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Acquisition of Geospatial Database for Primary Schools in Kaduna Metropolis

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Abstract: A map is one of the final products of surveying. This is of many types and uses. A digital map of primary schools is a thematic map which shows the location, distribution, the number of private and public schools in a given area and other relevant information. At the present, such a map for Kaduna is not available. This project aims at producing a digital map showing the location of all private and public primary schools within Kaduna metropolis to aid planning and decision making. The project was carried out with the aid of handheld GPS receiver as a tool for the field data collection and the use of a digital map of Kaduna town as a base map on which the positions of these schools were plotted. The plotting was done using ArcGIS.

Key words: Arc GIS, digital map and thematic map, GPS receiver, satelites

INTRODUCTION

A map is defined as a graphic representation on a plane surface, of the physical features both natural and artificial of the parts or whole of the earth's surface at a given scale, by the use of signs and symbols with the method of orientation indicated. Maps are of different types and are used for different purposes. These maps include; topographic maps, plan metric maps, orthographic maps, political maps, thematic maps etc. (Maptown, 2007).

However, before the map maker can design and produce a map, a surveyor has to collect the basic data. Natural and man-made features such as rivers, roads, buildings, boundaries hills etc. have to be observed, measured and recorded. Over the centuries, surveyors have used chains, theodolites, tapes, telescopes, spirit levels, etc, to achieve this. In the twenty-first century, new technologies like Global Positioning Systems (GPS) and computerization are altering the way that surveyor's work (Surveysinc, 2007).

Christian missionaries first established primary schools in Nigeria in the 1840's (Encarta, 2004). The right of ownership was later transferred to the government who converted them to public schools. Both government and missionaries established schools are regarded as public schools. Apart from these types of schools, there is a growing number of private owned schools run by private individuals. The government does not presently have knowledge of the number, location and other relevant information on all the schools in Kaduna metropolis. This is because of poor record keeping systems and poor responds of private school owners to governmental calls for registration and revalidation.

This study covers Kaduna metropolis, which is known as the city center or the central area in the north. It lies within the latititude 10ºC 26′ N and 10ºC 37′ N of the equator and between longitude 7ºC 26′E and 7ºC 28′E of the Greenwich meridian (Max, 1967). The area covers about 18 km² and consists of about 4 LGA's: Kaduna North, Kaduna South and parts of Igabi and Chukun.

This study aimed at providing a digital map showing the schools which would be of help to both the government and the general public.

The GPS satellite system: The Global Positioning System (GPS) is a satellite-based navigation system made up of a network of 24 satellites placed into orbit by the U. S. department of defense. GPS was originally intended for military applications, but in the 1980s, the government made the system available for civilian use. GPS works in any weather conditions, anywhere in the world, 24 h a day. There are no subscription fees or setup charges to use GPS. The 24 satellites that make up the GPS space segment are orbiting the earth about 12,000 miles above us. They are constantly moving, making two complete orbits in less than 24 h. These satellites are travelling at speeds of roughly 7,000 miles an hour (Garmin, 2008).

How GPS works: GPS satellites circle the earth twice a day in a very precise orbit and transmit signal information to earth. GPS receivers take this information and use triangulation to calculate the user's exact location. Essentially, the GPS receiver compares the time a signal was transmitted by a satellite with the time it was received. The time difference tells the GPS receiver how far away the satellite is. Now, with distance measurements from a few more satellites, the receiver can

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determine the user's position and display it on the unit's electronic map (Garmin, 1999).

METHODOLOGY

The execution of this study was carried out as follows:

- Acquisition of base map and list of schools
- Collection of coordinates from field using GPS
- Plotting of coordinates to obtain the final map

Acquisition of base map and list of schools: A copy of the base map of the study area was obtained in soft copy. This was studied so as to get acquainted with the map and the areas where the work will cover. The names and addresses of the private primary schools in Kaduna Metropolis were obtained from the educational resource center in Kaduna state (Table 1). This gave an idea of where the schools are located and the number in the study area (Fig.1).

Collection of coordinates from field using GPS: The coordinates of the schools were collected using a hand held GPS. Making use of the list of schools and their addresses already obtained, trips were made to the various schools and coordinates collected. The procedure of using the hand held GPS followed at each school is as follows:

- The ☼ key was pressed until the receiver turned on. The welcome page appeared while the unit conducted a self test. Once testing was completed, the satellite page appeared and when sufficient signals had been acquired, the satellite page was replaced by the position page.
- The 'mark' key was pressed to mark or obtain the coordinates points. The 'mark' position page appeared with a default 3-digit name for a new waypoint in the upper left portion of the page.
- The waypoint was saved with the default name and symbol. The saved waypoints were retrieved by accessing the main menu and highlighting a waypoint option; 'waypoint' to retrieve only one and 'waypoint list' to retrieve all.

