



Identification of Crime Vulnerable Areas in Ibrahim Badamasi Babangida University Lapai, Niger State, Nigeria

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ABSTRACT

The increase in global crime rate is due to increase in population and poor socioeconomic, political, and environmental conditions which trigger low income earnings and extreme unemployment. Increasing population in the cities and their surrounding areas without adequate planning and provision to improve the living condition of the teeming masses and provide amenities and essential services has been associated with increased crime. In addressing issues of crime, several attempts have been made include studies relating to analysis and prediction crimes by clustering and classification, crime analysis using K-means clustering, mapping and analysis of crime with ArcGIS spatial tools, identification of hotspots and safe ones of crime with Geo-spatial analysis approach, and crime hotspot mapping using Geo-spatial technique and ground data. The current parse of crime study has left much to be desire of, especially in the aspect of crime mitigation. This knowledge-gap will require the use of space base technology that can effectively manage network where in and outflow of population can be monitored as effective way of policing the society. The objectives of the research include; identification of locations of major crime activities in the study area using the crime records obtained from Security agencies and coordinates of these crime locations obtained using GPS receiver, determination of the entries and exits land points in IBBU Lapai using a very low-resolution satellite data and to map out crime hotspot IBBU Lapai using KDE. Based on the generated information and methods adopted, a crime hotspot map was developed. The result shows that 35 crime incidences were recorded on the three (3) major crimes that happen between 2014 and 2019 in the study area. Out of this, 32 recorded cases, representing 91.4% are theft crime incidences recorded during the period. Assault crime incident has 2 recorded cases, representing 6%. While burgling crime incident recorded only one (1) case, representing 3%. The crime scenes were noticed to be spread across the university community with concentration of crime spot synonymous to area of high population. Majority of the crime spot concentrated at the highly porous area where there exist free entry and exit either by road, footpath and open network.

Keywords: Crime Vulnerable, Mapping, Population, Socioeconomic, Geospatial

INTRODUCTION

The increase in global crime rate is due to increase in population and poor socioeconomic, political, and environmental conditions which trigger low income earnings and extreme unemployment issues. Increasing population in the cities and their surrounding areas without adequate planning and provision to improve the living condition of the teeming masses and provide amenities and essential services has been associated with increased crime. The low income earning of the global society is highly influenced by the increase in population that make crime the order of the day. (Paket *al.*, 2018) shown that the use of Geographic Information Systems in the generation of crime information and ultimately the decision-making

support system is successful in managing crime both in the developed, and developing worlds. The use of Geographic Information System is very paramount regarding the optimum functioning of an organization, and to make decision making easy steps to be actualised by the stakeholders in the sector.

In homogeneous environment of Ibrahim Badamasi Babangida University Lapai (IBBUL) where different tribe, character, behaviours, social and anti-socialites exist within the cycle,

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the use of GIS to map and analyse crime distribution play a major role by bringing to the notice of the decision maker in the security section so as to make and implement rules that reduce crime rates.(International Association of Police Chiefs, 2002)states that refusal to adopt new crime-fighting technology is a way of deteriorating police resources and a reduction in the days of informal, uncommon crime reporting by patrol officers sporadically. Progress can offer significantly enhanced problem-oriented policing skills, efficient allocation of resources, reduced crime rates, and thousands of crime prevention. Several studies such as tend to address the issues of crime studies such as (Kianiet al., 2015)that deal with analysis and prediction of crimes by clustering and classification, crime analysis using K-means clustering (Joshiet al., 2017), mapping and analysis ofcrime with AcrGis spatial tools (Ansari & Kale, 2014), identification of hotspots and safe ones of crime with Geo-spatial analysis approach (J. Kumaret al., 2012), This knowledge-gap will require the use of space base technology that can effectively manage network where in and outflow of population can be monitored as effective way of policing the society. To attain this state, this research thus is an attempt to develop a network monitoring map

to provide a framework for the effective policing of Ibrahim Badamasi Babangida Lapai (IBBUL) community and areas of similar heterogeneity population.The research made use of Geo-spatial technique and ground data to map and analyse crime in Ibrahim Badamasi Babangida University Lapai (IBBUL) with Geographical Information technique. The use of GIS to map crime allows an analyst to create custom displays focused on specific types of crime in specific areas so that trends or patterns can be visually checked.

