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ESTIMATION OF BAGHDAD UNIVERSITY REGION EXACT COORDINATES BY USING REMOTE SENSING TECHNIQUES & GIS

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Abstract

In this research exact Coordinate points of Baghdad University locations were estimated by utilizing one of importance Remote Sensing (RS) techniques: Differential-Global-Positioning-System (DGPS) field to measure referencing points, then Inverse-Distance-Weight (IDW) Interpolation of Geographical-Information-System (GIS) was applied to defined each point coordinates in the study regiondepending on DGPS measurments. Eight referencing points were measured in Baghdad University region for having exact coordinates: Longitude, Latitude and DEM. ArcMap-GIS & Excel programs were utilized to determine the results.

Keywords: Remote Sensing, DGPS, GIS and IDW.

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1. Introduction

RS has many definitions, like: Art, science, and technology of: object, scene, or phenomenon observation by instruments based techniques. "Re-mote" because the observing of the interesting object at a far away (no physically contact). The detection and real time display or recording devices of energy , which are emit or reflect from objects or scenes. The utilized energy may be a visible radiation or other type of EM radiation. [1]
Global-Positioning-Systems (GPS)
The GPS satellites system & signal receiver devices utilized for computing positions on the globe.

- 1.Space-Segment
- 2.Control-Segment
- 3.User-Segment

Figure1: illustrates the GPS satellite.[2]

1-GPS-Space-Segment

• It includes of a constellation of satellites are transmit radio-range-signals to devices of GPS.
•Fly-in “Medium globe Orbit”
•24-GPS-satellites (at least) were maintained by U.S. Air-Force.
•Six with the same space orbital planes, satellites were divided. Four satellites on each one.
•The satellite circling around Earth 2X/day
•Accurately position calculation Requiring at least 4 satellites [2].
Space-GPS & GLONASS satellites orbital about 12,000 miles of nautical over Earth. They were equipped a radio and an atomic clock [3].

