



**International Journal of Humanities & Social Science Studies (IJHSSS)**

*A Peer-Reviewed Bi-monthly Bi-lingual Research Journal*

**ISSN: 2349-6959 (Online), ISSN: 2349-6711 (Print)**

*ISJN: A4372-3142 (Online) ISJN: A4372-3143 (Print)*

*Volume-V, Issue-I, July 2018, Page No. 72-91*

**DOI: 10.29032/ijhsss.v5.i1.2018.72-91**

*Published by Scholar Publications, Karimganj, Assam, India, 788711*

*Website: <http://www.ijhsss.com>*

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## **Life Cycle Data Analysis for Smart Cities and Support with Geographic Information System (GIS)**

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### **Abstract**

*The dynamics of globalization have gained momentum with today's developing technology. So we are now faced with the problems of urbanization (and urban governance), which become more evident than in the last years. As the subject is city, interdisciplinary qualities must always be considered. In the study, too, the focus of the urban area are smart (intelligent) management that remained within this framework. GIS plays a major role in establishing the relationship between all kinds of analyses and visual information in the same environment and in determining the right strategies. For this reason, the use of GIS for decision makers is one of the most commonly used methods for intellectual production in the smart cities concept. This method will support systematic and sustainable applications in the future.*

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**Keywords:** Data Infrastructure and Integration, Spatial Data and Model Quality, Spatial Database, Spatial Data Mining, Smart Cities, Urban Planning, GIS.

### **1.INTRODUCTION**

With today's developing technology, the dynamics of globalization have gained momentum. So we are now faced with the problems of urbanization (and urban governance), which become more evident than in the old days. From this point of view, it is necessary to try to approach a more cautious designer role by going beyond the current approaches, to manage the urban area, which is becoming a smart and sustainable way, which is transforming into the competition of urban areas with technology and digital solutions in every respect.

Geographical information systems are playing critical roles for many administrators and decision maker because one of the most important factors of the information systems is the data in the last decades. It is very important to form the data available at the institutions according to an information system logic and to determine new data in the same way.

This is a subject with priority for each institution, which plans to set up an information system. Reformation of the data by the transformation of the graphical and qualitative data in different formations into formations, in which they can have an affair with each other, is one of the main points of the system. In the announcement, these two subjects examine generally and according to the conditions of our country, the problems determine, and suggestions put forward about the solutions. (Köktürk & Köktürk, 2002).

To this end, in parallel with the advances in computer and communication technologies, the fast-paced data processing world is becoming increasingly important. It is the forerunner to develop sustainable approaches in the solutions to the problems of urbanization and urban management. Globalization dynamics are overemphasizing in today's conditions.

In addition, as the subject cities, interdisciplinary qualities must be considered. In the study, too, the focus of the urban area was on the problematic issue of intelligent (especially, transport) management that remained within this framework level.

In this context, while the concept of smart cities use in the framework, it is now widely tried to develop a viewpoint that is conscious of a neoliberal view or a similar product-oriented approach to the consumption society, but in a more prudent position.

The developed countries had started with "e-government". All data about social life with these approaches are now turning into applications with the electronic restructuring, internet, etc. technology to make it always accessible via their decisions.

So that data and information now play a very important role in every aspect of life, is the inevitable support of correct decisions. Spatial data have an important place in the e-government approach.

Writer had presented by a proceeding as a trend in smart cities, "in recent developments in urban information toward m-state applications from e-government, by increasing the size of people's participation". (Kocalar, 2013b).

## **2.FINDINGS**

### **2.1 Urbanization and Environmental Problem:**

Urban areas and places with daily mobility form an important living space of communities and even living beings on our planet.

#### *2.1.1 Problems of Urban Areas and Places / Locations*

Some of these problems: Migration, population growth, quality of life, limited service capacity, security, etc. The problems created by distorted, urbanism immigration and overpopulation, the increasing need for different services in the urban environment that manifested by the volatility of urban living quality with many other factors.

As increasing security violations, cities must constantly inspect for security purposes as a common living space for human beings and animals.

#### *2.1.2 Problems of Protection of Urban Environment*

The cities need to be protect also by the parts that form a common living space for human beings and animals. Because of this, due to increased security violations in urban areas, it is necessary, to constantly inspect for security purposes. Environment and water pollution, the problem of the settlement in the natural resource reserves, human health-related threats appearing incrementing parameters are increasing day by day.

Therefore, it is now imperative that the numerical environments in which people are required to monitor the frequency of independent controls become more and more necessary. Unplanned urbanization, bringing along various infrastructure and related health problems, impair fully modern image we want to see the city today. For this reason, urban transformation projects brought to the agenda in our big cities and various projects carried out. (Yağcı, 2014).

## 2.2 Administrative Roles in Management

There are some gaps / conflicts / contradictions between the central and local governments' administrative roles (coordinated, disjointed). These problems, which grow increasingly serious in size, take place especially in the areas of responsibility of local governments and central government in sometimes. That is why it is necessary to produce common service solutions within on their premise.

