INTRODUCTION

Remote sensing has developed historically in parallel with other technological advancement such as optics, sensor electronics, satellite platforms, transmission systems and computer data processing. The first Landsat 1 provided the first detailed, high resolution, multispectral images of the entire land surface and the Landsat series continues today. The most outstanding developments began with the lunching of SPOT in 1986 by France. After that a series of satellites were lunched as IKONOS, QUICKBIRD, WORLD-VIEW and GEOEYE providing photos to the earth's surface with high resolution up to 40 cm nowadays ***(Chuvieco, E., and Huete, A., 2010).***

Different satellite images are currently available, suitable for various types of applications. Satellite image data enable direct observation of the land surface at repetitive intervals and therefore allow mapping of the extent and monitoring of the changes in land cover. Evaluation of the static attributes of land cover (types, amount, and arrangement) and the dynamic attributes (types and rates of changes) on satellite image data may allow the types of change to be regionalized and the proximate sources of change to be identified or inferred. This information, combined with results of case studies or surveys, can provide helpful input to informed evaluations of interactions among the various driving forces ***(http://www.ciesin.columbia.edu/TG/RS/RS-home.html).***

The growing availability of high resolution Google-Earth satellite images led to evaluations that are aimed at the definition of the mapping scale they can reasonably be defined for. At this high resolution, details such as buildings and other infrastructure are easily visible. Google will have access to details of 50 cm (20 in) which will be available commercially ***(http://en.wikipedia.org/wiki/GeoEye-1).***

Maps can be created from these images by the Orthorectification process which is the process of geometrically correcting an image so that it can be represented on a planar surface, conform to other images or conform to a map. Orthorectification is the process by which geometry of an image is made planimetric. It is necessary when accurate area, distance and direction measurements are required to be made from the imagery ***(Erdas field guide, Fifth Edition, 1999).***

The Database can be created using Geo Database as an example of Object based type of Databases as it saves both the spatial shape type and its attributes in the same file.
(Chuvieco, E., and Huete, A., 2010).

The Remote Sensing and GIS can be integrated to provide thematic maps for spatial features with attributes up to date information. Also analysis using GIS for Infra-Structure Planning purposes more speedy and low costs can be done.

Objectives of the Research

The main objective of this research was to Study the integration of Remote Sensing and GIS for providing thematic maps for spatial features with up to date attributes information for Infra-Structure Planning purposes more speedy and low costs. Another objective of this research to Study the possibility of using free products of Google Earth program as Google Earth control points as alternative source to GPS control points or even with it, Global DEM (SRTM) as alternative source to ground DEM especially for flat terrain areas and finally using satellite image extracted from Google Earth program GEO EYE satellite image in this case (Google Earth program doesn’t have the same spatial resolution satellite images for all areas) as alternative source to QUICKBIRD satellite images.

Two experiments were conducted to evaluate the planimetric accuracy of the results. The first one based on GEO EYE satellite image extracted from Google Earth program. The second one based on QUICKBIRD satellite image. All results were in UTM (Universal Transverse Mercator) system.

Structure of the Thesis

The remainder of the material of this research will be presented in the next five chapters, whose contents are summarized in the subsequent paragraphs:

Chapter 1 Discusses the Remote Sensing Data Concepts and Characteristics, Introduction of Remote Sensing. Brief history of Remote Sensing will also be discussed. Introduction to satellite imagery will be briefly outlined. Types and classes of Remote Sensing data also Satellite sensor characteristics and High Resolution Remote Sensing Satellites will be discussed in details and finally different applications of Remote Sensing.

Chapter 2 Discusses orthorectification of the satellite images and Digital Elevation Models, Definition of satellite imagery, Satellite images collection geometric errors, Definition and uses of DEM, The different sources of digital elevation models generation including Aerial and Space Images, Existing Topographic Maps, SAR, LIDAR, ground surveying, Global Positioning System (GPS) and Traditional Surveying Techniques also The factors affect the quality of DEM-derived products and the process of Vectorizating features.

Chapter 3 Discusses the Geographic Information Systems (GIS). The definition of Geographic Information Systems, Components of GIS, GIS Tasks and GIS spatial data representation (Raster and Vector) and Finally, GIS Database Design concept.

Chapter 4 Discusses the practical part of the research including the available data to provide thematic maps of spatial features with up to date attributes information for Infra-Structure Planning purposes starting with orthorectifying high-resolution satellite imagery then producing maps from these images and creating Geodatabase containing both spatial and attribute information of the study area. Then GIS analysis was applied for Infra-Structure Planning process especially for Water and Sewage networks. Several experiments were conducted to evaluate the planimetric accuracy of these maps.

Chapter 5 lists the conclusions obtained on the basis of the attained results. Recommendations for further future studies are provided.

Previous Trials and Experiences

(Alexandrov, A., et al., at 2004) has been studied the use of QUICKBIRD satellite imagery for updating cadastral information. Single panchromatic imagery from QuickBird, with 61 cm resolution in nadir is processed. A DTM from existing contours in *.SHP (shape file) type with contour interval 5 m is generated. After Least Square adjustment the results of the ground displacement for normally distributed check points were as follows: mean ± 0.82 m, maximal 1.64 m. The geometrical accuracy of the orthorectification of high resolution satellite images met the requirements for topographic map at scale of 1:5000 according to the local technical specifications.