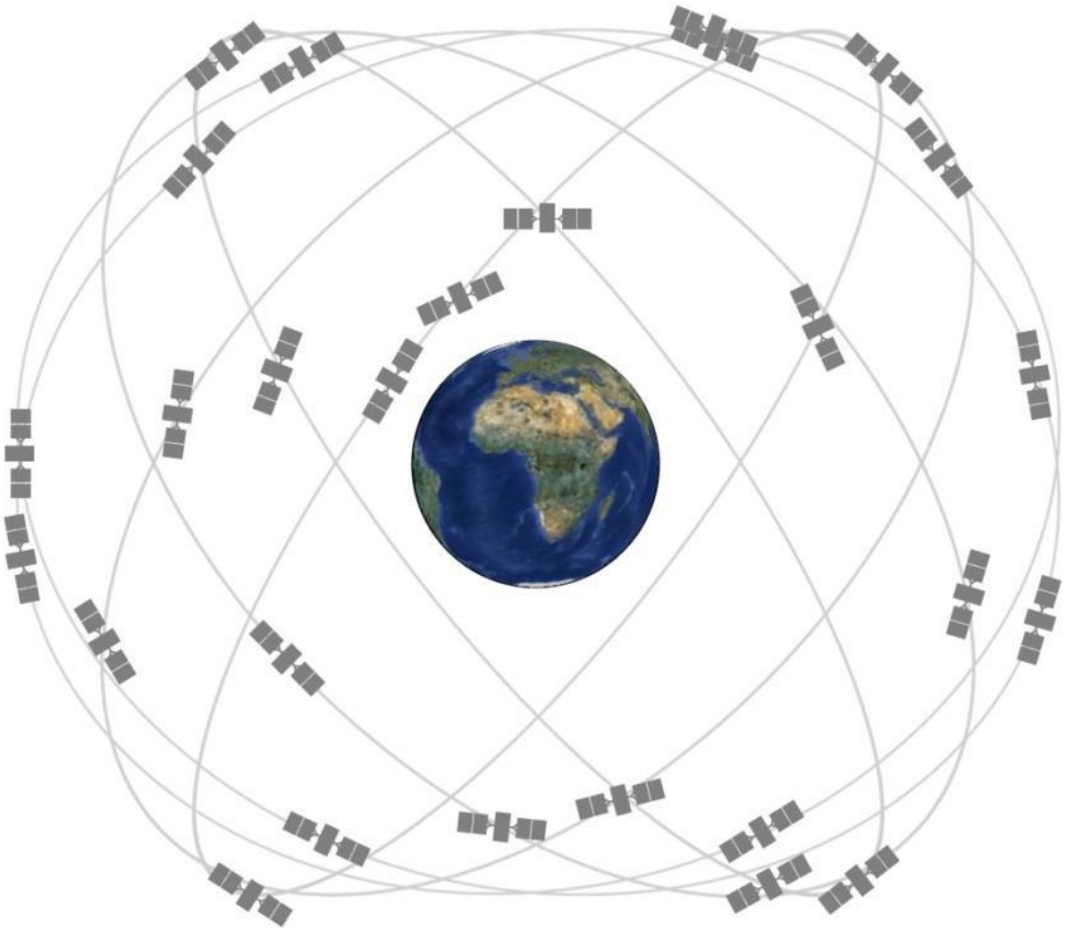

Figure 2: illustrates the GPS satellites on their orbital's[2].

2-Control-Segment

Control-Ground stations placed around the globe, equipping clock corrections and new ephemerides (satellite positions as a function of time), for ensuring of the satellites transmitting of data correctly [3].

A global-network of ground facilities that:

•Tracking the GPS satellites
•Monitoring their transmissions
•Performing analyses
•Sending commands & data to the constellation[2].

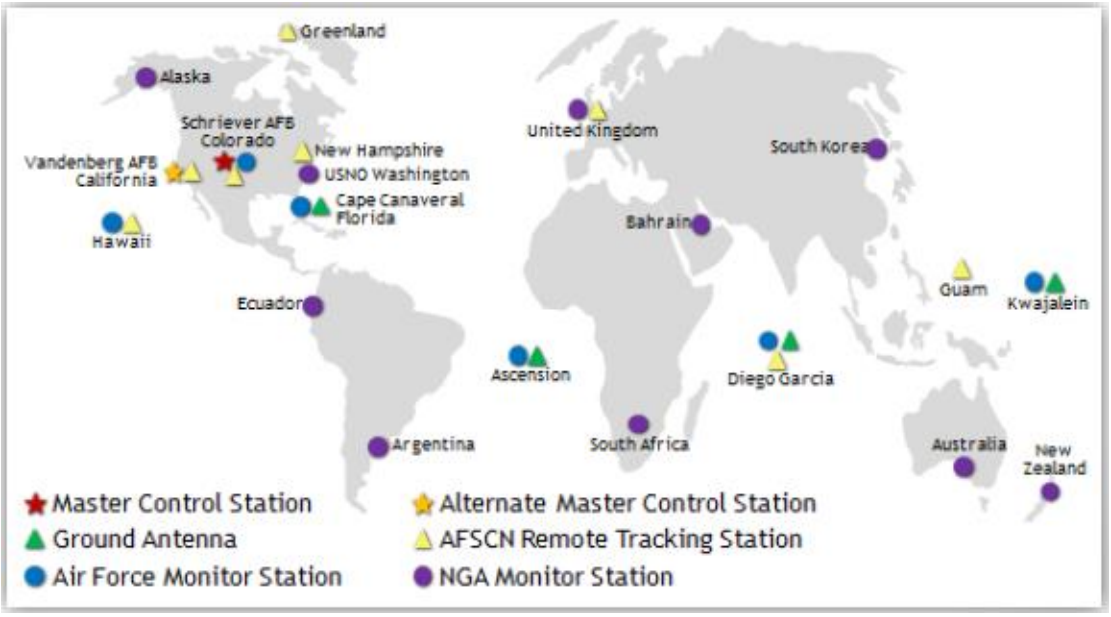

Figure 3: illustrates the GPS Control-Ground stations[2].

3-GPS-User-Segment
•High-Accuracy
•Hand-held: 1-10meter
•DGPS: 3mm–10cm
•Cost
•Hand-held: $150-$400
•DGPS: $2,500&up
•Juno-ST (DGPS) sub2-3m,$600