Study Area

Lapai local government has an area of approximately 3,051 km² (1,178sq mi) with a population of 110,127 as in 2006 census when Nigeria's total population was 140 million. Lapai extends from the north to the Paiko Local Government at a distance of 8 km from Lapai town Center. Suleja Local Government and Agaie are bounded to the North on the South. Lapai is situated at latitude 8° 49'N and longitude 6° 41'E to 6 ° 42'E on a geographical base of prominent hills in an undulating area. The rainy starts in March, April and ends in October. It has an average annual rainfall of 133 mm (52 inches) with September measuring 300 mm to 330 mm (11.7 inches) maximum rainfall.

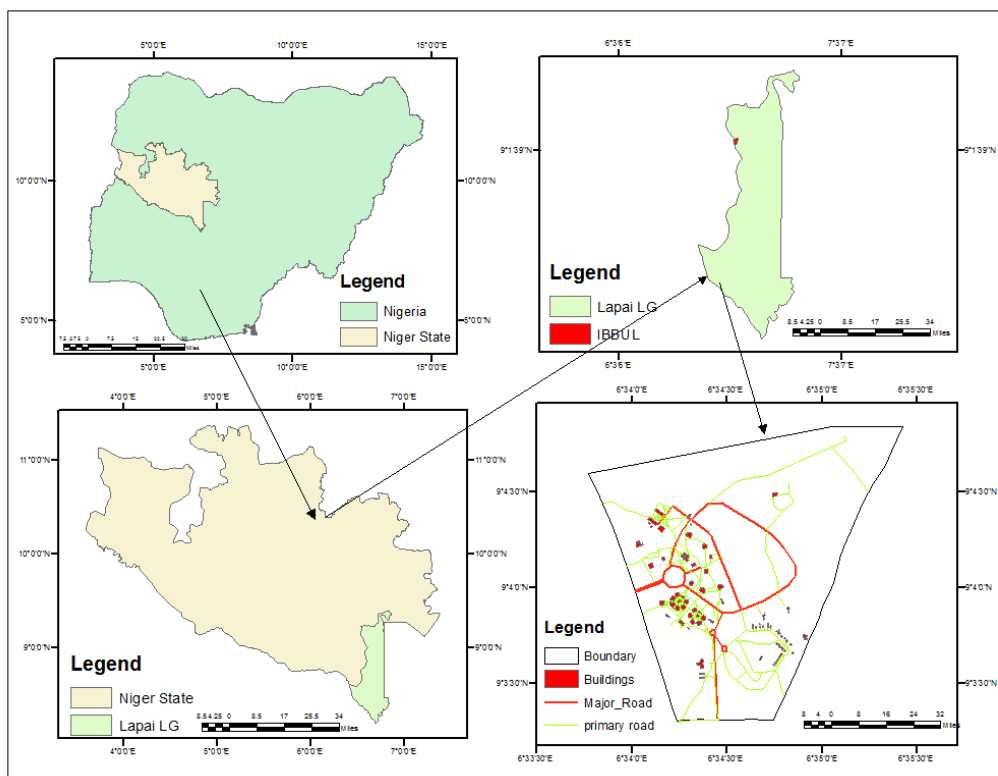


Fig 1: Map Showing the Study Area

METHODOLOGY

Identification of Crime Locations in the Study Area

Various crime location is being identified from the record obtained from security unit in the study area. The coordinates of these crime locations is obtained using hand held GPS receiver. The coordinates of the various crime locations is then be geocoded and imported into the ArcGIS 10.5 environment.

Determination of the Entries and Exits land points in IBBU Lapai using a very low resolution satellite data

To this end, the spectral signatures for the existing features on the image were extruded through density slicing and contrast enhancement to enhance image clarity. Sequel to the image correction and enhancement, training samples were developed using the spectral characteristics of the corrected images thus, five (5) spectral training samples were generated. The generated training samples correspond to; bare surface, developed regions, farmland, and vegetation and tarred road network. The classified features were further subjected to complex network analysis where three features (vegetation, farmland and developed region) visibilities were reduced to enable the floating of bared surface. The floating bared surfaces was further analysed to derive all the footpaths and untarred networks while isolating the resolve surface that has no linear attributes (Xu *et al.*, 2017; Shivers *et al.*, 2019).

