

CREATING BASIC TOPOGRAPHIC-SPATIAL OBJECT MODEL FOR ITU-ACDIS

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ABSTRACT

Geographic Information Systems (GIS) which has begun to be used widespread by the development of the computer technology and has found place for itself in the working areas like planning, defense, disaster management, commerce, agriculture, mining and tourism. GIS is being used in governorships, municipalities, cadastral directorates, defense and disaster councils and in several private and public enterprises, commonly from nineties.

The subject of this study is to present the topographic-spatial object model generated for the Ayazaga Campus Disaster Information System (ITU-ACDIS) in the Istanbul Technical University. ITU-ACDIS would be a basis especially for emergency planning and practice in ITU Ayazaga Campus in order to prepare for the expected great Istanbul Earthquake. In this concept, this study is an application of Turkey Disaster Information System (Türkiye Afet Bilgi Sistemi-TABIS) in ITU Ayazaga Campus. In the study a relational database is drafted and queried by using the TABIS General Object Catalog (TABIS-OK).

1. INTRODUCTION

Efforts for reducing loss of disasters consist of the studies and preparations before the disaster. Taking precaution, forming the organizations for help and logistics to the disaster region can be done with an organized, systematic and well-informed system. Geographic Information Systems are perfect tools for the Planning and Disaster Management [1].

Some disasters like flood, fire, landslide and especially earthquake and also some disasters results from the people have occurred in our country [2]. These disasters cause:

- Social and cultural damages like dying, being damaged of social living environment,
- Destruction of the environment like spreading the harmful materials, damaging the nature,
- Materialistic damages like agricultural products and collapsing the buildings.

The study can be perceived as a pilot application of the TABIS project to the ITU Ayazaga Campus using Basic Topographic-Spatial Object Domains Catalogue of the TABIS project (TABIS-TOK). The objects in the catalogue are matched to the objects in the campus and gathered attributes entered to the system.

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2. TURKEY DISASTER INFORMATION SYSTEM (TABIS)

The TABIS project is a GIS based information and management standard model, which will be an example for the applications like emergency management planning and practice and in any probable disaster, disaster management and loss estimation. In addition to this context, it is aimed to serve as a decision support system for the ministries, governorships, district head offices, and municipalities in official activities. TABIS project is made between Turkish Ministry of Internal Affairs and Istanbul Technical University (ITU).

Turkey Disaster Information System (TABIS) is developed in the scope of “Development of a National Database Using Geographical Information Systems and Remote Sensing System and Standards for a Disaster Management Decision Support System” at the Istanbul Technical University.

TABIS is the abbreviation of the Turkey Disaster Information System Project realized by the partnership of the Republic of Turkey Ministry of Interior and Istanbul Technical University. The system provides the user association to reach the current, correct, and consistent data. It is observed to share the required information, to combine the useful information and to use of the mutual interaction results of this information in planning and managing with a style that prevents the chaos originated from the excess of information [4].

3. TABIS- OBJECT CATALOGUE (TABIS-OK)

The heart of the Turkey Disaster Information System is the spatial database. The reference model of the TABIS system constitutes of two vector components.

These components are named as;

- Digital Spatial Model (SMM),
- Digital Disaster Model (SAFM).

Both digital models constitute the space on a basis based on the object by separating the place one by one to its components. This process is the atomizing of the space in the database modeling. Atomized data of both of the digital models were prepared as object catalogues [2].

TABIS Object Catalogue takes its shape from two components whose final products are SMM (Digital Spatial Model), and SAFM (Digital Disaster Model). These two components are named as; TABIS-Basic Topographic-Spatial Object Domains Catalogue (TABIS-TOK), and TABIS-Disaster Management Object Domains Catalogue (TABIS-AOK). The probable attributes of the objects are given in both catalogues.

The advantages of the TABIS Object Catalogue are;

- Enlarging the data without any control will be prevented because of the Geographic Information Systems infrastructure modeled with definite standards.
- Managing the same data by distinct institutions will prevent.
- The efficiency will increase with working interdisciplinary, so it will be lay a foundation of different quality Geographic Information Systems all around the country.
- Data exchanging problems will be ended because of the standards prepared in the field of data exchanging.

4. TABIS-BASIC TOPOGRAPHIC-SPATIAL OBJECT DOMAINS CATALOGUE (TABIS-TOK)

The aim of the TABIS-TOK is modeling the objects, which are the parts of the topography, in the set land of the system. Due to this aim this component of TABIS-OK is named “Basic Topographic-Spatial Object Domains” [2].

