

# **A Web Based Geographical Information System Design for Monitoring Urban Growth, Case Study Bosna-Hersek District in Konya**

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**Key words:** Land management; Urban renewal

## **SUMMARY**

With the increasing population and growing cities, the need for proper management and planning techniques reveals for the urban centers. For providing vital functions in rapidly growing urban centers needs to decision-support systems for instant decisions. Because of this needing, the changing's and developments of urban cities over time must be monitored for deciding about new buildings area.

In this study for Bosna-Hersek district in Konya province, because of it grows rapidly, a web based geographical information system is created for monitoring urban growth. Bosna-Hersek district has a very crowded student population because of the nearest district to Selçuk University. It is rapidly growing without any management. Therefore, infrastructure and roads are getting more inadequate for the needing. Satellite images and vector maps are used together for detect the changing's over time. Addition to this data, waste storage areas, forestry areas, and air contaminated areas are mapped as a layer in ArcGIS software. By creating this geographical information system, with the support of current satellite images, new buildings, contaminated areas, and risky areas can be determined. With population and region status information, needs of new roads and new settlement areas can be determined with the support of satellite images. For the purpose of getting the view of current satellite images Google MAP API used to integrate vector maps with satellite images. ArcGIS and GeoServer softwares are used for creating system for the most rapidly growing district of Konya, Bosna-Hersek.

## 1. INTRODUCTION

Urbanization is the most important issue in all developing countries. Studies show that urbanization and the economic development status of a developing country are linked. Because urbanization is saving serious kind of economic support of governments. (Smith, 1975; Cheema, 1993). However, urbanization tends to accentuate a number of problems, such as inadequate housing and urban services, proliferation of slums, pollution and deterioration of the urban environment. Urban professionals can make significant improvement to the urban environment by adopting an integrated management approach, in order to resolve the conflicting interests of multiple-stakeholders and achieve equity, while keeping in view urban dynamics and uncertainties.

Nowadays, local governments are using a variety of information systems for providing resource management, monitoring urbanization and provision of necessary infrastructure. However, systems that are used to provide sustainable urban management must be well designed according to need. For the purpose of determining new resources and need in rapidly growing urban areas, information systems are using widely in department of planning. Information systems, also called urban information systems are allows local governments in taking the right decision in decision making processes.

Thus, with working accurate data and suitable data infrastructures, it is possible to minimize problems about decision making processes. In addition, system will play an important role if it allows multiple Professional discipline support in right decision making processes.

As a reflection of technological developments, the concept of information system has been adopted by many professional disciplines. As a result, vocational studies are planned in geographic information systems considering protocols that are required for spatial data management and sharing of information system is carried out within the concept of GIS. Thus, the capabilities of local governments and official institutions to manage data increased and with developing interoperability, needs to share and serving data began to be felt day to day more intensively. At this point, the Internet is currently the most effective means of global communication and brought a different dimension to the process of sharing spatial data and presenting to the users. Thus, web based gis concept has started to use intensively in different kind of applications in our country. (Sarı, F., 2012).

In this Study, for the purpose of monitoring urban management and urbanization, a web based geographical information systems is designed and an application is prepared in Bosna-Hersek district in Konya.

## 2. DATA COLLECTION AND PLANNING CONCEPT IN TURKEY

In Turkey, there are some problems in data infrastructure which are used in management and planning activities. In Knowledge collecting, updating, sharing, etc issues a holistic approach has not been adopted. On the creation of a standard data base, although efforts are being made for many years, it is clear that we are still far away from the aim of creating an integrated information system. Status of Information infrastructure also negatively

affects the planning and management activities. It is become a difficult subject for planners to find the right, current and accurate information which will make it possible to decide. So planners started either collect the information or try to decide with general assumptions. Administrators are also experiencing similar problems in management activities.

This situation is preventing the right decision making processes and also causing to the deficiency in urbanization monitoring. At the same time, local governments are facing with failures in right decision making. With this form, extraordinary circumstances such as earthquakes, climate, environmental disasters, and local governments are remaining insufficient in emergency responses. So, in extraordinary circumstances, wrong decisions will occur to fatal results and losing life standards.

