONDES-LUZ), this program begun with the development of two projects: the first one, to establish the structure of subsystems according the tourism planning knowledge field; and the second one, to generate the information system platform for documentation and analysis processes. Both projects took Maracaibo city as initial study case, but the ultimate goal is the creation of tourism GIS for whole Zulia State.

Gradually, other institutions were associating to the project. Mayoralty of Maracaibo City, Regional Office of Urban Development National Secretary and Zulia Tourism Corporation, gave their support giving information and facilitating employees hours for collecting and structuring activities. Assistance to technical congress and advertising the research trough professional meetings and press reviews, helped to give viability to the implantation of the system proposed. Esri University LAB KIT Agreement, signed between Esri, LUZ and AT SISTEMAS as local distributor on January 1996, supported software acquisition and technical consultancy.

Past December, first phase of research program concluded and now it's in renovation time, improving consulting systems with postgraduate students helping and preparing new information groups about Maracaibo city also other main cities on Zulia State.

System Structure

Preliminary studies about the different factors that participate on tourism planning converged on the proposal of a Theoretical - Methodologic Referential Model, which included fifteen variable subsystems. These subsystems were oriented to the sustainable spatial ordering of tourism activities, involving contextual consideration as income groups or natural restriction to construction. I order to the structural analysis of tourism according to an integral planning accessible, research team determined two groups of variables:

1. Variables that functionally **delimitate** tourism space:

- Political-territorial
- Natural resources
- Cultural resources
- Tourist Facilities
- Accessibility.

2. Variables that **qualify** tourism space:

- Tourist demand
- Infrastructure basic services
- Urban equipment basic services

- Environmental quality
- Superstructure
- Local community
- Possession and land value
- Land uses
- Economic Activities
- Historical Occupation.

All this group of variables plays with different weight in tourism planning analysis, in order to answer two groups of questions estimated to resolve for the final user of the system. Table 1 and 2 show preliminary resolve intention of SIGTUR.

Table 1: ESTIMATED QUESTIONS FROM SIGTUR'S TOURIST USER

1. Where is located the city, the state or the country?
2. How is the climate? It has a warm or cold weather? What's the better time in the year to visit it? What clothes would be better to wear there?
3. Which is the official language?
4. What kinds of public transport can use tourists? Where are located car-rentals and tourism shuttle agencies? What types of service they offer?
5. Where are the accommodations in the city? How is their classification? How are their rates? What services they offer?
6. Where are located the natural and/or the cultural attractives of the city? Which is their operation schedule? How much are the rates? How it is acceded? Are there any limitations for visiting?
7. What attractive places are near to lodging?
8. Where are the travel agencies? What services they offer?
Where are recreational sites in the city? What are their visiting schedule?
9. Which is the typical gastronomy ? Where are located the feeding and drink sites in the city? How are their other services?
10. Where are banks and bureau de change?
11. Where are hospitals and health centers?
12. Where are embassies and consulates?
13. What are emergency numbers?
14. Where are police stations?
15. Where are the shopping centers? Where are the greater popular markets?

Source: Caldera & Reyes, 1999; Research Program SIGTUR-ZULIA, 1996-2000.CONDES -LUZ

Table 2: ESTIMATED QUESTIONS FROM SIGTUR'S RESEARCHERS

1. How are territorial divisions of municipalities, regions or states?
2. Where are the tourist interest areas?

3. What are the physical-geographic characteristics of those areas?
4. What are location, categorization and hierarchical structuring of natural and cultural tourist resources?
5. What are the accessibility means, stops and station facilities of public transport?
6. Where are accommodations, and how are their classification and categorization?
7. What are the demographic and social-economic characteristics of local population of each tourist spaces?
8. Where are located and how to categorize urban equipment such as education, health, security and financial services?
9. What are public and private institutions with competence in tourism planning ?
10. What laws, regulations or norms, apply on the spatial tourism development?
11. What are plans, programs and projects that really would impulse positively development of "tourist spaces"
12. What is the tourist demand of attractive places, tourist equipment and services? How are their social, geographic and economic characteristics?
13. What infrastructure services are in current and potential tourist areas?
Which is the service quality?

Source: Caldera & Reyes, 1999; Research Program SIGTUR-ZULIA, 1996-2000.CONDES -LUZ

System processes

SIGTUR is based on three kind of process, combining automated commands and know-how operators knowledge:

1. **Documentation.** This process feeds GIS system with graphical and attributive information.

