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TOPOGRAPHIC INFORMATION SYSTEM (TIS) AS A TOOL FOR ENVIRONMENTAL MANAGEMENT, A CASE OF PART OF FEDERAL UNIVERSITY OF TECHNOLOGY, AKURE, ONDO STATE

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Abstract

The use of topographic information systems as a tool for environmental management is examined in this research. Recent developments at the Federal University of Technology, Akure have seen the construction of new buildings and roads. Such constructions, especially those in areas considered unstable land, must be properly and adequately planned, with a Topographic Information System (TIS) serving as one of the essential planning tools. This paper focuses on designing a topographic information system for a part of the Federal University of Technology, Akure, to serve as a tool for managing the institution's environment. Field and office reconnaissance surveys were conducted to understand the terrain and to plan the methodology and equipment needed for acquiring and compiling spatial and attribute data. DGPS (CHC X900) was used to capture boundary coordinates (x, y, z), while the Total Station (South NTS-352R) was employed to record spot height coordinates at 10-meter grid intervals, along with additional details. The collected data were downloaded and processed using scripts drafted in Notepad, along with Microsoft Excel and AutoCAD 2010 software, to produce a topographical map comprising a spot height plan and a contour map of the area. All natural features, including roads, streams, and rocks, were mapped using the Total Station. The entire area was divided into a grid of 10m x 10m squares. The heights and planimetric (horizontal) coordinates of the grid points were determined simultaneously, achieving a linear accuracy of 1/32,000. This site covers an area of 4.13 hectares. The paper recommends that the government and its agencies enforce the use of geographic information systems as a tool for monitoring environmental management.

Keywords: Development, Topographic Information System, Maps, Planimetric

1. INTRODUCTION

Surveying is a process of direct measurement and analysis specifically designed to document the existence, the identity, and the dimension or size of natural or artificial features on land or in the air, space or water for the purpose of producing accurate and reliable maps, suitable for visualization if needed, of such documentation. It is the practice of taking measurements of features on and occasionally above or below, the earth's surface to determine their relative positions of the building. Land surveys may be required for geographical, layout design, architectural design, agricultural, geological, mineral, ecological, construction, land ownership or other purposes. (Muskett, 1995).

Topographic Survey is a survey of selected natural and artificial features of a part of the earth's surface to determine horizontal and vertical spatial relation. The object of Topographical Surveying is to produce a topographic map showing elevations, natural and artificial features and form of the earth's surface. For any engineering project, topographic survey is very necessary. This survey is performed to determine the planimetric location and/or elevation of surface or subsurface features, facilities, or utilities. Whether it is laying a railway or highway or designing structures or drainage system, the topographical features of the place must be known so that correct engineering decision may be taken. (Roy, 1999).

A Topographic Survey is a plan viewing the depiction of the relief of a parcel of land. This depiction may be accomplished either by contour lines or spot elevations. A Topographic Survey may show contours at ten, or five meters intervals, a smaller contour interval will result in more field measurements and higher cost. The Topographic Survey may be referenced either to a known benchmark somewhere near the project site or to an assumed benchmark established on site for the project. The scale of the Topographic Survey will conform to the needs of the client and survey regulations. There is various method of obtaining the topography of a land, in this paper, coordinate square method was adopted.

Topographic surveys are extremely useful not just for engineers and architects, but also for homeowners, businesses, governments and builders. The information can be valuable in determining if a project can be accomplished. Then, the data collected can show how the project can be accomplished and what obstacles need to be overcome.

II. STUDY AREA

The project site is located within the Federal University of Technology Akure, precisely Southern Eastern part of the School, Akure South Local Government area of Ondo State. The site lies approximately between Geographical Coordinates Latitude 07^0 17' 34'' to 07^0 17' 40'' North of the equator and Longitude 05^0 08' 43'' to 05^0 08'48'' East of the Greenwich Meridian.