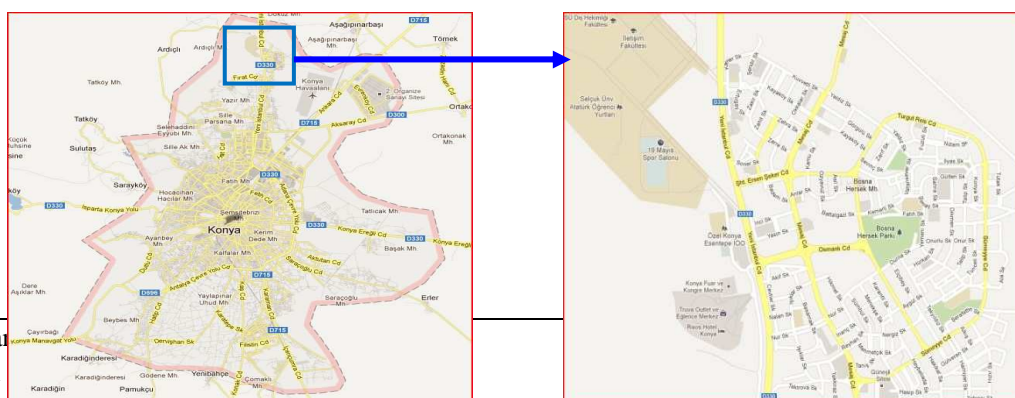
In this Study, the base aim is providing right and useful data infrastructures with integrating data which are produced according to different standards. For the purpose of helping to the planners, managers and decision makers, data interoperability tried to apply urban data.

Monitoring of urban development in particular, the prevention of illegal structures, determination of the potential risk areas and to contribute to the implementation of measures to be targeted.

### 3. MATERIAL METOD

As an application area, Bosna-Hersek district in Konya city is selected. Bosna-Hersek is the most rapidly growing district in Konya city. Its population is over 40.000 already and this amount is quite big for a district. Because of this district is near to the Turkey's one of the biggest university, namely Selçuk university, it has a big population potential. With this Study, potential risky areas in Bosna- Hersek district will be determined by the reason of old stream areas exist in Study area.

With this Study, a web based geographical information system is constituted, for realize data interoperability of existing data and integrating global map sources as like Google Maps and providing instant data access. Web based geographical information systems are used to process, storage, Analysis and serving data to the users by using internet protocols and concerned web services.



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**Figure 1 :** Study Area

In web based geographical information systems, data, which are stored in geodatabases, are processed as a map image by using web map server standards. Thus, data can be used in external geographical information systems and web applications. To understand web based geographical information system's firstly common principles must be known. In client-server structure, client and server connects to each other by using internet or intranet with TCP/IP (*Transmission Control Protocol/ Internet Protocol*) protocols. GIS client sends request to server with web browsers. Response is sent to the client after compilation of process with URL (Uniform Resource Locator). (Aydinoğlu, 2003).

Components of web based geographical information systems are;

- Server
- Client
- Web Server Components
- Geographical Data Server
- Web Browsers

**Server:** Servers are the main object of the web GIS applications. Server manages databases that geographical information stored in. Runs web server components and application data.

**Client:** Clients are the computers which request geographical information by using internet or intranet.

**Web Server Components:** Web Server Components are responsible to response the request which is coming from clients. It serves web pages and data with using database management systems. In Windows this component name is IIS (Internet Information System).

**Geographical Data Server:** These softwares are responsible to build map images and serve on internet. It can get the data from databases and prepare referenced map image.

**Web Browsers:** Web browsers are the softwares that clients used to display web pages and web applications.

#### 4. APPLICATION

With this web based GIS application, it is aimed to detect data up to date situation and monitoring urbanization. With this application without using any GIS software urban monitoring can be realized. Existing applications can be easily modified to new applications.

