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Research Paper

Updating Large Scale Topographic Databases at Adamawa State Polytechnic Using Total Station

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ABSTRACT: *Physical development has experienced a setback in the recent decade due to a lack of reliable spatial information, which forms the basis for project planning and design. The total station is used for the majority of surveying work for mapping applications. Because many of the places examined are distant, surveys are frequently conducted in unprotected, local, assumed coordinate systems.However, without the survey data projected in real-world coordinates, the range of feasible analysis is restricted, and the value of existing imagery, elevation models, and hydrological layers cannot be fully used. This research focuses on the Adamawa State Polytechnic, Yola (Main Campus).Information on a certain building in polytechnic may be obtained quickly and efficiently. Most of our public agencies in charge of environmental management have extremely limited data on the environment. Where such data is accessible, it is sparse and preserved in paper files, which might deteriorate with time.The total station was used to collect survey data (RUIDE RTS 825A). All features' adjusted boundary coordinates and detailed coordinates were plotted using ESRI's ArcGIS 10.3 software (Environmental Systems Research Institute USA).This study was to investigate the effect of employing geodetic GPS, hand-held GPS, Google Earth (GE), and Base maps as control point sources on the precision and relative accuracy of total station surveys.These effects were examined using many points from the study area of 440,244.42 m^2 of land with a perimeter of 2,779.58 m, and the findings showed that the total station is the best instrument for maintaining the relative accuracy of the converted points.Moreover, the study found that creating digital maps provides trustworthy, timely data and information properly to formulate firm management strategies for the polytechnic using GIS.This would pave the way for additional studies into the application of contemporary technologies in the management of land resources. Adamawa state will lay a solid platform for future research and growth.It is therefore concluded thatderived Land surface temperature map derived is suitable for study industrial thermalenvironments at 1:5000 ~ 10,000 scales, adequately to be used for environmental impactassessment.*

KEYWORDS: ***Perimeter survey, Detail Survey, Digital Elevation Model, Mapping, Coordinatetransformation***

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I. INTRODUCTION

Human actions are referred to as sustainable land management, which indicates that they will continue in perpetuity. It is a phrase that aims to reconcile the frequently contradictory principles of economic growth with environmental integrity and viability. Economic activities might range from intensive agriculture to natural resource management (1). Over the past decades, in Nigeria, physical development has suffered a setback due to a lack of good spatial information which provides the basis for planning and design for various projects. There is the need to provide a good source of information from where data relevant for various needs can be extracted by various experts for the purpose intended. Surveying is the art of determining relative positions of points on the surface of the earth. Relative position means a location concerning a reference point obtained by measuring distances, both horizontal and vertical, and angles or directions (2). Mapping Surveys are made to determine the locations of naturals and cultural features on the Earth's surface and to define the configuration (relief) of that surface. Once located, these features can be represented on maps (3). Natural features normally shown on maps include vegetation, rivers, lakes, oceans, etc. Cultural (artificial) features are the products of people and include roads, railways, buildings, bridges, boundary lines, etc. The relief of the Earth includes its hills, valleys, plains, and other surface irregularities. Lines and symbols are used to depict features shown on maps. Names and legends are added to identify the different objects (4).Since Surveying provides the basis for the planning of physical structures on the ground and in space, there is then the need to capture this information from the site to produce plans and maps. So far as to achieve the above, therefore, we need to combine the various types of survey techniques. A situation where height differences are combined with horizontal controls and both natural and man-made features all combined gives a beautiful result. This process can best describe as a Detail surveying process which is what we need in the 21st Century as a tool for national development.This project involved digital mapping of physical features and attribute data using a total station instrument. The essence of topographical mapping is basically to produce the topographical map and made improvements on existing structures, such as roads, footpaths, buildings and other features. Hence there is a need to carry out topographic mapping which is an aspect of engineering surveying that is carried out to obtained sufficient data for planning. However,it covers the practical, which include: preliminary office work, planning, field observation, computation and plotting. The techniques employed in the field were traversing, tachometry and detailing to produce a topographical map of the area.

The technical work was effectively and efficiently executed using the necessary and available surveying instruments and equipment to meet the specification of the project. A topographical map was produced for future used.It was observed that the Adamawa State Polytechnic's main campus is expanding at a very high rate; building constructions are erupting everywhere, thereby making the campus more complex. This implies the need for an increase in facilities such as road networks, water reticulation, electric line networks, erosion control and the need to locate new buildings in amore orderly and planned manner. All the mentioned planned development cannot be achieved effectively without an up to date detailed map. Hence, this project is set to provide the solution.The primary significance of this project is to produce a well-designed up to date map of the Adamawa State Polytechnic, Yola (main campus) for the purpose site, where a large or small, new constructional development or rebuilding or repositioning of some infrastructural structures could be either natural or cultural (artificial) features. The secondary significance of this work will contribute to the academic importance to the Adamawa State Polytechnic, Yola. This will benefit managers, students, private organizations, individuals and the society at large. It would put an end to all storage and retrieval problem of paper records of filling information. This particular project is limited to Adamawa state polytechnic, yola (Main Campus). The study is saddled with the responsibility of producing a digital map and database for the specified area. It involved the use of a total station to pick optometric height and other details and features. The data collected was inputted, managed, manipulated and analyzed using ArcGIS 10.3 and surfer 10 software.

Digital mapping is the process by which a collection of physical features from a location is compiled and formatted into a virtual image the primary function of this technology is to produce a map that gives accurate representations of a particular area and detailing all features of interest that would be valuable to a user. Digital mapping can be found in a variety of computer applications. Early digital maps had the same basic functionality as paper maps that is, they provided a "virtual view" of the terrain encompassing the surrounding area. However, as digital maps have grown with the expansion of GPS technology in the past decade, live traffic maps updates, point of interest and service locations have been added to enhance digital maps to be more "user conscious" digital maps heavily rely upon a vast amount of data collected over time ranging from land observation data to remotely sensed data and satellite imageries. Maps must be updated frequently to provide the user with the most accurate reflection of a location.