### 2.2.1 Institutional Issues

There are administrative jobs: data collection and conversion, lack of expertise, infrastructure problems, security breaches, etc. However, in the researches of nowadays had been showed that our agencies which provide different services in cities have never been sufficient in terms of data collection and value transformation. Especially the lack of expertise is a reality and infrastructure problems are continue. On the other hand, any security violations may occur can be serious problem areas.

Therefore, the fact that the value obtained from the verbal values is still not very warm. On the other hand, in order to the security breaches in the use of electronic media, providers of value will become increasingly important in different types of initiatives.

The first of all, the solutions for institutional issues depends on management with enough money. For example, the lack of expertise, the problems of new infrastructure installations and updates are important previous steps before data collection, conversion and integration, etc. steps, also to be ready for security breaches, etc. in anytime.

### 2.2.2 Legal Issues (Gaps in the Legislation / Contradictions)

Neo-liberal affect increase the decisive role on legislation. Rapid changes brought about in the different vacancies and contradictions like as Table 1 at below.

Table 1. Current or changed some legislation about related city/region subjects (2007).

Some Laws names	Current Laws#	Old Laws#
Metropolitan	5216	3030
Other Municipalities	5393	1580
Housing and slum	775, 2981, 3194	
Reconstruction	2018	
Financial Control	5490	
Numbering	2694	
Provincial Administrative	5302	
Financial Structures in Mun.	4856, 5302, 5216	
Zoning Plans	5216	
Urban transportation & traffic	5393, 2918, 4925	

## **2.3 Utilizing GIS Based Information Systems in Urban Management**

By dealing with all these problems are very difficult. Especially, to decide quickly and correctly at different levels of authority needs more information.

Urban administrations as well as for the central government is a problem in itself.

Together with the developing technologies to overcome these problems, some of the GIS based information systems on the agenda listed at below.

GIS based information systems:

- Tracking systems\*,
- Address information systems,
- Transportation information systems,
- Earthquake information systems,
- Infrastructure information systems\*\*,
- Urban information systems,
- Planning information systems,
- Management information systems,
- Reconstruction information systems,
- Immovable information systems,
- Tax information systems

\*GPS and GSM technology also uses in these technological systems. Many transportation firms for vehicle files uses these technological systems in their sectors.

\*\*SCADA uses in these infrastructural information systems with time. SCADA is not an open system so this situation is problem for interactivities.

It is necessary between them coordination and integration with time, especially in smart cities vision too.

Thus, repeated data entry prevent and verification quality can increase in this way. We can give these benefits, first by highlighting the stakeholders and then the author's short summary of those views by grouping and updating in the direction of the vision of the smart cities.

Stakeholders of smart cities:

- City citizen (Real person)
- Companies (Legal entity)
- Municipal administration and employees
- Investors
- Immovable Owners (public, private: real, legal person)

Information management systems, which designed with different focussed in urban area and used with geography based, will create smart cities of the future these facilities at above.

Benefits to facilitate perception grouped with key topics at below:

- Services
- Operation (Network)
- Planning
- Coordination
- Investments

### 2.3.1 Services:

In the subjects provided, bureaucracy reduce, operations accelerate. From shared veneers, remotely service procurement will become widespread. Citizens will be happy. Service and operations are easy, costs are reduced, the quality of service increases. Continuity in service should be clear. (7x24)

### 2.3.2 Operation (Network):

Technical infrastructure, water and natural gas subscriber and network data will collect instantaneously.

### 2.3.3 Planning:

According to social and demographic facts planning facilities, it provided. According to the concrete measures of the future of cities, it plans. Prevention against accidents and disasters fast and furious, it may plan things.

### 2.3.4 Coordination:

Sewerage network and other infrastructure networks' related plans are more realistic. A cooperation way between the related institutions support success easily.

The municipal investment objectives should share with all stakeholders be in harmony.

### 2.3.5 Investments:

Have all information about the city. Thus, according to population forecasts and facility capacity necessary investments directly. All decisions about investments should be fast and more accurately.

### 2.3.6 Living environment:

Thanks to environmental protection and risk mapping creating a healthier and livable environment, it will become possible.

## 3. SOLUTION DYNAMICS in SMART CITIES by GIS:

A technical framework of some current approaches are here. Urbanization requires finding new landmarks for arriving is in town and this leads to the following:

- The expansion of urban areas and
- A narrowing of the opened areas leading to other uses.

This is in turn, leads to significant energy consumption and environmental impacts of gases such as carbon monoxide and greenhouse gases. For this, both ecological and technological cities (smart cities) need.

If the urbanization is uncontrolled, it is more likely that there will be problems such as inadequate infrastructure, illegal construction and different demographic structures.

Identification of the current status of cultural heritages is another important thing for documentation, preservation, and for use as a base or restoration. Documentation studies need robust and scientific methods. GIS and (especially digital terrestrial) photogrammetry have recently been the most commonly used scientific methods of processing information of historical monuments on computers for documenting cultural heritages digitally.