- *Recolection*, by in-site registration, telephonic surveys and institutional information
- *Systematization*, ordering information according subsystem variables
- *Transcription*, digitizing
- *Geo-coding*, locating urban services and potential tourist places.

2. **Analysis.** It use GIS capacities to calculate relation phenomena between urban variables.

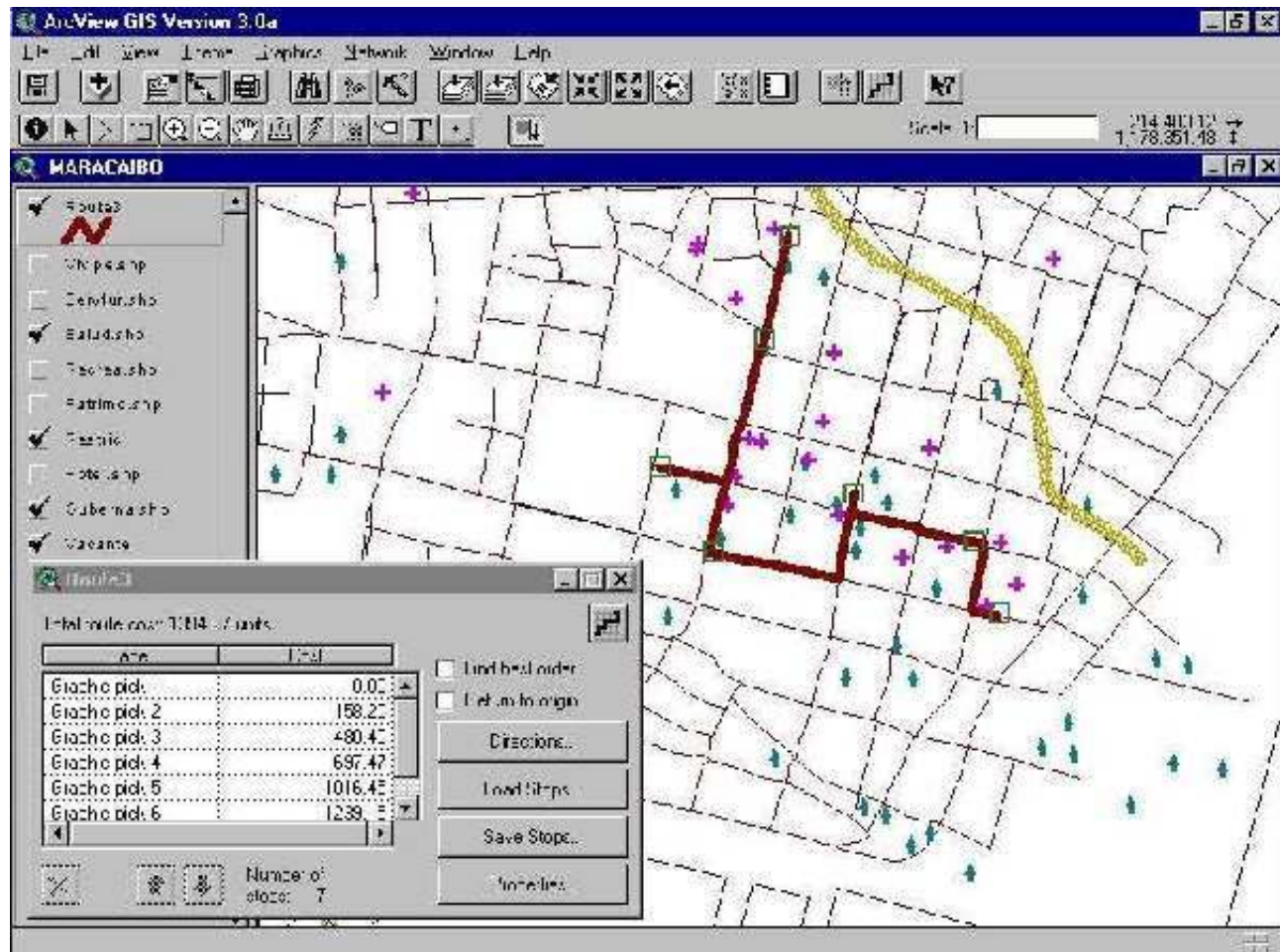
- *Concentration*, applying statistical analysis to count amount of units per vicinity or urban area.
- *Proximity*, using buffers to calculate influence areas from punctual, lineal or polygonal attracting sites
- *Accessibility*, using network analyst to determinate best routes to interesting sites (Figure 1).