Several methods are used to show accurately the configuration of the land surface on topographic plane or maps, the methods of showing relief are however inadequate because they do not tell the reader of the elevation above the sea level of all points on the map or how the shape is but topographical contour gives this information and makes useful types of topographical maps. Data can be gathered through many sources such as oral interviews or questionnaires for data, land surveying instruments like total station, GPS aerial photographs, digitizing and scanning equipment's can be used to produce topographic and create the database using GIS software(5). Most of the topographic maps currently in use were produced manually. For map makers, however, the future is here today. A well-established network of navigation satellites forms the basic Global positioning system (GPS). This system allows field surveyors to accurately determine horizontal position within a few feet, even in the most remote terrain where conventional surveying techniques are impossible. This significantly reduced the time required to produce or update and would improve the overall accuracy as well. Computer technology will not change the way maps are made but how they are used. Computer-assisted map production is making it easier to produce new paper maps and to revise existing ones. The widespread acceptance of computers and related technologies has accelerated the demand for mapping information in a computer-compatible form(6). Government agencies and private businesses now require digital topographic and database information for their computer-based system. The goal is to stay at the forefront of the technology that will modernize the production of traditional maps while responding to the growing need for the database in digital form. Geographic information systems (GIS) are at the forefront of the mapping revolution. A GIS makes it possible to combine layers of digital data from different sources and to manipulate and analyze how the different layers relate to each other.

II. STUDY AREA

The study area of our research project practical is the Adamawa State Polytechnic, Yola. (Main Campus), which is located in the middle of Jimeta town. It is located along Galidima way, adjacent to the Police Barrack Jimeta yola and opposite the cemetery. The study area main campus of Adamawa State Polytechnic, Yola rest on Latitude $9^0$14’N and Longitude $12^0$2.2’E.

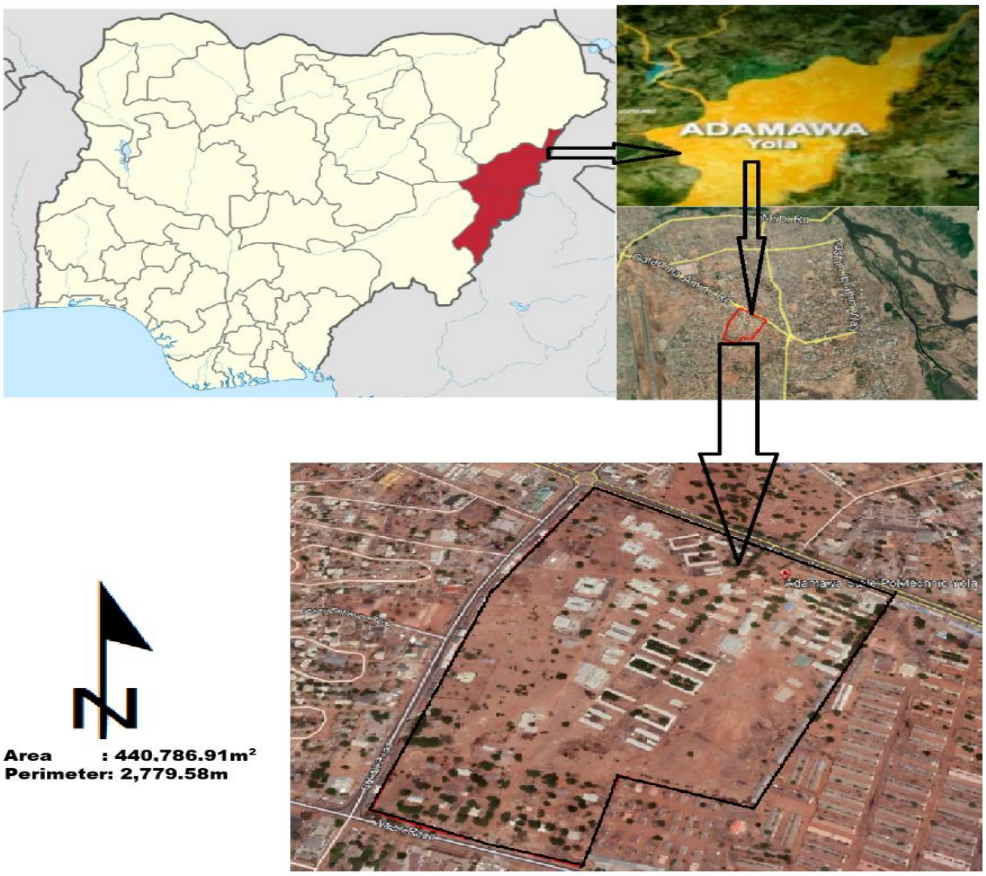

Figure 1. Map of the study area

III. MATERIAL AND METHOD

This project focused primarily on the digital mapping for features that have to do with both the spatial and attributes data in the study area. To serve as a base map and reference infrastructural installation facilities and give detailed information for the proper administration of the area. It also focused on the type of data needed for the production of topographical maps and procedures of data collection, processing and presentation.

3.1 Method and field operation

This study involves the practical field operation of the project work. It shows the procedure that will be involved in the reconnaissance, methods of data acquisition, quality of data, data types, instruments and materials used, the method of data adjustment and processing means and processes of data presentation etc. A traverse is a form of control survey used in a wide variety of engineering and property surveys. Essentially, traversing is series of established stations tied together by angle and distance, angle is measure by a theodolite or total station; the distance can be measured by electronic distance measurement (EDM) instrument(2), sometimes by steel tapes. Theodolite traversing allows the connection of large numbers of stations linked in a sequence by measuring the angle between successive and the distance between the station(7). A traverse survey, therefore, provides a network of control stations over an area for subsequent use either for topographic surveying or for engineering surveying where details are required for the preparation of site plans before the design and layout of survey work(8).