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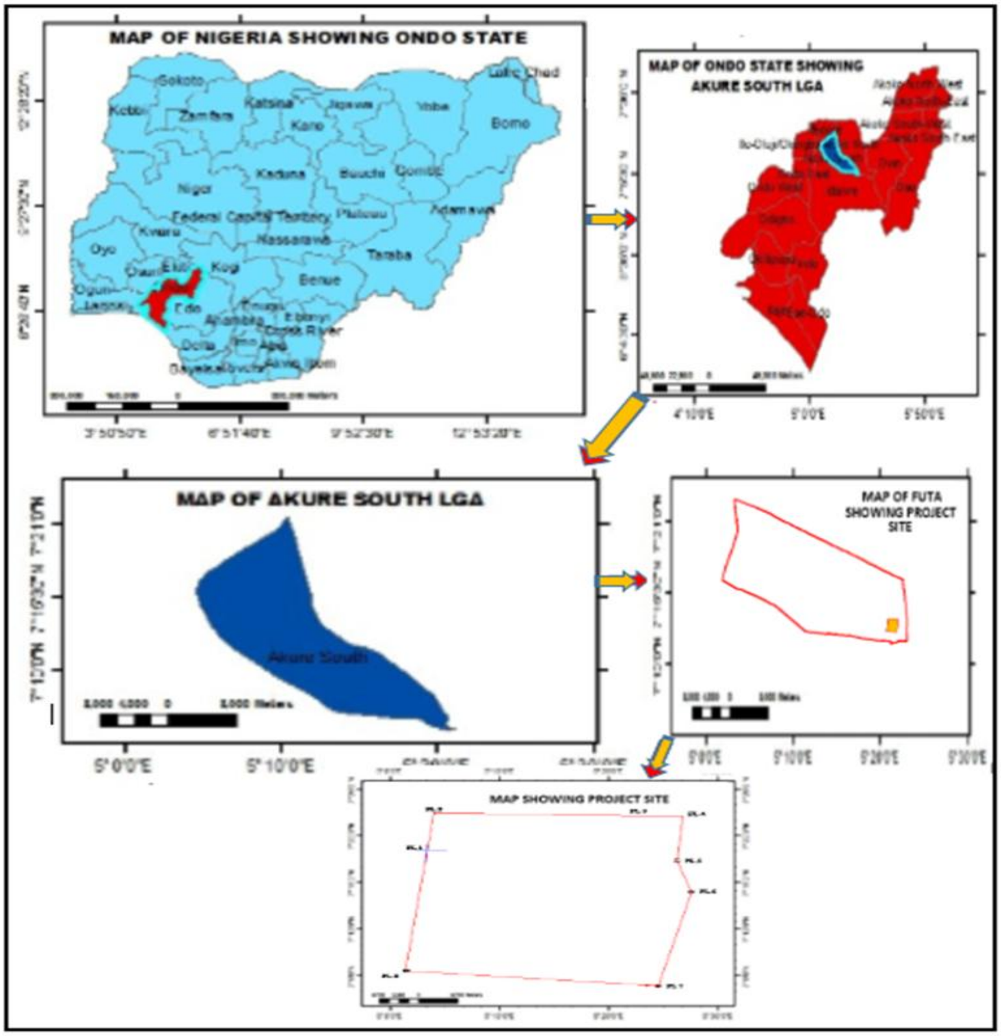

Fig. 1: Study Area Map

METHODOLOGY

Both primary and secondary sources were used to gather the following information: the coordinates of locations near the project, a previous analogue map of the area, and past control points near the project area. Others are the coordinates of the field's features and points. A computerized electronic device that combines EDM and theodolites was used to measure distances, angles, fix details, and determine point coordinates. The vector approach of data acquisition was employed, meaning that the x, y, and coordinates of the objects of interest were obtained using a Total Station. It is a basic guideline in surveying that for a new area; reference must be made to old existing controls by way of linking the new survey from the existing one.

Working from whole to part was the surveying guideline that was applied. Figure 2 below shows the workflow chart for the project work.