In cited study for documentation, all data of 46 historical monuments located in Silifke/Mersin collected and transferred to a database so that it made queryable. Some of those heritages were reconstructed as 3D models by the use of photogrammetric techniques. Finally, 3D Models were integrated into the system for presentation. (Doğan and Yakar, 2018).

Turkish Topographic Vector Database (TOPOVT) is a 3D vector database comprising 1:25.000 scale or higher resolution topographic features, contours representing the topography and geographic names. TOPOVT is the basic geographic data source for our country mapping and base for GIS applications. Feature collection stage of TOPOVT will soon be completed by covering whole Turkey. The updating works have already begun and will go on with an acceleration in 2018. Real time or near real time updating of continuously changing geographic features in our country as far as possible and avoiding the duplicate geographic data production by governmental institutions are the main objectives of General Command of Mapping which is the biggest geographic data producer in basic scales in Turkey. By this system, all the governmental institutions needing topographic database for their applications will easily reach TOPOVT, make use of the data in their field works and present the data they produced to country use. In addition, by avoiding the duplicate geographic data production, national sources utilized economically and effectively. (Yılmaz and Camberk, 2018).

Land use maps of rangelands were generated for past and current years. Then, by using these maps, temporal changes in rangelands were determined. A database was created with information about the rangelands in the study area for analyses and queries according to the results of a study; the structure of the current rangeland information system was examined, deficiencies were identified, and a sustainable rangeland information system was designed with the aim of eliminating the deficiencies. (Akar and Gokalp, 2018).

Such developments all over the world also reveal the necessity of smart cities.

### **3.1 A Technical Overview of the Framework of Intelligent Approaches to Urban or Spatial-Oriented Virtual Environments**

Urban spaces with daily mobility are an important living space for communities even for living things on our planet. Urban (location awareness etc.) spatially focused virtual environments are becoming increasingly widespread in our everyday life with their different application possibilities. Such urban or spatial-oriented digital environments increasingly need for the collection, processing, preservation, and conversion of data into various value-added works.

Especially for the increasingly vigorous urban environments, these needs are increasing rapidly. Their classification (technology used, user population, brand / model, etc.) can be quite diverse and will exceed the limits of this declaration.

Here, only those who have notified the position will emphasize, as well as access to the sectoral solutions will examine and then general solutions will give with titles only.

### **3.2 New Business Models for Smart Cities**

The need in Europe has led to the formation of European smart cities and communities (European innovation partnership - EIP).

The most important task of the EIP is the implementation of innovative and technological solutions in the cities for the formation of sustainable cities. This idea naturally leads to the idea of sustainable control.

Organizations such as the United Nations economic commission housing and land management unit (UNECE), UN HABITAT offices, FGD, City planners organization, Dubai real estate institute, European environment agency, OECD, EBC had decided to organize a joint project in this frame.

With the concept of smart cities in the project, in order to overcome their implementation difficulties low middle income in countries with economies, it is aim to pass on the principles and practices of sustainable urban development including that new business models that will enhance technology and management skills.

The committee for these studies did not announce the period until 2020.

There are many GIS applications near the smart cities concepts or subjects nowadays. In the study, the focus of the urban area was on the problematic issue of intelligent (especially, transportation) management that remained within this framework level.

### *3.2.1 Urban Daily Mobility (Location Notified Individual Flow) and Intelligent Services:*

Urban virtual environments (location statement etc.) are becoming increasingly widespread in our daily life by providing usable applications. The collection, processing and preservation of data in these digital environments creates new and important business areas. So much so that it is increasingly necessary for cities, to transform this activity into various value added works.

Service quality directly relate to reliability, precision and up-to-datedness of the data/analysis. During planning process, GIS apply as an objective and precise tool for analysis, synthesis and decision making phases, replacing planner's ability to use self-initiative. GIS provides accurate and rapid data updating, and thus eases deciding for areas where urgent planning or changes are required.

Utilizing GIS, problem rapidly define and urgent solutions found. The statistical data, which collect by utilizing remote sensing and geographical information system in transportation planning, examine with information systems and solutions per locations produce rapidly. GIS also provides objective and precise analysis for future density projections. (Güvenal, Çabuk, Yavuz 2005).

### *3.2.2 Transportation Networks with Intelligent Services:*

Especially monitoring and security of the transportation network purpose auditing is also highly desirable. In addition, since the needs grow rapidly and diversity, it is inevitable that the solutions are a part of life for urban environments that are particularly populous.

Within a study, "data derived from traffic accident reports in Eskişehir County has been used for transportation planning process, as well as determination of critical locations/points in the city". It is about transportation plan decisions with GIS.

Thus, current transportation plan decisions within the regions with determined critical points has evaluated. Proposals for redesigning the traffic restrictions has been presented according to the analysis results executed in a GIS environment." (Güvenal, Çabuk, Yavuz 2005).