(Aguilar, M., et al., at 2005) has been studied the Geometric correction of the QUICKBIRD high resolution panchromatic images . The ancillary data were generated by high accuracy methods: (1) Check and control points were measured with a differential global positioning system (DGPS) and, (2) a dense digital elevation model (DEM) with grid spacing of 2 m generated from a photogrammetric aerial flight at an approximate scale of 1/5000 (RMSEz<0.32 m) was used for image orthorectification. Two 3D geometric correction methods were used to correct the satellite data (3D rational function refined by the user and the 3D Toutin physical model). The number of control points by orthorectified imagery (9, 18, 27, 36 and 45 control points) was studied as well. This study showed the high importance of the quality of ancillary data (DEM and GCPs) on the accuracy of the final products. When the dense DEM was used for the image orthorectification by CCRS (Canada Centre for Remote Sensing) model, RMSE of between 0.48 m and 0.61 m were obtained. These values correspond to approximately 0.8 or 1 pixel.

(Roberto. C., et al., at 2005) has been Orthorectifiy High Resolution satellite images with space derived DSM . This study showed the orthorectification of high resolution satellite images and assessmed the final accuracy which where achieved when Digital Surface Models (DSM) provided by other remotely sensed data. By using a photogrammetric processing, a DSM was obtained from an EROS (Earth Resources Observation System) high resolution stereo pair acquired over a portion of the city of Bologna (Italy). After the accuracy assessment of the terrain model through the comparison with external Digital Elevation Model (DEM), a broad range of orthorectification procedures with high resolution satellite images (IKONOS, QUICKBIRD and EROS) have been therefore investigated by the authors. The accuracy in final positioning provided by the orthorectification of QuickBird imagery with the EROS-derived elevation dataset was evaluated using a evenly spaced set of Ground Control Points from GPS survey. The achieved accuracy could met the requirements needed in technical cartography specifications (to scale as large as 1:10000) updating of well recognizable features or entities and generic mapping procedures.

(Volpe, F., at 2005) has been studied the Geometrical processing of QUICKBIRD high resolution satellite data . This study showed that geometrical processing of QUICKBIRD data can be carried out with several approaches starting from each of the three QuickBird base products. The results could be obtained in terms of accuracy were strongly depend on the starting product, on the morphology of the area and on the quality of the ancillary information (GCPs and Digital Elevation Model) that were involved in the processing. The results showed similar trends and accuracy levels for all the images belong to the same group and a clear influence of the quality of the ancillary data on the achievable geometrical accuracy. It is important to note that the analyzed approach was just one of the possible solutions to the issue of the geometrical processing of QUICKBIRD data.

(Alkan, M., et al., at 2008) has Integrate a high resolution QUICKBIRD images with GOOGLE EARTH . In this study, Zonguldak city which is located in North-West part of Turkey was selected as the test field. The high resolution (60 cm) images of American QUICKBIRD satellite were used as pads. Besides, 1:1000 scale digital topographic maps were used for the extraction of details like roads and buildings with cartography and to provide the currency of satellite images. The data which were acquired from satellite images and cartography have been integrated with each other in a GIS. In GOOGLE EARTH, the information from high resolution satellite images and cartography do not exist for Zonguldak region that's why the results obtained from this study have been planned for the integration to the GOOGLE EARTH in Zonguldak city. The results of this study were proved that the high resolution satellite images and cartographic data in GIS environment and they are harmonious with GOOGLE EARTH.

(Ahmed R., et al., at 2008) has been studied the Planimetric accuracy of orthorectified QUICKBIRD imagery using non-parametric sensor models . This study has showed that the non-parametric sensor models were useful for orthorectification of QUICKBIRD imagery to produce orthoimages. In the framework of the investigation, accuracy evaluation of the planimetric position of the obtained satellite orthoimages was done. The results showed that Generation of orthoimages with high accuracy can be done effectively from Ortho Ready Standard panchromatic product using non-parametric models this does not require the data of imaging sensor and orbit elements. The user could also order smaller Ortho Ready Standard panchromatic scenes which are cheaper instead of full scenes and The RPC (Rational Polynomial Coefficients) non-parametric model could also used for orthorectifying QUICKBIRD imagery of flat terrain with accuracies 4.875m, 1.499m and 2.028m according to the three methods of orthorectification (1- using the RPC supplied with data only, 2- using the RPC supplied with data + 2GCPs and 3- using built RPC from 3D GCPs). These accuracies of the orthorectification had met theoretically the requirements for orthoimages at scale 1:10000, 1:3000 and 1:5000 or smaller.

(Alkan M., and Marangoz M.A., at 2009) has been studied the Creation of cadastral maps for rural and urban areas by using high resolution satellite imagery. This study showed that the advantages and disadvantages of using QUICKBIRD and IKONOS imagery for producing cadastral maps. In this study, high resolution IKONOS and QUICKBIRD images of rural and urban test areas in Zonguldak and Bartın have been chosen. Firstly, pan-sharpened IKONOS and QUICKBIRD images have been produced by fusion of high resolution PAN and MS images. The parcel, building and road network objects have been extracted automatically from these datasets by initially dividing it into segments and then classified by using spectral, spatial and contextual information. On the other hand, these objects have been manually digitized from high resolution images. These vectors have been produced automatically and manually and compared with the existing digital cadastral maps and reference vector maps (scale 1:5000) of the test area. The success of object-oriented image analysis results was tested by GIS software; the results showed that QUICKBIRD image produced suitable mapping results. The main problems in the study area are the shadows of neighbored buildings. Besides, QUICKBIRD image produced non-suitable mapping results for parcels objects in city area.