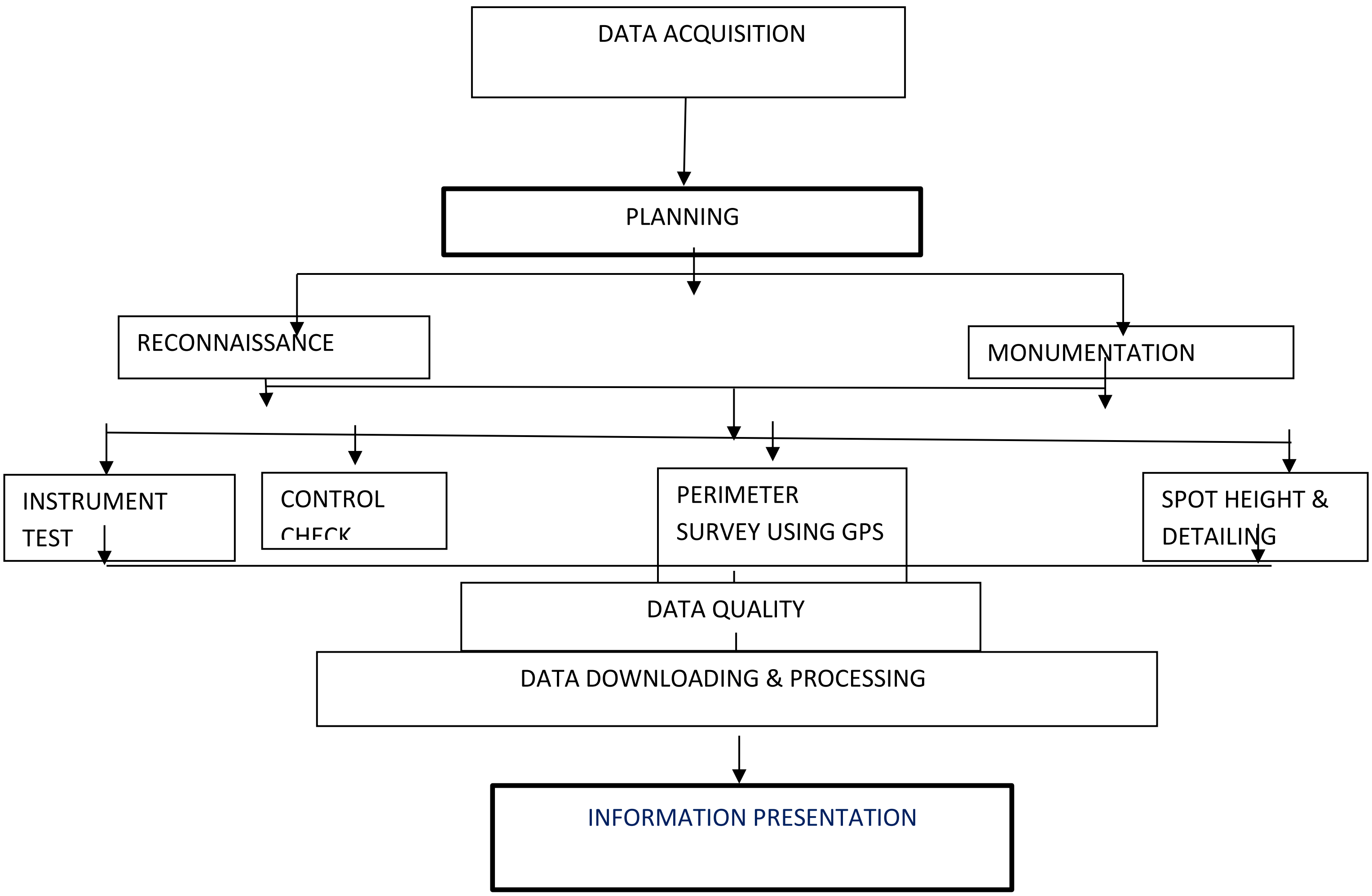

Fig. 2: Flow chart of the research methodology

DGPS (CHC X900) was set up on GPS C01 as base station while centring and levelling were performed on the instrument, the instrument was switched on and all necessary basic configuration such as point name, instrument height, code were registered on the data logger (or controller). Another GPS was set on one the one of the boundary point PL1 as rover station at real time kinematic using five minute at a station. While

