DESIGN AND IMPLEMENTATION OF GEOGRAPHIC INFORMATION SYSTEM FOR THE LOCAL AUTHORITIES IN TURKEY

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ABSTRACT:

In this paper, design and implementation of GIS for the local authorities which are responsible to develop healthy and correct policies in contemporary cities under the current conditions are examined and an application on a selected area is presented. Present situation and the relationship between municipality organizations and other sectors, problems and expectations are examined in the system analysis phase of the implemented system. After this step, the database design were generated in the PC/ARC/INFO GIS software. Digital (DGN) and graphical map sheets were used as the source of geographic data. Graphic and non-graphic (descriptive) data were stored, processed and transformed into the country coordinate system. Also an application program were created in the SML, using the CLIPPER compiler and commands of GIS SW and different queries and results are presented.

1. INTRODUCTION

There is a remarkable migration from villages to cities in Turkey which is a developing country in the world. Because of economical and political reasons approximately 400 - 500 thousands immigrants come to İstanbul each year, which is the biggest city of the country. It is almost impossible today to provide enough residence, water, sewer, energy etc. to the great deal of people. There are squatter’s houses which are builded without permission and planning on the public lands even in unhealthy circumstances. This phenomena have continued in the big cities in Turkey and especially in İstanbul since 1950s. In present situation all public lands are under the treat of illegal occupation. From time to time, especially just before the general elections the governments legalize the de facto situation of those squatter’s houses, surely to get political advantage. Due to the same reason, the municipalities doesn’t try to hinder this process. Today, inhabitants have to live in inconvenient city conditions, like destroyed nature, sea and water pollution due to insufficient utility systems, air pollution due to uncontrolled heating and car exhaust-systems. The local governments who are responsible to perform common needs of habitants and to provide for them contemporary and modern services are helpless (Alkış, 1994).

The aim of this paper is to present the study which is the implementation of GIS as a solution for controlling of urbanization, taking into consideration the desperation of local governments. The study includes an application of a pilot project. The initial hardware and software investment has been foresighted to have low cost but effective solution. Therefore a GIS is preferred which is cheaper and manageable by personal computers.

2. IMPLEMENTATION STAGE OF LOCAL GEOGRAPHIC INFORMATION SYSTEM

In this study, the steps were followed according to structured system analysis and design method (SSADM) which has been developed on the base of classical database modeling. These are; system analysis and feasibility, system design, implementation, application and maintenance (Serbanoğlu, 1990).

2.1. System Analysis

For determination of existence status in the local government’s establishments and other related state and private organizations, the research to working areas and their data usage, data sources, data outputs, organization charts and data process and flows were conducted.

In the study, the purpose of the system, expectations and requirements of the users, priorities of the city were evaluated too.

2.2. System Design

At this stage, entities (geographic data) which will be used in GIS has been determined. The geographic data were evaluated in three (3) different types as polygon, line and point layers according to the logic of the used GIS software. Attributes which define the graphic data were determined working commonly with the related organization’s authorized people. Item names, type, width, lookup tables, symbols of features for each graphic data were determined for design of database and a data dictionary generated for the system. Designed graphic data layers were illustrated as follows:

Polygon layers: Cadastral blocks, cadastral parcels, boundary of planning, buildings, roads, boundary of protected water sources, boundary of transportation areas, natural and artificial resources, sport facilities.

Line layers: Telephone, energy, sewer, water, natural gas lines, administrative boundaries, natural and artificial rivers.

Point layers: Map features of PTT (manholes), sewer (manholes, vaults, outfalls etc.), water (valves, hydrants, pumpen stations, etc.), energy (poles, transformers, etc.), natural gas (valves, reductor, etc.), poles, single trees, geodetic reference points.

The design of GIS were implemented to generate and perform the following issues:

• Controlling the buildings of city (whether they are suitable for planning, ownership, climatological, geological data etc. or not).
• Heating system of buildings (to prevent environment pollution).
• Types of buildings (calculation of the demolition probability).
• Information on inhabitants (to define demographical and sociological existence and voter registration and election district).
• Information on the office employers (workers to be employed illegally).
• Information on the protection of historical buildings.
• Information on religious buildings (information on the planning of buildings depending on the population).
• Information on schools (information on the planning of buildings depending on the population).
• Correct taxation assessment and tax collection (in order to control the real estate and rent).
• To prevent incorrect and illegal building permissions.
• Information on road main tenance.
• Information on utility systems (in order to co-ordinate between utility companies and to control the registered members).
• Information on lighting and signalization (to be able to do correct traffic planning).
• Information on geodetic reference points.

### 2.3 System Implementation

First, a pilot area was selected in Etiler/Istanbul for implementation and application the analysis and design of the system was completed. Graphic and non-graphic data types together with source that has been used in application are in Table 1. presented below.