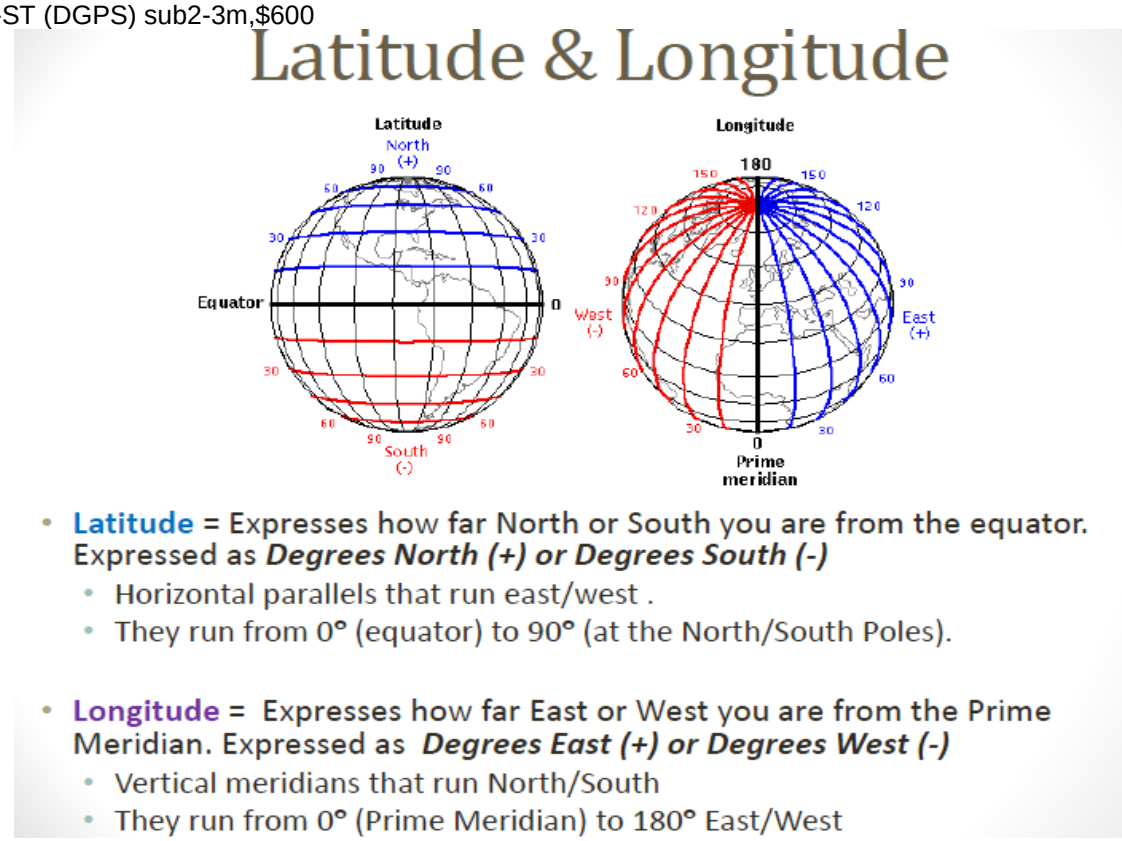

Figure 4: illustrates the Latitude and Longitude [2].

The GPS position measurement usually may be represented by 2 techniques:
1.Point - Position
2.Relative - Position
DGPS: Is the measuring system of Differential Coordinates of 3D points of the Earth surface by satellite, the obtained accuracy of the observations depending on the techniques and measuring devices [3].

Interpolation
In Mathematical Field of numerical analysis, "interpolation is a type of estimation, a method of constructing new data points within the range of a discrete set of known data points"[4].

$$E_p = \frac{\sum_{k=1}^{m} e_k / b_k^2}{\sum_{k=1}^{m} \left[1 / b_k^2 \right]}$$

The interpolation using function of the Inverse Distance Weighted technique is: ……..(1)

Where:

E_p : is the calculated Z coordinate of the point P (the interpolation effecting); e_k is the Z coordinate used for calculating the height at point P; b_k is the lengths among each point to point P; m is the using points number to estimate Z coordinate the point P [5].

Study Region:
The location is the University of Baghdad. The survey for this region was done by using DGPS.
Baghdad province Located along the Tigris,with Latitude 33o20'N and Longtude 44o23'E. which surrounding of the north with Taji-city, and of the south by Mahmudiyah-city [6].
The coordinate system of the utilized data is adopted as a geographic and projection coordinate system by : WGS84 /UTM - ZONE 38.

Figure (5): University of Baghdad satellite image.

Coordinates Data Collection:
DGPS Principle:
The Differential GPS is the basic concept of correction and augmenting the GPS position solution. The base of DGPS is of the principles that any receiver in the same vicinity instantaneously experience common errors. In this study, Static method was applied for observing the location points coordinates.

To get accurate coordinates, generally 2 steps must be applied in this technique: first: The observation of the undefined points for about two hours (can be increased), second: The coordinates correction for all points and that was obtained by applying 2 steps: the first is the correction of only the Base Point. The second is correction of the other (control points) depending on the correction of the Base Point.
In this paper, the utilized DGPS is Topcon-GR5 receiver. It is a multi-frequency Global Navigation Satellite System (GNSS) receiver.