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master GPS still remain at it position, the same procedure were performed at all other boundary points, PL2, PL3 and PL4 to obtain the Northing, Easting and Height. (XYZ). Total Station was used to provide 10m height grid values for the area and contours of the project site to enhance the planning of meaningful development within the area. The grid method was used for this operation. The grid interval of 10m was pegged out along the boundary survey lines and named P1-P22, by setting the instrument on PL1, backsight to the GPS C02 to turn the base line PL1 to PL4. Also the whole landed property was gridded at interval of 10m which was done by turning perpendicular line, which is angle 90^0 at every P1 to P22. All these grid line were coordinated and saved in the memory of the Total Station. Detailing was carried out simultaneously while capturing data for spot heighting, The Point Id of the detail features to be captured were edited.

IV. RESULTS

GIS uses this spatial analytical skill to answer fundamental general issue of location, condition, trend, route, pattern and modeling by the manipulation and analysis of input data. The major studies performed in this research were overlay operations, topographic operations and spatial search. The data obtained in the field were automatically processed by connecting the data logger to computer system. The processed data were copied to excel. The raw data was processed to give the required information which was used to produce the Digital terrain model and contour plan using suffer 7.

Table 1: Coordinates of the Boundary Station

NORTHING (m)	EASTING (m)	HEIGHT (m)	PILLAR NO.
806748.753	737203.315	352.343	SVG/PG/16/002
806557.151	737186.955	356.311	SVG/PG/16/001
806590.949	736966.575	344.277	SVG/PG/16/013
806748.753	737203.315	348.383	SVG/PG/16/014