Another study had presented in 4th Highway Traffic Symposium, it was about intelligent traffic flows, named "A decision support systems had been designed for special purpose vehicles towards the prevention of traffic accidents in driving safety for road motor in Motorway and Rubber Wheel". (Kocalar 2013-a).

### 3.2.3 Urban Transformation Perspectives with GIS:

A study with GIS-approach for smart buildings, “From design to project, Sustainable Building Supervision and Management Model (SYDYM) for Building Construction Process Life Cycle” was named, had been presented as a proceeding in Smart and Green Buildings Congress and Exhibition. (Kocalar & Takçı, 2013-c).

Rapid population growth in our living space spread and urban renewal need by the city's social, economic and physical improvement. Urban transformation has also emerged in order to solve the problems concentrated in the urban depression areas in a coordinated manner. Urban regeneration which in solving urban problems is an important tool of there are a lot of policies and procedures in this regard different from each other, in our country as well as around the world and have been widely discussed, monitored and implemented. Geographic Information System through which pad to use in urban areas will allow you to undoubtedly more accurate conversion.

Especially, obtained with using thematic-based base maps, decision-makers can be taking the lead in making the right decisions. In practice, in the field of urban transformation, geographical information technologies, registration, analysis, synthesis with features decision makers more precise results. Such that; map, linking table documents establish spatial relationships and making it possible to make inquiries. (Yağcı 2014).

### 3.2.4 Common Living Spaces and Intelligent Services Aimed at Improving:

A common living space for people and animals in cities it should supervise for security purposes. Street and in-building camera and surveillance systems are also widespread today.

The fact that the cities enter into new economic relations, consumption habits and changes in patterns; the emergence of new housing, business and management centers, and most importantly, the growth of physical criteria with parallel to the increase in the urban population, new technological urban infrastructure and public services bring to the agenda as a necessity. (Bozkurt 2008).

Here, in the post-modernization, the use of new technologies in these kind of fields also have to increase over time rapidly.

## 4. REALITY for GIS APPLICATION

Geography Information Systems (GIS) had used as general title for City/Urban Management Systems (CMS/UMS) and/or Spatial Information Systems (SIS). They are using depends on the aiming areas in these work.

### 4.1 Basic Description of Database Systems (DBS)

A DBS consists of a database, a database management system (DBMS) and a system interface or database language that acts as a user access point, as shown in Table 2. A database stores large amounts of information over long periods of time; this information is managed and controlled by DBMSs. The DBMS enables a unified description of all aspects of the DBS including data model overviews, security information and transaction management, user access control etc. The viewing and manipulation of data can only be

performed by the DBMS. An important prerequisite for the use of a DBS in a practical application is the definition and implementation of the database itself.

Table 2. Database Systems

Database System		
Database	Database Administration	Database Communication Interface
Data Storage	Software and Control Administration of Data	System Interface (Point of Access)

## 4.2 Overview of Spatial Information System Components

The descriptive part of the cadastre is the Digital Automated Land Survey Register (ALB) (Table 2). It contains information about:

- land parcels;
- type(s) of land use;
- estimates;
- legal issues; and
- additional data on each parcel.

Table 3. Cadastre structure

Cadaster and Survey Register		
Land Registry	Cadaster Maps	Number Registry

In general, there are two types of geographic data: vector data and raster data. Vector data (points, lines, polygons etc.) can be linked to a variety of different data types and sources (such as population levels, altitudes, street numbers), while raster data (aerial photos, satellite photos etc.) only contains a greyscale or colour-value. Raster data sets are used to measure and determine distribution patterns and in distance analysis. Hybrid GIS are capable of working with both raster and vector data types – this allows altitude models and spatial statistics to be generated (Table 4).

Table 4. Geoinformation systems with application layers

Data Sets									
High Voltage	Water	Sewage	Cadaster	Cable TV	Traffic	Telecom	Heating	....	...
Geo-data for data sets and functions*									

### 4.2.1 General and Technical Cost Problems According to the Contents of the Components in the Systems:

Since spatial data is also an important part of the e-government approach, the information content system components (hardware, software, data, institutional structure, human resources, rules, etc.) should be considered as a whole. In view of the authors' work,

visualizations will make clearer through the following three separate tables. (Köktürk & Köktürk 2002).

Table 5. Distribution of load of jobs for every components within total cost. (Köktürk & Köktürk 2002).

Jobs in total cost	Distribution of load (%)
Consultancy	5
Preparing	5
Hardware	10
Software	15
Others*	65

Others item in Table 5. at above is covering identification, compilation and structuring of data.

Table 6. Average life span of system components. (Köktürk & Köktürk 2002).

The main system components      Average life span (min.-max. in years)

Life of hardware equipment	1-2
Software life	5-10
Data life *	50

Data life is more than others in Table 6. However, it is not certain for every systems no doubt.

#### 4.2.2 Related Subjects with Distributions of Uses for Spatial Information System:

The areas and rates of use of data constructed in a spatial information system are as following Table 7 at below. As writers, spatial data gain an important position in various social activities, and because of these characteristics, "change values" are stronger than the old ones. Increasing use values of spatial data give rise to increasing exchange values. (Köktürk & Köktürk 2002).

