



THE FEASIBILITY OF EXPORTING GEOGRAPHICAL INFORMATION SYSTEM DATA TO GOOGLE EARTH

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Abstract

Image satellite is one of the important sources for the Geographical Information System (GIS). With world-level coverage of satellite, aerial photography, streets points of interest and more, made the Google Earth (GE) as one of the geobrowsers programs that enable data with a spatial component to be used by both GIS and non-GIS users

The objective of the present study is to explore the feasibility to export and integrate existing GIS format data including shapefiles into a GE format for display as a layer at the same location of the study area, and manipulation by using various ArcGIS9.2 tools. Export_to_KML software was used for converting the data from GIS format to GE format. This process is potentially very useful in the direct interaction of the GIS datasets over the internet by desktop mapping tools such as GE, where their integration with GIS information is especially helpful in the viewing the information in a spatial context. All the created shapefiles of this study have been done by author using ESRI's ArcGIS9.2 Desktop and defined according to WGS84_UTM_Zone 38N projected system.

The results revealed that both GIS vector and attribute data can be effectively exported and visualized using GE. Moreover, most of the GE functions can be applied on the exported GIS layers that can be visualized on the GE window.

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(geobrowsers)

(shapefiles)

(ArcGIS9.2)

(KML 2.2.3)

(WGS84_UTM_Zone 38N)

(ArcGIS9.2)

Introduction

Geographical Information System (GIS) is a nonlinear process that involves acquiring, processing, analyzing, and displaying spatial data through the integration of computer software, hardware, and people [1]. The primary focus of the GIS is the analysis of spatial data and their associated attributes. The analysis may include data query, measurement, statistics, and operation on one or more of the available layers of the GIS database, as well as exploration and analysis of graphic display of spatial data. Practically, most of the available maps now are related to satellite images and GIS technology integration through the spatial information.

Google Earth (GE) was developed by Keyhole, Inc. and was initially known as "Earth Viewer." Google acquired Keyhole in 2004 and renamed the product Google Earth. It was formally launched in June of 2005 [2]. GE is a free internet tool that has given the possibilities of digital geography. In essence, it's a "virtual globe" that allows the user to zoom from space right down to street level. Besides viewing any place on Earth, viewers can view locations and features created by other GE users [3]. It maps the surface of the Earth by superimposing images from satellites and aerial photography. It depicts the Earth as if you were looking at it from an airplane or orbiting satellite.

However, the ease of use and functionality make it a useful tool for geographers as well as professional cartographers and surveyors.

Recently, the data used in real-world GIS implementations are derived from national topographic reference datasets and Google Earth, which have been devised and developed for cartographic, surveying and real-time Global Positioning System (GPS) tracklog purposes [4],[5]. Thus, techniques and methodologies for developing the GIS – GE integration should be of concern to the GIS researchers and users who care in the exchange

of information and real-time sharing of data through the online programs such as GE.

The intent of this paper is to present the utilization of Keyhole Markup Language (KML) file as an integration tool to export the GIS data to GE and make use of GE's functionality.

GIS and Google Earth Integration

There is no doubt that satellite images have become sources of important data that are available on a permanent basis, but the problem in their prices which is not be at hand in many cases. For example, remote sensing center is very interested in providing the modern image satellites, but their prices are so high, therefore it depends on the available image satellites of acceptable accuracy and date, which are compatible with goal of the research.

As noted above, the detailed satellite imagery coverage and capability of user interfaces have made GE as one of the most internet sources of the image satellite for remote sensing and GIS applications. In the other side, many GIS users and researchers have started to utilize GE in their application as a visualization and exploratory data analysis tool.

Most of GIS software (such as ArcGIS9.2 Desktop and Global Mapper 11.0, ERDAS 10.1) provides tools and techniques to allow some inter-compatibility through the use of (KML), KML is a programming language similar to HyperText Markup Language (HTML), was specifically designed to allow spatial map and features to be displayed in virtual earth browser, such as GE [6]. By supporting KML toolbars, ArcGIS9.2 which is adopted in the present study allows shapefiles to be converted for viewing in GE, (i.e., the KML file is the mediator of the interrelationship between the GE and GIS programs) as shown in figure (1).

Materials and Methodology

1. Materials

In order to implement this research work, the following software have been used.