The most important object in urban monitoring is data and data up-to-dateness. Because of this in Analysis processes up-to-date data must be used for specifying urban situation. Comparing data objects (as like satellite images, vector maps, etc.) must be up-to-date for monitoring latest situation of urbanization.

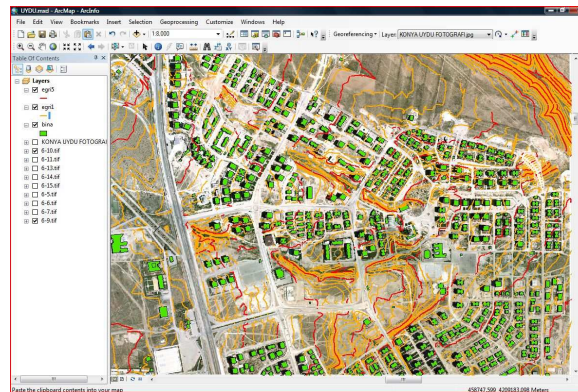
In table 1 shows the dates of data and data types, there are 3 satellite images in different dates.

**Table 1:** Data Types

DATA	DATA DATE
Google Map Image	2011
Aerial Images	2007
Satellite Images	2004
Vector Maps	2007
Buildings	2007

In this situation, latest satellite image for Konya city is Google Map image. Because of this, in addition to the other satellite images, Google Map Satellite images used in application. Google Map provides users to use global images in their web applications. By using Google Map API, satellite images can be use in web applications and layers can be display on it. Google Maps API is a JavaScript library allows users to modify and integrate with global images. For Konya city, Google Map has up-to-dated images in 2011 year. Also aerial images are present which has gathered in 2007 year. Ikonos image which has produced in 2004 year is also used in this application. Thus, provide 7 year time interval for urbanization monitoring.

Firstly, layers are prepared for display on satellite images. These layers are buildings and contours with 1 and 5 meter interval. Layers are obtained from CAD vector maps, and converted to the GIS format to use in ArcGIS software. In ArcGIS software layers are processed for coordinate transformations and attribute data integration. ArcGIS software has a worldwide user groups and has a strong tools which provide users to constitute databases and data integrations. With using data management tools, satellite images and vector data are stored in geodatabases. In figure 2, ArcGIS software with layers has shown. Buildings, contours and as a base Layer satellite images can be seen.

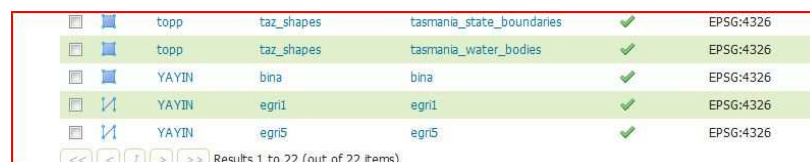


**Figure 2 : ArcGIS Software**

For serving geographical data on internet, geographic data server softwares must be installed on server. These softwares are producing a map image of layers to serve users. In this application, GeoServer software to serve data as Web Map Server (WMS). GeoServer is supporting ArcGIS database software and file formats with their attribute data. GeoServer allows users to serve their data on internet and to the external GIS applications with strong tools and interfaces. In table 2 Web services are shown which are constituted in GeoServer software.

**Table 2: Web Services**

Data	Web Service
Building	WMS
Contours	WMS
Points	WMS
Satellite Image 2004	WCS
Aerial Images 2007	WCS



**Figure 3 : GeoServer Layer Window**

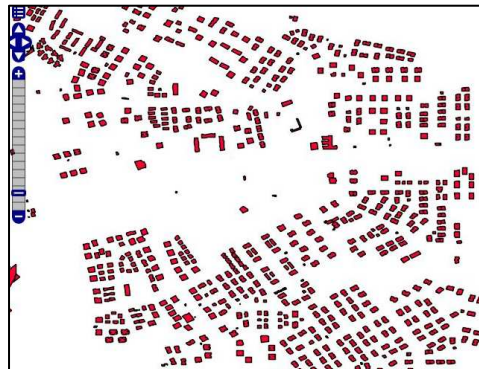
GIS softwares have an ability of display the web services as a Layer on map windows. Thus, it is enough that giving WMS addresses to users for display layers in external gis applications. Users can display layers, query them, integrate with satellite images or another layers and analyze. In figure X, layers has shown in external GIS application map window.





