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Geospatial Quick Response Model by Police: A Case Study of Kaduna Metropolis

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ABSTRACT

Delay in responding to crime by police departments may lead to loss of lives and properties. Efficient management within the shortest possible time will address this problem. Geographic Information System (GIS) can be used by police personnel and individuals to plan effectively for emergency response. Early arrival plays a crucial role in managing crime, therefore best route analysis helps in determining the shortest route. This research aimed to develop geospatial database for responding to crime scene by police departments within Kaduna metropolis through database creation and linking attribute tables to geometric data, Spatial location distribution of police departments within the study area, designing the best route (suitable) analysis for police departments to incident in the study area, and best route analysis of police departments in Kaduna metropolis. Satellite image was obtained and handheld GPS was used to obtain location of each police department. The study revealed that there is need for more access roads to various locations for easy access and also recommend seminars and training on the use of GIS in managing crime.

Keywords: Crime, Police Stations, Best Route, GIS.

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INTRODUCTION

The level of development in any community depends to a large extent on its state of security. The rate of crime in Nigeria has been on the increase and these crimes are being carried out with more perfection and sophistication, due to lack of adequate and modern technology and sufficient manpower (Fajemirokun, 2006)

The distribution of crime across the landscape is geographically random since crimes are human phenomena. For crimes to occur, offenders and their targets, the victims and/or property, must exist at the same location for a period of time. Several factors, including the lure of potential targets and simple geographic convenience for an offender, influence where people choose to break the law. Therefore, geography plays an important role in law enforcement and criminal justice. A popular slogan says criminals are not spirits.

They move from one place to the other, and live in the society just like every one of us (GIS team, 2005).

Crime theories are critical for useful crime mapping because they aid in the interpretation of data and provide guidance as to what actions are most appropriate (Eck, 2002). Therefore, understanding how crime theories account for hotspots is critical. Several theories of crime and disorder concentrations (hotspots) exist. Crime theory explains different types of crime phenomena that occur at different geographic levels. Each level requires different units of analysis for the things being examined. One can think of units as corresponding to the geographic area being depicted on map points, lines or polygons (Harries, 1974). Some theories explain point concentration of crime while others help explain linear concentrations of crime or hotspot crime polygons. Urban

crime has measurable spatial and temporal distribution that requires urgent attention of the specific arm of government responsible for maintaining law and order which is usually the police and the judiciary (Agboola, 1997).

In the recent years, the rate of crime occurrence grew sharply to nearly epidemic proportions, particularly in Kaduna and other urbanized areas due to population increase.

GIS supports planning, preparedness, mitigation, response, and incident management. GIS extends the capability of maps - intelligent, interactive maps with access to all types of information, analysis, and data. More importantly, GIS provides the required information when, where, and how it is needed. This research will examine how GIS technology is helping the fire service meet the needs of the community more efficiently than before (ESRI, 2006).

GIS is used to capture, display, and analyze data spatially. GIS combines layers of information about a place to give users a better understanding of that place. Unlike a flat paper map, a GIS-generated map can present many layers of different information that provide a unique way of thinking about a geographic space (Cova, 1999).

Geographic Information System (GIS) can be used as a tool by police personnel to plan effectively for emergency response to scenes, determine mitigation priorities, analyze historical events, and predict future events (Johnson, 2000). In addition, it can help to locate the best route to a scene.

Statement of problem

Kaduna state has witnessed series of crimes which have claimed lots of property and many lives in the process. The casualty is usually much because of the slow response time of the police department. Spatial distribution and best route analysis to crime scene can address the challenges and reduce the losses.

Creating a spatial database for Police emergency response within Kaduna metropolis has therefore become imperative as it is needed to help the Police department identify the places where the crime occur and to find the best and fastest route to the crime scene.

Aim and objectives

The aim of this paper is to develop a geospatial database for responding to crime scene by police departments within Kaduna metropolis.

The objectives of this paper are:

1. Database creation and linking attribute tables to geometric data.
2. Spatial location distribution of police departments within the study area.

3. Design the best route (suitable) analysis model for police departments to incident in the study area

Study area

Kaduna metropolis comprises of Kaduna South Local Government and Kaduna North Local Government. It is located in the North Western part of Nigeria. Kaduna lies between latitudes 10° 20' N and 10° 33' N and longitudes 7° 45' E and 7° 75' E covering an area of about 46, 053 sq.km.

It has a population of about 6 million according to the 2006 population census with a population density of about 130/km² (Ngex, 2015).

