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/ARCINFO 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 S/W 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 Istanbul 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 Istanbul 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 (Sarbonoğlu, 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, voults, 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 :

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- 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 tenanence.
- 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 n Table 1. presented below.

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

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/ARCINFO 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.
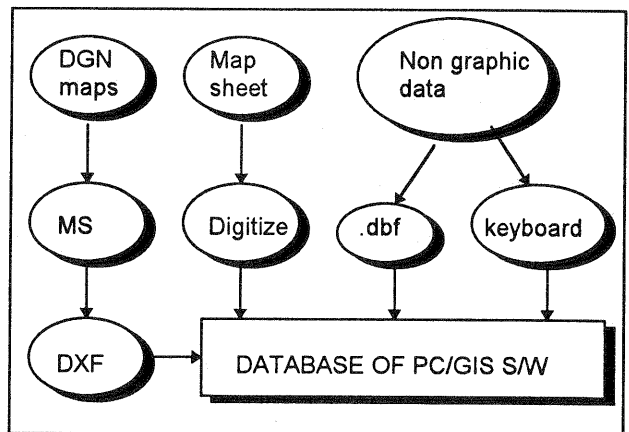

Figure 1. The Process of GIS 's Software

2.4 Application and Quering of the System

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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 quering in the application menu were shown in Figure 3.
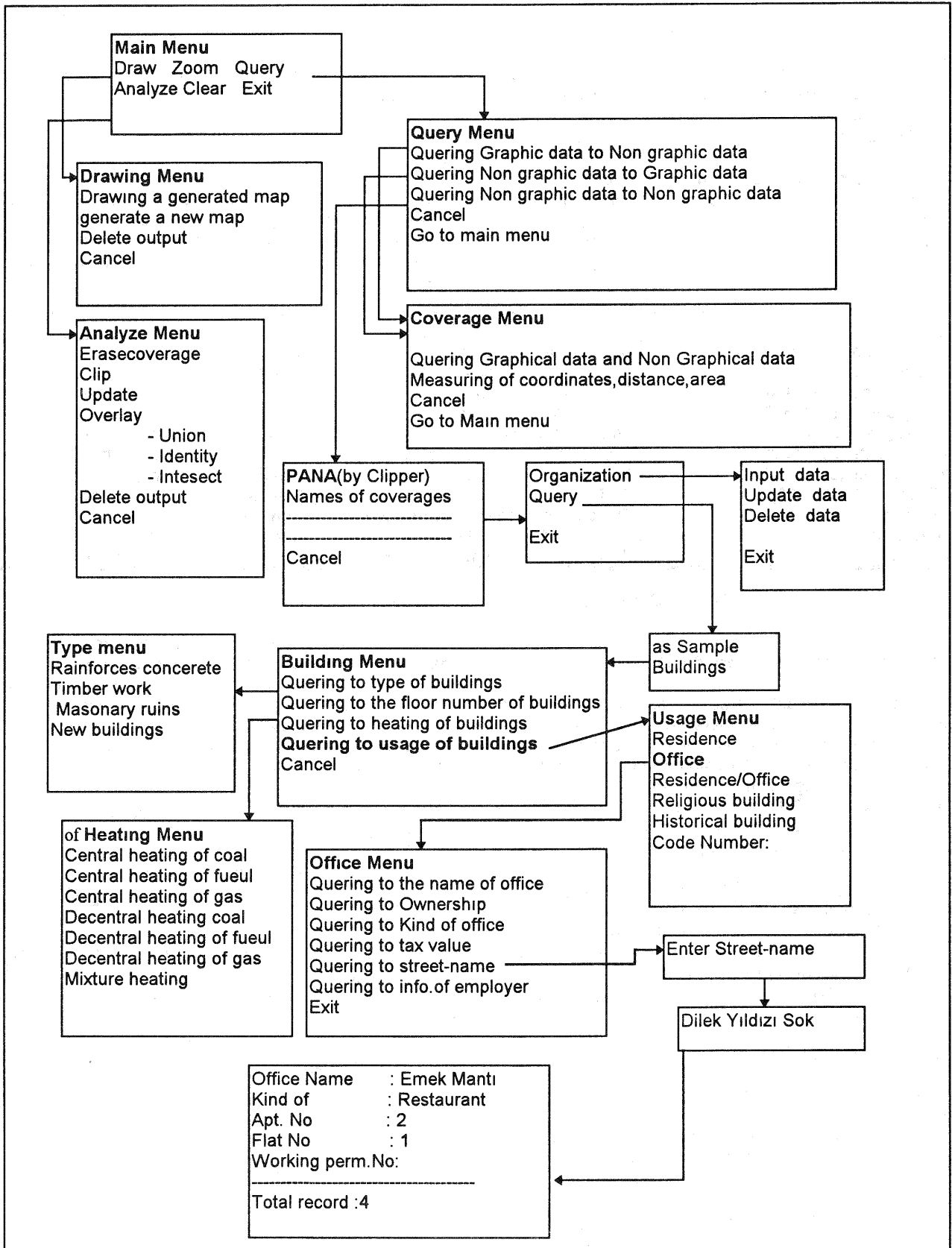

