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**Investigation of the use of GPS in  
Georeferencing Satellite Images of Awka,  
Anambra Nigeria (PAPER 7458)**

• **By**

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### SUMMARY:

This is a summary on the paper Investigation of the use of GPS in Georeferencing Satellite Images of Awka in Anambra State Nigeria. This is a new trend in georeferencing of satellite images to compare results of affine georeferencing methods. Eight first order GPS controls were identified on ground, their values known and used to re-georeference the imagery. Georeferencing can be seen as assigning geographic information to an image; it will allow the usage of the image and its location in the geographic space. GPS is used in many applications such as sea navigation, air navigation, positioning,



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### Summary continues

Finally with eight coordinate points and got the following results. Four coordinates gave Standard Deviation = 0.0022978 and coefficient of variation of 37.344 %, six coordinates gave Standard Deviation = 0.0012 and coefficient of variation of 1.981% and finally, eight coordinates gave Standard Deviation = 0.0052933 and coefficient of variation 6.958% for the average of the three resolutions. It is therefore, strongly recommended that georeferencing be performed using six GPS coordinates, for optimum performance of GIS analysis of satellite imagery. This information is required for very high precision satellite image analysis.



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## A brief Introduction

- GPS is used in many applications such as sea navigation, air navigation, positioning, GIS/ Surveying, precision agriculture, recreation and vehicle tracking this is the area of interest of this study. Georeferencing can be seen as assigning geographic information to an image; it will allow the usage of the image and its location in the geographic space. Knowing where a point is located in the world allows information about the features contained in it to be determined. Satellite imagery has been widely used in different applications which depend on different professional approaches. There has been much advancement in satellite imagery this will be relevant for the purpose of this study. This study presents a detailed analysis on the investigation of the use of GPS in Georeferencing of Satellite Imageries using Awka and its environs as the study area. Some studies carried out on using different methods on the above and related topics have been highlight and their needs. Data requirement for the study and techniques for data acquisition, processing and presentation is highlighted.



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## Aim and Objectives

This study is aimed at carrying out investigation on the use of GPS in georeferencing of satellite images. This will be achieved through the following objectives.

1. To process the image to correct errors that might be in the image and enhance visual quality of the image,
2. To identify suitable and clearly defined points from the image that will serve as control points for georeferencing,
3. To georeference the satellite image using the reference first order GPS coordinates of identified points on the image obtained from GPS, and
4. To perform statistical evaluation of the results obtained.



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### STUDY AREA

The study area is Awka and environs in Anambra state Nigeria. Anambra state is one of the South Eastern states of Nigeria Figure 1.0 below shows the study area. The state lies between coordinates  $6^{\circ}35'E - 7^{\circ}30'E$  and  $5^{\circ}40'N - 6^{\circ}48'N$ . It was created on 27 August 1991 and has an approximate area of  $4,844 \text{ km}^2$  ( $1,870.3 \text{ sq mi}$ ). Awka is the capital of Anambra state geographical coordinate of  $6^{\circ}12' 25'' N$  and  $7^{\circ} 04' 04'' E$ . Awka has a certain kind of aura about it, because it was the place of the blacksmiths that created implements which made agriculture possible. Chinua Achebe. Based on 2006 population census, the population of Awka is about 301657 (three hundred and one thousand six hundred and fifty-seven) people.



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### Study Area Continues

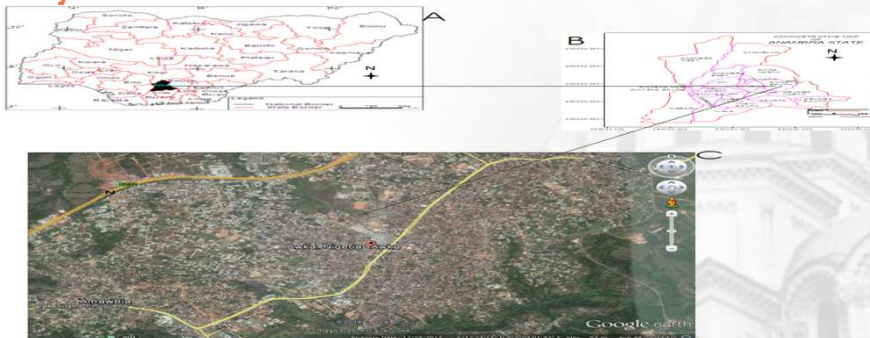


Fig. 1.0 A is Map of Nigeria showing Anambra State, B is Map of Anambra State showing Awka, C is satellite imagery of study area Awka and environs. (Not to scale). Source: Ministry of Lands and Survey, Awka.

