JRBE JOURNAL OF RESEARCH IN THE BUILT ENVIRONMENT
ISSN 2636-6363
JRBE 2025
VOLUME 2 ISSU 4
PAGES 15-28

ENHANCING COMMUNITY SECURITY MANAGEMENT USING GEOSPATIAL TECHNOLOGIES

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ABSTRACT

When the security of any community is jeopardized, it begins to have resultant effects on the economy and welfare of the people of that community. This is the reason every locality, be it villages, towns, local authorities, states, or nations, should prioritize the issue of its security both within and without. The study assessed the community security management in the Aba Erinfun community of Ado-Ekiti, being a student-populated area, using geospatial technologies. It identified prevalent security challenges, the factors responsible for these security challenges in the area, the groups that are more vulnerable to security threats in the area and mapped the hotspots of security concerns in the area. Both primary and secondary data which contain both spatial and non-spatial data were used. A total of 150 questionnaires were sampled using the stratified random sampling technique. A 5m multispectral resolution of NigeriaSat-2 image was acquired from National Space Research and Development Agency (NASRDA). Garmin 75X Hand held GPS was used to pick the coordinates of points identified as crime hotspot zones in the study area and these were plotted on the shapefile created from the Nigeria Sat 2 imagery. More than 50% of the respondents observed that socio-economic factors have great influence on the deteriorating security of Aba Erinfun community. Thefts were observed as the most prevalent crime incident in the community with 60 (39%) of the respondents agreeing to this and students are the most vulnerable to these crimes. GIS-Based Crime Monitoring System should be embraced by law enforcement agencies for real-time crime tracking and analysis to improve response strategies. Community residents may be trained on simple security tips that will enhance their responses to crime and reporting of same to the appropriate authorities.

Keywords: Crime Hotspots, Security, Environment, Geospatial Analytics, Vunerabity

1.0 Introduction

Human security means safety from chronic threats such as hunger, disease, and repression as well as protection from sudden and harmful disruptions in the patterns of daily life – whether in homes, jobs or communities. (UN, 2021). When the security of any community is jeopardized, it begins to have resultant effects on the economy and welfare of the people of that community. This is the reason every locality be it villages, town, local authority, states or nations should prioritize the issue of its

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security both within and without. Hazards that can significantly affect livelihoods and population safety and security include environmental changes, extreme weather occurrences, climate change, societal upheaval, and violent conflicts. These are frequently connected, and when several things happen simultaneously or consecutively, their effects might be especially bad (Leonard et al., 2014; Haile et al., 2019;Anderson et al., 2021; Lwanga-Ntale & Owino, 2020). In addition to the hazards that occur, the exposure, capability, and sensitivity of populations also play a role in how such occurrences affect people and increase risk (Lavell et al., 2012). Therefore, knowing people's locations is essential for managing and lessening the effects of occurrences.

Many communities in Nigeria are facing serious challenges of security threats and problems depending on the nature of insecurity operations in the area. For example, there are the operations of book haram insurgents and bandits in the far north of the country while kidnapping and ritual killings are so rampart in the eastern and southern parts of the country. Security challenges in Nigerian urban communities have been extensively documented in literature, with studies highlighting the multidimensional nature of urban insecurity. Adeyemi (2022) noted that rapidly developing communities often face increased vulnerability to crime due to infrastructural deficits and limited security presence. Similarly, Ogunleye (2023) identified socioeconomic conditions, demographic changes, and migration patterns as significant factors influencing security challenges in emerging urban settlements.

Research by Adebayo and Johnson (2021) emphasize the importance of community participation in security management, suggesting that effective community policing models can significantly reduce crime rates and improve residents' sense of safety. Furthermore, Oluwadare (2023) identifies those technological solutions such as CCTV surveillance, emergency response systems and digital reporting platforms can complement traditional security approaches in addressing contemporary security challenges. The literatures consistently emphasizes that sustainable security solutions must address both physical infrastructure needs and social dimensions of community

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safety, including trust-building between residents and security agencies, community cohesion and economic empowerment (Ademola, 2024).