TABIS-TOK is a data standard for the institutes in public or private sector which want to make more detailed GIS for their special purposes. Objects models, object definitions, attribute definitions and the data types belong to the attributes in TABIS-TOK can be synchronized with analog topographic map content. Therefore a synchronized Disaster Management System model to the TABIS-TOK can accommodate with the other Geographic Information Systems on the same region having different purposes.

4.1. TABIS-TOK Configuration

4.1.1. Object Domain

Object domain exists on the physical earth’s surface and describe mainly the topographic character of its region. It covers the object groups. There are eight object domains in the TABIS-TOK. These are:

- Settlement
- Administrative Regions
- Transportation Structures and Infrastructure
- Running and Dead Waters
- Plant Cover
- Geodesic Reference Points
- Topography

- Cadastral

4.1.2. Object Group

Object Group is a concept covers same type objects. There can be a single object domain that the object group belongs.

4.1.3. Object Type

Objects are everything that could be observed by the sense organs or could be describe with other instruments on the spatial area. Objects have topological relationships, attributes, definition and geometry.

4.1.4. Lump Object

Lump objects are the sub parts of an object. They have geometry and particular geometry.

4.1.5 Attributes

Attributes are qualitative or quantitative information belongs to an object or an object part. The probable attribute values of some object types are given in the TABİS-TOK. Data Types for the Attributes are Number, Real, Integer, Logical (and, or etc.), Boolean (right or wrong), String, Binary, Array, Date, Money [2].

5. STUDY APPLICATION

5.1. Application Area

The application area is ITU Ayazaga Campus in Istanbul province, Şişli district and Maslak region. ITU Ayazaga Campus is one of the five campuses of the ITU in Istanbul. Its total area is 1.6 km² and the biggest campus of the ITU. There are seven of thirteen faculties in the Ayazaga Campus. These are, faculty of civil engineering, electric and electronic, chemistry and metallurgy, mines, naval architecture and ocean engineering, literature and science, aeronautics and astronautics, and totally 10 separated research laboratories. Also there are houses provided to lecturers (8 apartments), totally 30 dormitory buildings for the students, 1 exhibition centre, 2 social centre, 1 dining hall, presidency and management units and a lake, forest...etc. There are four of five institutes of graduate and doctorate education studied in Ayazaga Campus. These are institute of energy, institute of science and technology, Eurasia institute of earth sciences and institute of informatics.

5.2. Data

Before the study, digital map of the ITU Ayazaga Campus in 1:2000 scales is provided from the Construction Department of ITU in dwg format. The scale has been enough for the study because the TABİS Object Catalogue has designed for the objects between 1:5000–1:25000 resolution. The campus data is dwg format and in UTM coordinate system. This digital data is controlled in AutoCAD for the problems of non-closed areas. Some mistakes about this problem are removed. Then the data is transferred to Arcview software in dxf format.

5.2.1 GIS Resolution

The resolution concept in GIS is defining the objects, which will exist or not exist in the system due to their planimetric sizes, while designing the system. The resolution of TABİS Project is between 1:5000-1:25000 scales so the objects are defined due to this resolution [5].

5.3. Software

In this study Arcview (3.2 version) software is chosen for GIS process, and also AutoCAD (2002 version) is used for the ITU Ayazaga Campus data. The software used is licensed to ITU Geodesy and Photogrammetry Department.

ArcView is full-featured GIS software for visualizing, managing, creating, and analyzing geographic data [7]. Arcview GIS software is produced by ESRI.

AutoCAD software is the world's leading customizable and extendable CAD software for 2D drafting, detailing, design documentation, and basic 3D design [6]. AutoCAD software is produced by Autodesk.

During the study a computer used with 40 GB HDD, 256 MB Ram and Windows 2000 operating system in GIS Laboratory of the Geodesy and Photogrammetry Department. The computer is connected with ITU Local Area Network (LAN).

5.4. Database

TABIS Basic Topographic Object Catalogue is designed for Turkey, so the objects in the catalogue do not exist in the ITU Ayazaga Campus, for example railway, refining ...etc. Instead of whole objects in the TABIS-TOK, the objects exist both in TABIS-TOK object catalogue and in campus are used in the database. Therefore Arcview attribute table is capable for these objects.

In the study the objects in the campus like buildings of both faculties, institutes, presidency and the departments under presidency, laboratories, dormitories, football fields, swimming pools, roads, exhibition center, lake, forest, houses of the employers... etc. are matched with the TABIS-TOK objects. The coding system in the TABIS-TOK is used in the attribute table also.