ArcGIS9.2 desktop: It is an Environmental Systems Research Institute’s (ESRI) software. It is used for the purpose of creating the shapefiles that will be converted to KML format [7].

Google Earth Plus: There are three main versions of GE, GE free, GE Plus, and Professional GE. In the present study, GE Plus was adopted because it is available and adds KML support as well as enhanced drawing and sketching [8].

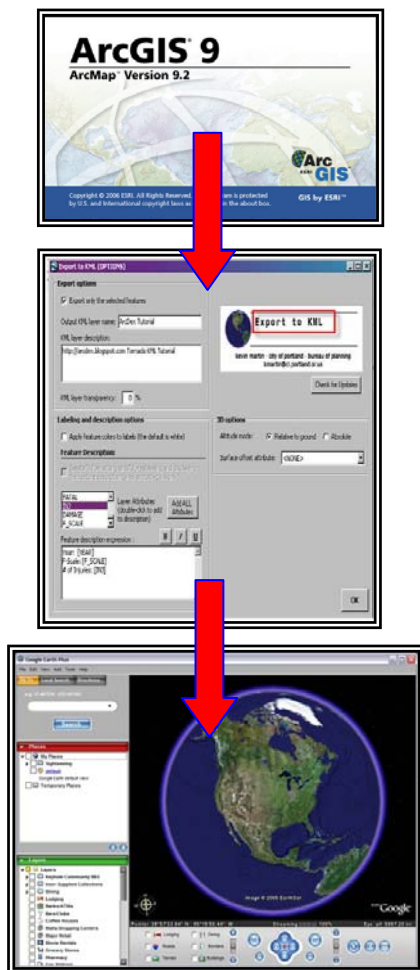


Figure 1: The interrelationship between the GIS, KML, and GE programs.

Export_to_KML: is an extension developed for ArcGIS9.x. It allows the ArcGIS users to export GIS data in KML format for viewing in GE. KML is an Extensible Markup Language (XML) grammar and file format for modeling and storing geographic features such as points, lines, images, polygons, and models for display in GE and Google Maps [3]. The extension can be freely download by [9].

2. Methodology

The main steps followed in the execution of this research work can be summarized from figure (1) in section (2).

Through the ArcMAP9.2 window of the ArcGIS9.2, two shapefiles layers were created on the IKONOS image satellite covered Mosul City and add to the ArcMAP9.2 window as shown in figure (2). The layers represented the following features inside Mosul city:

Generator.shp layer contains a points represent the Global Positioning System (GPS) geographical locations of some diesel electrical generator sites (Implemented by the authors)

Block.shp layer contains a polygons represent the residential areas in the city of Mosul (Implemented by the Municipality of Mosul). The layers were reprojected to UTM, WGS84 in Zone 38N in order to be similar with the geographical projected system used by GE.

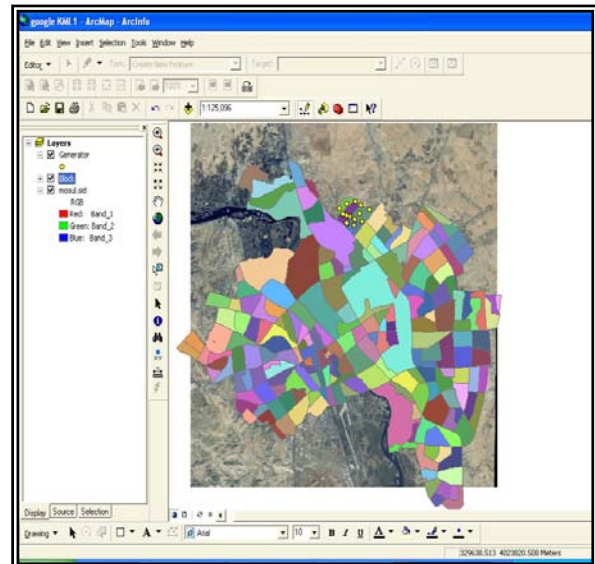


Figure 2: The two shapefile layers.

In next step, the shapefiles must be converted to KML format by using Export_to_KML ArcScript package. To activate the package as an extension in ArcGIS9.2, it must be installed on a computer. Then enable it by opening the 'Tool' menu and check the checkbox next to 'Export to KML' through the extension option as shown in figure (3).