Despite having the visually pleasant appearance of a modern city, Ado-Ekiti, a rapidly expanding metropolis in sub-Saharan Africa, lacks the contemporary management approaches for an efficient mapping, monitoring, and management of crime to meet the attainment of a livable environment. The intelligence that geospatial technologies supply is used to manage the cities of the developed world. The difficult challenge of managing crime has been made possible by advancements in space technologies. In order to create a safe and secure environment in Nigerian urban and rural communities, several organizations tasked with city planning and management have not, however, taken advantage of, utilized, or domesticated the available technologies. Over the past forty years, geographic information systems, remote sensing, and related technologies have taken many different shapes.

Crime hotspot analysis, a subset of crime mapping, focuses on detecting locations with a high frequency of criminal activities over time. Studies have shown that hotspot analysis enables law enforcement agencies to optimize patrol strategies, allocate resources efficiently, and implement preventive measures (Kennedy et al., 2011). Several criminological theories explain the spatial distribution of crime. Routine Activity Theory suggests that crime occurs when a motivated offender, a suitable target, and a lack of capable guardianship converge in space and time. The Broken Windows Theory postulates that visible signs of disorder, such as poor lighting and abandoned buildings, encourage criminal behavior. Environmental Criminology emphasizes the role of spatial factors in crime occurrence, highlighting the significance of geographic profiling in crime prevention (Wortley & Townsley, 2016).

Security concerns in student-populated areas are a growing issue, requiring a strategic approach to crime detection and prevention (Gyebi, 2021). The aim of this work is to assess the community security management in Aba Erinfun community of Ado-Ekiti being a student-populated area,

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using geospatial technologies. Specific objectives was to identify prevalent security challenges facing residents of Aba Erinfun community, identify the factors responsible for these security challenges in the area, identify the groups that are more vulnerable to security threats in the area and to map the hotspots of security concerns in the area. Addressing the challenges of crime mapping in Nigeria requires enhanced crime reporting systems, capacity building in GIS application and increased investment in security infrastructure. This study contributes to the growing body of research on crime mapping by applying geospatial techniques to analyze security concerns in Aba Erinfun, Ado-Ekiti, providing actionable recommendations for crime prevention and control.

1.1 Study Area

Aba Erinfun is located in Ado-Ekiti, the capital city of Ekiti state in southwestern Nigeria. The community is characterized by a mix of residential housing, small businesses and educational institutions. Notable streets within the community include Damola street, Olarewaju street, Oyebam street and Annex street, with varying population densities and security profiles. The community has experienced significant growth in recent years, attracting diverse residents including students, civil servants, business owners and farmers. It is a community of mixed tribes and cultures. This demographic diversity shapes the security landscape and presents unique challenges for community safety management. Its proximity to open spaces and forested areas poses security challenges, making it significant for crime mapping and urban planning.

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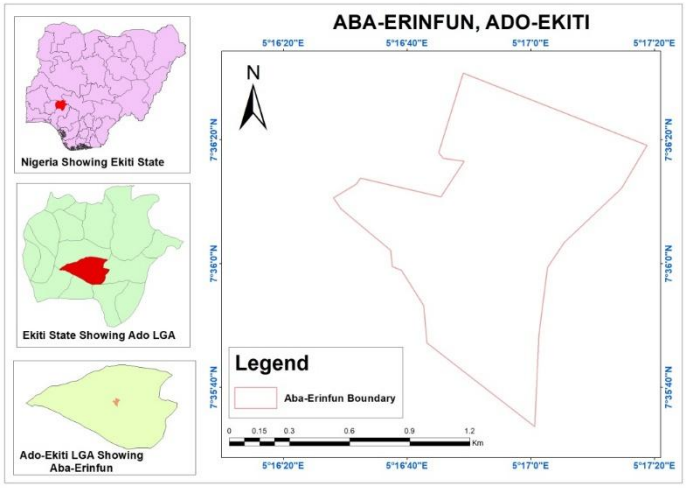

Figure 1: Study area map

1.2 Data

To accomplish the set objectives of the study, both primary and secondary data which contain both spatial and non-spatial data were used. These include existing documentation like books, journal articles, satellite images, paper maps and other related literature. The GARMIN GPS 76CSx was used to acquire locations (coordinates) of the crime hotspots.