Plotting of coordinates to obtain the final map: The obtained coordinates were typed in Notepad with .txt format. The ArcGIS software was used in plotting. The procedure of plotting these coordinates in ArcGIS is as follows; Launching of ArcGIS, the base map was added by clicking add data, and georeferenced using projected coordinate system (UTM).

The points defined by coordinates were plotted onto the base map, by selecting tools and add XY data. On the dialog box that appeared, the directory containing the

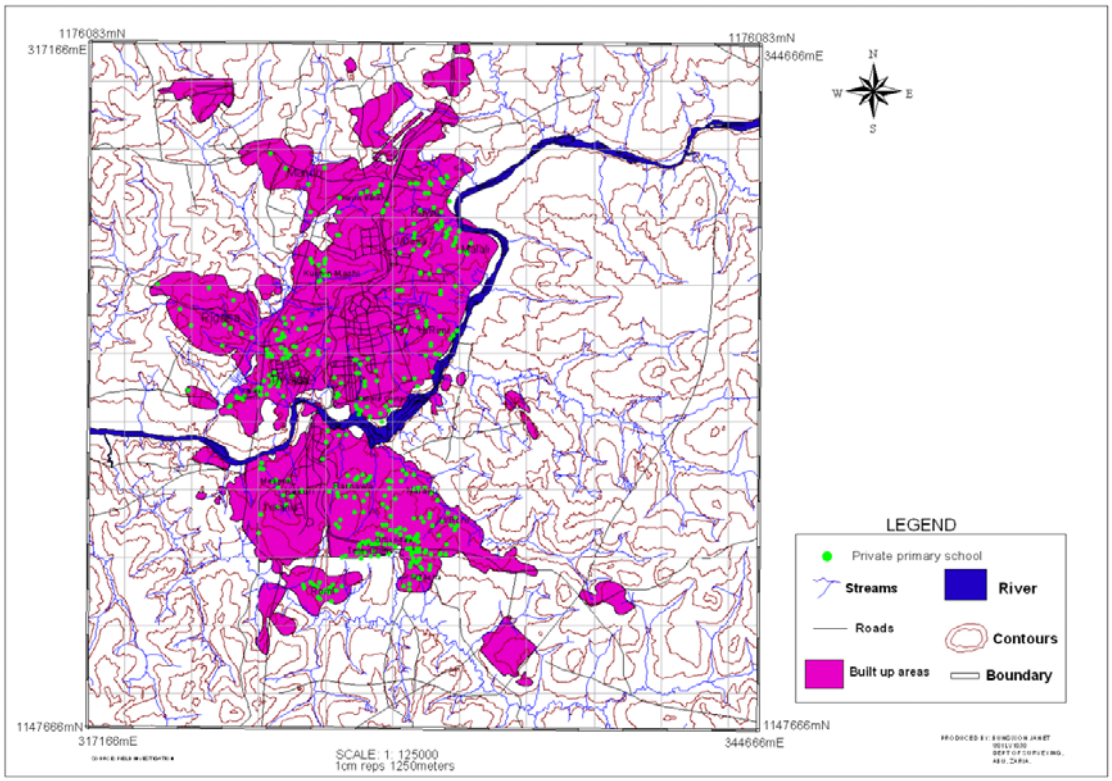

Fig. 1: Showing the distribution of private primary school in Kaduna Metropolis

Table 1: Showing some of the primary sch. in Kaduna Metropolis with their easting and northing