Theodolite traversing is a fast and economical method of increasing the control point density between triangulation points of determination by intersection and resection (Leaurila 1983). However, in traversing instrumental errors have the following major causes: Non-adjustment of bubble, line of collimation not being perpendicular to the vertical axis, graduation not being uniform and vermin being eccentric. Also, there are personal errors that are caused by any of the following; (i) The centring may not don perfectly due to carelessness. (ii)The levelling may not don carefully according to the usual procedure. (iii)Vanier may not be set in the proper place.A total station can measure and record horizontal and vertical angles together with slope distance. The microprocessor in a total station can perform a different mathematical operation, for example, averaging multiple angle measurement average multiple distance measurement; determine horizontal and vertical distance, determine X, Y, and Z coordinates, remote object elevation and distances between remote points; and performing atmospheric corrections.With the total station, dual-axis compensation measures and corrects for left/right (lateral tilt and forward/backwards) longitudinal tilt. Tilt errors affect the accuracies of vertical angle measurements. Vertical angle errors can be minimized by averaging the readings of two-face measurement: with dual-axis compensation, however, the instrument processor can determine tilt errors and remove their effects from the measurements thus much improving the surveyor’s efficiency. A typical total station, one of a series of instruments that have angle accuracies from 0.5 to 5 seconds, and distance ranges (to one prism) from 1,600m to 3,000m. Control surveys establish the precise horizontal and vertical position of the reference monument. These serve as the basis for originating or checking subordinate surveys for a project such as topographic, hydrographic, mapping; property boundary delineation; and route and construction planning, design layout. They are also essential as a reference framework for giving the location of data entered into the land information system (LISs). Control points (9)are needed not only in large construction projects but also in the area to be covered by aerial survey; this is supported by Clark 1968, who opined that in ordinary air surveys certain amount (ground controls) of horizontal and vertical are required to enable the photographs to be plotted for work on a large or medium scale.

However, (10) the aerial photographic survey is very suitable for small scale work particularly in flat country and also be used to construct a plan on a relatively large scale(11). Aero-triangulation may consist of series of bridging operations in which tie point must be chosen in the lateral overlap to monitor the error developing between the adjacent strips blocks adjust in a composite exercise which like radial triangulation achieves the best mean fit to ground controls between adjacent strips as well as between each of the photographs in any one trip.The method of detail survey follows the basic survey principles of “working from whole to part” first a precise control survey is carried out, which is followed by less accurate methods of the detailed survey are, however, sufficient to meet the requirements for the map or plan. This follows the survey principle of “economic of accuracy”

Plane tabling was a traditional method used in the 19^{th} and early 20^{th} centuries. A control framework and the short offset measurement, to pick up the detail. In this case-control and detail surveyswere carried out simultaneously. But in other methods, a control traverse or triangulation survey would come first. A control plot was fixed on a table which was set up on a tripod set up over a control point. The table was rotated to orientate the plot with a neighbouring station and detail was fixed by direction and distance (radiation) or by direction (intersection) the method had the advantage that the map could be seen in the field, but the wet climate of the UK was a distinct disadvantage. Stadia-tachometer was a method widely used in the 20^{th} century, the difference between the top and bottom stadia hair readings in the theodolite telescope on to staff when multiplied by 100 gave the distance, and horizontal and vertical angles allowed positions to be fixed by radiation. A theodolite with special stadia hairs called self-reducing tacheometers was developed to minimize the calculations. This method was the forerunner of the modern method of radiation survey using total stations. To conserve accuracy, the length of sights was limited. This method was the forerunner of the modern radiation survey using total stations. Today there are three methods commonly used for detail survey as follows, (a) Radiation with total station (b) Real-time kinematic GPS (c) photogrammetry. For the case of this study, radiation with total station is the preferable method that will be used;

In the radiation method, with a total station instrument set up at a control point, the azimuth angle, slope, distance, and direction are observed to each desired item of mapping detail from the zenith angle and slope distance, the elevation of the point 3can be determined, and by incorporating the direction, its horizontal position can be computed. These computations are often performed by the internal computer in a total station or by the data collector. The sights to details radiate from the occupied station, hence the name for the procedure. This method is essentially efficient if a data collector is used to record the point identifies and their associated descriptions. Vertical distance, horizontal distances, and directions. The data collector permits downloading the observations directly into a computer for processing through an automated mapping system. The field procedure of radiation with a total station can be made most efficient if the instrument is placed at a good vantage point (on a hill or ridge) that overlooks a large part or all of the area to be surveyed. This permits more and longer radial lines and reduces the number of set up required(4).

Topographic means the arrangement of the physical feature of an area. Hence topographic surveying means the process of determining the position of natural and artificial features such as rivers, streams, lakes, railways, towns, villages and canals. The positions of features in their horizontal, as well as vertical, are to be found and plotted. For showing the position in a vertical direction, the methods used are shading launchers, drawing form lines or contours. Contour representation is the best method of showing the vertical position of features(12–14).

3.2 Data Acquisition

The data acquired during the perimeter survey, the detail survey and spot height determination were all XYZ (NEZ) coordinates in UTM projection form. The field operations involved in data acquisition for this project were. Perimeter survey, Detail survey. Spot heights determination. Each of the above comprises separate observational procedures, checks, recording and information. The field operations involved in data acquisition for this project were, (i) Perimeter survey (ii) Detail survey (iii) Spot heights determinationEach of the above comprises separate observational procedures, checks, recording and information.