Table 7. Related subjects with distributions (percentage) for spatial information system. (Köktürk & Köktürk 2002).

Related subjects	Distribution (%)
The central inst. of the state	6
Local institutions	20
Transport sector	4
Telecommunication	19
Technical infrastructures	22
Education	2
Spatial marketing	4
Construction sector	5
Cartographic studies	5
Land valuation	9
Private sector & others	4

There are some steps for information systems of data processing in Table 8. at below.  
It is necessary to transform it into form (or data conversion to required form).

Table 8. Some steps for data processing of information systems (Köktürk & Köktürk, 2002).

Some data processing steps	
1	to be obtained
2	be processed
3	configurations
4	in the course of presentations (according to requirements)

There are some critical points in these systems according to writers (Köktürk & Köktürk 2002):

. First, heterogeneous properties will be dominate in the related hardware and software structures.

. The concept of "exchange of data" takes precedence but for "changeability", it is also seen that "transformation" may be necessary.

The cost of the collection and reformation of the data according to the system logic is nearly 65-70 % of total cost of an information system about residential subjects. It is important to be aware of that point because that ratio is generally not open. On the other hand, data sharing between the institutions and the units is also another problem. It gets more difficult to create the database of the information systems about the residential subjects under the working conditions with institutions and managers that are tight about data sharing. To put forward the rules and conditions of data sharing, to accelerate and to cheapen the data flow are gaining importance for the expectations of the information systems to come true. (Köktürk & Köktürk 2002).

### 4.3 Urban Transformation with GIS

With a master thesis, (Yağcı 2014) using GIS facilities in urban transformation studies, analytical data and images that directly or indirectly affect decision-making mechanisms can use at below:

- location,
- geological situation,
- state of active faults,
- soil land class tribe,
- Urban land use equilibrium,
- slope,
- bond,
- cadastral status,
- zoning situations,
- environmental plans,
- transport,

- infrastructure,
- temporal change and environmental

Using these parameters, the urban transformation phenomenon in the thesis was examined by further realizing the urban transformation of Meram District Altınhamle.

In another paper, “transfer of property and development rights in applications of development plans” by GIS used is possible. (Kocalar 2016-b).

Firstly, the City Information Management System must be established in a city by the municipality, before it is necessary to start urban transformation studies, etc. For that the infrastructure information, integration with other information about the land, technical infrastructural cadastral information must be ready to use in different urban studies.

Urban management with City Information-Management Systems(CIMS/UIMS): These kind of facilities at below can be provided with for all urban data, using the possibilities of GIS technology, in the urban (transportation, management, transformation, etc.) projects: Storage, information access, interrogation, analysis, decision making, reporting, visual presentation of results with thematic maps.

The digitalization of maps and other forms of spatial information opens new possibilities for GIS to be used to visualize geographic knowledge and to transform geographic information. They provide users with a range of analytical tools that are only provided by GIS to explore spatial relationships in data, including data collection, data modelling, data manipulation, data analysis and data storage.

This combination of both basic and advanced spatial data analysis functions is not found in generic information systems. The functionality offered by GIS is often required to understand and to manage activities and resources for highly specific purposes. This results in specialist GIS applications, such as:

- Geoinformation System
- Land Information System
- Environmental Information System
- Resource Information System
- Network Information System
- Picture Processing Information System
- Design Information System
- Spatial Data Processing System
- Spatial Information System
- Multi Purpose Cadastre
- AM/FM - Automated Mapping and Facilities Management

#### **4.4 Natural Resources with GIS in Regional Studies**

There is a proceeding about water resources in Sivas and planning through the apparent effects of climate change (Dams and Ponds and Irrigation Channels) in the UZAL-CBS 2014. (Kocalar 2014-f).

## 5. COMPLEXITY EVALUATION for DATA PROCESSING in GIS

There are very different data structures (graphical, verbal) in GIS, so that this complexity in data processing are important with all components: Data Types/ Structures/ Resources/Software.

### 5.1 An Overview of the Computer Architecture Basics

Table 9. Overview of computer architecture basics.

<b>Data structure</b>	<b>System Hardware Usage / # of users</b>	<b>Data model storage/ present. Envrnm.</b>	<b>Transactions</b>
<b>File - Core (Jet)</b>	PC-Personal Computer	Personal Files (.mdb, .dbf,)	Transactions in single personal computer
<b>Client Server</b>	- Multi-user but without Internet	Central server files / in network	Terminals access to Central server for operations in network
<b>Client – Web Server</b>	Multi-user with Internet	Central web server files / in Internet	Terminals access to Central server for operations in Internet

First, an overview of the computer architecture basics with hardware, software and database components are in Table 9. at above.

Operation systems and application software depends on hardware firms in the similar operating principles. GIS components depends on issues in all these architectures.