Primary Data: Data collection involved the administration of questionnaires across the study area. A total of 150 questionnaires were sampled using the stratified random sampling technique. The questionnaires extracted general information of the inhabitants, awareness and readiness of community stakeholders in security management as well as security challenges and gaps in the study area. GPS was used to establish the geographical location of crime hotspots which was later used on the Google Earth imagery.

Secondary Data: A 5m multispectral resolution of NigeriaSat-2 image was acquired from National Space Research and Development Agency (NASRDA).

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Table 1: Primary and Secondary Datasets

S/N	Name	Year	Format	Source	Scale / Resolution	Extent (Long/Lat)	Date of Acquisition
1	Nigeria Sat2	2011	Digital	NARSDA	5m	7º 35' 40" - 7º 36' 20" N 5º 16' 20" – 5º 17' 20" E	16/07/2023
2	Security data	2025	Excel	Questionnaire	Non	-	
3	Crime hotspot data	2025	Excel	Questionnaire/GPS	Non	-	

1.3 Survey Administration

The questionnaires were administered in-person to respondents by trained survey personnel. Twenty (20) copies of questionnaires were distributed to each of the major streets and other streets

in Aba Erinfun making a total of 160 questionnaires out of which 152 were returned. The major streets are Damola street, Olarewaju street, Oyebam street and Annex street while others are unnamed streets branching from these four streets. Participants were briefed on the purpose of the study and provided informed consent before completing the survey. The survey was conducted during the weekend period to allow many residents to be at home. The survey utilized dichotomous (Yes/No) responses.

1.4 Analysis

Simple percentages were used to analyse the dichotomous yes/no responses but the MsExcel package was used to show the frequencies in pie chart formats. The QGIS 3.14.16 version was used to produce the crime hotspot map in the end.

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1.5 Ethical Considerations

All respondents participated voluntarily, and confidentiality of individual responses was maintained throughout the research process. The study received approval from the appropriate institutional authorities before implementation.

2.0 Methodology

The methodology adopted for this research ranges from data conversion, manipulation, analysis and generation of other geospatial datasets for the result and analysis. Survey was carried out to identify crime hotspots within the study area. See below the flowchart of methods adopted to carry out this research. Garmin 75X Hand held GPS was used to pick the coordinates of points identified as crime hotspot zones in the study area and these were plotted on the shapefile created from the Nigeria Sat 2 imagery. Structured questionnaire was used to obtain information about the more prevalent crimes in the area, the group of people more vulnerable to security threats as well as how the people usually report security incidents whenever it happens in the area. A total of 152 questionnaires returned were used in the analysis.