<table>
<thead>
<tr>
<th>Data</th>
<th>Source</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planimetric maps (sc 1:1000)</td>
<td>Municipality of Istanbul</td>
<td>Graphic DGN</td>
</tr>
<tr>
<td>Cadastral Maps (sc 1:1000)</td>
<td>Directorate of Cadaster</td>
<td>Graphic DGN</td>
</tr>
<tr>
<td>Planning sheets (sc 1:1000)</td>
<td>Municipality of Istanbul</td>
<td>Graphic pap. sheet</td>
</tr>
<tr>
<td>Energy sheets (sc 1:500)</td>
<td>Energy Corp. of Country</td>
<td>Graphic pap. sheet</td>
</tr>
<tr>
<td>Natural gas sheets (sc 1:200)</td>
<td>Gas Corp. of Istanbul</td>
<td>Graphic pap. sheet</td>
</tr>
<tr>
<td>Water sheets (sc 1:1000)</td>
<td>Water and Sewer Corp. of Ist</td>
<td>Graphic pap. sheet</td>
</tr>
<tr>
<td>Sewer sheets (sc 1:1000)</td>
<td>Water and Sewer Corp. of Ist</td>
<td>Graphic pap. sheet</td>
</tr>
<tr>
<td>PTT sheets (sc 1:1000)</td>
<td>PTT</td>
<td>Graphic pap. sheet</td>
</tr>
<tr>
<td>Owner registers</td>
<td>Directorate Land Reg. of Beşiktaş</td>
<td>Non graphic .dbf</td>
</tr>
<tr>
<td>Inhabitants</td>
<td>Wards of district Etiler</td>
<td>Non graphic .dbf</td>
</tr>
<tr>
<td>Real estates</td>
<td>Assumed of estimated samples</td>
<td>Non graphic keyboard</td>
</tr>
</tbody>
</table>

Table 1. Graphic and Non Graphic Data Used in the Application

#### 2.3.1 Graphic Data Input into the GIS

Planimetric and cadastral maps in DGN format and UTM coordinate system were obtained from the related organizations. Levels in DGN file were determined and transferred into the DXF by using MicroStation software in view of the design of database then into the PC/GIS software. Since, DGN format isn’t accepted by the existing GIS software. Therefore, DGN/DXF/FARCINFO conversion had to made for graphic data input.

Other blue copy maps (utility sheets) were digitized by using PC/GIS software’s digitizing module as polygon, line and point feature. All the digitized map sheets from the digitizer units were transferred into UTM coordinate system and the topology was constructed. After editing, topology has been reconstructed and then adjacent maps were joined.

#### 2.3.2 Non -Graphic Data Input into GIS

Owner registers data (owner file) have been obtained from the related organization as a .dbf and the connection with the parcels numbers were set up. Inhabitant records have been also obtained in .dbf and connected to the number of apartment and flat. Other non-graphic data of the buildings, like owner or renter, type of building, tax and rent values, heating systems, number of floors, type and name of the offices and their employer’s information etc. were surveyed in the field and typed. Other non graphic utilities and planning data were read from the map sheets and entered to system. The symbols, the code tables were determined and related with ID numbers to feature attribute table which has been created automatically by processing graphic data. After that, graphic and their descriptive non graphic data (tabular) were joined. The process of the GIS database was shown in Figure 1.

![Figure 1. The Process of GIS 's Software](image)

### 2.4 Application and Quering of the System
An application program were created in the macro language of PC/GIS software using the clipper compiler and commands of GIS software (Alkış, 1995). The menus of the application program were illustrated in Figure 2 and the map which has been produced by querying in the application menu were shown in Figure 3.

Figure 2. The Main and Submenus of the Application Program
3. CONCLUSIONS AND PROPOSALS

The priority target of this study was to present a more economic and productive implementation of GIS for municipalities. In the cities like Istanbul which are rapidly growing but not developing properly, GIS is to be used as a solution for the control of urban areas. If a distributed GIS is implemented for the city, the created design and application program can be used and expanded for any area in this system. The base maps which are produced and approved by the municipalities in 1987 (Alkış, 1993), should be also updated. Since, many buildings were not indicated. It has been also observed that many buildings have not been constructed on the present maps according the planning data. Although it has been registered as public lands, the private buildings are constructed in these areas. The utility maps were produced in different scales, coordinate systems, precisions and standards. For this reason, it is difficult to connect all these maps and relate each other in order to coordinate the data and make use of it a common base map should be used. An organization which will be responsible for the coordination of the above mentioned bodies should be established. All public organizations and private sectors who will use a GIS have to employ system experts in their body. Therefore universities in Turkey should providing educational programs on geomatics in near future.

REFERENCES

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