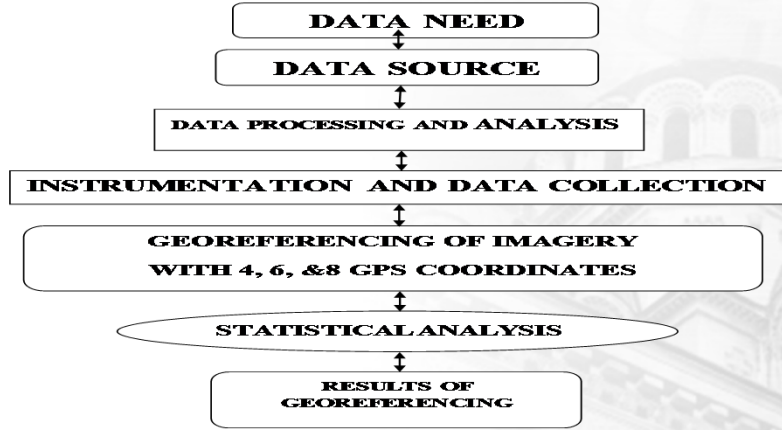




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**METHODOLOGY**



**FLOW CHART**



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**3.5.0 RESULTS OF GEOREFERENCING**

The results of the georeferencing procedures will be presented below as it were and after the analysis their values will be summarized as my research findings.

**Table 3.0 FIRST ORDER GPS COORDINATES USED FOR GEOREFERENCING**

EASTINGS	NORTHINGS	DECIMALDEGLONG	DECIMALDEGLAT	DEG MINS SEC	DEG MINS SEC
288120.240	688768.873	7.085012254	6.227786177	7°05'06.04411"	6°13'40.03024"
291001.175	692154.871	7.110930995	6.258493804	7°06'39.35158"	6°15'30.57769"
284508.538	691631.933	7.052286452	6.253551596	7°03'08.23123"	6°15'12.28575"
285240.437	685050.308	7.059117586	6.194071454	7°03'32.82331"	6°11'38.65723"
286034.749	688005.342	7.066195910	6.220814321	7°03'58.30528"	6°13'14.93156"
283297.414	693613.172	7.041277294	6.271423129	7°02'28.59826"	6°16'17.12326"
287727.537	691850.219	7.081362927	6.255632152	7°04'52.90654"	6°15'20.27575"
291767.267	689603.596	7.117938323	6.235451755	7°07'04.56716"	6°14'07.62632"



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**Table 3.1 FOUR COORDINATES OF V. H. R GEOREFERENCING**

283297.365860	693613.235191	283297.414000	693613.172000
287727.381072	691850.214316	287727.537000	691850.219000
291766.949697	689603.517828	291767.267000	689603.596000
286034.252069	688005.196427	286034.749000	688005.342000

**POSITIONAL ERROR = 0.00327m** Transformation type: 1<sup>st</sup> order polynomial (Affine)

**Table 3.2 FOUR COORDINATES OF H. R GEOREFERENCING**

283297.495576	693613.088753	283297.414000	693613.172000
287727.596740	691850.162948	287727.537000	691850.219000
291767.365285	689603.588089	291767.267000	689603.596000
286035.454999	688005.657205	286034.749000	688005.342000

**POSITIONAL ERROR = 0.00960m** Transformation type: 1st order polynomial (Affine)

**Affine transformation of V.H.R, H.R & M.R of 4,6&8 points Georeferencing**



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**PRESENTATION AND DISCUSSION OF RESULTS**