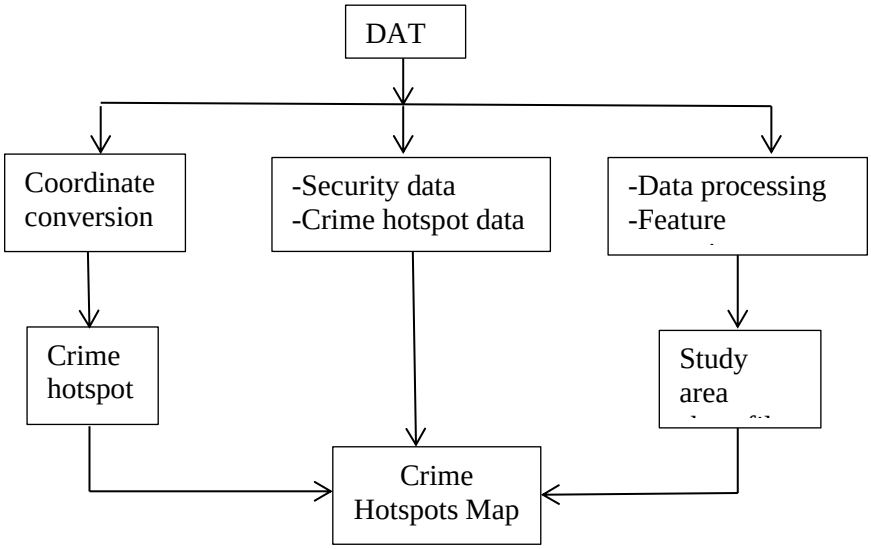

Figure 2: Methodology flowchart

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3.0 Analysis and Results

Length of residency of Respondents in Aba Erinfun

The survey on this question showed that largest percentage (39.1%) of the respondents have lived above five years in the community and they should have a good knowledge of the happening there. The figure below further explains the full response to the question.

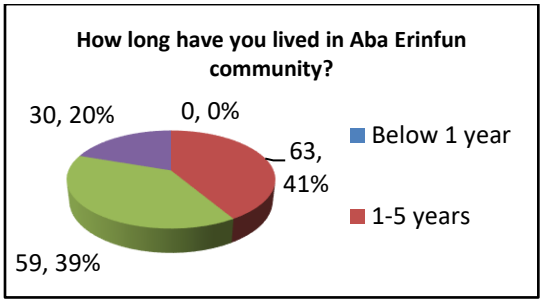

Figure 3: Length of residency

Prevalent security challenges facing residents of Aba Erinfun community

More than 50% of the respondents observed that socio-economic factors has great influence on the deteriorating security of Aba Erinfun community. This is followed by emerging technologies which is the response of 16% of the respondents. Poverty significantly impacts security by creating vulnerabilities and instability. Extreme poverty can lead to desperate measures, including illegal activities, which can undermine social order and create a climate of fear and violence.

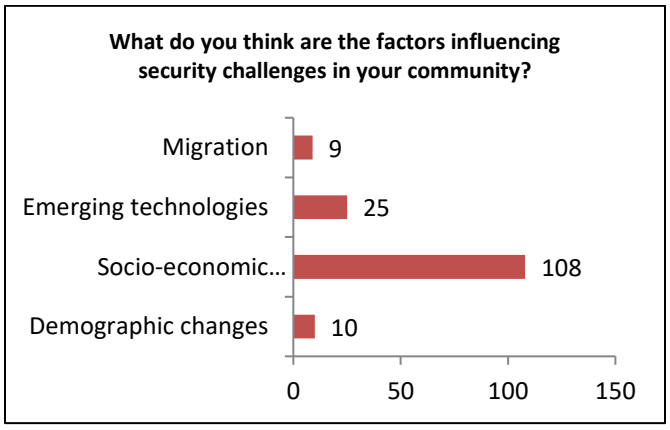

Figure 4: Prevalence of security challenges

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The next results showed types of crime or security incidents that have occurred in the community in recent time. Regarding crime incidents in recent time in the community, 39% of the respondents stated that theft is the most common crime incidents. Burglary (25%) and robbery (22%) closely followed one another as the types of crime or security incidents common in the community. From the responses, homicides, arson and vandalization are have not been happening in Aba Erinfun community.

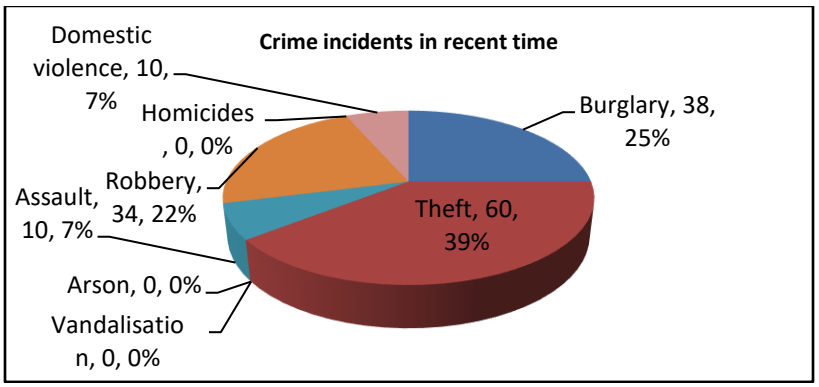

Figure 5: Crime incidence

Vulnerability to security threats

A question was asked to know the specific groups or individuals in the community that may be more vulnerable to security threats and the chart in figure 5 shows the responses.