3. **Results.** It search the delimitation and qualification of potential tourism sites.

- *Direct final products*
 - Thematic maps by aspect, by screen or ready-to-print
 - Database reports, by search criteria or inventory outputs
- *Indirect sub-products*
 - Digital maps, useful as consumables for another applications

- Database tables, applicable to interchanges with other external systems

Figure 1: Accesibility analysis to tourist attractions, applying Network Analyst extension over Road structure



Users, accesses and interfaces

There is a close relation between the different kind of users preliminary served by SIGTUR, and access interface to data :

- **Public users:** they need easy tools to obtain specific information about punctual questions without any knowledge on GIS technology.
- **Planner users and government technicians:** they can use GIS tools to process geo-codified data in order to define a decision about planning or administering urban problem.

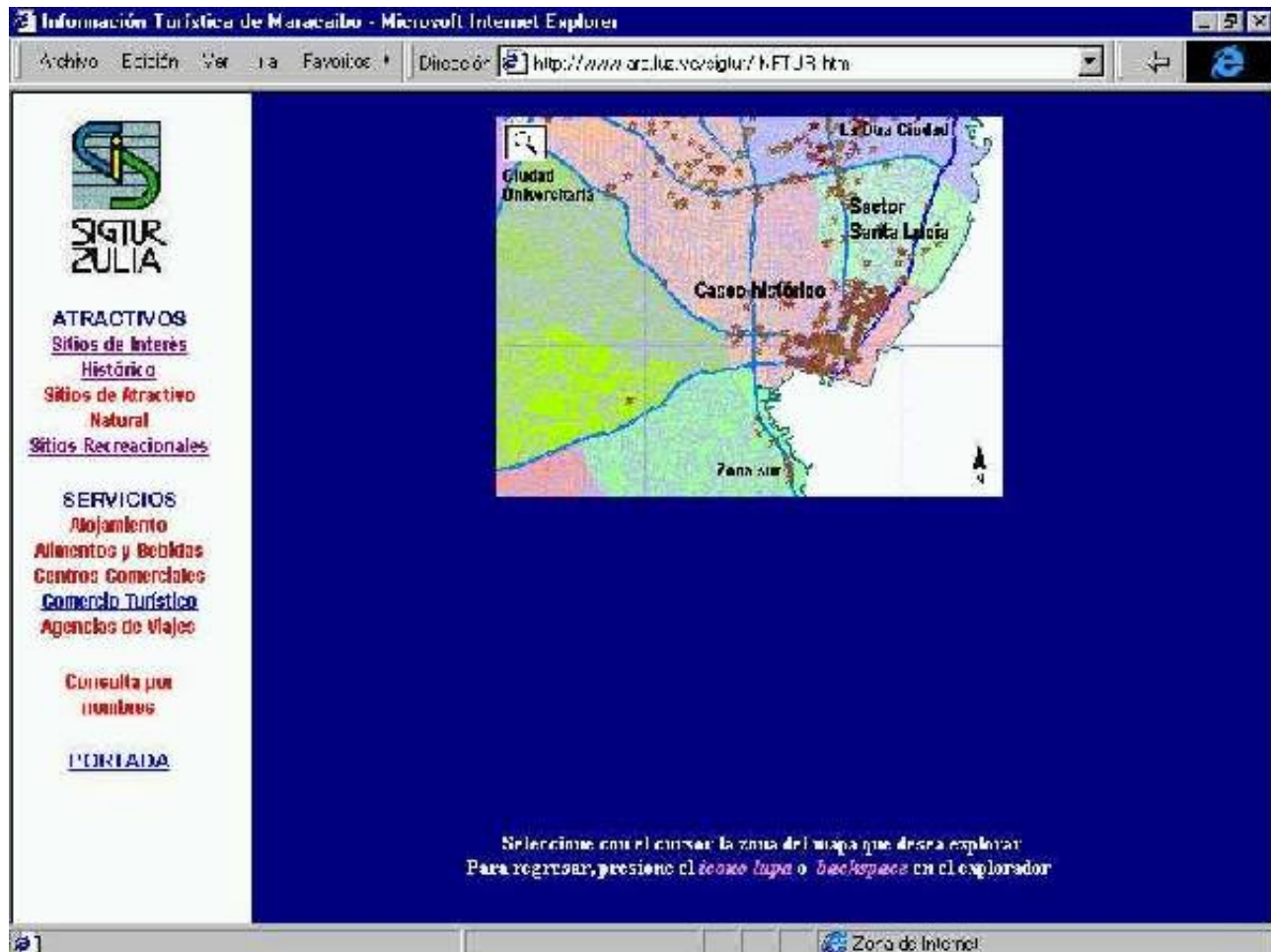
For both cases, system structured two kinds of data access:

- **Public access,** through telematics systems such Internet/Extranet
- **Local access,** through spatial analysis tools on an Intranet

Public access implies a restricted use to data, only for its partial visualization according to pre-selected questions. It works as a server-based environment, where clients receive certain outputs through menu selections. Here, users can not manage directly whole groups of data. This access is possible by Internet or Extranet connection to SIGTUR servers, according access level of users and their institutions. It uses a generic Internet browser like Navigator 4 or IE4 (figure 2), or a map-based browser like Esri

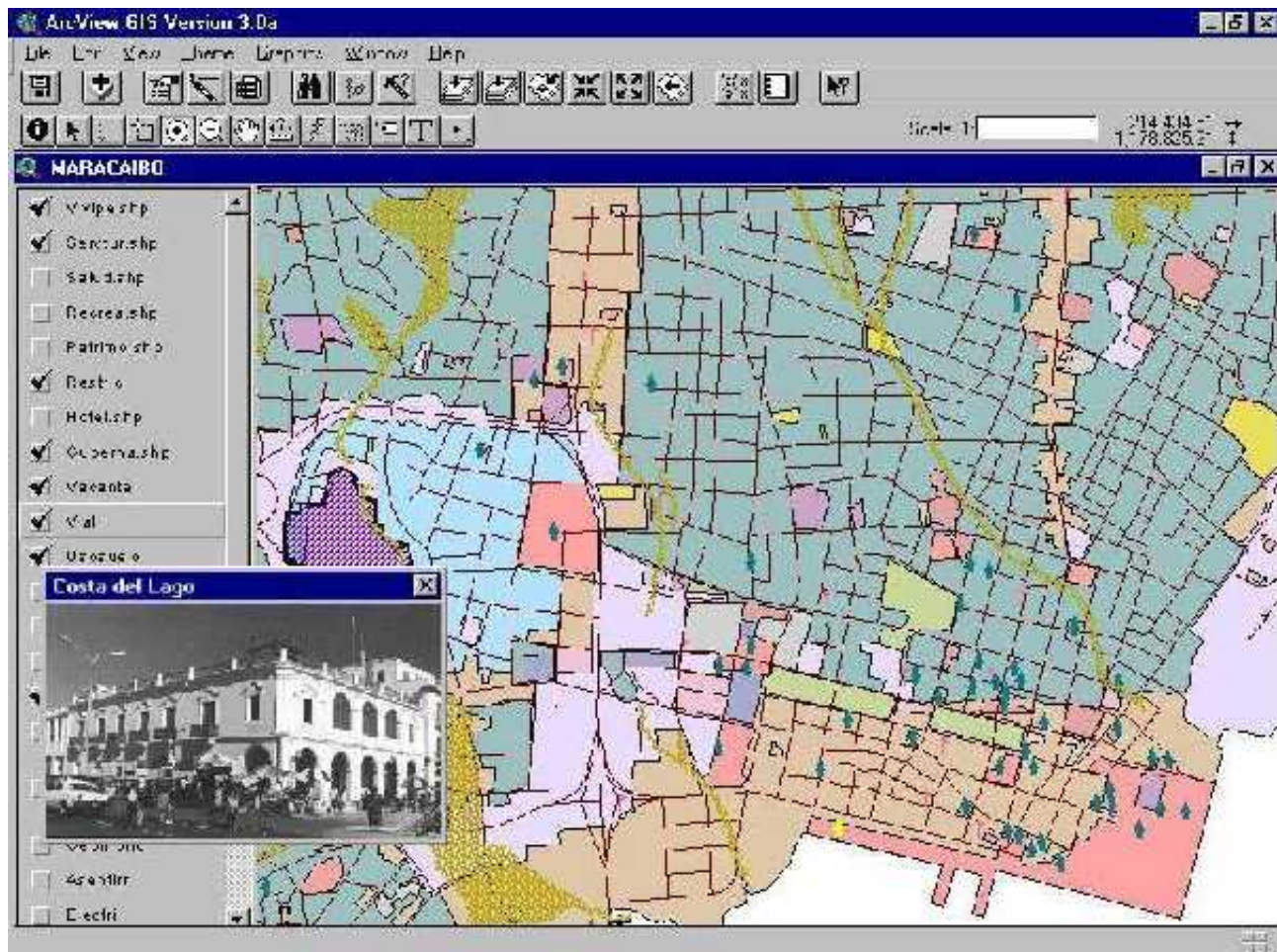
ArcExplorer. It generate basically single thematic maps with referential information.

