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Employ GIS Data to update the Map of the College of Water Resources Engineering Using Aerial and Satellite Images

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Abstract

The study has used Geographic Information Systems (GIS) data and Arc GIS software, to produce a new map. This map contains a spatial database of the newly constructed buildings, in the area of water resources engineering college, and using the above tool for updating contains the college in any time, also the map and browse all buildings individually or in clustered, for example, browsing geometric data, statistical data and the plans of drawings, and make any necessary changes to these sectors immediately, or in the future, like the expansion of the study halls by constructed a new floor, or add supplements, prepare any electrical to any building, and anything else. The paper also, updates the old Google Earth image, for the college boundary that took place before some years ago, and drawing the new locations, of a new building, the Global Positioning System (GPS), to produce a new map.

Keywords: Global Positioning System (GPS), Geographic Information Systems (GIS), Thematic Maps(TM), Digital Elevation Models (DEM).

توظيف بيانات نظم المعلومات الجغرافية لتحديث خريطة كلية هندسة الموارد المائية باستخدام الصور الجوية وصور الاقمار الصناعية

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الخلاصة

تضمنت الدراسة استخدام بيانات نظم المعلومات الجغرافية GIS وبرنامج Arc GIS لانشاء خريطة جديدة وقاعدة بيانات لأبنية كلية هندسة الموارد المائية المشيدة حديثا، بحيث يمكن عرض هذه الخريطة وتصفح جميع الأبنية بشكل منفرد أو مجتمعا وعرض وتحديث جميع البيانات الهندسية والإحصائية والمخططات الصورية المحفوظة كبيانات أوكبنك معلومات في الحاسبة الخاصة بالكلية وإجراء التغييرات اللازمة عليها،مثل توسيع القاعات الدراسية او إضافة ملاحق للابنية الموجودة بالإضافة الى أي تغيير فيها ، او معرفة أي معلومات يراد استرجاعها مثل شكل بناية معينة اومخطط للدوائر الكهربائية وغيرها. كما شمل البحث تحديث الصورة الفضائية القديمة المأخوذة من برنامج الكوكل ايرث ورسم مواقع الأبنية الجديدة التي شيدت بعد عام 2014 باستخدام نظام إيجاد الموقعGPS لغرض تسقيط المباني الجديدة وإنتاج خريطة جديدة لموقع الكلية بجميع المباني المشيدة عليها.

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1. Introduction

GIS is a tool for planning, coordination, and decision-making, at all locations of the globe, and for various disciplines [1], Geographic Information Systems (GIS), are means of relying primarily, on the use of computers to collect, process, display and analyze data, associated with these geographic locations, for the purpose of studying or deriving information of great importance, for the purpose of making important decisions, for the implementation of various engineering projects [2], for the purpose of any project. The context for geographic, research has shifted from a data-scarce to a data-rich environment, in which the most fundamental changes are not just the volume of data, but the variety and the velocity at which we can capture georeferenced data; trends often associated with the concept of Big Data, [3]. One of the advantages of this system is to store information about the world as a set of layers Thematic Maps(TM) geographically connection between each other, see Figure-1.this system useful for all scientific branches of life [4].

2. Aim of the study

1. The GIS system used to date on all newly constructed within the college boundaries, which extends from 2014 to 2018.
2. Updating of the old satellite taken in 2004 and drawing the boundaries of all new buildings, which constructed after 2014 in the form of a three-dimensional image.
3. Producing a new map of the college site.
4. Statistical, visual data for newly constructed buildings and any information in the main computer of college by used GIS programming.