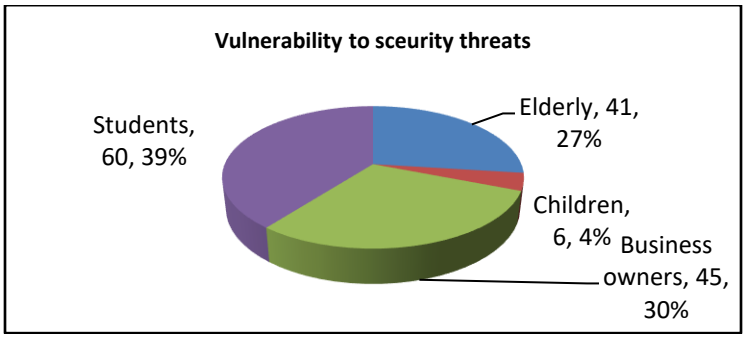

Figure 6: Vulnerability to security threats

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The implication of the above is for the fact that Aba Erinfun is a student community characterized of small scale businesses ranging from provision stores, pepper sellers, mini restaurants, eateries, photocopy/computer centres, etc.

Reporting security bridge incidents

The way and manner in which security incidents are reported is very crucial to how such reports are responded to. Therefore, the research made effort to know how and the channels through which residents report security incidents in their areas whener it occurs. The responses was analysed with the chart below.

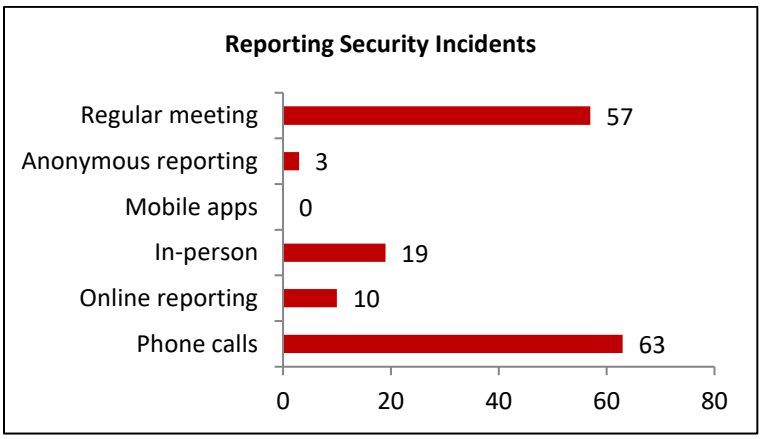

Figure 6: Mode of reporting security incidents

Hotspots of Security Concerns

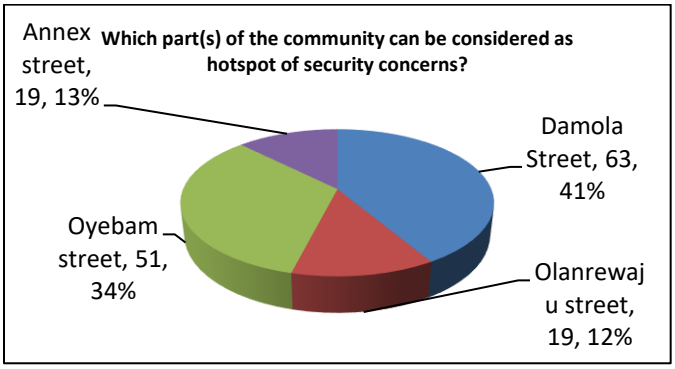

Figure 7: Hotspot of security concerns

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The chart above showed that Damola crime incident is prevalent in all the streets within the community of Aba Erinfun. However, Damola street has the highest percentage followed by Oyebam street. Annex street which is the street beside the polytechnic fence is considered to have least security concerns and this may be due to the fact there is security post of the institution along the street. The map below is used to depict the locations of the hotspots as described by the respondents.