3.2.1 Equipment used/ Instrument Test

The following equipment was used for the project namely (i) Total station instrument (RUIDE), (ii) Tilt reflector prism, (iii) Tripod stand and plumb bob, (iv) 100 m steel band (v) Pegs, hammer, cement, nails and beacon cap.Instruments normally undergo a strict process of checking and adjustment by manufacturers, which ensures that it meets quality requirement before it is been sold out. However, after long periods of transport or under a changing environment or prolonged usage, there may be some influences on the internal structure. Therefore, before the instrument is used for the first time, or before any precise surveys, the user should launch checks and adjustments where necessary to ensure the precision of the job.
The tests of the instrument performed were: plate bubble (vial) test, collimation, index error (Reticle) Trunnion axis and Diaphragm test.

3.2.2 Plate Vial Test

The bubble tube is made of glass, which is sensitive to temperature changes. Therefore this ‘plate level test’ was performed to make sure that the bubble is not off its Centre of the run during the survey

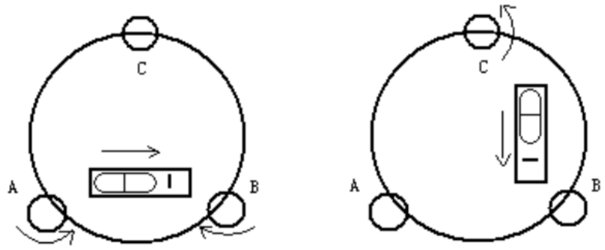

Figure 2. Plate level test

After the instrument was set on firm ground, the plate bubble was set parallel to two-foot screws A and B and brought to the centre, with the two-foot screws.The upper part of the instrument was turned through 90^o and bubble brought to Centre with third foot screw.The upper part of the instrument was turned back to the first two-foot screws A and B and the bubble was brought to its Centre again.The upper part of the instrument was turned through 180^o and the bubble remained at the centre. This indicates that the instrument is free from horizontal plate level maladjustment.

3.2.3 Test and adjustment of the instrument

It is a requirement in every aspect of surveying, that the instrument is used for error. Care should be taken to ensure that all instruments to be used are in good working condition. In case of any fault or error in the instrument, the adjustment should be carried out immediately when possible taken to a specialist in case of an adjustable error. Ideally, a total station just like in theodolite should meet the following condition as follows; (i) The Vertical circle reading should be precisely equal to zero at the zenith point/line. (ii) The line of sight should be perpendicular to the tilting and vertical axis. (iii) The vertical axis should be vertical. (iii) The tilting axis should also be perpendicular to the vertical axis if the condition mentioned above is not met, the following term is used to describe the particular error.

3.2.4 Horizontal collimation error

This is an error due to the deviation of the line of sight from the normal. The error is the deviation of the line sight and the tilting axis or plunge. This type of error affects all measured horizontal circle reading but can be eliminated by observing two faces (i.e. face right and left). For this type of error, there is an onboard calibration use to determine the value of C on the total station equipment. The error was tested by sighting a reflector placed at a distance of 100m from the instrument station. From the menu calibration was selected, the triggered button was then pressed on the face right, the reflector was then sighted again and the error displayed as 0.003m. I then concluded that the total station was in a good condition due to the negligible magnitude of the error to the order of specification guiding this project. The field procedure of in-situ check carried out using total station was as follows; (i) The total station was set up on MCAASP03 and all temporary adjustmentswere carried out. A reflector prism was centred on MCAASP04. (ii) Station orientation was carried out using the coordinates of MCAASP03 as the position of the instrument station and coordinates of MCAASP03 as the position of the back (reference) station. (iii) Then the reflector at MCAASP03 was bisected and measurements of angle and distances were carried out. (iv) The reflector was then transferred to MCAASP03. (v)The reflector was again bisected and both distance and bearing readings were recorded. The coordinates of the present position of the reflector were displayed on the screen.

3.3.5 Observational Procedure in Perimeter Survey

Detailing in this context refers to the process of determining the horizontal and vertical positions of all features within the project area. This was achieved using radiation with the total station. Figure (3) illustrates these procedures the steps followed in field observation of detailing using the total station was as followed; (i) The total station was set over control point MCAASP03 and accurately centred using the optical plummet and levelled, (ii) A job named detail was created and saved. This folder was activated so that all work to be done will be saved in that folder, (iii) The height of the instrument, I from ground to the transit axis was measured using a tape and noted, (iv) The reflector was adjusted to 1.5m height and locked. Then it was taken to the other control point MCAASP04 (R.O) where it was held vertically by utilizing the attached spirit level, (v) The R.O was sighted using the telescope and accurately bisected. And instrument orientation was carried out by imputing the coordinates of the instrument station and that of the R.O, (vi) Measurements were taken to the reflector at the reference station. The displayed coordinates were compared to the one entered to ascertained the correctness of orientation, (vii)Then the reflector was taken to the first corner of the building to be positioned and measurements were taken. The position of the building corner was recorded as Bd1 in the instrument's internal memory, (viii) The reflector was moved to the next corner and the same procedure was repeated but the position saved as Bd2, (ix)These were repeated to all building corners that were visible from the instrument and all the positions were saved serially with the prefix B to indicate it's a building, (xi) After all the visible buildings corners were exhausted, a point was established and positioned with the name C. P1. the point was chosen so that other set of building corners can be seen from it, (xii) Again the procedure of positioning the corners was carried out, (xiii)The same procedure applies to all other features like roads, trees, electric poles, (xiv)The procedure was repeated until all features within the project area were positioned, (xv) Checks to verify the reliability of the radiation was carried out concurrently during the observation by sighting to visible control points and other already positioned points on the perimeter fence. The coordinates displayed were compared with the already known coordinates. If the difference is within the acceptable limits of the project order, the work progresses.