METHODOLOGY

Materials used

The software, hardware and data used are:

1. Laptop computer Microsoft Office.
2. Handheld GPS (Garmin 76).
3. ArcGIS v10.3 Desktop
4. Microsoft Office.
5. Bing Satellite image
6. Police Station records

The procedural steps used in the analysis of the datasets in this study are summarized in (Figure 1).

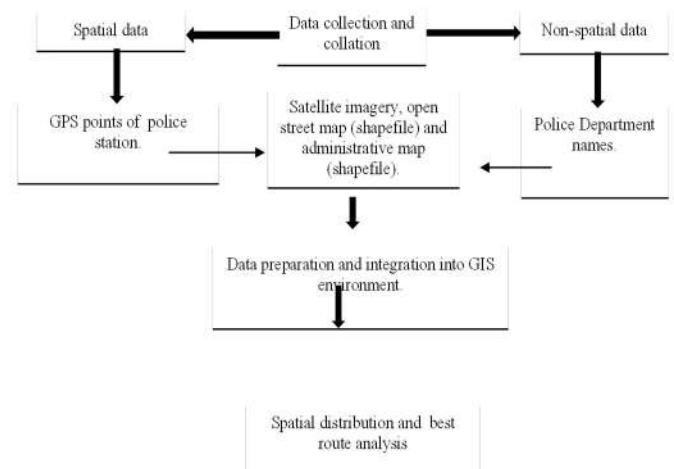


Figure 1: Procedural steps.

Data collection and collation

Coordinate was collected for all the police stations. such data was collected through physical survey of the area using Garmin hand-held GPS equipment.

Data preparation and integration

All datasets were converted to projected UTM WGS 84 zone 32N coordinate system. Each spatial data was typed into rows and columns and saved in .xlsx Microsoft Excel format. In a similar manner, all GPS data were also saved in tabular form for easy access and for further use in this study, satellite imagery was clipped to the exact study.

Spatial distribution: After entering the coordinates of each police department and integrating it with the map in ArcGIS Software it was then displayed in the window. **Best route:** From the network analysis window, analysis tool was clicked then make route layer was clicked and

the properties were filled. On the analysis window, impedance attribute was clicked and drive time was filled, then add location was clicked and the starting point and end point were selected on the model window and the connect tool was clicked. View bottom was clicked to see the model display. The police station is clicked as well the incident location too from which the best route is displayed.

RESULTS AND DISCUSSION

Distribution of facilities

There are 53 police departments within Kaduna metropolis (Table 1). The police stations are sparsely distributed within Kaduna North and South LGAs of the state.

Table 1: Police Stations Attribute Data.

S/n	Name	Classification
1	NPF State H/Q	State H/Q
2	Kabala Doki Divisional H/Q	Divisional H/Q
3	Sabon Tasha Divisional H/Q	Divisional H/Q
4	Cooperative Police Post	Police Post
5	Ungwan Romi Police Post	Police Post
6	Television Police Post	Police Post
7	Maraban Rido Police Post	Police Post
8	NNPC Police post	Police Post
9	Gonin Gora Police Post	Police Post
10	Gabasawa Divisional H/Q	Divisional H/Q
11	Kakuri Divisional H/Q	Divisional H/Q
12	Market Police Post	Police Post
13	Trikania Police Post	Police Post
14	Industrial Police Post	Police Post
15	Nasarawa Police Post	Police Post
16	Kurmin Gwari Police Post	Police Post
17	Railway Police Post	Police Post
18	Kawo Divisional H/Q	Divisional H/Q
19	Afaka Police Station	Police Station
20	Ungwan Magaji Police Post	Police Post
21	Mando Garage Police Station	Police Station
22	Ungwan Gwari Police Post	Police Post
23	zaria Garage Police Station	Police Station
24	Ungwan Dosa Police Station	Police Station
25	Abakpa Police Station	Police Station
26	Kawo New Extension Police Station	Police Station
27	Kawo Market Police Station	Police Station
28	Legislative Quarters Police Post	Police Post
29	Farin Gida Police Post	Police Post
30	Hayin banki Police Station	Police Station
31	Rafin Guza police station	Police Station
32	Kaduna Airport Police Station	Police Station
33	Sabon Gari Divisional H/Q	Divisional H/Q
34	Warri Street Police Post	Police Post
35	Central Market Police Station	Police Station
36	A.B.S Police Post	Police Post
37	Barnawa Divisional H/Q	Divisional H/Q
38	Narayi Police Station	Police Station
39	Trade Fair Police Post	Police Post
40	Tudun wada divisional H/Q	Divisional H/Q
41	Kinkinao police Post	Police post
42	Kurmin mashi Divisional H/Q	Divisional H/Q
43	National Eye Centre Police Post	Police Post
44	Fertilizer Police Post	Police Post
45	Asikolaye Police Post	Police Station
46	Kabala West Divisional H/Q	Divisional H/Q
47	Ungwan Ma'azu Police Station	Police station
48	Malali Divisional H/Q	Divisional H/Q
49	Badarawa Police Post	Police Post
50	Ungwan Sanusi Divisional H/Q	Divisional H/Q
51	Ungwan Rimi Divisional H/Q	Divisional H/Q
52	Kinkinao police Post	Police Post
53	Rigasa Divisional H/Q	Divisional H/Q