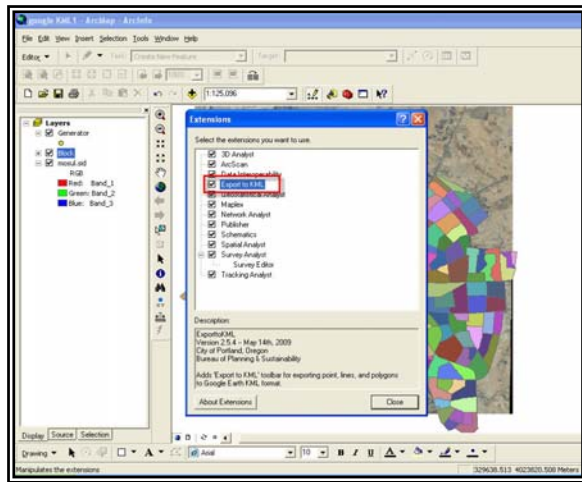


Figure 3: Activated the Export to KML extension.

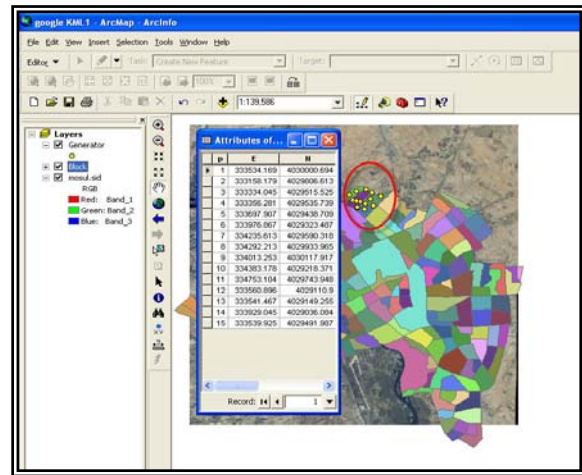


Figure 5: Attribute table of the Generator sites layer

After performing the previous step, the 'Export to KML' will be appeared as a toolbar in the ArcMap9.2 window. At this step, the KML format of the shapefiles layers can be generated and ready to be exported to the GE for application on menu.

Results and Discussion

Through the preliminary work stages of the study, it is found that what can be seen on the GE window is essentially what will be exported into KML format from the GIS output dataset. Therefore, attention was paid to incorporate the two layers symbology into the exported KML (i.e., labeling of point and polygon features) by using their database attributes. Figure (4) shows the attribute data of the Block layer, while figure (5) shows the attribute data of Generator sites layer.

For the Block layer, the (Q_NAME_E) field which represented the attribute data that described the name of the residential areas in Mosul City have been chosen to label the Block layer as illustrated in figure (6). By using the Export_to_KML toolbar, the Block layer shown in figure (6) was directly converted to KML ArcScript and the simultaneously interconnection between ArcGIS9.2 and GE was activated so that GE was displayed the Block layer with the same symbology and label description identified by the author in the ArcMap9.2. Moreover, GE was automatically zoom into the geographical location of the layer according to the identified projected system. Figure (7) shows the Block layer with all label description that have been added and displayed in the contents window of the GE.