3.3.6 Observational Procedure for Spot heights determination

A similar procedure for detailing as above was used for spot height determination, the only difference is that here is that positions of points at a span of 20m (where applicable) were determined instead of buildings. Below illustrates the procedure. Due to the nature of the terrain involved and considering its extent; the spot height was taken at the interval as described below instead of the gridding method. The instrument is set up on an established point with known positions (C.P), and another close by similar established point is used at a reference point. The line connecting the CP and RO points were used as the reference line for orienting the total station using coordinates of those points. The height of the instrument and that of the reflector is taken paramount in this observation.After the orientation processes, the reflector was held vertically at a far distance on one of the chosen lines of sight. Then measurements were taken and recorded with the name SPH1 meaning spot height 1, then the reflector was then moved to a distance of 20m approximately on the same line of sight (horizontal circle of the total station remained locked). And another measurement was taken and recorded. The instrument automatically named the second measurement as SPH2. This process continues until all the 20m intervals on the line of sight were exhausted. Then the horizontal motion is unclamped and the instrument was rotated to an angle of 20^o from the previous line. Measurements were repeated similar to the first line and each time it's recorded automatically in the internal memory, with the prefix SPH followed by serial numbers. These processes were continued until 360^0 is coverage from the instrument station was achieved with several spot heights taken. Then the instrument was transferred to another established point and the whole process repeated until the entire project area was covered with spot height determinations. However, where the 20 interval and or the 20m interval is not possible due to either a building or any inconvenience, the interval is adjusted a little to accommodate what is intended.

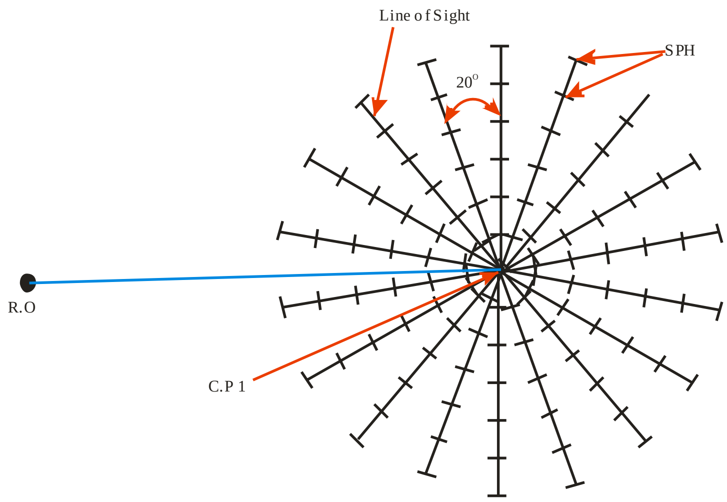

Figure 3. Procedure for Spot heights determination.

3.3.6 Observational Checks and Recordings

Checks are very important in controlling the accuracy of survey jobs, in this project, few techniques were employed to verify the closeness of the work to its true status. For example during observation, after the total station is transferred to another position, positions of close known points were re-observed to see if there are unacceptable deviations. During the detailed survey, positions of some features were fixed from different instrument stations, thereby providing checks. For the perimeter survey, since it was a close-loop traverse, the coordinates of the closing control station as measured were compared with the already known coordinates. Automated surveying instruments were used for this project; therefore, all measurements and observations were recorded in the internal memory storage of the device. However, other additional measurements made on the field (plus measurements) were recorded on field books that were used for guiding the survey fieldwork. Also, the field book was used to record and identify some features with the identification's numbers used in the instruments in other, not to confused some IDs later. See appendices. Although automated surveying types of equipment were used, plotting and identification of some features would have been almost impossible without the field sketches. As mentioned earlier, a satellite image obtained from Google earth was used as a guide, the printout of the image was utilized during the fieldwork, sketches, IDs and other necessary recordings were made on the printed image (See Appendices). This assisted the author enormously during the plotting phase of the project in identifying which ID belongs to a particular feature and which point connect to the other.

3.4 Data Processing

The data collected from field works is yet to be meaningful information until subjected to different processing. This depends on the technique of data collection, type of data collected and the instrument type employed. The following sections will explain the type of data acquired, the method of data transfer, data reductions, computations, adjustments.

3.4.1 Downloading

The data as mentioned earlier was saved in the internal memory storage device of the total station. These data must be transferred to another device before it can be put to use for the project. This was achieved using the instrument's data transfer software (RTS Transfer V1.4).The following steps were used to download the required data from the instrument into the laptop; (i) The link cable (y-cable) was properly connected to both the total station and the PC, (ii) The communication parameters of the instrument were set to be the same as that of the computer as indicated in the figure below, (iv) Then the job to be downloaded was selected, and the format of data was also selected, (iv) Then a command for data transfer to the PC was activated, hence the data was transferred and saved in the PC

3.4.2 In-situ check

Before using any control in survey work, it has to be checked to ascertain their proper and accurate position in terms of angular measures and distances from the times of establishment to the present day. The process involved in achieving in-situ checks was called on the following station.

3.4.3 Angular and Linear check

The bearing of the line joining the three stations was computed from the above coordinate and further deduce the angles between the lines. The ground station The computed was found that the discrepancy given was permissible it means that the stations are in-situ. The distance between the three stations was computed from the existing coordinates, similarly, the total station was used to measure the ground distances. The comparison of the computed and measured distances. Shows the permissible discrepancy and thus the linear quantities are in-situ using.

3.4.4 Data quality

The quality of data used for an experiment can be determined by the validity and reliability of such based on the assumption that the observer of such data is trustworthy and experienced(15).The validity of the data is measured by the precision of the accuracy of such data. (RUIDE 825A) total station instrument was used instrument and the number of setups (i.e. the number of stations) of the boundary as well as the subsidiary station determines the data quality. The set of readings taken, also determine the data quality e.g. when a theodolite is used (5” accuracy) the average of five sets of reading will be accurate than the set of values. The production of a topographic map is a cadastral job and therefore will record a third-degree order with linear accuracy of 30” per where is the number of stations.