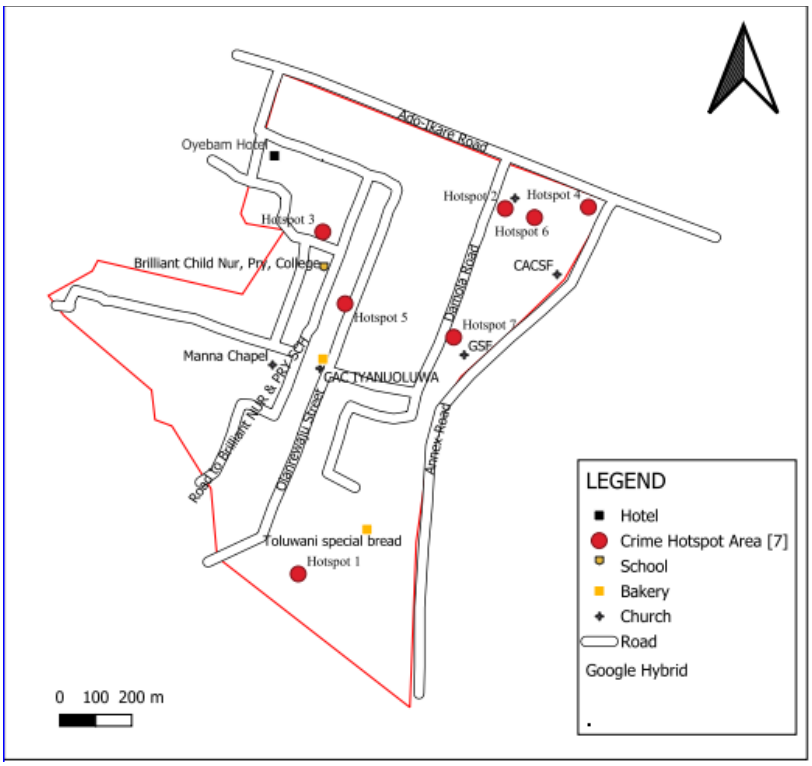

Figure 8: Crime hotspot zones

4.0 Conclusion

This study successfully mapped crime hotspots in Aba-Erifun, Ado-Ekiti, using geospatial techniques, providing valuable insights into the spatial distribution of security threats. The results revealed that robbery, cultism, and stealing are the most prevalent crimes in Aba-Erifun, Ado-Ekiti, with criminal activities often concentrated along major roads and poorly lit areas. The

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application of GIS-based analysis has demonstrated its effectiveness in identifying high-risk areas, enabling better resource allocation and proactive crime prevention strategies. This research highlights the importance of integrating geospatial technologies into security planning to enhance crime monitoring and mitigation efforts in Aba-Erifun and similar urban environments.

4.1 Recommendations

Poorly lit areas should be equipped with functional streetlights to deter criminal activities and enhance nighttime visibility. This coupled with encouraging community-led security initiatives, such as neighborhood watch programs and local crime reporting systems, will foster collective responsibility for safety. Regular Security Patrols especially in identified crime hotspots will enhance security presence and deter criminal activities. This can even improve data collection and crime reporting whereby centralized database can be developed for systematic crime data collection, incorporating mobile applications and GIS-based reporting tools.

GIS-Based Crime Monitoring System should be embraced by law enforcement agencies for real-time crime tracking and analysis to improve response strategies. Community residents may be trained on simple security tips that will enhance their responses to crime and reporting of same to the appropriate authorities. Government and stakeholders should invest in skill acquisition programs, vocational training, and employment opportunities to reduce youth involvement in crime. Making these changes will require everyone working together, community leaders, local government, police, and residents. With teamwork and the right approach, Aba Erifun can become a much safer place to live, work, and study.

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