



3 DIMENSIONAL MODEL MAP OF GENERAL HASSAN USMAN KATSINA UNITY COLLEGE, BAUCHI

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Abstract:

This study is aimed at producing 3 Dimensional model map of General Hassan Usman Katsina Unity College, Bauchi. A total station (TOPCON GST213) was used to obtain the rectangular coordinates (E, N, and Z) of natural and man-made features of the study area. The coordinate were later typed in note pad and exported to AutoCAD 2006 and SURFER8 software for analysis. The AutoCAD was used for plotting of the feature while SURFER8 was used for 3D Terrain model (DTM) the AutoCAD drawings were exported to the ARC VIEW for the generation of contours. The map was produced in different layers. The layers were superimposed on one another to form 3D model map. The 3D model map of the study area was produced. It is recommended that further research should be conducted using other methods such as 3D modelling using Google sketch up application software or satellite imagery methods. It is also recommended that the map may be used for further construction within the college by the authorities concern.

Keywords: *3Dimensional model, reconnaissance, coordinates, spot heights, contours*

Introduction

The number of applications that use 3D information of topographic objects increased rapidly few years ago. Example can be found in location based services, virtual reality tasks, visualization city (urban) planning, archaeology, virtual tourism, advertising, marketing, simulations, restoration etc. These applications required 3D topographic input data.

Acquiring 3D topographic data is even more complicated than 2D, where 2D is the determination of position of discrete points of an object in terms of X and Y while

3D include X, Y and Z. Any approved conventional method in surveying can be used to achieve a 3D model. 3D modelling is therefore the process of developing a mathematical representation of object(s). The models define the volume of object they represent.

Statement of the Problem

Production of a 3D model will provide solution to the problems such as:

- a. Identification of the amenities in the school to know which other ones they need
- b. Faster and easier retrieval of information for instantaneous use by government agencies and individuals.
- c. To meet up with advancement in today's competitive world.

The existing map of the study area is in 2D format which is limited only to the length and breadth of the geographical features that are in the area. 3D maps provide several benefits over 2D which include the actual representation (shape) of objects, boost up sale (Real Estate) Through Architectural 3D Presentation Design, visual interpretation among others.

Aim and Objectives

The aim of this study is to produce a 3D model map of General Hassan Usman Katsina Unity College Bauchi, Bauchi State.

The objectives are:

- To generate height of points by interpolating the contours within the study area.
- To produce 3D model map of the study area.

Study Area

The study area covered the entire General Hassan Usman Katsina Unity College which is located opposite Abubakar Tafawa Balewa University, Yelwa Campus along Bauchi Dass road. The college is bounded by Yelwan Makaranta to the north, Yelwan Makaranta/Lushi to the east and Yelwan Tudu to the south. The study area is geographically bounded by latitude of $9^{\circ} 31'$ and $12^{\circ} 31' N$ and longitude of $8^{\circ} 50'$ and $11^{\circ} 50'$