However the study scale is larger than the TABIS project, some attributes are added which can be used in a probable disaster in ITU Ayazaga Campus. For example a data standard for civil engineering faculty includes;

- Object Domain: *Settlement (A.A.)*
- Object Group: *Other Usage (A.A.3.)*
- Object Type: *Building; Insaat Fakultesi (A.A.3.10.)*
- Attributes:
 - Function: *Education and Research*
 - Ownership: *Public*
 - Situation: *Working*
 - Underground/Aboveground: *Aboveground*
 - Historical Value: *None*
 - Building Permit: *Legal*
 - Floor Number: *5*
 - Structure Type: *Reinforced Concrete*
 - Building Regulation: *1997-1998 Regulation*
 - Damage Situation: *None*
 - Console: *Exist*
 - Fire Escape: *None*
 - Daytime Population: *956*
 - Night Time Population: *3*
 - Week Population: *956*
 - Weekend Population: *30*
 - Summer Population: *660*
 - Winter Population: *2660*
 - Handicapped Population: *15*
 - Foreign Person Population: *0*
 - Child Population: *0*
 - Domestic Animal Population: *2*
 - *Academician Population: *260*
 - *Officer Population: *67*
 - *Laboratory Number: *16*
 - *Bachelor's Degree Students: *4322*
 - *Graduate Students: *1279*

* Attributes added due to the aim of the study except from TABIS-TOK

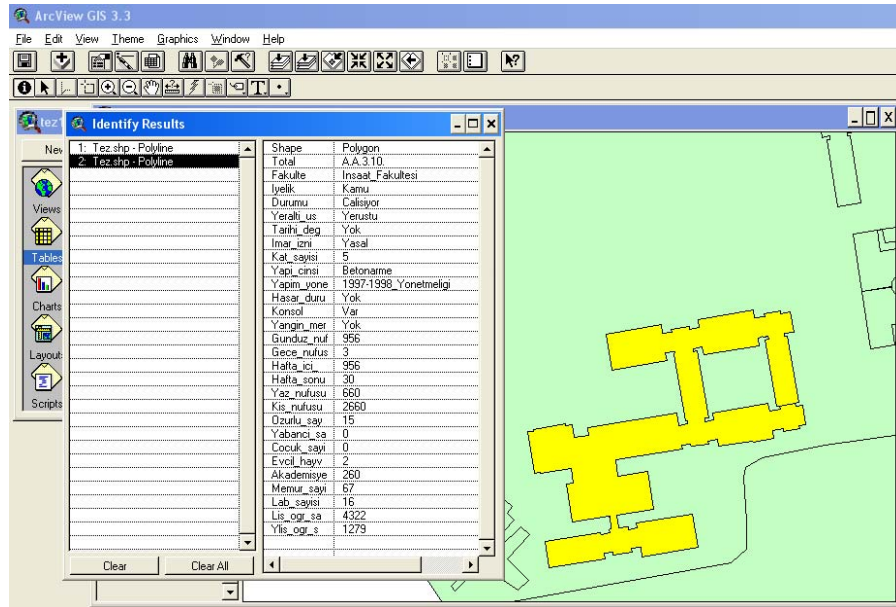


Figure 1. An example from the project, identifying an object (Faculty of Civil Engineering) and its attributes

Furthermore the GIS software can produce some attribute data using the scripts in the library of the software. Scripts can supply many advantages according to the aim of the system. In this study two scripts are prepared except than the attributes from TABIS-TOK have. These scripts are area and perimeter of the objects.

The system is very scalable because of the possibility of gathering more attribute data, so making more analyses due to the planning or management aims like showing the buildings have more floors than 8 and have fire escape, have night population bigger than 20...etc.



Figure 2. An example from the project, identifying the object types named building and has larger area than 5000 m²

6. CONCLUSION

This study is a pilot application of the TABIS to the ITU Ayazaga Campus using Basic Topographic-Spatial Object Catalogue. The objects in the catalogue are applied to the objects in the campus. Gathered attributes entered to the system.

In the near future, the products of this project will be combined with the the Disaster Management Object Domains Catalogue prepared by H. Karaman¹ for the ITU Ayazaga Campus.

However, the scale of the study can be reduced and more specific analyses can be done onto the study by gathering more specific attributes, like the laboratories have less than ten fire extinguishers and have burning material ...etc. The Project of creating the Basic Topographic-Spatial Object Model of the whole objects in the Ayazaga Campus area finished and only the attributes of Faculty of Civil Engineering are being gathered yet. When the attributes gathered for the whole objects (especially faculties and institutes) in the study area, it is expected that the system will be work more efficiently.

¹ Himmet Karaman is research assistant in the Department of Geodesy and Photogrammetry Engineering, and also a membership of TABİS project and designed the database structure of TABİS AOK for his graduate project in 2002.

7. REFERENCES

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