Main Menu
Draw Zoom Query
Analyze Clear Exit

Drawing Menu
Drawing a generated map
generate a new map
Delete output
Cancel

Analyze Menu
Erasecoverage
Clip
Update
Overlay
        - Union
        - Identity
        - Intesect
Delete output
Cancel

Query Menu
Quering Graphic data to Non graphic data
Quering Non graphic data to Graphic data
Quering Non graphic data to Non graphic data
Cancel
Go to main menu

Coverage Menu
Quering Graphical data and Non Graphical data
Measuring of coordinates,distance,area
Cancel
Go to Main menu

PANA(by Clipper)
Names of coverages

Cancel

Organization ———
Query ————
Exit

Input data
Update data
Delete data
Exit

Type menu
Rainforces concerete
Timber work
 Masonary ruins
New buildings

Building Menu
Quering to type of buildings
Quering to the floor number of buildings
Quering to heating of buildings
Quering to usage of buildings
Cancel

as Sample
Buildings

Usage Menu
Residence
Office
Residence/Office
Religious building
Historical building
Code Number:

of **Heating Menu**
Central heating of coal
Central heating of fueul
Central heating of gas
Decentral heating coal
Decentral heating of fueul
Decentral heating of gas
Mixture heating

Office Menu
Quering to the name of office
Quering to Ownership
Quering to Kind of office
Quering to tax value
Quering to street-name ———
Quering to info.of employer
Exit

Enter Street-name

Dilek Yıldızı Sok

Office Name   : Emek Mantı
Kind of   : Restaurant
Apt. No   : 2
Flat No   : 1
Working perm.No:

Total record :4

Figure 2. The Main and Submenus of the Application Program

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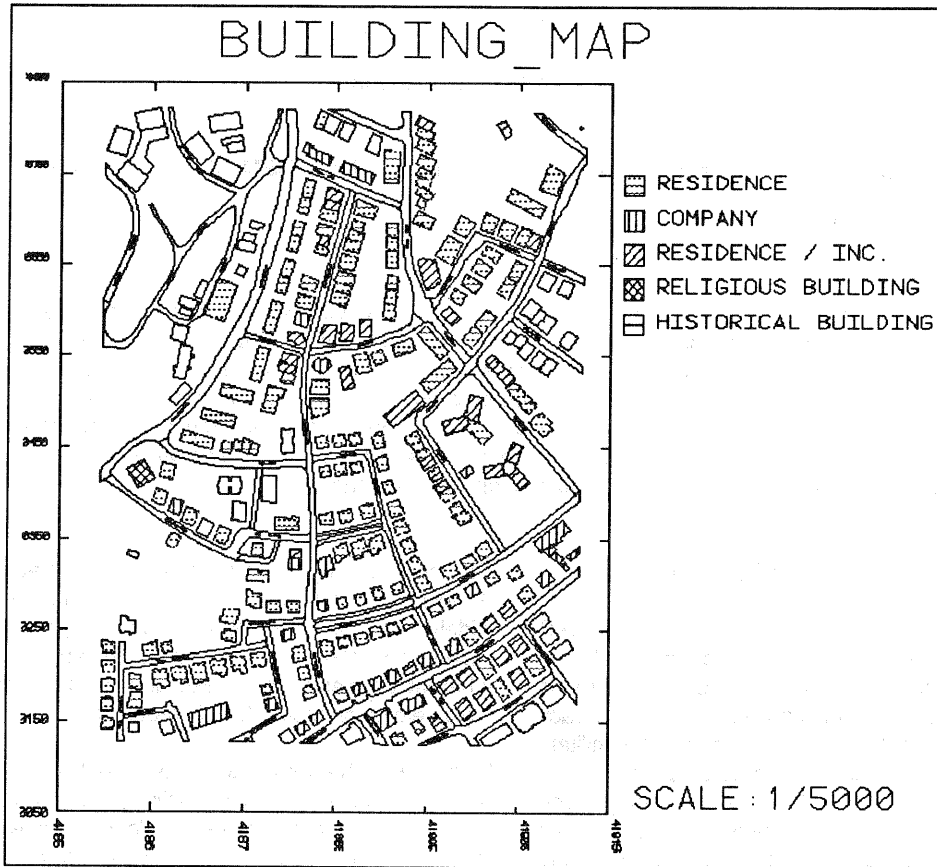International Archives of Photogrammetry and Remote Sensing. Vol. XXXI, Part B4. Vienna 1996

Figure 3. The Map Were Produced By Query Which is Determination of the Building
Like Residence Office Residence/Office Historical and Religion.

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.

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