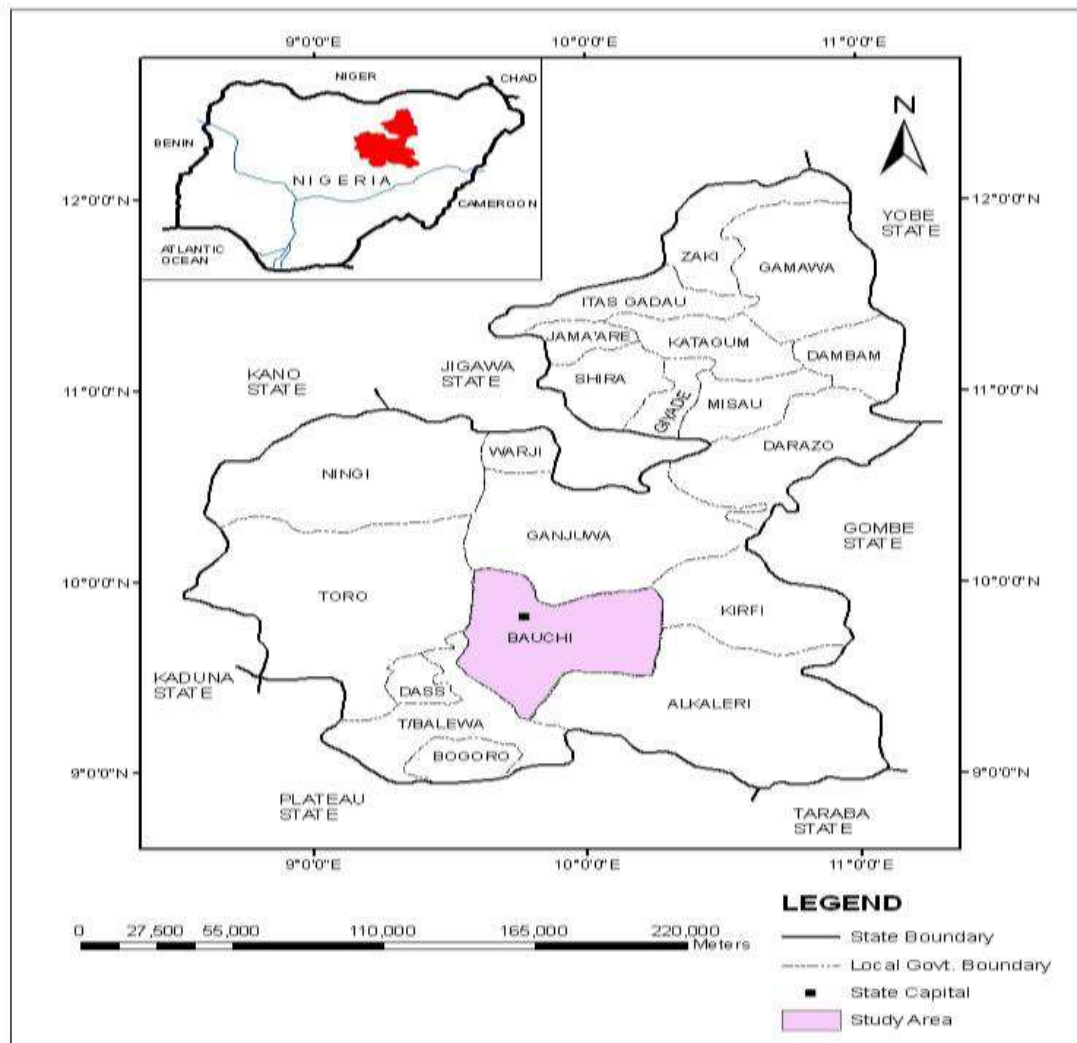


Figure 1: Location map of the study area.

Source: Bauchi State Ministry of Lands and Housing (2013).

Methodology

This section, states the description of equipment used, data acquired, software applied and the methods adopted in this study.

Equipment and Software

Hardware

- Total station (TOPCON GST 231)
- A prism reflector
- German etrax10 channel GPS Receiver with accuracy of 3m.
- Steel Tape (30meter)

- Pegs(nails)

Software Used

- Auto CAD
- Arc GIS
- SUFFER8

Reconnaissance

This is the preliminary survey or inspection of survey field with view to determine the best survey method to be adopted to achieve the aim and objectives of the project tasks. It consists of office and field reconnaissance.

The office reconnaissance involves gathering of information such as pillar number, beacon coordinates and the existing map of the study area.

The field reconnaissance involves site inspection to observe the existing situation, thereby making sketch known as reconnaissance diagram that would help in successful execution of work in the field and to avoid the problem of inter-visibility between stations.

Data Acquisition Procedure

This involves the steps and procedures used in data collection from the site.

Perimeter Survey

The geometric data which is the 3-Dimension coordinates X, Y, Z was captured using total station instrument.

Testing Existing Controls for in-situ

The survey regulation requires that new surveys should be connected to existing survey controls. Therefore, any connection to any displaced beacon will give a bad result; hence, the survey will not close. The existing control points found are UTB 05, UTB 06 and UTB 07 which were tested to verify if they are still in their original positions.