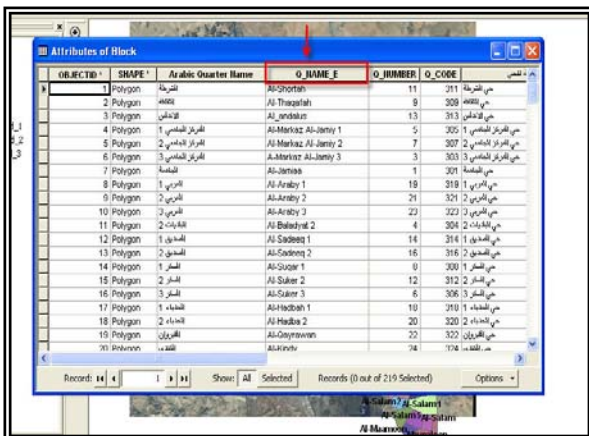


Figure 4: Attribute table of the Block layer

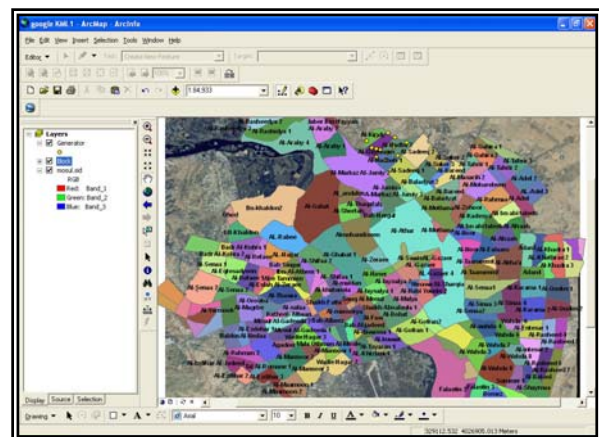


Figure 6: The name's labeling of the Block layer as shown in contents window in ArcGIS9.2

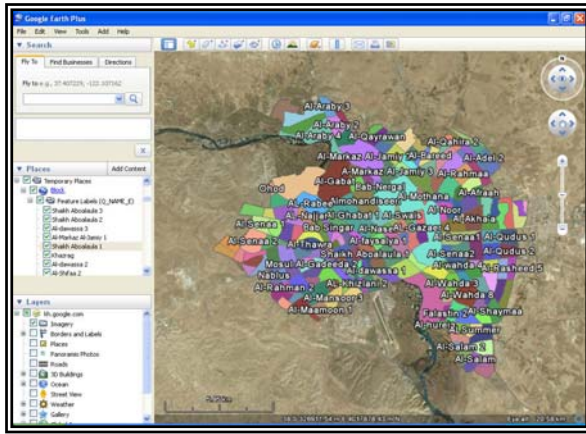


Figure 7: Extent of Block layer with symbology and Label description as shown in GE.

Figure (7) illustrates that the layer symbology receives the same color as its associated with the label feature from the ArcGIS9.2. Also the feature labels (Q_NAME_E) were listed in the places menu on the left hand side of the GE window in a way that can give the possibility to reach any residential area by clicking on its name directly. As seen from the figure (7) that, the coverage of the image satellite in the GE is extended more than adopted one in the ArcGIS9.2. This important feature will give the user the possibility to interpret the topological relationship between the study area and the surrounding topography parameters. Captured image of the Block layer with its contents features displayed in figure(7) can be taken from GE as a JPEG file with a Premium resolution of (4800 * 4147 dpi) and then imported into ArcMap9.2 to be as a base map for further editing and analyzing. But it must be note that GE doesn't provide an automatic methods of including geospatial reference data with the imported image. Therefore, this information must be added to the image manually by a method known as Georeferencing [10].

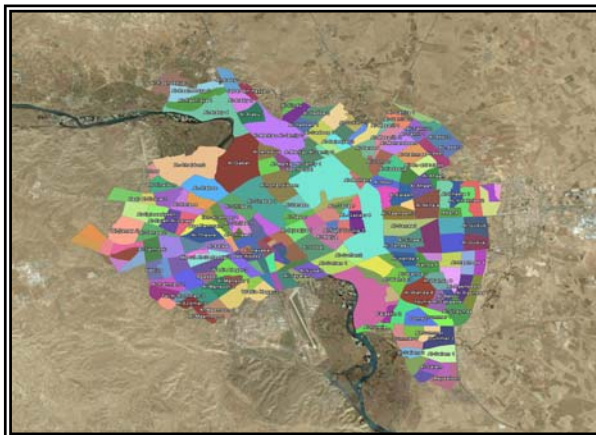


Figure 8: The capturing image from GE.

For the Generator sites layer, as shown in figure (5) that, the table contains only the site locations without height values for each site. Depending on the Export_to_KML function, the height values were extracted for each site from GE by spatially overlaying the Generator shapefile's layer with the satellite images of the GE as shown in figure (9). Table (1) lists the spatial dataset and the extracted height values of the Generators sites from the GE.