3.5 Plotting

Plotting can be defined as the mechanical /electronic (i.e. computerized) or mathematical process (manual) process by which points or details located are positioned concerning their geographic or grid coordinate In this research ArcGIS 10.5 software was used to plot the boundary and details of the study area while surfer 8 software was used to generate digital elevation model as shown in Figure 5.

IV. PRESENTATION AND ANALYSIS OF RESULTS

The chapter is a journey in GIS that takes us from raw data capture from the field to presentation of the various categories of Digital topographic map of the polytechnic.

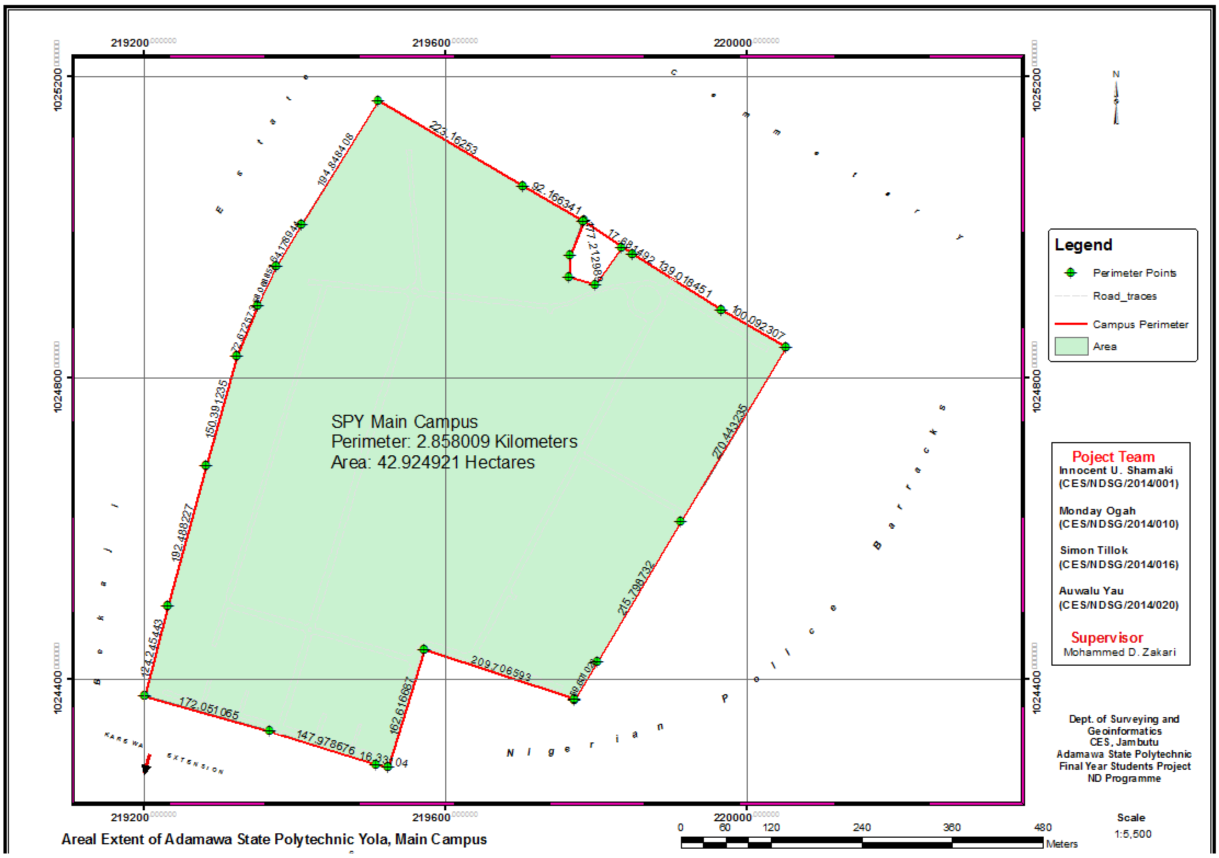

Figure 1. Areal Extent of Adamawa State Polytechnic, Yola. (Main Campus)