### 5.2 GIS data components (Data Models, Types / Structures)

GIS database software depends also on issues in all these four data models in Table 10. Graphical software depends on Graphical Data type / structures are in Table 11. at below.

Table 10. Classification of database software according to data models.

<b>Data models</b>
<b>Relational</b>
<b>Hierarchical</b>
<b>Network</b>
<b>Object-based</b>

Table 11. Simple comparative analysis of systems for producing digital maps specific to cartography study area.

<b>Asset information</b>	<b>Complex Data type</b>	<b>Topological Data type</b>
Data structure / database	Coordinate information	Geometric relations with coordination info.
Storage	Stack	Flexible
Repeat records	Not Optimum	Optimum
Data associations	Unrecordable	Recordable
Data Analysis	Difficult	Easy
Data types	Parcel, building, etc. without contents.	Parcel and building but with contents.
Additional tools- Algorithms	Required	Are not required
Data model presentation	Desktop environment	Network and Internet
CAD data integration	Yes, easy	Yes, but difficult
Reporting, Querying	A little difficult	Easy
Sample SW		Arc Info CBS

Table 12. Geographic Information Systems (GIS) Basics Components and Cartography

<b>GIS Data Types / Constructions / Resources / Software / Components</b>						
<b>Data Types &amp; SW</b>	<b>Graphical Data and Graphics Software-SW (Complex, Topological)</b>					
<b>Data types</b>	Raster (Complex, large size)			Vector (Topological, small size)		
<b>Data Source</b>	Satellite Photo	Aerial Photo	Doc Map Ph Scan	Geodetection measuring data	Photograph Evaluation data	Digitized data
<b>Add. Comp.</b>	Image processing software			Computer Aided Design (CAD) and Drawing software		
<b>Data elements</b>	Photographs			Graphic elements (Point, Line, Area)		
<b>Data operation</b>	Comparison, Classification, Processing,			Comparison, Classification, Processing, Attribution		
<b>Objectives</b>	2D / 3D Imaging			Mapping, 2D / 3D Design		

Data components (data streams, structures, resources, database, etc.) with application software in GIS are important, so they are giving by Table 12. without hardware in easy way at above.

In this Table 12 only graphical data and graphical software (Complex, Topological) show in very. However, there is a critical point about data processing related with data types in GIS.

### 5.3 Critical Points (Different Data Types / Structures) in GIS

As there are different data structures (graphical, verbal) in GIS, so that this complexity in data processing must be decreased with the design of systems.

In the Client - Server (network type, multi-user) systems structure, very useful with this approach. The server part is attentive and regular, increasing the quality of data and service with high-level control.

This system structure are using in advanced GIS environments quite more. Thus, it is possible to use with graphics data and verbal data on the same server.

These situations were also taking advantages like a list at below. Advantages of storing and using graphical and verbal data in the same database in advanced GIS environments are:

- . Query with geographic data SQL statements.
- . Min. data with max. questioning.
- . Editing user transport rules
- . Presenting sneaky by filtering data.
- . Providing convenience, flexibility and security in data presentation on the Internet.
- . Relation of graphics and verbal data.

#### 5.3.1 Vendor Specific Technology Information (Arcs DE and Oracle SDO):

For example, ESRI Arc Info / Arcs DE and Oracle SDO database systems and Geographic databases created by ESRI products, called Geodatabase.

Geodatabase specific information:

In Arcs DE technology, non-graphical (verbal, attribute, tabular) data is easily managed by being stored in a relational database, and the management convenience provided by such use is superior to this product. Databases can select differently for personal use (.mdb) and for multiple uses (Oracle, MS SQL, IBM DB2, Informix). (While SDE technology uses with ESRI products, but other GIS software such as Geomedia and MapInfo cannot use SDE technology.)

Advantages of geodatabase data modeling:

- Regular configuration for data (quick access to data, ease of editing, updating and correcting with inter-learner relationships).

- Better definition of geographical objects, simple geometric shapes (point, line, multiline, closed area) as well as curves, curves, etc. in shape, etc. also ease of arrangement, update and correction.
- In the same database, related data (vector, raster, TIN, address descriptions) can be placed and managed.
- It provides easy-to-use data editing and versioning capabilities within the authority of the Internet.

### *5.3.2 Open Approaches (OpenGIS Consortium-OGC):*

Open GIS was announced in 1994. ESRI and Oracle entered into this consortium in 1997. OGC has been supporting with related studies with Open GIS Reference model by many workgroups in OGC's issue way. (Buehler 2003).

## **5.4 Data Processing in GIS-design in Internet**

Compilation of data from sources, transfer into the computer environment, analyze, process, convert information and take part in GIS require very good planning.

The quality of the data, specifications, standards, formats, compilation methods, sensitivities, etc. should consider in detail during system design.

## **5.5 Automatic Data Integration in Cartography Mapping Periods**

Data must be also smart data in the GIS in data productions and processing operations period as suitable with data specifications, standards, formats, compilation methods, sensitivities in high quality.