Development of crime hotspot in IBBU Lapai.

The Kernel Density Estimation (KDE) was utilized in mapping the crime hotspots. KDE is a type of non-parameter density estimator, meaning it creates an estimate using all data points (Li *et al.*, 2010; Hao *et al.*, 2011). KDE is a good way to use crime data, as it measures how the number of incidents varies across the study area. It produces a smooth map where the density reflects the number of points in the surrounding area at each location (Hart & Zandbergen, 2014). We start by laying a fine grid over the study area in Kernel estimation. A constant bandwidth circular window is placed over the study area on a grid. The density is calculated within the window. Points closer to the centre of the window are given more weight than points further away (Hu *et al.*, 2018). We use kernel estimation because the approach

produces an esthetical pleasing image that allows users to classify hotspots based on density contours. The mean and standard deviation of the Kernel Density Estimation was used to determine the hotspot and also a raster map was generated, where the intensity of crimes is represented by continuous surfaces.

RESULTS AND DISCUSSION

Locations of major crime activities in the study area

Figure 1, revealed three (3) major crimes; theft, assault, and burglary were identified to be most prevalent in the area. See appendix (I). The crime rate appeared to be dominant in area with concentration of students except for some few isolated points. Reference to that is student's hostel which is dominated with much crime case ranging from theft to bugling of rooms. Student hostel in Ibb university environment is one of the most dominant area with high population concentration of student with heterogeneous people of varying character. Inference into the factors responsible for the concentration of larger university population is largely attributed to the poor economic situation and affordability of the facilities and sometimes the inadequate monitoring of number of people to occupy such facilities according to the specification.

The Entries and Exits Land Points in IBBU Lapai

Road map was utilized in determine the entries and exits land point in the university. The digitized road network map was zoomed to the maximum resolution where both the entries and exits land point were obtained as shown in figure 2. These entries point and exits land points include; the school major entrance gates in which one is on the west of the school bounded by a tarred road leading from Paiko to Lapai while the other is on the east of the school bounded by an un-tarred road that leads from Lapai to Mikugi. The exits point is often characterized by sudden interruption due to the obstruction of part ways, looking for alternative route to elude. The exits points are; the path that runs from caster to the tarred road leading from Paiko to Lapai, the path that runs from behind twin theatre to Mr. Chef, the path that runs from hostel B to Cheche, the path that runs from central mosque to school farm and the path that runs from staff quarters to un-tarred road leading from Lapai to Mikugi as shown in Figure 2.