The test was done by comparing the computed distance and angle, with the measured distance and angle respectively, as shown in the tables below:

Table 1: Coordinates of Control Points

Known Control Points	Easting (m)	Northing (m)	Height (m)
UTB 05	587134.911	1136382.489	613.815

UTB 07	587095.642	1136175.718	614.324
UTB 06	586892.167	1136153.012	616.101

Source: Surveying and Geo-Informatics Department ATBU Bauchi

Table 2: Computed Bearing and Distance

Station	Bearing	Distance (m)
UTB 07 to UTB 05	349 ⁰ 14 ¹ 48.10 ¹¹	210. 467
UTB 07 to UTB 06	276 ⁰ 22 ¹ 03.00 ¹¹	204. 739

Computed included angle = 72⁰ 52¹ 45¹¹

Source: Field work

Table 3: Observed included angle

Occupied Station	Sight	Face	H C R	Reduced Angle	Mean Angle
UTB 07	UTB 05	L	00 ⁰ 00 ¹ 00 ¹¹		72 ⁰ 52 ¹ 57 ¹¹
	UTB 06	L	72 ⁰ 53 ¹ 00 ¹¹	72 ⁰ 53 ¹ 00 ¹¹	
	UTB 06	R	252 ⁰ 52 ¹ 50 ¹¹	72 ⁰ 52 ¹ 54 ¹¹	
	UTB 05	R	179 ⁰ 59 ¹ 56 ¹¹		

Source: Field work

Table 4: Observed Distance

Station From	Distance (m)	Mean Distance (m)	Station To
UTB 07	210.459		UTB 05
	210.460		
	210.463	210.461	
UTB 07	204.742		UTB 06
	204.740		
	204.738	204.740	

Source: Field work

Table 5: Difference between computed and observed included angles

Computed Angle	Observed Angle	Difference
72 ⁰ 52 ¹ 45 ¹¹	72 ⁰ 52 ¹ 57 ¹¹	00 ⁰ 00 ¹ 12 ¹¹

Source: Field work

Table 6: Difference between computed and observed distance

Station	Computed distance (m)	Observed distance (m)	Difference
UTB 07 to UTB 05	210. 467	210. 461	0. 006m
UTB 07 to UTB 06	204. 739	204. 740	0. 001m

Source: Field work

Connection of the Survey

Additional control points were established and coordinated.

Field Observation

The total station (Topcon GST 213), and 50m steel tape were used in carrying out the field observation, in order to obtain the coordinate of details and other point of interest such as: boundaries of the college, spot heights of points, roads, buildings etc.

The field observation began by settling up the total station over (UTB07) and reflector was held vertically over station (TPO1). The height of the total station above the occupied station and that of the reflector were measured. The bearing of the reflector station (TPO1) from instrument station (UTB 07) was computed. The instrument height, the reflector height and the computed bearing were inputted into the instrument after which the reflector was sighted in order to orient the instrument.

After the instrument was oriented and the X, Y, Z coordinate of (TPO1) was recorded then the instrument was oriented as before and the X, Y, Z coordinate of (TPO2) was recorded. The instrument was moved to (TP02) and the coordinates of details that were visible from that station were observed and recorded in the field book. The observation continues until all the available details within the vicinity were measured. The procedure continues until all the available details were measured by moving the reflector to various visible points in order to obtain coordinates of the points. The instrument was taken to another station (TP01) the same procedure was applied in order to orient the instrument and measure details until the whole area was covered.

Results and Discussion

Figure 2 shows the interpolated spot heights which form the contoured map of the study area. It shows both the nature of the ground surface and the position of details within the study area. The 3D model map of the study area was produced as shown in figure 4. The 3D model map of the study area consists of different layers and each layer is called a theme.