Figure (6): DGPS, Topcon-GR5.

Data Collectors Software:
- Post-Processing-Static (PP Static).

The PP Static method utilized for observing the undetected coordinates for finding a GCP. Work depends on about two hours so that, an accurate coordinates could be in hand, resulted of changing the active satellite numbers at the surveying location.

Methodology:
Part 1:DGPS (PP Static):
1. Setting up the Base Receiver on undefined point and configuration the sitting of a job file to define the station information like: antenna height, geographic and projection system, elevation mask, point name and other details),
2. Note: All the sitting were done by the data collector.
3. The equipment was turned on and the observation was started from the satellite and leaving it on until the work is ending, because it will be representing the reference point for correcting the other points, the observations of the receivers must be at the same time range of the base receiver.
4. Setting up the Rover receiver to a second undefined point and changing some of the point information in the same sitting of the job file like: point name and antenna height
5. At this time, the two receivers were received the signals of the satellites (in the same time). The other points observation were obtained by utilizing the Rover receiver.
6. After completing the observation of the points the data collection the data must be recorded at the receiver's memory card, then, it is input to computer for combining and processing by:
7. Correction of the Base Point by sending it's file to the on-line-positioning user service for submitting it directly to national-geodetic-survey for automatically processing.
8. Adding the files of points to the Processing Program of Topcon-tools and applying a correction process to the control points depending on the new base coordinates, and upon to it, all the points are of the same rate of the correction.

Part 2:
1. An image of a scene of Baghdad University that need to create exact geo-reference by using the creating points resulted from the first methodology, these referencing points are illustrated in table 1
Table 1: illustrates each creating referencing point with its coordinates (longitude and latitude)

	longitude	latitude
CP 1	44°22'32.11"	33°16'27.07"
CP 2	44°22'34.91"	33°16'29.10"
CP 3	44°22'42.51"	33°16'33.25"
CP 4	44°22'46.30"	33°16'29.93"
CP 5	44°22'50.09"	33°16'29.91"
CP 6	44°22'39.36"	33°16'22.05"
CP 7	44°22'33.41"	33°16'23.55"
CP 8	44°22'40.09"	33°16'24.82"

2. These referencing points were performed as a data base of ArcMap-GIS program.
3. The Geo-reference technique was applied to the scene. The resulting scene is illustrated in Figure 7.
4. The DEM values were performed as a data base of Excel program as shown in table 2, then opening in the ArcMap-GIS program to interpolate them.
Table 2: illustrates the perform of each creating referencing point with its coordinates (longitude and latitude) and DEM (as a data base of Excel program).

	longitude	latitude	Elev. (m)
CP 1	44°22'32.11"	33°16'27.07"	33.295
CP 2	44°22'34.91"	33°16'29.10"	32.651
CP 3	44°22'42.51"	33°16'33.25"	32.489
CP 4	44°22'46.30"	33°16'29.93"	33.602
CP 5	44°22'50.09"	33°16'29.91"	32.407
CP 6	44°22'39.36"	33°16'22.05"	32.349
CP 7	44°22'33.41"	33°16'23.55"	33.224
CP 8	44°22'40.09"	33°16'24.82"	32.139

5. An extraction process of the spatial analysis of the toolbox (of the location among the creating referencing points) was applied before the application of interpolation technique as shown in Figure 8.
6. IDW interpolation technique was applied to the DEM values to define the real coordinate of all locations among the creating referencing points as shown in Figure 9.