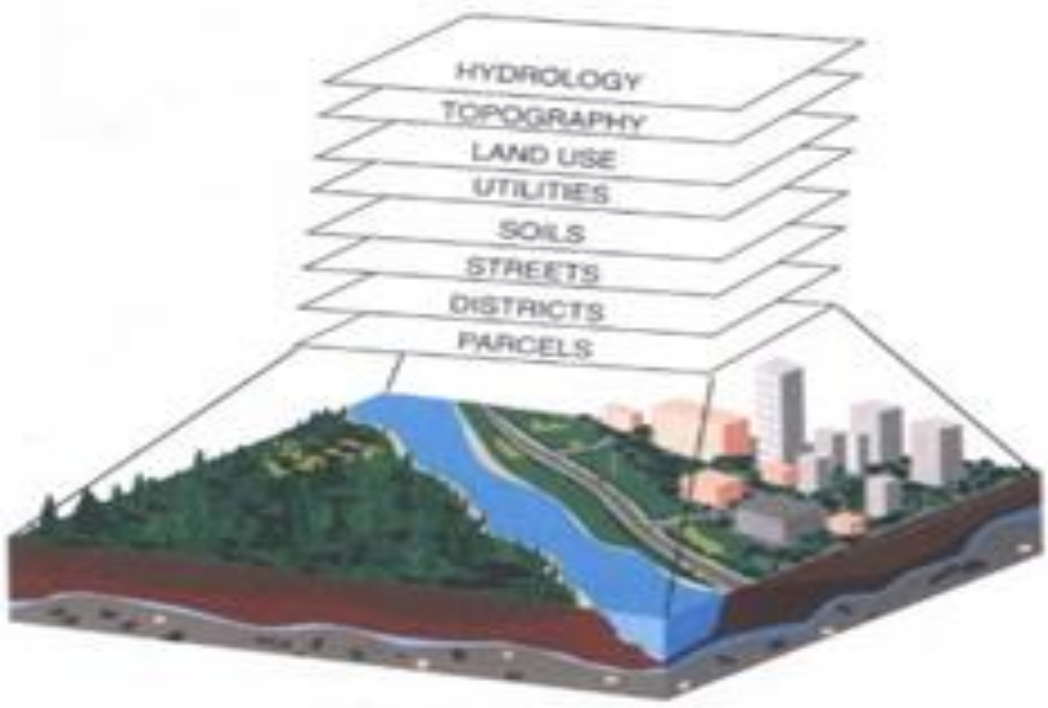

Figure 1-Surface of the Earth layers [4].

3. Data Handled By GIS

Given these imperatives, improving methods of the reproducible map is a topic gaining traction across a range of scientific disciplines [5], these data can be aerial photos, Digital Elevation Models (DEM), topographic features and many other elements allowing interpretation of spatial dynamics and processes [6].

a. Maps; First base maps it includes streets, highways, and boundaries of neighborhoods, residential areas, rivers, lakes, gardens, place names, and land use maps. These maps represent the foundation and used in different types of applications in all fields Second. Data maps or thematic maps:

b. Air photos.

c. Satellite images.

d. Statistical tables and Statistical Data: It is set of tables, reports and every data closely related to the required application, which the GIS use in it various analyze to derive information from them [7].

4. Area of Study

The study is located in the province of Babylon, AL-Qasim district, Water Resources Engineering College, Easting 470524, 470443, Northing 3574174, 3574143, and between Easting 470378, 470468 and Northing 3574321, 3574349.

5. Methodology

The research included several aspects, theoretical and practical aspects. The theoretical aspect included obtaining information, preparing Arabic and foreign sources, and creating information and software for the computer, the practical aspect included fieldwork using (GPS) as well as office work in data transfer and work on the computer in the introduction, analysis, and mapping of buildings. The measurement of coordinates was the most difficult stage of the research because we must rise to the roof of buildings to complete the survey work of the area, and must obtain official permissions from the presidency of the university to do works.

A. **Theoretical work**

The theoretical work included the following steps:

1. A color satellite image of Google Earth pro. [8], was accurately cut of the general view of the empty ground college borders, scale 1 to 385 feet,1:346500cm, the image was taken on 1984 (old image) Figure-2. Before any present buildings. In addition, Figure-3, aerial photograph, I took this photograph on 2013, after choosing the area to be the site of the Faculty of Engineering Figures-4,5) when the buildings were started to the constructions.

2. Collections the data and plans for newly constructed buildings during the period (2014-2018), from the Engineering Projects Office of the University, to make data bank.