S.no	Name of Schools	Address	Easting	Northing
1	Ejirho lntl. School	Q27 Gyshare Str. Kakuri	325669	1157103
2	Macdave schools	AG 30 Mekera Rd/ 22-24 Sch Rd Nassarawa	324604	1158583
3	Vico N/P Sch	D6 Matazu Rd Nassarawa	325243	1158099
4	Excel N/P Sch.	No 3 Samaru, Air force.	325294	1157029
5	Fabun N/P Sch.	BZ 25 Baranawa Rd, Nassarawa.	324717	1158556
6	Standard lntl. Sch.	No 1/2 Kufana Str. Trikania	324619	1156698
7	New World Qulitative Sch.	No 20 Kunai Rd Nassarawa.	324672	1158796
8	Our Saviours lntl Sch.	No 21 Rahaa Close.	325339	1157804
9	National School.	D14 Maazu Rd Nassarawa.	325114	1158057
10	Pet lntl. Sch.	No 1A&B Kufena Str. by Police Station Trikanai	324545	1155953
11	Al-Ameen Academy	No 15 blk. 2 Babandoo Str. Mekera	326307	1157716
12	Ansar-ud-deen N/P Sch.	No 30/31 Umar Danlaje Kakuri.	325747	1158110
13	First Royal N/P Sch.	4B, 20 Mekera Rd .	326314	1157644
14	Christ Supreme N/P Sch	Samaru Rd	325897	1157464
15	Heyik lntl Sch.	Samaru Rd	325861	1157448
16	Zenith Intl. Sch.	No 10 Rahama Rd.	325542	1157491
17	Christ Ambassador's College.	Juji Rd S/Tasha.	330804	1155100
18	Treasure Academy	No 17 Baraje Str. S/Tasha	337040	1154580
19	Bestway Intl Sch.	No 3 Tukur Rd. S/Tasha	330879	1154240
20	1st ECWA N/P Sch.	Magajin Gari Str. U/Barde	330724	1153893
21	Chrisdom N/P Sch.	Behjind ECWA Church U/Barde	330486	1153807
22	Destiny Academy	No 9 College Rd U/Barde	330711	1153684

Table 2: The number of private and public primary schools in some of the settlements in Kaduna metropolis

S.No	Settlements private schools	Public	schools
1	Sabon Tasha/U/Pama/U/Boro	57	6
2	U/Television	24	3
3	U/Romi	17	3
4	Mekera/Kakuri	10	2
5	Narayi	17	4
6	Malali	17	1
7	Tudun Wada/U/Sanusi	35	11
8	Rigasa	11	3
9	Kawo/Hayin Banki	23	2
10	U/Dosa/Badarawa	17	4
11	Branawa	27	3
12	U/Rimi	27	3
13	U/Sunday	13	0

required data was navigated to and the file containing the data was selected. The coordinate system was also selected (UTM coordinate). Eastings and Northings were selected for x and y fields respectively. 'Ok' was selected and a new layer was added. This layer contains all the points on the table. The layer was converted to a shape file to enable further analysis, by right clicking on the name of the layer in the table of content, select data and click on export data, in the dialogue box appeared the directory to save the exported shape file was navigated and selected. The XY coordinates were in the attribute table automatically while other fields such as 'Names' and addresses of the schools were created and their respective data were recorded. Other relevant data such as road, contours, rivers etc were digitized. Their respective fields for the attribute were also created.

Other relevant data such as roads, contours, rivers etc. were digitized. Their respective fields for the attribute were also created.

Map was placed on a layout by selecting 'Layout' from the 'View' menu and marginal information was created in the layout view such as the scale, legend, title and north indicator.

RESULTS AND DISCUSSION

The map produced depicts the locations and distributions of private primary schools in Kaduna metropolis. From the map, it could be seen that the schools are not evenly distributed; some areas have the schools concentrated at particular places while some areas have none.

The areas with more schools are Sabon Tasha, U/Television, U/Romi, Tudun Wada and U/Sanusi. Schools are fewer in areas like Rigasa, Mando, Narayi, Malali and U/Rimi. The central area of Kaduna town has very few schools.

Tudun Wada, U/Sanusi, U/Romi, Kurmin Mashi and Kakuri have a larger number of schools concentrated at the central area with few located at extremes of these areas. Schools are more evenly distributed in Kawo, Rigasa, U/Rimi, Barnawa, and Kabala Costain. Badarawa and Rigasa with their large population have very few schools not enough to serve the entire community. Also the central area of Kaduna has very few schools as it is the commercial area of the city. The number of private and public primary schools in some of the settlements in Kaduna metropolis is shown in Table 2. The map shows that, some settlements are deficient in private schools while others have excess. Also, the schools are not evenly distributed in most places, to serve the immediate population. That is, some areas have schools concentrated in certain parts leaving other parts of the area with none, so residents would have to travel a little before they could get to school.

CONCLUSION

The coordinates of private and public primary schools in Kaduna metropolis were obtained using handheld GPS and plotted using the ArcGIS software. The map gave firsthand information of their spatial distribution, and other relevant information which would provide information that would help in decision making and planning.

Makino and Watanabe (2002) concluded that "integrating all the school data and converting it to the digital format will make us easily and efficiently do present condition analyses or simulation on future school building planning. In addition to this, creating the database that can be linked to features in GIS is very significant, since the features without detail attributes cannot help us do further analyses".

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