Drawings should be defined as which kind of draw (for examples; building, road, slope, channel, lakeshore, rainwater grate, garden border, etc.).

## **5.6 Geo-Referencing Systems Standards**

There are also many geo-referencing systems standards. Some of them used in GIS ready-systems and maps produced in institutions since 1895. Then systems standards changed with 1942, 1953, 1954. The country coordinate systems accepted by mapping law regulation in Turkey, 1974.

However, after 1980, many local coordinate systems were used with plans (1/1000, 1/2000, 1/5000) in local authorities and institutions.

The selected coordinate system for GIS graphical data will also require some transformations between coordinate systems.

## **5.7 Data Exchange Format Standards**

The different data processing methods and the different software's produce different formats for geographic graphics data, raster data and verbal data (registration records, etc.) also. So that many of data need to be exchange while using.

There are also defined standards for these data, depends on different countries in differently. (DIGEST is for ABD and NATO countries).

## **5.8 Data Compilation**

Data comes from different sources, then analyzed with different criteria's (in last section at above) and integrated in to the GIS in compilation period.

After coordinate exchanging, data integrity operations between map booklets takes also more time in this period.

(For examples: building, road, slope, channel, lakeshore, objects shapes of garden border type etc.)

## **5.9 Methods in GIS**

As a summary, methods can give shortly in here. For example, ownership records needs to be correction operations.

Methods use with GIS at below:

1. Data compilation
2. Database administration
3. Position determination
4. Monitoring and analyzing
5. Human resources management
6. Financial resource management
7. Risk management
8. Time and resource management

Data compilation methods:

These questions should ask in this period at below:

1. Which data will compile?
2. Which sources of data will compile?
3. What will be the sensitivity and the quality?
4. Which tools will use?
5. How much resources will use?
6. How much staff will use?
7. What time will take place?

Operation steps in this period will define after answers to these questions.

Data administration methods:

Data administration methods depend on data quantity and dimension.

Important steps in data administration are at below:

1. Data security (intruders, energy droppings, etc.)

2. Data sharing rules (depends on users)
3. Data vendors' producers' administrative levels (users authorities and responsibilities)
4. Data presentation model (in web servers, etc.)
5. Data editing, updates, etc.

## **6.CONCLUSION**

Analyses that can take a very long time with traditional methods, it can do much more simply and quickly with GIS.

For smart cities on GIS –based, a brief summary of what is expected or advised can present as follows:

- Pre-planning for smart cities (and cities) and instant / continuous / uninterrupted-7/24 monitoring determination of priority sectoral areas.
- Sectors (Transportation network etc.) are also use for control purposes (instant / continuous / uninterrupted-7/24) monitoring and security purposes, continuous improvement in over time.
- Critical data on these sectoral areas will be collected institution / organization and non-governmental organizations and their authorities sharing the data at the border, producing new data / reports sharing with the public.
- Sample applications can develop with working together to find solution proposals need to identify the problems in the big data and information urban focussed, security areas in country or international level.
- There ise another thing most importantly, scientific and commercial activities, which are aimed at contributing to the acquisition of different and new values, values are increasingly valued by safely processing existing data in the public.
- The support of Geographical Information Systems, which provide the infrastructure of the urban systems in which such applications take place, also maintains its importance seriously in today's rapidly developing conditions.
- Use of the terrestrial-spatial data analysis a more detailed framework should establish for social purposes.
- Acceptance and dissemination of data standards will bring new possibilities to work and practice in particularly.
- These crosscutting issues evaluate in detail in terms of data analysis on a few examples (Traffic management, urban management and urban transformation, etc.)
- A conclusion has been drawn that such multidimensional discussions of interdisciplinary will be useful both for those studies and it is thought that the common results will provide enriching contributions to the smart city framework approach.
- In the future, by using geographic information systems, alternatives that put forward, (like minimizing in accident risks, etc.) the findings based on scientific studies that can carry out for different purposes should try sampled.
- Here, post-modernization and the use of new technologies in the urban studies fields also have to increase over time.

- It is possible to use GIS techniques more effectively by working together with many disciplines in different issues to smart cities in the future.

Some disciplines relate with GIS and smart cities at below:

1. Computer science and data science
2. Research and planning
3. Mathematics
4. Statistics
5. Cartography
6. Geodesy, Photogrammetry, Survey, Remote sensing
7. GPS technologies
8. Constructing engineering
9. Other disciplines (meteorology, city and regional planning, property evaluation management, traffics, first aid, etc.)