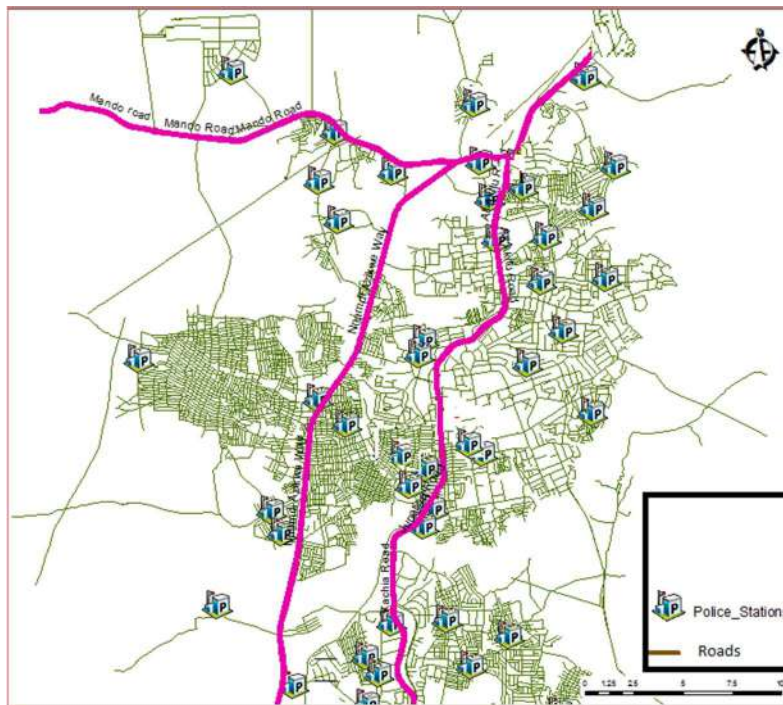


Figure 2: The distributions of Police departments within Kaduna metropolis.

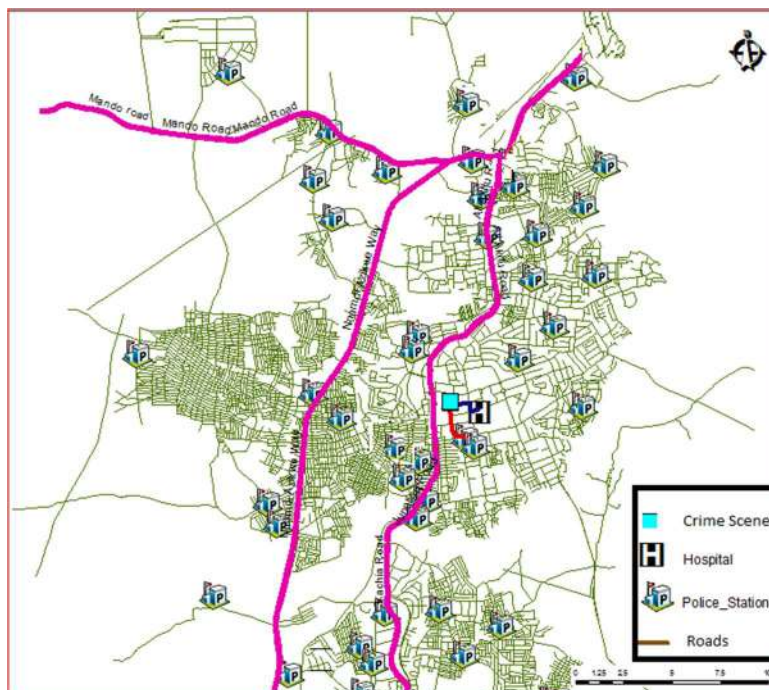


Figure 3: Best route analysis from crime scene to police station and from crime scene to Hospital

Response model

From (Figure 2), there is 1 State Headquarter, 14 Divisional H/Q, and 14 police Stations and 24 police posts. Figure 3 shows the route from crime scene located

along Kantaroad by Bida road junction to police station and then from this crime scene to Barau Dikko General Hospital. Figures 4 and 5 show the directions, distances and drive time.