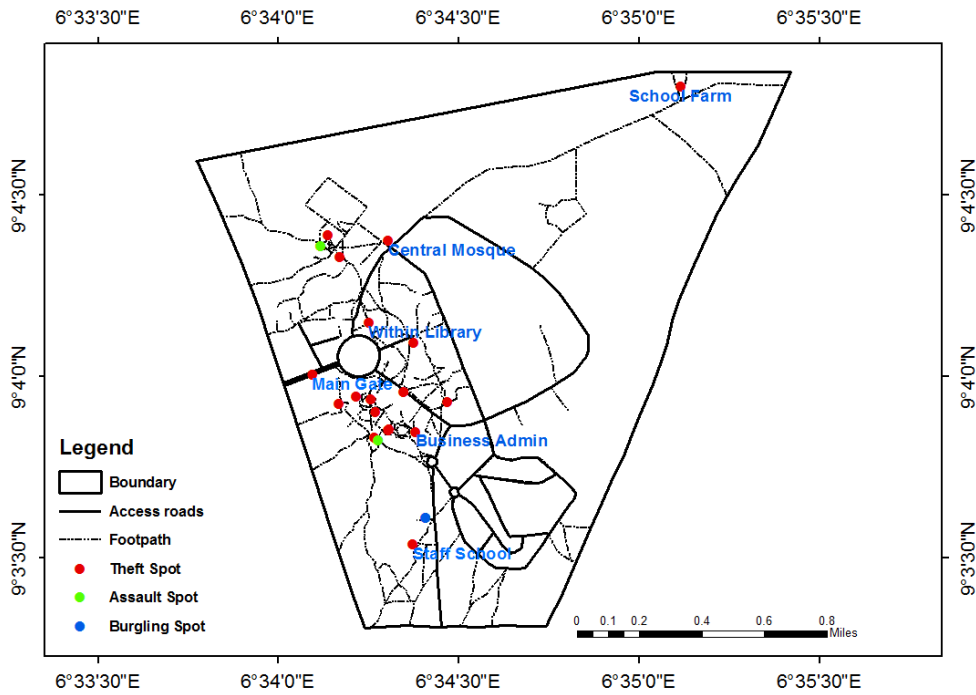


Figure 2: Crime scenes

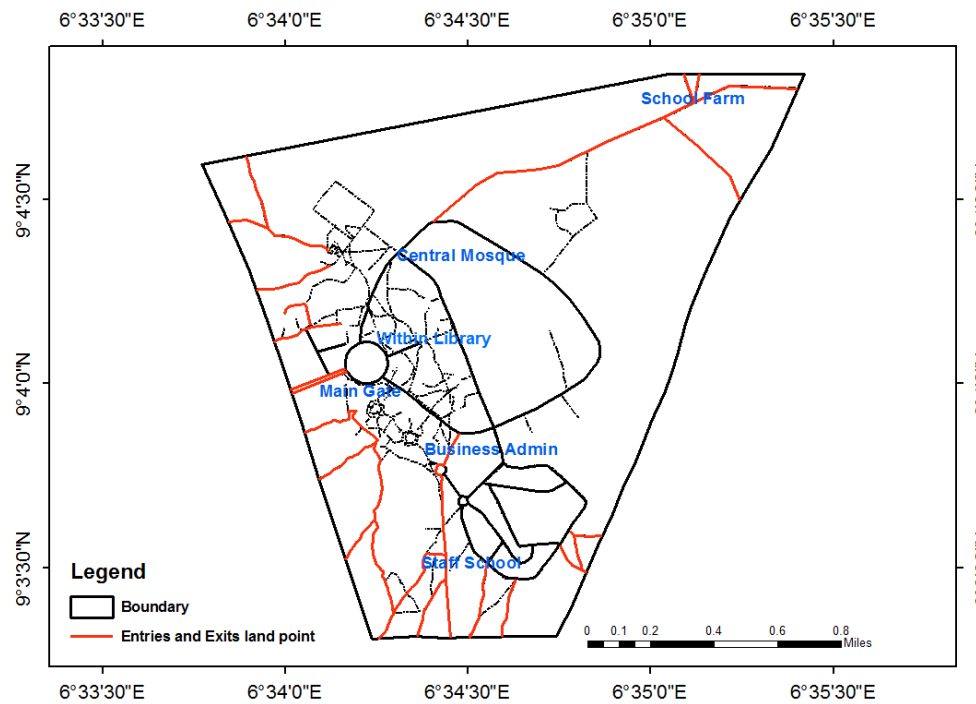


Figure 3: Entries and Exits land point in IBBU Lapai

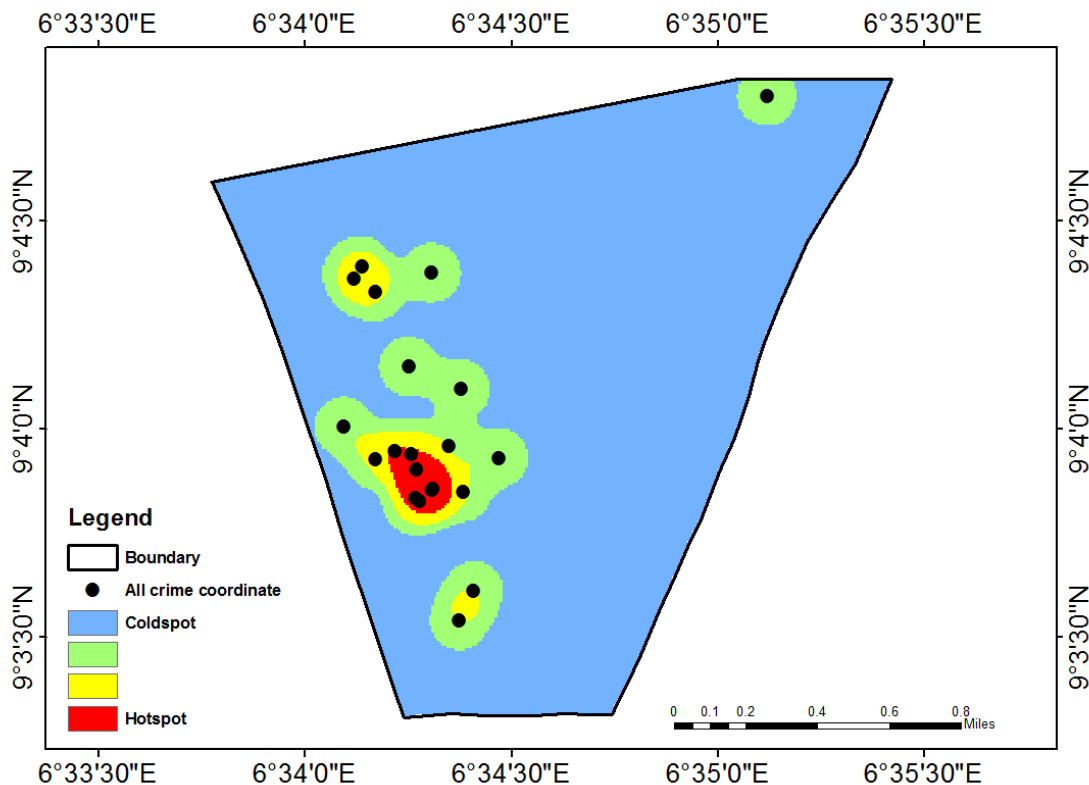


Figure 4: Crime Hotspots Map of the Study Area

Develop crime hotspots in IBBU Lapai

The crime hotspot map in figure 3, shows four concentric region of crime in red, yellow, green, and blue colours respectively. The first concentric region with red colour, represent Hotspot (high crime rate), covering Geography department, French Lab., SLT, Economics department, Economics Lab., and Business Administration with high occurrence of crime. The second region with moderate crime rate which is represent in yellow colour covers the following areas; Central Laboratory, Sub-station 3, Economics department, Hostel B, Staff School, Hostel C, Admin Block and Hostel A. The areas tend to experience restrained crime compare to the Hotspot. The third concentric region which is green in colour covers area as follows; School Farm, Central Mosque, Main Gate, Library, ICT, and NLT with little occurrence of crime in such region while the fourth concentric region which is the Cold spot area (blue colour)5 covers the boundary of the school with no crime scene.

Summary, Conclusion and Recommendations

Summary

In this study an approach to locate the major crime scenes from satellite imagery using the crime scenes coordinate obtained was carried out. After mapping the spatial distribution of the crime scenes in the study area, it was observed that most of the crime scenes are located within the structures in the study area. It was further observed that incidents of burgling are decreasing, while assault and theft are on the increase. Exertion was made to determine the entries and exits