**Figure 4 :** Layers and Satellite Images

However, the application requested only for use with Internet applications, Internet applications need to be developed for displaying the data. Therefore, in this Study, a web page was designed to be used in Internet applications. One way of displaying web services in web pages is using OpenLayers web interface. OpenLayers is an easy way to display, query and integrate data with web pages. Considering the file size of the data which has used in applications, it is important that web interface must be simple and useful. In figure OpenLayers simple map window has shown with buildings Layer.



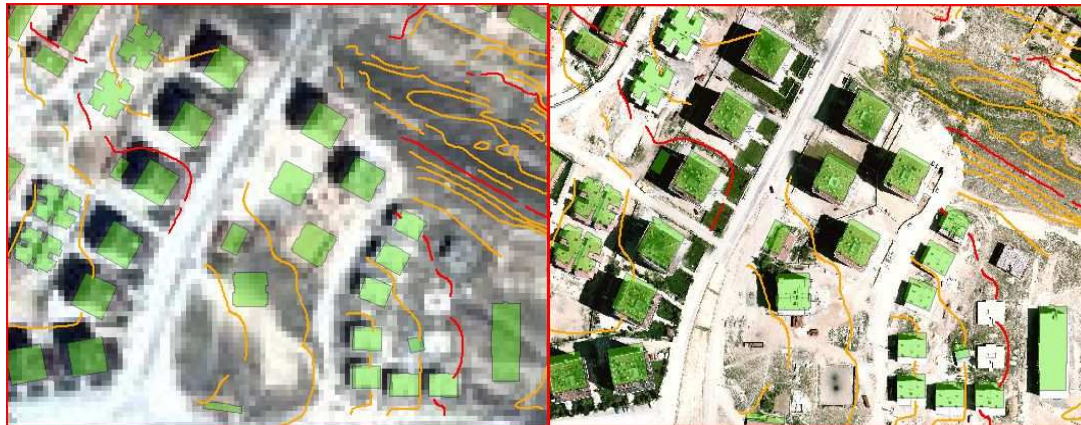
**Figure 5 :** OpenLayers Web Interface

In OpenLayers interface, it is possible using global map services as a Layer such as Google Map, Yahoo Map, Bing Map and Open Street Map for the aim of supporting applications as like base Layer. In this application these global maps are added as base Layer to display with layers. Then buildings and contours are added as selectable layers. When clients requests the URL of OpenLayers web interface, server is starting to prepare map image as defined in URL and then send the map image to the client computer, so clients can see layers in their web pages. In figure web page has shown which prepared with OpenLayers interface.



**Figure 6 :** OpenLayers Web Interface with Base Layers

The figure has shown differences between 2004 and 2011 year satellite images. On the left side, 2011 image, on the right side 2004 image has shown. As seeming in the figures, buildings are tend to be clustered in the stream areas and red circled buildings are new buildings.



**Figure 7 :** Differences Between 2004 and 2011

## 5. CONCLUSION

Cities are constantly changing and evolving, characterized as a dynamic phenomenon. Managers and planners face a continually changing new expectations and demands. The main source of information infrastructure to meet the expectations and demands. Information plays a very important role in decisions made on the nature of property and infrastructure. Clustering data which are obtained by different institutions, in decision making process will play an important role for planners. Developments of information systems have become sufficient to realize this kind of projects. These developments are making easy to work with different kind of data and multi-disciplinary data interoperability for planners, managers and decision makers.



In our Study, it has cleared that possibility of serving data which are different time interval, scale and various standard catalogs. One of the useful objects of this Study is make it possible to monitor the urbanization dynamically and detect the prevention techniques and methods. Similarly, with large datasets such as earthquakes, climates, geological surfaces, water resources and other data sets, before and after disaster situations can be determined or urban security. The scale is depends to the data sets and number of layers.

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