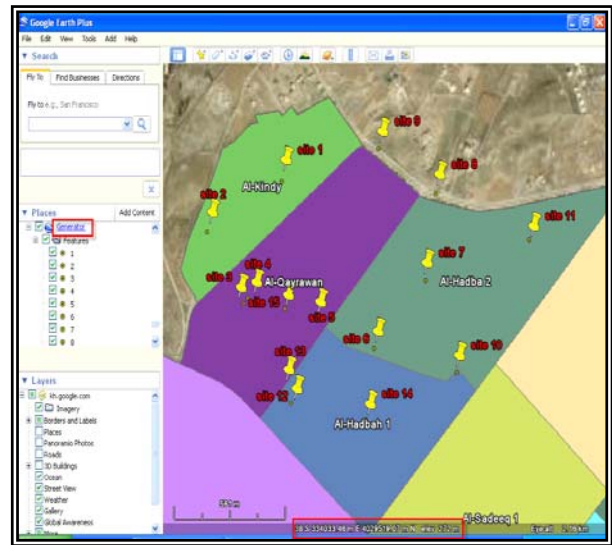


Figure 9: The generators site location as displayed in GE windows.

Table 1: The spatial dataset of the Generators layer as located in GE.

Site no.	UTM coordinate (m)		Heights (m)
	Easting	Northing	
1	333534.169	4030000.694	265
2	333158.179	4029806.613	257
3	333334.045	4029515.525	261
4	333356.281	4029535.739	262
5	333697.907	4029438.709	268
6	333976.867	4029323.487	261
7	334235.613	4029590.318	273
8	334292.213	4029933.965	275
9	334013.253	4030117.917	278
10	334383.178	4029218.371	262
11	334753.104	4029743.948	259
12	333560.896	4029110.900	259
13	333541.467	4029149.255	259
14	333929.045	4029036.084	256
15	333539.925	4029491.987	265

Figure (9) illustrates that there is an excellent matching between the in situ measured coordinates of the generator sites and the spatial coordinate system of the GE. This result come from our depending on the same geodetic system factors adopted in the GE program when creating the shapefiles layer adopted in the present study. Also, this result may give us the capability to adjust the level accuracy of the

geographical projection of GIS data with the global projection system used by GE.

By using the 3D option properties of the Export_to_KML ArcScript package, the height difference of the generator sites between the extracted height values listed in table (1) and the terrain features approved by GE program can be shown in figure (10) below. These differences explained the expected height of each generator sites plus the actual ground elevation of the GE at the base of these sites.

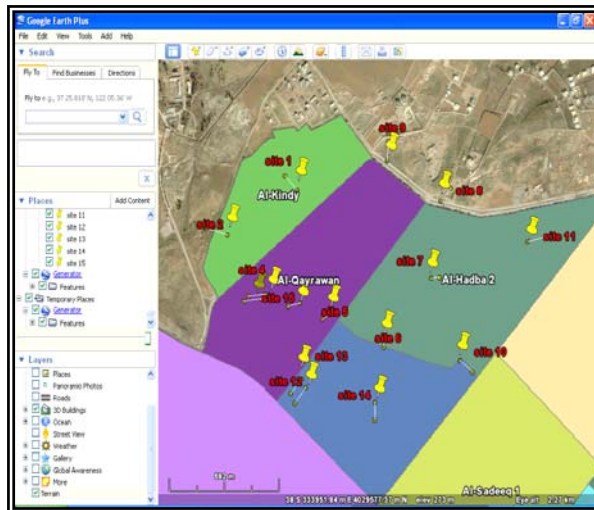


Figure 10: Heights difference of the generator sites as relative to the GE terrain features.

It should be noted that the viewing of any adopted GIS shape file layers relative to the image satellites coverage of the GE program is depended on the required scale, which is in turn depended on the zooming option of the program

Also it must be taken into consideration that, the output results is just showed and saved by the online GE of the user.

Conclusion

This research utilizes the KML package to incorporate the spatial output (vector and attribute) data sets from a GIS into GE. From the output results of the research, it can be concluded that the combination of spatially georeferenced imagery with customized GIS layers gives the ability for users to add their own features and symbology to online mapping program such as GE. This technology leads to find that it's more convenient to use GE for the image satellite overview while at the same time symbologizing and finalizing the map by adding the own descriptions of the GIS files to it. This combination of GIS and GE will give a

useful tool for geographers as well as professional cartographers and surveyors.

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