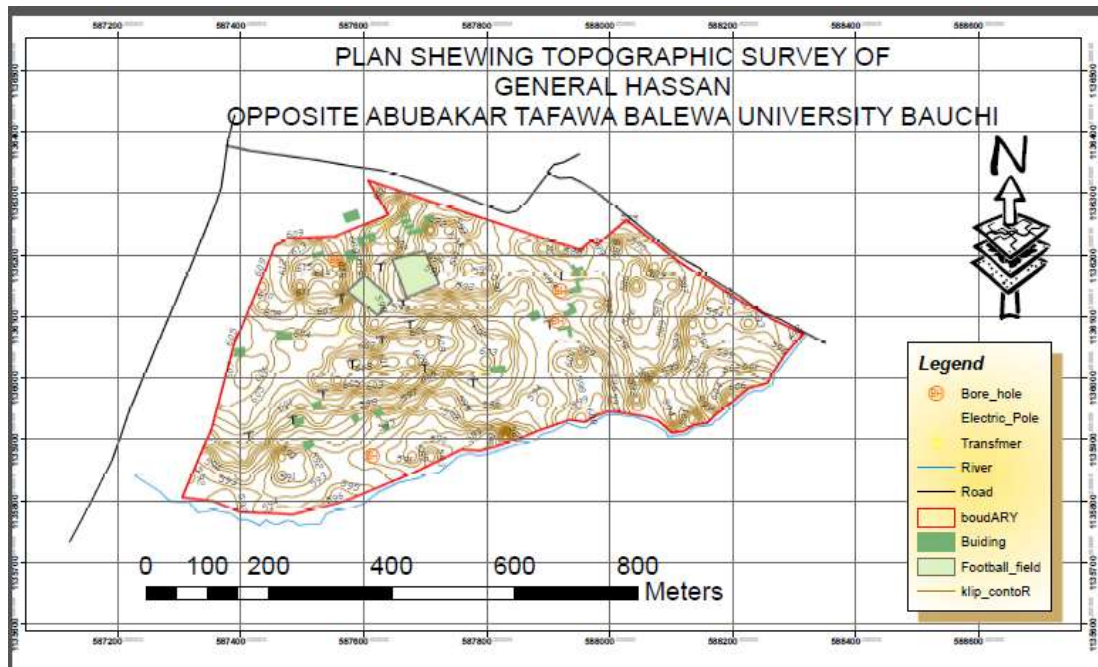


Figure 2: Topographical map of the study area
Source: Author's laboratory work

DIGITAL TERRAIN MODEL

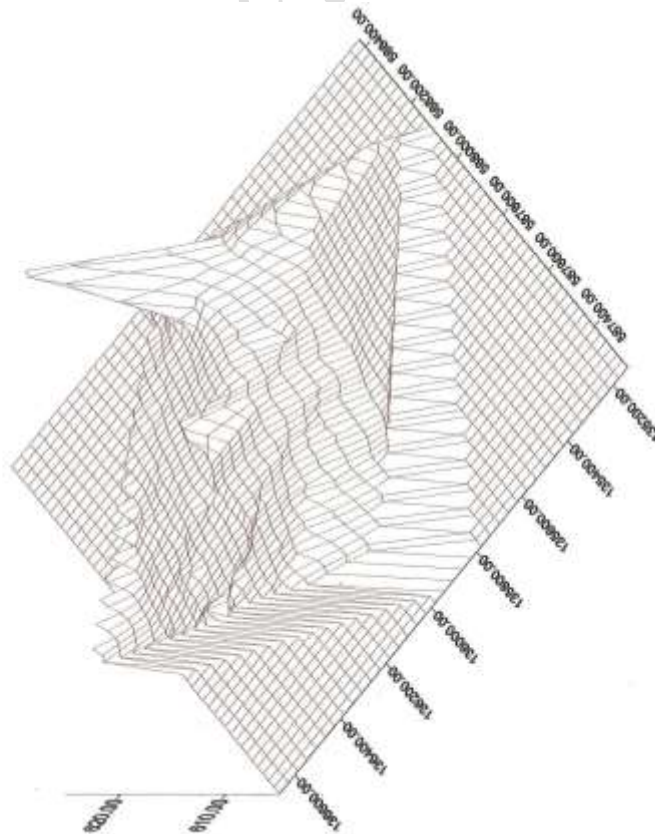


Figure 3: Digital terrain model map of the study area

Source: Author's laboratory work



Figure 4: 3D model map of the study area

Source: Author's laboratory work

Conclusion and Recommendation

The 3D model map of General Hassan Usman Katsina Unity College Bauchi was achieved by employing the field survey method using total station (TOPCON GST 213) for data collection of natural and man-made features of the college. The data collected were processed with the use of computer and software packages (AutoCAD, SURFER 8 and ARC GIS). The composite (3D model) map was produced in different layers. So that thematic maps can be produced very quickly and cheaply for different uses. The uses may include the preparation of land information system (LIS) map which will serve as the best tool for proper and effective environmental and infrastructural management within the college. Therefore, It is recommended that further research should be conducted using other methods such as 3D modelling using Google sketch up application software or satellite imagery methods. It is also recommended that the map may be used for further construction within the college by the authorities concern.

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