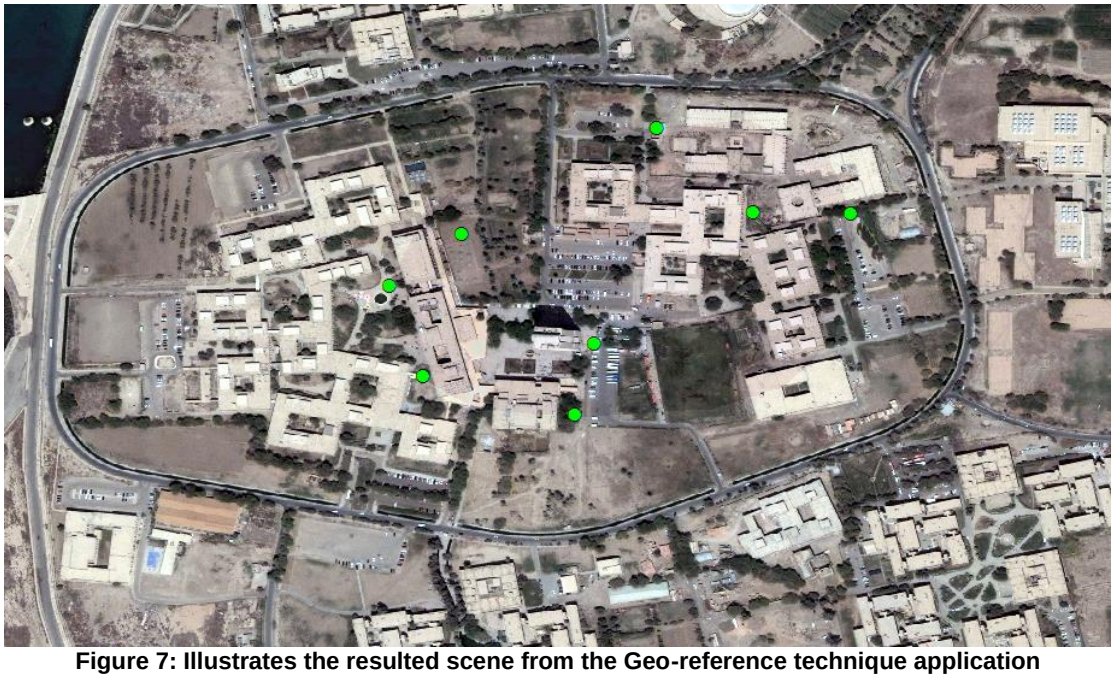

Figure 7: Illustrates the resulted scene from the Geo-reference technique application

Figure 8: Illustrates the resulting segment scene after applying the extraction process

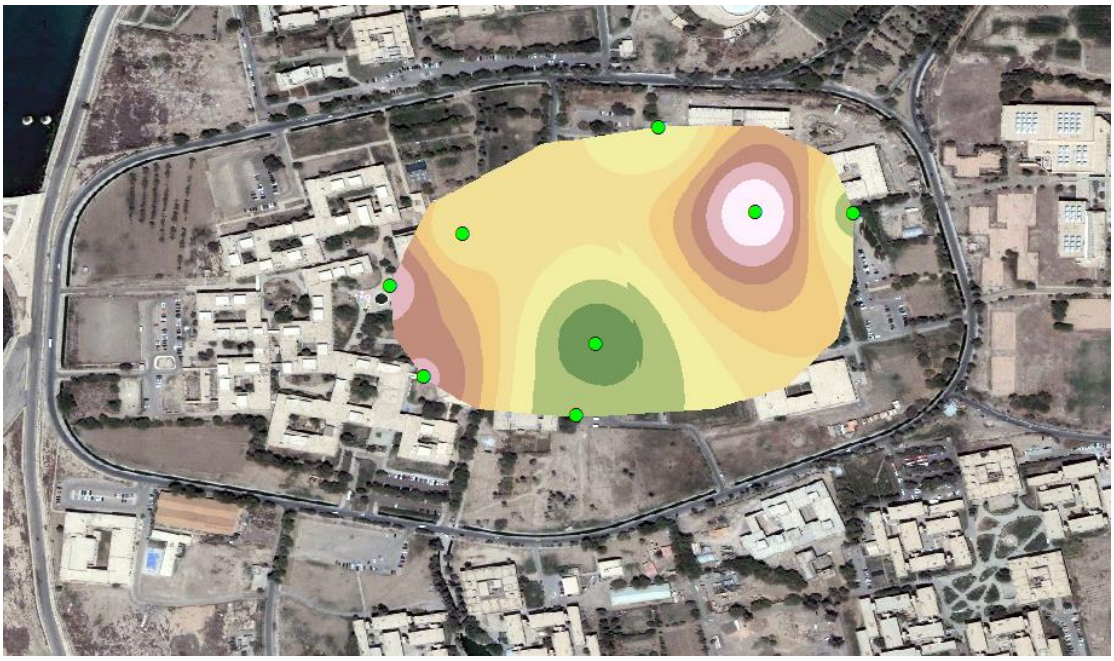

Figure 9: Illustrates the resulted IDW interpolation of DEM raster

Results & Discussion

This paper is focus on appearing the importance of utilizing GPS techniques by the creation of referencing points by using DGPS technique. DGPS technique was done and an utilization of these creating points to geo-reference an image of Baghdad university with exact latitude and longitude coordinates as shown in Figures 7 and 8. After that, other utilization of these referencing points was done by applying the IDW interpolation technique of the elevation at these points to the area among these points to have an exact DEM for Baghdad university area.

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