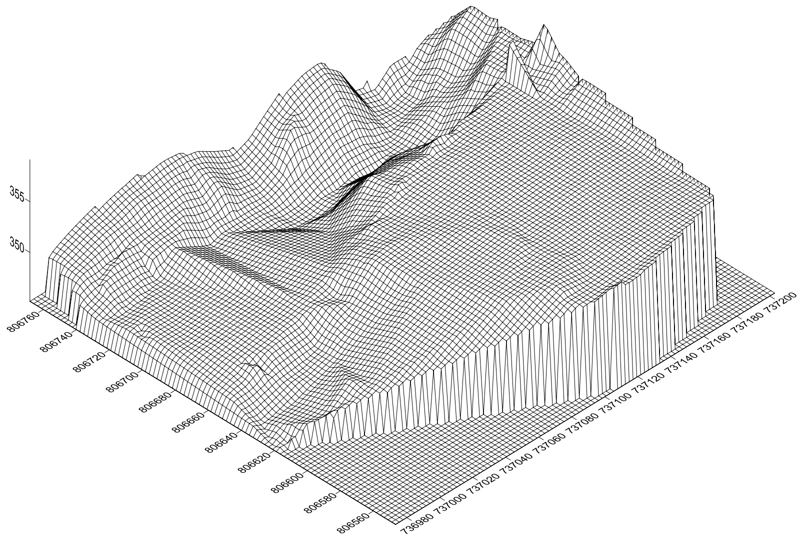

Figure 3: 3D Wire frame map

TERRAIN AND CONTOURS PLAN

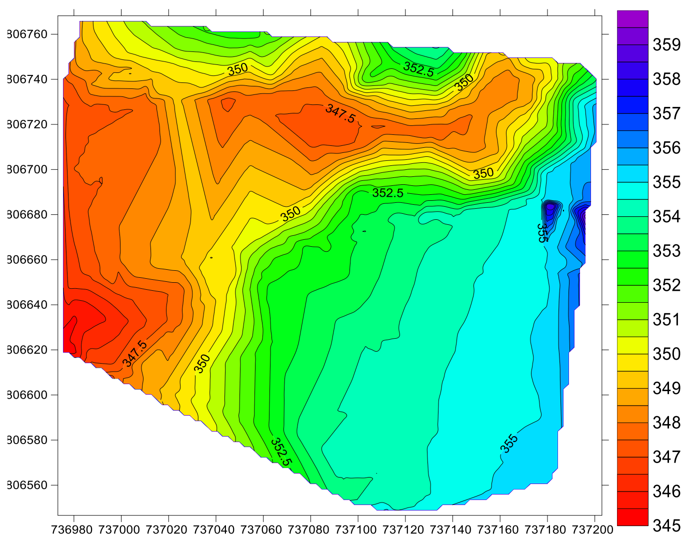

Figure 4: Terrain and contour plan

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GRID VECTOR MAP

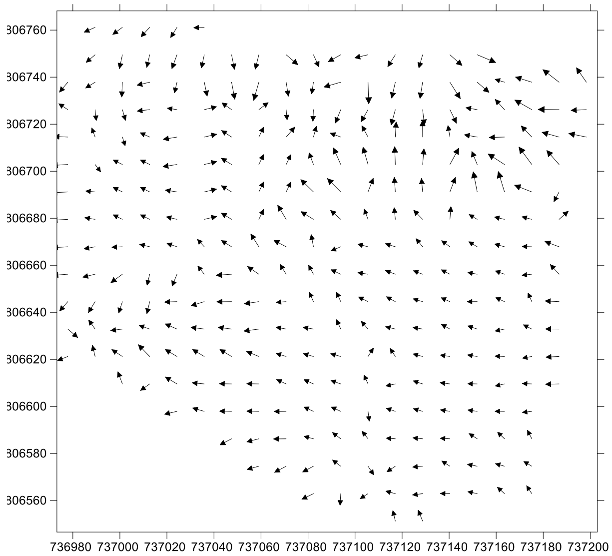

Figure 5: Grid Vector Map

DIGITAL TERRAIN MODEL

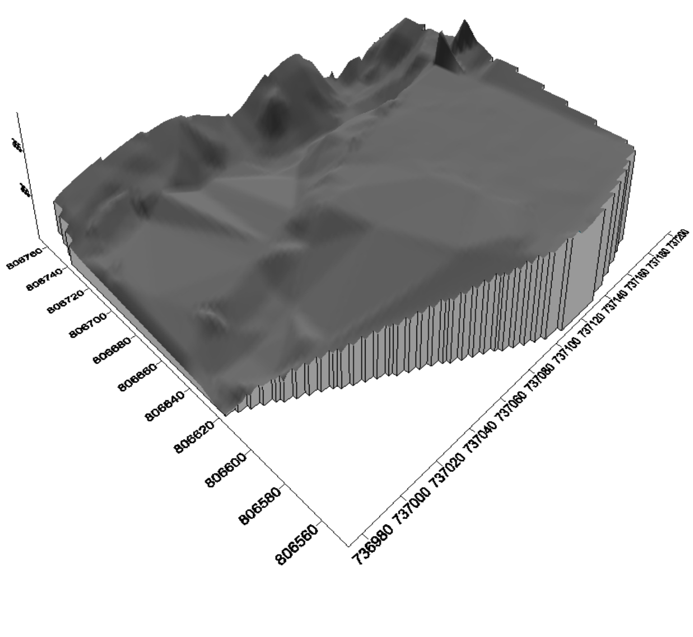

Figure 6: Digital Terrain Model

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V DISCUSSIONS OF FINDINGS

From the spot height information, it is observed that the height information varies from least value of 347.148m to 359.665m, which shows that some area are low while some area are high, of course, the high values is as a results of mountain and some area that are rocky in nature. The 3D Wire Frame Plan and Digital Terrain Model depict the pictorial of the land terrain; it is obvious that some areas are low while some area are high. The Grid Vector Map show the direction of water flow with the direction of arrow, which shows that water flow from higher ground level to lower ground level.

VI CONCLUSION AND RECOMMENDATIONS

The paper revealed terrain of the land which would help the Institution to plan for the construction of new buildings and roads, there by ensure that plots of land and roads are design in the appropriate location which will enhance the economic suitability of the community. That TIS products should be implemented to aid in environmental management and serve as a tool for decision-making.

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