land point in the school (IBBUL) after digitizing the road network using the generated satellite imagery and ArcGIS spatial tool and environment. A crime hotspot map was produced to estimates how the density of crimes varies over the study area. This study work to demonstrates the ability of GIS in capturing spatio-temporal data.

Conclusion

From the finding it is concluded that IBBU Lapai as a learning environment with moderate routes linking various buildings such as faculties and departments, hostels, lecture halls, library, ICT, not to mention but few that are associated with high crime rate, of which three (3) major crimes were identified to be the most prevalent (theft, assault and burglary). After mapping the crimes, it was observed that most of the crime scenes are located at lecture hall, departments and hostels. From the analysis, it was observed that 35 crime incidences were recorded on the three (3) major crimes that happen between 2014 and 2019 in the study area. Out of this, 32 recorded cases, representing 91.4% are theft crime incidences recorded during the period. Assault crime incident has 2 recorded cases, representing 6%. While burglary crime incident recorded only one (1) case, representing 3%.

Recommendations

It is recommended that security be reinforced along the structures (lecture halls, department, and hostels in the study area, to ensure safety and security of students and staffs since most theft crime incidents are within the structures especially the lecture halls, department, and hostels. Hotspots crime areas are supposed to be treated. Where there is no presence of security personnel, adequate arrangement should be made to deploy them to ensure full security coverage of such areas.

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