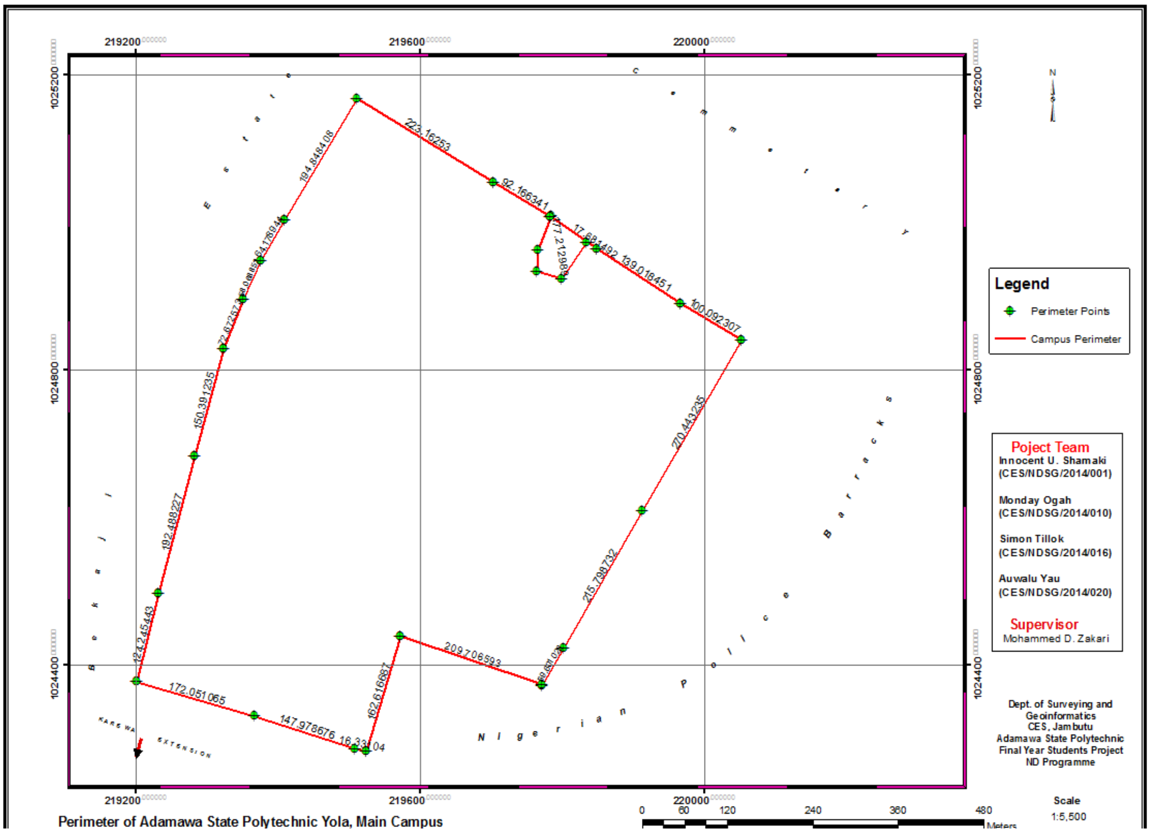

Figure 2. Perimeter of Adamawa State Polytechnic, Yola.