Figure 2: Map access to attractive building, surfing by city maps through Internet Information Server Web site.



Local access consists to create complex queries, update o generate new data, o create information subsystems about specific data field. It works in a client-server environment, where SIGTUR server supply geo-referenced database to workstations through intranets, and support development of data analysis interface on smart client stations. For this, SIGTUR use Esri ArcView GIS workstations, any of them with Network Analyst extension and other with 3dAnalyst extension, to create complex thematic maps with concentration or accessibility analysis (Figure 3). Other one uses Esri ArcExplorer to save AEP projects as support to consulting o urban research activities.

Figure 3: Thematic map combining land uses with tourist services, on Esri ArcView GIS platform with graphic hot links.



Technical environment.

SIGTUR was created initially as a Data Mart project, thinking in a Corporate Data Warehousing about urban information of Maracaibo city initially, and Zulia State later. Authors' Institution, Faculty of Architecture and Design Research Institute, has developed a lot of urban studies about Maracaibo city and Maracaibo Lake Basin, from three Urban Development Plans in the '90s, to urban improvement proposals on special interest areas. Due to Tourism is an activity that collaborate with development of cities and territories, it needs a lot of common urban variables with other human activities and natural consideration; for that, SIGTUR is belonging to a cross-related data storage that supply information to specific thematic projects and that let to considerate them respect to the other studies of the city life.

For these considerations, SIGTUR Data Mart is physically located on three Intel-based servers, conceived under MS Windows NT 4.0 environment with partial replication services and supported by Internet Information Server 4.0 (IIS) and MS SQL Server 7.0. With a user-level security developed on a research data domain, and MS Proxy2.0 firewall to manage dynamic IP configuration on a isolated network frame, data is protected from inbound intruders and undesirable local accesses.

Data storage is structured according three criteria's:

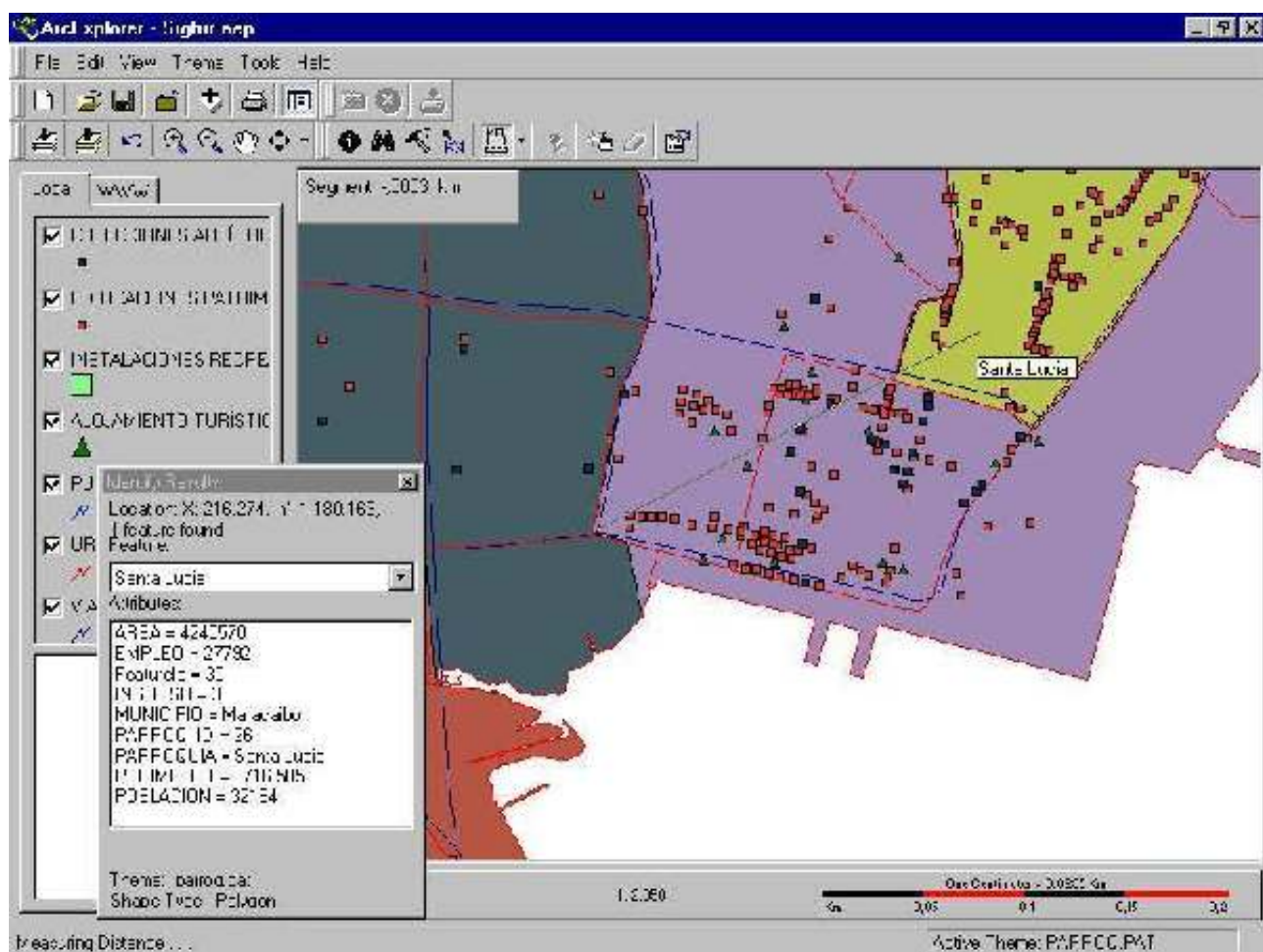
- **Data belonging**, where files are nested inside codified-name folders, each of one associated to the subsystem variable that they documentate;
- **Data type**, where folders and files are contained in data groups primarily defined by their generating and processing tools, as GIS coverage's, worksheets, lists or image banks.
- **Data access**, where most sensible data is stored on non web-sharing folders, accessible only by

Unified Resource Location (URL) sharing names inside local LAN, and shareable data can be accessed on virtual directories through IIS service.

Network clients can be:

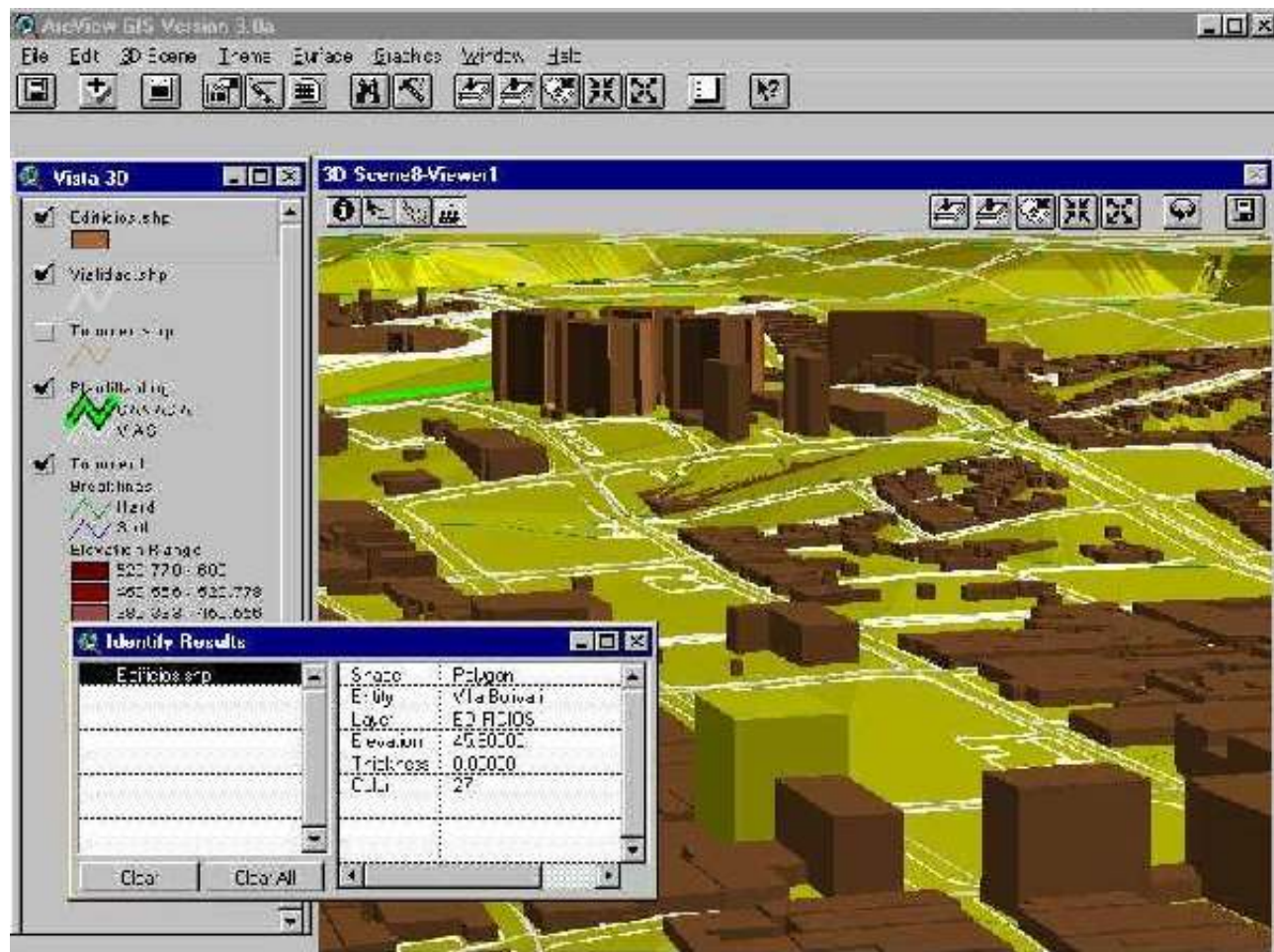
- **Single Web clients**, running Netscape Navigator 4.0 or above, or MS Internet Explorer 4.1 or above
- **Advanced Web clients**, running Esri ArcExplorer 1.1, or using any web browser with Autodesk Whip! Plug-In.
- **Single LAN client**, using MS Access 97 or MS Excel 97 in a server-client data environment
- **Medium LAN client**, running Esri ArcView GIS 3.0a or above, or Esri ArcExplorer 1.1 demanding data from SIGTUR Data Mart (Figure 4)

Figure 4: Concentration map of historic sites, compared with vicinity areas classified by income group, Esri ArcExplorer client on MS WinNT server-client environment.



- **Advanced LAN client**, running 3D Analyst or Network Analyst extensions over Esri ArcView GIS, or operating PCArcInfo on powerful developer workstations (Figure 5).

Figure 5: View point analysis on downtown, applying 3D Analyst extension to show topography and panoramic views.



A fifth kind of client is being created, through Esri MapObjects controls on ActiveX complement, which process data from a trial Internet Map Server prototype. This work is being developed through two master degree students on Informatics Applied to Architectural Design. Also, SIGTUR is attending any non-Esri clients, as MapInfo Pro 4.0, ITC Ilwis 3.0, and a non-Windows platform (MacOS 8 or above), due to the current diversity of computers and system requirements on our Institute and in the other related regional institutions.

CONCLUSIONS

This project is generating sooner its first results. Conformation of collaborative thematic information networks, within already it has been included our institution, will allow to handle consistent data closely linked with social realities on our region, where poverty reaches excessive limits and where tourism must arise simultaneously to processes of urban improvement.

The leadership that our institute has obtained at local level grants us a triple commitment, not only like solution provider for our institutional surroundings, or like human resources trainer at bachelor and graduate level, but even like booster of technological changes that public university must to promote for integral development of Venezuelan Country.

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