3. The constructions of the buildings of the college started in 2014, and the aerial photograph is taken to the college by quadcopter camera.

Figure 2-General view of the empty ground of water resources engineering college [8]

Figure 3-Aerial photograph 2012, before start the constructed of the buildings

Figure 4-ground picture, start the constructed of the deanship 2013/2014

Figure 5-ground picture new buildings are started constructed2014.

B. Practical work

I. Coordinates Measurement:

a. Used Garmin map78s GPS, accuracy ±5m (navigation mode), and used WGS84 coordinate survey system.

b. Bring down the coordinates of the new buildings from 2014 to 2018 and drowning the boundaries of these buildings in the updating map of the location of the college, Figure-6, and Figure-7, which taken by a quad copter camera, after finishing the constructions. Table-1 the coordinates of these buildings

Figure 6-Map of college2018**.**

Figure 7-General view of the college 2018(my quad copter camera)

Table 1-Coordination of new buildings

Building Name	Code	Numbers of Reading (GPS)	Corner Numbers of Building	Easting	Northing
External College coordination	A	16	1 2 3 4	470446 470520 470465 470381	3574149 3574177 3574349 3574311
Classes of Study	B	16	1 2 3 4	470441 470473 470477 470447	3574234 3574231 3574227 3574221
Engineering Workshops	C	16	1 2 3 4	470459 470442 470434 470419	3574148 3574144 3574209 3574205
Bathrooms for men	D	16	1 2 3 4	470483 470479 470493 470496	3574213 3574223 3574229 357422
Bathrooms for women	E	16	1 2 3 4	470504 470513 470508 470516	3574215 3574216 3574203 3574202
Student Club	F	32	1 2 3 4	470477 470482 470461 470468	3574228 3574216 3574221 3574218

Deanship building	G	20	1 2 3 4	470504 470511 470485 470469	3574228 3574196 3574173 3574174
Consultation office	H	16	1 2 3 4	470418 470439 470437 470412	3574208 3574210 3574228 3574219

II. Data Input to PC

The works by the personal computer (PC) include:

a. Prepare the satellite and aerial images and make many adjustments and correction using ERDAS V.9 Imagine software.

b. Using ARC GIS 10.2 software to input the data and any information about the new buildings as a digital data; or any scanning plans to create a database, for each new building, on a single layer. Those layers included any changing, for one building, such as a layer for expansion or addition another flower above the holly classes, layer for the plan of water pipeline, layer for the plan of electric circles and so on. When we want any layer, it becomes simply with a click on any place of the general engineering-shape plan of building, like click on building (b), just the layer of building (b) will be displayed on the screen, and when we would like to add or change, or just want any information, for example, how long meters of electrical cables that were used in this building, or any feature be obtained easily.

III. Geometric Correction

One of the survey problems, which we encountered during dropping the ground-coordinates, on the old satellite image, shifting locations, for new buildings from the true locations. Because of using GPS (navigation mode), there is a need to correct the readings, for this reason, many different readings were taken, and compared with different readings of GPS (survey mode) in order to correct the locations by georeference, Root Mean Square (RMS) command of the program, on the map of the college.

5. Results and Discussion

All the engineering works need topographic and Cadastral maps for carrying out the construction works on the ground. Therefore, the importance of the research is to produce a map to all buildings, and we can updating and save the information in the PC, as an archive to deanship, which can be retrieving from the computer at any time. Moreover, maps help us to measure the extent and distribution of resources, analyze resource interactions, identify suitable locations for specific actions (e.g., development or preservation), and plan future events [9]. Therefore, the research contains the following:

a. In the practical side, after completing the calculations of the measured coordinates taken from the roofs of the buildings and corrected the locations of these buildings, drawing on the old space image of 2004, see Figure-(2, 3). Then, it has been produced a new map of updated constructed buildings during the period (2014-2018) shown in Figure 6,and updating the old satellite or aerial images, and entering the data, that were not previously present, shown in the general view, of the Figure-7, taken by a quad copter camera.

b. Used GIS program, to display all database that store in the main computer of the college. For any needed-changes to any item, it has been easily by one click display all the information about that item. For instance, clicking on the plan of engineering workshop building(C) in the main map, and all the information, tables, and data are showing clearly, see Figure-8. In addition, the plan can be viewed in 2D and 3D visions, or any other building selected from the map, see Figure-(9, 10). For the future, it can be easily added any information relating, to any building as shown in Table-2, which is part of the database of such buildings established during 2014-2018 and according to the availability of information.