This section discussed the procedures adopted in the presentation and discussion of the final results. The procedures to be adopted in the presentation of results was based on the software's operation used, this helped in carrying out required analysis by the step by step method used in its operation. Though the difference made on the imagery after the series of georeferencing done with the GPS coordinates was not noticed because of the accuracy of the coordinates, if not the imagery would have warped and will lose its shape and form, showing that the georeferencing was poorly done. More so, looking at the values Root Mean Square (RMS) gotten during georeferencing one will quickly agree that using GPS coordinates will yield a better result compared with other methods of georeferencing. All the values gotten during this operation were good. The final result solves another research need. It is generally believed that the more the coordinates used the better the accuracy of the imagery georeferenced, these has further proved that for accuracy and best performance of the imagery the number of GPS generated coordinate to be used should be six, though this is subject to review in future research when other factors are considered. This has further demonstrated the readiness to complete the study by fulfilling the aims and objectives of this study.

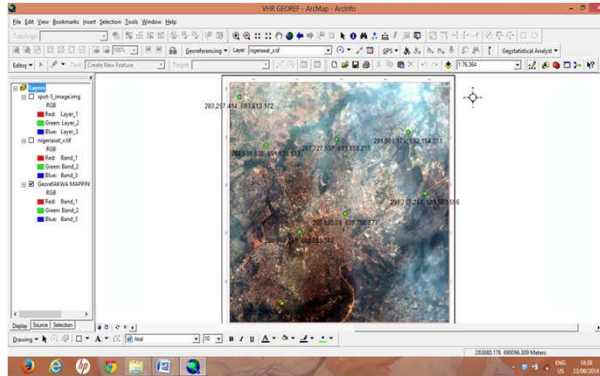




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## Research Products



VERY HIGH RESOLUTION IMAGE OF STUDY AREA SHOWING LOCATION OF CONTROL POINTS (QUICKBIRD)



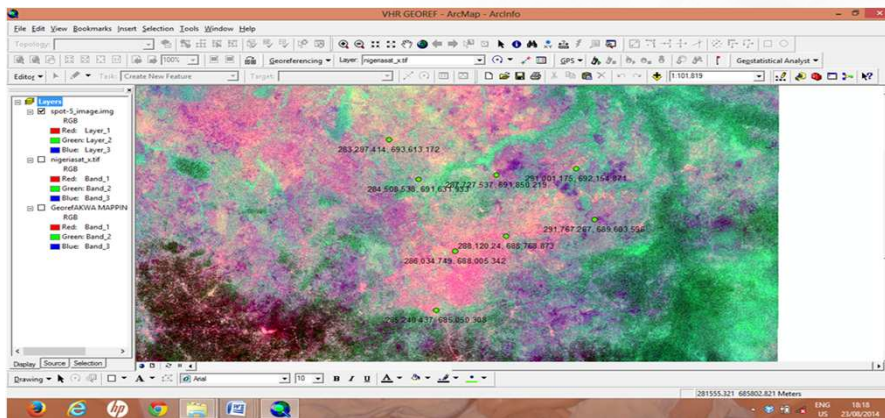
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HIGH RESOLUTION IMAGE OF STUDY AREA SHOWING LOCATION OF CONTROL POINTS (SPOT 5)



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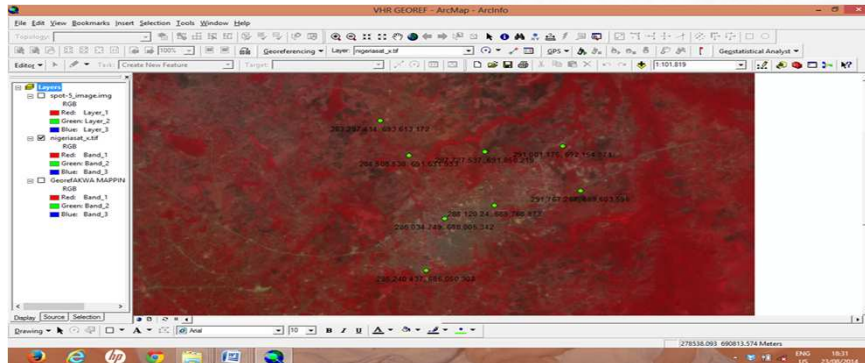




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## Research Products continues



MEDIUM RESOLUTION IMAGE OF STUDY AREA SHOWING LOCATION OF CONTROL POINTS (NIGERIASAT\_X)



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