### **Acknowledgements:**

*Acknowledgements of support for the paper are welcome to Computer Engineer (Data Scientist) M.Sc. Şaban Dalaman.*

*This paper presented by author in a workshop.\**

*\*KOCALAR, Aziz. Cumhur. (2017-a).Life Cycle Data Analysis For Smart Cities And Support With Geographic Information System (GIS), 4th International Workshop on GeoInformation Science: GeoAdvances 2017, 13-16 Ekim 2017, Karabük Üniversitesi, Karabük.*

### **References:**

1. Akar, A. and Gokalp, E. 2018. Designing a Sustainable Rangeland Information System for Turkey, International Journal of Engineering and Geosciences (IJEG), Vol; 3;, Issue; 3, pp. 087-097, October, 2018, ISSN 2548-0960, Turkey, DOI: 10.26833/ijeg.412222
2. Bozkurt, İ. M. 2008. 19.yy Kentiçi Toplu Ulaşımında Modernleşme ve Yeni Teknoloji Kullanımı: İstanbul Örneği, Selçukludan Cumhuriyete Şehir Yönetimi, Ed. Erol Özvar, Arif Bilgin, Türk Dünyası Belediyeler Birliği, İstanbul.
3. Buehler, K. 2003. Open GIS Reference model.
4. Doğan, Y. and Yakar, M., 2018. GIS and Three-Dimensional Modeling for Cultural Heritages, International Journal of Engineering and Geosciences (IJEG), 2018 Volume 3, Issue 2, s: 50 - 55, ISSN 2548-0960, 2018, June 2018, Turkey, DOI: 10.26833/ijeg.378257
5. Güvenal, B., Çabuk, A., Yavuz, M. 2005. Trafik Kazaları Verilerine Bağlı Olarak CBS Destekli Ulaşım Planlaması: Eskişehir Kenti Örneği, Harita ve Kadastro Mühendisleri Odası, Mühendislik Ölçmeleri STB Komisyonu 2. Mühendislik Ölçmeleri Sempozyumu, 23-25 Kasım 2005, İTÜ – İstanbul.
6. Güzel, G., 1998. Türkiye Koşullarında CBS/KBS Oluşturulabilmesi için Yazılım Araştırması ve Tasarımı, Doktora Tezi, Yıldız Üniversitesi Fen Bilimleri Enstitüsü, Jeodezi ve Fotogrametri Anabilim Dalı, İstanbul.

7. Güzel, G., 2007. Coğrafi Bilgi Sistemleri, Yönetim Bilgi Sistemi ve Belediye Uygulamaları, Forart Matbaacılık.
8. Kocalar, A. C. 2013a. Karayolunda Motorlu ve Lastik Tekerlekli Özel Amaçlı Araçların Sürüş Güvenliğinde Trafik Kazalarının Önlenmesine Yönelik Bir Karar Destek Sistemi Tasarımı, 4. Karayolu Trafik Sempozyumu, Ankara, 08-09-10.5.2013.
9. Kocalar, A. C. 2013b. E-Devletten M-Devlet Uygulamalarına Doğru Kentsel Bilişimdeki Son Gelişmeler ve Halkın Yönetime Katılım Boyutunun Arttırılması, The First International Symposium on Digital Forensics and Security (ISDFS), Elazığ, 20-21 May 2013.
10. Kocalar, A. C. and Takçı H. 2013c. Tasarımdan Projeye, Yapı İnşaat Süreciyle Yaşam Döngüsüne Yönelik, Sürdürülebilir Yapı Denetimi ve Yönetimi Modeli (SYDYM), Akıllı ve Yeşil Binalar Kongresi ve Sergisi, Gazi Üniversitesi Mimarlık Fakültesi, Ankara, 23-24.5.2013.
11. Kocalar, A. C. 2014f. Sivas'ta Hayat Bulan Su Kaynakları ve İklim Değişiminin Görünen Etkileri Üzerinden Planlamanın Vazgeçilmez Hafifliği (Baraj ve Göletler ile Sulama Kanalları), Uzaktan Algılama-CBS Sempozyumu (UZAL-CBS 2014), YTÜ, İstanbul, 14-16.Ekim.2014.
12. Kocalar, A. C. 2016b. İmar Uygulama Araçlarından “Mülkiyet ve İmar Hakları Aktarımı Modeli (MİHAM)”, 6.CBS-UZAL 2016 Sempozyumu, Çukurova Üniversitesi, Adana, 5-7.Ekim.2016
13. Köktürk, E. and Köktürk, E., 2002. Conversion and Exchange Problems of the Data in Geo-Information System, GIS 2002-International Symposium on Geographic Information Systems, Istanbul-Turkey, s: 287-300, 23-26 September 2002.
14. Kumar, V. 2014. Geographic Information Systems for Smart Cities, Copal Publishing Group, India.
15. Yağcı, C. 2014. Kentsel Dönüşüm Projelerinde Fiziksel Değişimin Coğrafi Bilgi Sistemi (CBS) Yoluyla Araştırılması, Selçuk Üniversitesi, FBE, Harita Mühendisliği Anabilim Dalı, Yüksek lisans tezi, Konya.
16. Yılmaz, A. and Canıberk, M. 2018. Real Time Vector Database Updating System: A Case Study for Turkish Topographic Vector Database (TOPOVT), International Journal of Engineering and Geosciences (IJEG), Volume 3, Issue 2, s:73 - 79, ISSN 2548-0960, June 2018, Turkey, DOI: 10.26833/ijeg.383054

Revised July 2018.