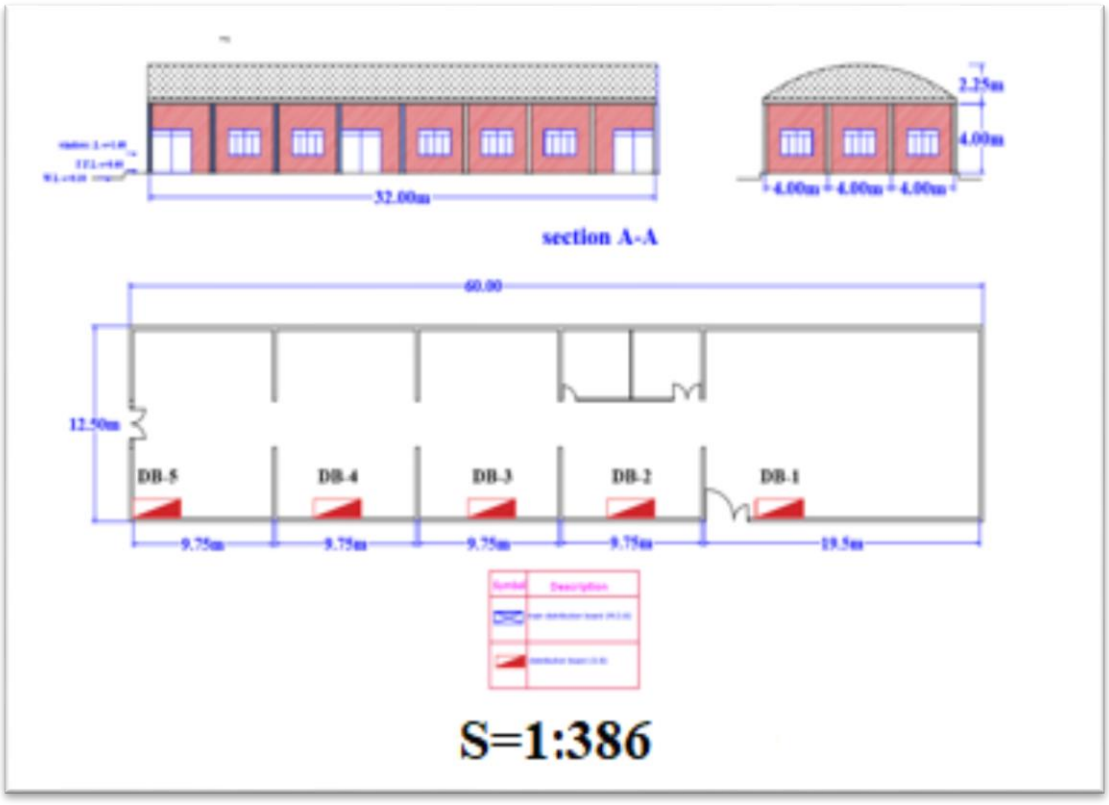

Figure- 8 engineering work shop building

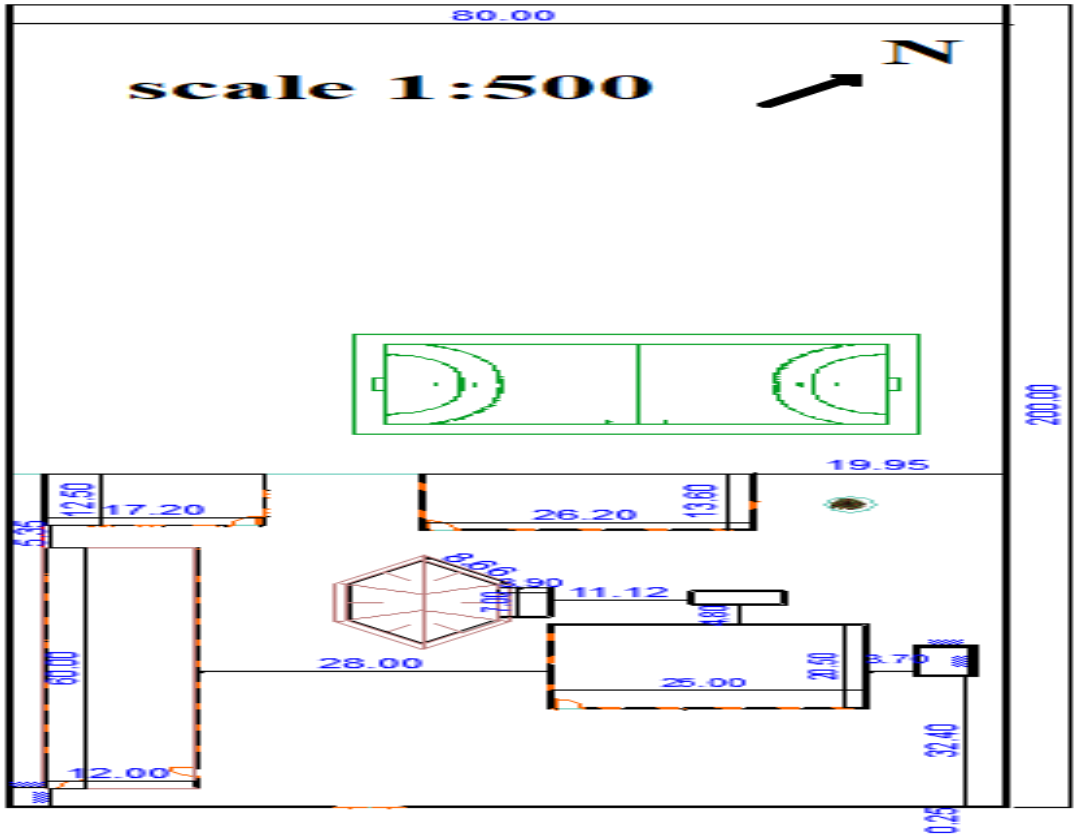

Figure 9-2d Map of new building (2014-2018).

Figure 10-3D Vision for the new building 2014 -2018.

Table 2-Data base for new building

Name Of Building	Code	Contractor Name	Cost of the project (IQD)	Area (m^2)	L×W(M)
External wall of college	A	Contractor Company Hamza Kadim Asr	1.102.286.360 Within the enterprise	16000	80×200
Classes of study	B	Al-Fayafi General Contracting Co. Ltd.	380.000.000	364	14×26
Engineering workshop	C	Eng. Abdul Sattar Sabbar Company	190.000.000	720	12×60
W.C for men	D	Contractor Company Hamza Kadim Asr	1.102.286.360 Within the enterprise	35	5×7
W.C for women	E	Contractor Company Hamza Kadim Asr	1.102.286.360 Within the enterprise	35	5×7
Students club	F	Contractor Company Makki A.M.Al-Saffar	83.500.000	150	Prismatic shape
Dean of college	G	Contractor Company Hamza Kadim Asr	1.102.286.360 Within the enterprise	1000	Irregular geometry
Consultation office	H	Contractor Company Makki A.M.Al-Saffar	840.354.000	204	12×17
football stadium	I	Al-Fayafi General Contracting Co. Ltd	30.650.000	2000	40×50

7. Conclusions

1. Handheld GPS type (navigation mode), cannot be used in the works of survey for drawing planes of buildings and mapping, because inaccurate and unable to give accurate measurements.
2. GIS is one of the best systems that deal with visuals such as satellite images and maps for the possibility of creating several individual layers in addition to the presentation of mathematical and statistical information for each layer.
3. The best way for building and construction and planning is remote sensing techniques GIS and GPS in terms of saving the cost effort and time in the construction engineering projects, especially the economic nature of the important service of the country instead of traditional works.

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