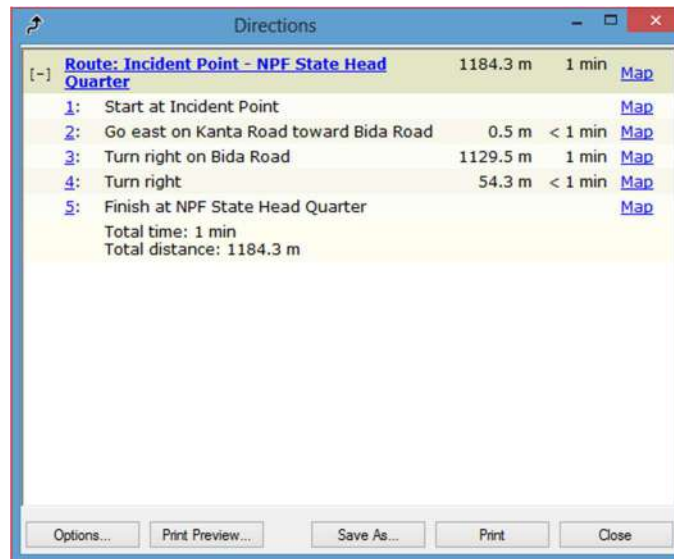


Figure 4: Direction box from crime scene to police station.

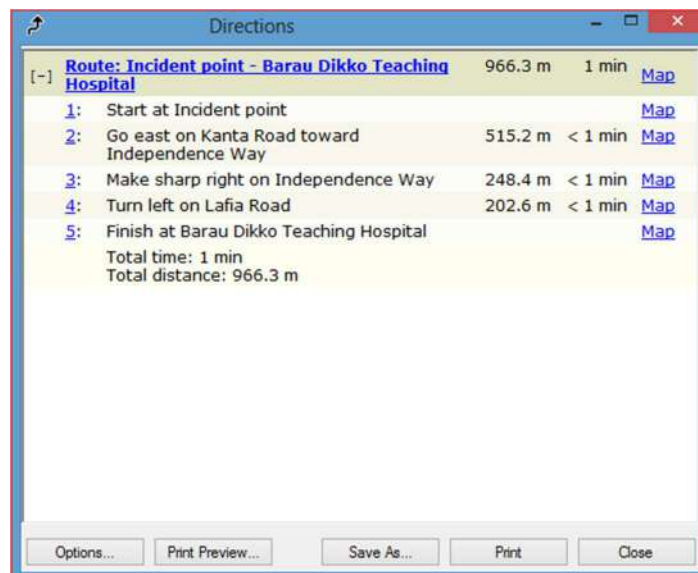


Figure 5: Direction box from crime scene to Barau Dikko general Hospital

Conclusion

Geographical Information Sciences (GIS) has been applied in the spatial distribution of police departments and best route analysis from and to crime scene within Kaduna metropolis. Therefore, findings were observed from the distribution of facilities and best route analysis. From the findings, the spatial distribution shows 1 State Headquarter, 14 Divisional H/Q, 14 police Stations and 24 police posts within the study area. One of the avenues

of helping to achieve the objective is to design best route analysis. The best route provides greater clarity, minimal distance and time taken to and from crime scene and various points of interest. The study recommended that there should be seminars and training organized on how to utilize GIS application for a smooth security service delivery and there should be efficient access roads provided in markets and other areas, so that security vehicles can reach crime scene locations in markets effectively on time.

RECOMMENDATION

The study makes the following as its recommendations:

1. There should be seminars and training organized on how to utilize GIS application for a smooth service delivery.
2. There should be efficient access roads provided in markets, so that fire fighting vehicles can reach fire incidents locations in markets effectively on time.
3. More studies should be done to verify the exact factors considered in the distribution of police stations and personnel.
4. Geographical Information system (GIS) should be given much emphasis in police and other security agencies.

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