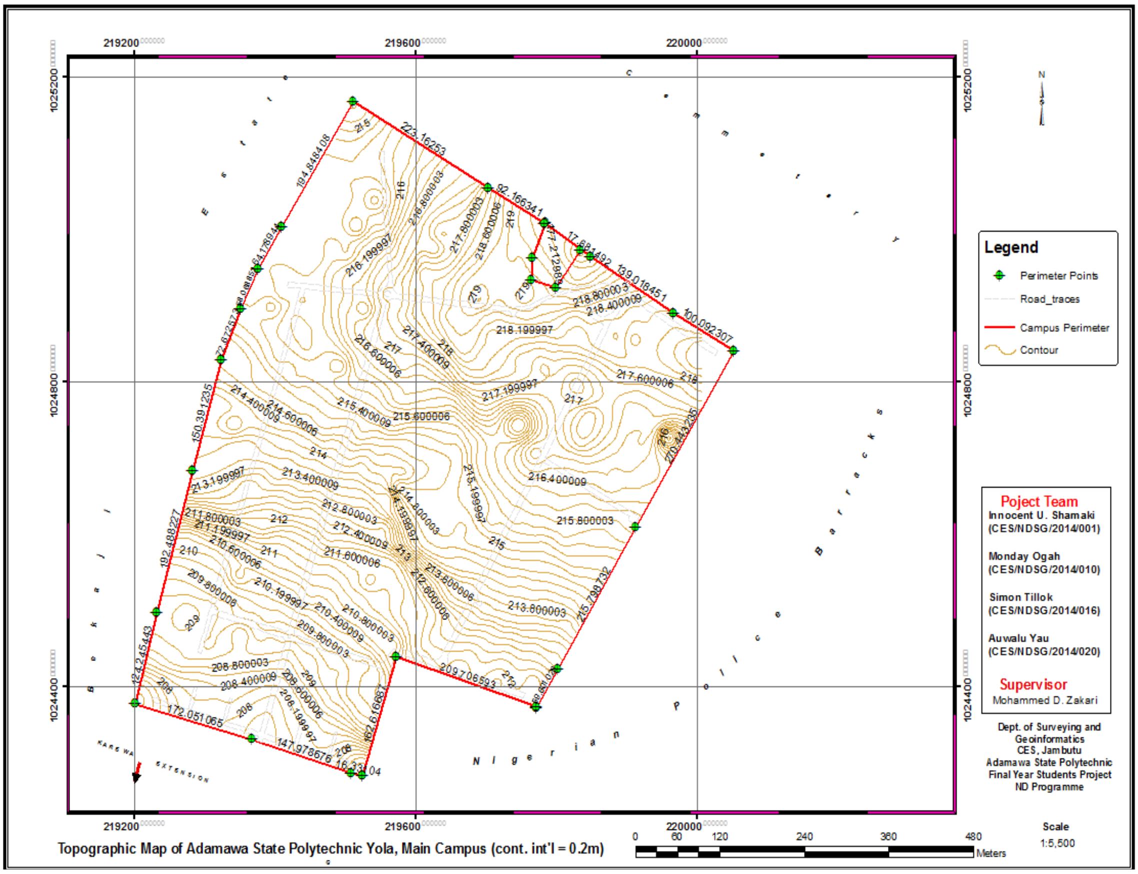

Figure 3. Topographic Map of Adamawa State Polytechnic

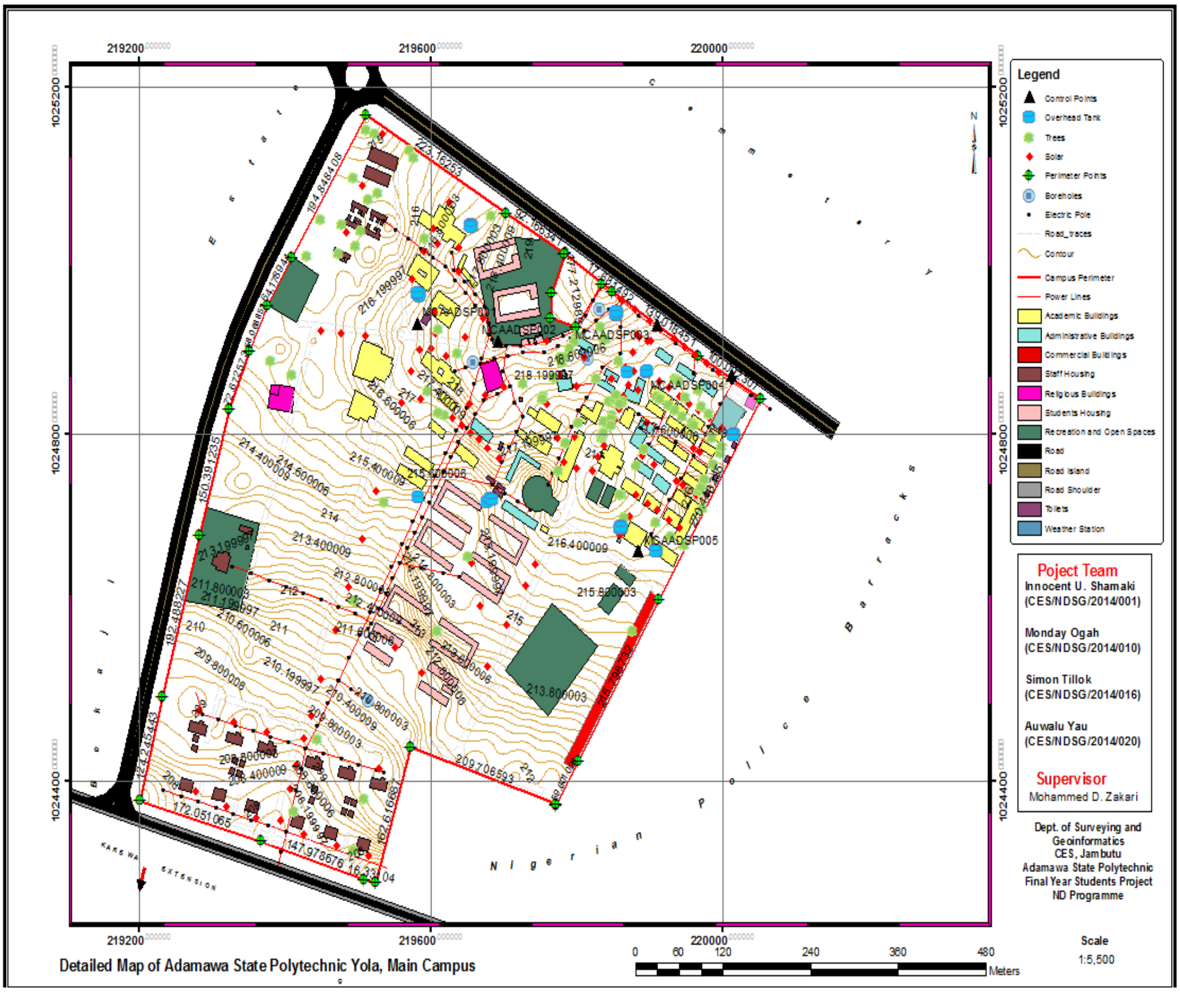

Figure 4. Detailed Map of Adamawa State Polytechnic, Yola

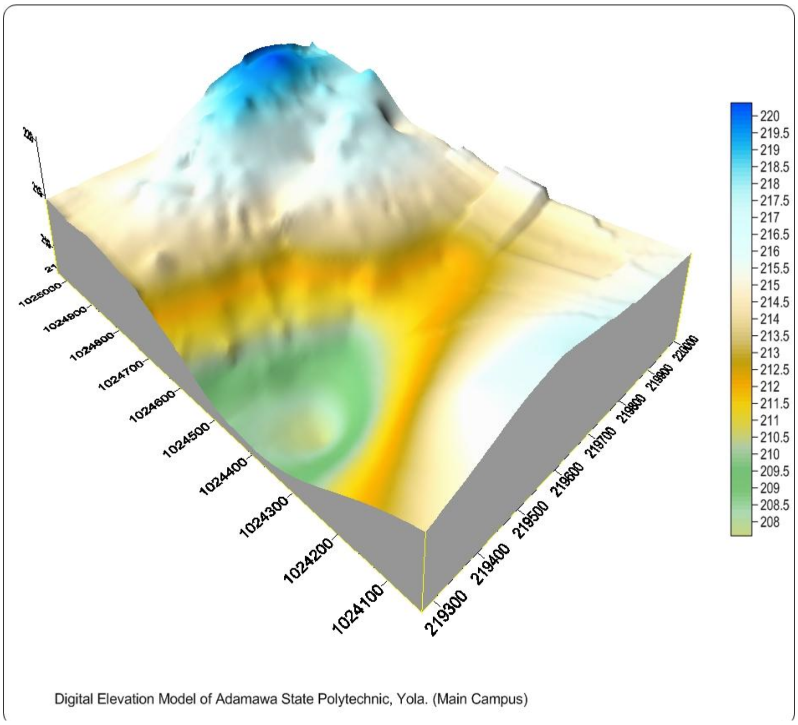

Figure 5. Digital Elevation Model.

4.1 Production of the digital elevation model

The SURFER 10 software worksheet was opened to the key is the x, y and z coordinates of all stations heightened in the project. Data gridding the SUFFER 10 was perform based on scattered data interpolation (SDI) and save in a file. The file was then imported into the map contour environment to plot the contour. Similarly, the same method was applied to produce the DTN.

V. CONCLUSION

The result obtained was the creation of a digital photographic map for the polytechnic. Information system through which information on a particular building of interest of the polytechnic can be readily made available by querying the data. The result generated as a result of queries by the user is instantaneous. It has reduced the time required to search a building the method thus provided the much-needed solution to the problem of land resources management by storing, updates, manipulating data and information regarded. Digital technology provides convenient quick, accurate access to information used for planning, design/redesigning and handling of data and the record updating, changing or modification, including the insertion of new recording and deleting of old. This study showed that digital mapping creation provides reliable, timely data and information in a suitable form for the task of developing firm management policies for the polytechnic using GIS. This would open up more adventures into the use of modern technology in the management of land resources. A big foundation for further studies and expansion in future shall be laid in Adamawa state.

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